Journal of Environmental Policy & Planning
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/cjoe20

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Published online: 06 Oct 2014.

To cite this article: J. Marvin R. Macaraig (2014): Citizen Science and Greenspace Planning in the Rouge River Watershed, Journal of Environmental Policy & Planning

To link to this article: http://dx.doi.org/10.1080/1523908X.2014.965808

Journal of Environmental Policy & Planning, 2014
http://dx.doi.org/10.1080/1523908X.2014.965808

Citizen Science and Greenspace Planning in the Rouge River Watershed

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ABSTRACT *The Rouge Park is a large 46-km^2 protected greenspace situated in one of Canada's largest urbanized regions, the Greater Toronto Area (GTA), an area that covers the Region of Halton, Region of Peel, Region of York, Region of Durham, and the City of Toronto. This article highlights the actions and participation of civil society groups working in the park and how they have been successful in utilizing citizen science and ecologically based arguments to legitimize their case for conservation and thus build broad public support for their goals. Using a typology of key environmental planning case studies relevant to the park, the article identifies three distinct ways civil society groups utilized scientific expertise to facilitate and enforce a conservation narrative. First they identified and utilized existing scientific reports, second they published their own reports/studies, and third they applied a hands-on approach and initiated community-based restoration and monitoring programmes. This article concludes that in community-level environmental controversies, science represents a powerful tool for civil society in the planning and land management regime in Ontario.*

KEY WORDS: Rouge Park, Rouge River, civil society, citizen science, greenspace, Greenbelt, protected areas, Toronto, Ontario

Introduction

In rapidly urbanizing regions it can be anticipated that two distinct narratives of productivism versus nature conservation will come to the forefront of the public discourse. A productivist narrative is closely tied to economic development activities such as, aggregate extraction, road and sewerage infrastructure development, the construction of shopping malls, industrial/corporate parks, and low-density housing (Macaraig & Sandberg, 2009; Patano & Sandberg, 2005). In Canada, provincial governments are mainly responsible for setting population, infrastructure, and economic growth targets for lower municipal governments. These municipalities often view growth as a chief priority in order to remain competitive in a glo-

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balized economy (Hanna & Walton-Roberts, 2004; Laidley, 2007). In contrast, a nature conservation narrative focuses on slow or no growth, and acknowledges the need for long-term protection of greenspace based on a precautionary approach. During the past decade, Ontario has passed the *Places to Grow Act* (2005), *Greenbelt Act* (2005), and the *Oak Ridges Moraine Act* (2001), and taken together this legislation has served as both real and symbolic measures of the province's commitment to environmental protection. Moreover, in the Canadian experience a nature conservation narrative is also closely tied to post-productivist values associated with NIMBYism and elite countryside living where nature is viewed as an amenity and is easily accessible (Chambers & Sandberg, 2007; Murdoch & Marsden, 1994; Wallace & Shields, 1997).

This article investigates the role of citizen science and the actions of civil society in the establishment and management of the Rouge Park, a large, 46km^2 protected area located in the Greater Toronto Area (GTA), which includes the Region of Halton, Region of Peel, Region of York, Region of Durham, and the City of Toronto. The article argues that when civil society groups participate in citizen science programmes and/or practice science, such actions play a significant role in building public support for their goals. The actions of civil society were fundamental in facilitating a discourse of conservation throughout the watershed. Through an examination of nine separate environmental planning case studies relevant to the Rouge River watershed, this research constructs a typology and identifies three distinct ways civil society made use of science and experts to help enforce an ecologically based nature conservation narrative. These case studies show the importance of citizen science during significant landmark moments in the struggle to protect the watershed. In some instances they used existing published research to support their ideas, sometimes they conducted credible research on their own, while in other cases they took part and put into action their ideas to prove their validity. This research sheds light on how science ultimately affords a powerful privileged position in environmental planning and resource management. This is especially relevant as civil society groups are typically at a disadvantage when compared to the state and private enterprise, which both have access to greater financial resources and scientific expertise. The objective of this article is to go beyond a narrow examination of the work of individual experts and their associated institutions, but to consider and evaluate how civil society groups utilized scientific expertise and ecologically based arguments to legitimize their case for conservation. For the purpose of this article ecologically based arguments are defined as specific arguments and the body of knowledge that are explicitly based on the natural sciences such as ecology or biology.

Citizen science and community-based monitoring programmes can be defined as the participation of the general public in scientific research (Bliss et al., 2001; Conrad & Hilchey, 2011; Silvertown, 2009). Projects that examine the ecology of either the local environs or an entire bioregion are increasing, and have been viewed as an important strategy to increase local participation and stewardship (Whitelaw, Vaughan, Craig, & Atkinson, 2003). Vaughan (2007) argues that a notable benefit of citizen science is that it can help bridge the gap between society's decisions and society's policies, specifically it can provide decision-makers with a mechanism to obtain the information needed to make effective policy choices. He further adds that citizen science has great potential to engage entire communities and ultimately empower citizens.

For the lay public, the connection between environmental controversies and expertise often presupposes that nature can be epistemologically linked to positivistic or technological vocabularies. Industry, civil society, and the state all utilize specific narratives and discourses to frame both the controversy and their respective debates, and scientific expertise often plays a fundamental role in the policy-making process (Bocking, 2004; Jasanoff, 1990; Richardson, Sherman, & Gismondi, 1993). Such a scenario can result in a competition between opposing stakeholders each utilizing experts to discredit the other's findings and credentials (Gismondi & Richardson, 1994; Patano & Sandberg, 2005). A focus on the testimony of experts may also marginalize competing perspectives such as the economy, human health, and any other socio-cultural norms and values. It is important to consider that these perspectives can complement one another, but often they are used to discredit a competing viewpoint. In planning controversies that contain several special interests, these different perspectives aid in the production of narratives that compete for supremacy, in an attempt to convince the public how the issue should be framed, discussed, and negotiated.

The GTA and the Rouge Park

The Rouge Park is situated in the Rouge River watershed and is located in the GTA, which is also Canada's largest urbanized region (Figure 1). The areas of the park are subject to intensifying pressures, which typically include industrial development, the construction of housing, and its infrastructure requirements such as roads and sewerage. The headwaters of the Rouge River begin in the Oak Ridges Moraine, which is a mostly hilly geological formation that is located in south-central Ontario, which extends from Rice Lake in the east, to the Niagara Escarpment in the west, a length of over 160 km (Paterson & Cheel, 1997). The moraine serves as a water recharge area and is called 'Ontario's water barrel', as many communities directly depend on it as a primary source of drinking water (Bocking, 2005; Meriano & Eyles, 2003). The biodiversity found in the valley is noteworthy, as it contains one of 36 critical Carolinian forest sites remaining in Canada (Varga, Jalava, & Riley, 1991).

Due to its close proximity to urbanized areas, the park accommodates a number of disparate land uses, which include commercial, industrial, residential, agricultural, and recreational lands. The park was officially opened in 1995 and was managed by the Rouge Park Alliance[1] (RPA) until 2012, when it was dissolved as a result of a recent federal government decision to transform the Rouge Park into a National Urban Park (Parks Canada, 2013). Interestingly, the RPA did not have tenure over the land it managed and therefore it relied on the formal legal powers of its respective government partners and state agencies to achieve its goals (Macaraig, 2011). This particular management and governance structure was the result of several social and political events beginning in the 1970s, which coincided with increasing development pressures in the former City of Scarborough, which was rapidly urbanizing and is now part of the amalgamated City of Toronto (formerly known as Metro Toronto).

Civil Society Involvement in the Rouge Watershed

To better understand the factors that lead to the establishment of the Rouge Park, it is useful to examine the involvement of civil society actors. Simply put, the park

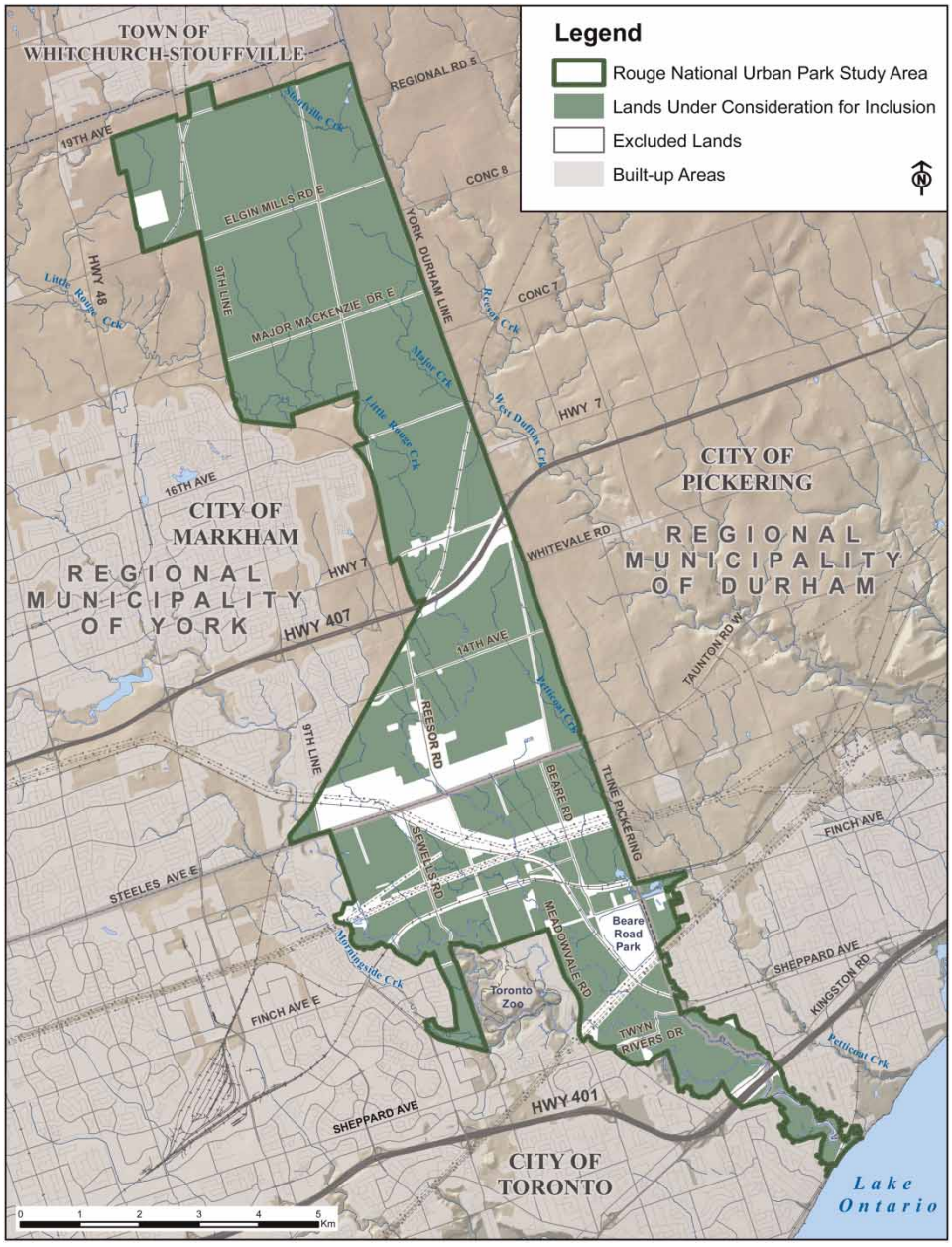

Figure 1. Rouge Park location map.
Reproduced with the permission of Parks Canada.

would not exist in the form we see today without the deliberate involvement of civil society. Residents became involved in the mid-1970s with concern over several development proposals and their potential to negatively impact the natural features of their communities. Plans included the widening and construction of several roadways, and the expansion of the Beare Road Landfill. In 1976, a small group of citizens then formed Save the Rouge Valley System (SRVS), whose

goal was to raise community awareness regarding the proposals and to bring attention to first the ecology, and later the cultural history of the watershed (Robb, Gregorio, & James, 2014). Throughout the 1980s, SRVS challenged and became involved in several environmental planning issues, and in some instances the group was successful in gaining political traction and brought forth changes in development plans, while in others they found limited support for their ideas. Over the years, the organization called for the protection of 2000 ha of land with the creation of a new park, and further raised its public profile through the media by securing political support from nearly all of Scarborough's elected officials at all levels of government. This local support for a new protected area was notable for it put Scarborough's politicians at odds with the growth aspirations of Metro Toronto, the province, and a powerful development industry.

After numerous politically charged battles over development in the valley starting in the 1970s with the Beare Road Landfill Expansion, followed by the Centennial Swamp development, and the Metro East Transportation Corridor, political support for the creation of the Rouge Park came in 1990 and resulted in the creation of a new protected area in the watershed (Ferguson, 1993). The plans were supported with $10 million from the federal government, with the funds to be administered by the Waterfront Regeneration Trust, which was an arm's length governmental agency responsible for coordinating development along Lake Ontario's waterfront. Public consultations followed and a multi-stakeholder advisory committee was convened to draft a park plan, which was approved by the Ontario Ministry of Natural Resources (MNR) in 1994. The park opened in April 1995 with the claim that it was the largest urban park in North America. In the following years, the park has grown and now includes lands in the adjacent Region of Durham and the Region of York.

Civil Society and Science

The following section identifies and provides summaries of environmental case studies that have played a role in shaping the Rouge Park. The list is not meant to be exhaustive, but rather the purpose is to highlight and identify the key environmental planning issues that have occurred in the watershed throughout the years and how civil society actors deployed and utilized ecologically based arguments, scientific expertise, and citizen science programmes in an effort to frame the issue. These case studies are presented in a typology (Table 1), where I identify and highlight three distinct ways in which civil society actors used both experts and conservation arguments (grounded in science) to promote and support a conservation narrative.

The material gathered for this article was collected over a three-year period (2010–2012). Semi-structured face-to-face interviews ($n = 15$) were conducted with self-identified leaders of civil society organizations. Interviewees included staff from these groups, bureaucrats, policy-makers, and current/former elected officials. A few interviewees only spoke on the condition that anonymity would be provided. Interview data were supplemented by archival research involving the examination of scientific studies, technical reports, and planning documents published by both civil society actors and the state. Finally, a comprehensive set of field notes were also used to supplement the interviews. These notes were collected through my personal involvement as a participant observer during public meetings.

Table 1. Typology of environmental planning case studies in the Rouge River watershed highlighting three distinct ways in which civil society actors utilized science to support their conservation narrative

The identification of expertise and utilization of scientific reports	The production of their own scientific reports	The practice and hands-on application of science
Civil society groups identified and used existing scientific studies and publications to support their position	Civil society groups authored and published their own scientific reports and disseminated their results	Civil society groups drew upon scientific expertise and best practices to validate their actions and goals
Beare Road Landfill expansion (1975–1990) SRVS argues that the Rouge Valley's natural heritage is ecologically sensitive, and thus worthy of protection. The group examines government published research and planning studies, some dating back to the early twentieth century, that highlight the biological diversity and unique geology found in the watershed. SRVS makes special note that the valley contains regionally rare Carolinian forests, and several other rare species like the Redside Dace, a species protected by the Ontario's *Endangered Species Act* (2007)	Metro East Transportation Corridor (1980–1990) SRVS opposes plans by Ontario's MTO for a new expressway claiming that the infrastructure development would result in both short- and long-term negative impacts to the valley. The group counters the proposal by publishing its own planning and growth management study titled the LAARLE report. The report included input from planners, engineers, and ecologists, and was disseminated throughout the community	Reclamation of the Beare Road Landfill (2003–2010) Decades after the closing of the landfill, FRW initiates a multi-year plan to reclaim and rehabilitate the adjacent site into a wetland. FRW facilitates input from a wide variety of expertise and employs best practices to recreate ecologically viable habitats consisting of permanent and seasonal ponds. Monitoring plans are initiated with the cooperation of other civil society groups with an effort to document the changing biodiversity and ecological integrity of the site
Centennial Swamp development (1983–1986) Civil society groups argued that the swamp contained rare flora and fauna. Residents sought support from NGOs and referenced the commentary of scientific experts, notably from the Toronto Zoo and the Federation of Ontario Naturalists to back their claims that the wetland was unique to Scarborough and thus warranted protection	YDSS expansion (2000–present) FRW solicited third-party expertise to produce their own hydrogeology reports and presented their results to elected officials to counter the claims of York Region and the TRCA. The group released several stream monitoring studies and surveys documenting the environmental impacts of the construction	Creation of the Reesor Wetland (2007–present) Building on the success of the Beare wetland, FRW submits proposals to the RPA to convert an unused agricultural field into additional wetland habitat. The project is ongoing, however, monitoring initiatives have already begun and include extensive citizen participation
DRAP and its addition to the Greenbelt (2000–2006)	Development impacts on the Morningside Tributary (2001–2006)	Stream monitoring and biodiversity surveys by Citizen Scientists throughout the watershed (2001–present)
FRW and the RDGC argued that obtaining formal protection for the agricultural preserve presented a significant opportunity to establish the Rouge Park as an ecological link bridging Lake Ontario, the Oak Ridges Moraine, and Ontario's newly established Greenbelt	FRW observed that the stream contained a population of Redside Dace. The group initiated a community-based monitoring programme, to monitor changes in the watercourse and further committed to publicizing all the data, observations, and results it collected at public meetings	Established in 2001, Citizen Scientists initiate detailed stream and habitat monitoring throughout the watershed. In addition, the organization has provided its volunteers with provincially recognized certification through the Ontario Stream Assessment Protocol (OSAP)

The Identification of Expertise and Utilization of Scientific Reports

First, civil society groups were successful in identifying and utilizing existing science and experts. As stated earlier, the fight to protect the valley from development began in the mid-1970s with the formation of SRVS. The group was concerned over the potential impacts of several developments and other changes in land use in the watershed. However, one particular proposal, the expansion of the Beare Road Landfill, galvanized local residents and served as the catalyst for SRVS to formalize their opposition. The 80.5-ha landfill was opened in 1968 and was scheduled to close in 1983, but a plan by Metro Toronto to expand the site in order to extend its operating life was vigorously opposed by SRVS. The landfill continued to receive waste until 1988 and the expansion plans continued into late 1980s, but was eventually abandoned with the announcement of the Rouge Park in 1990. SRVS interviewees state that in order to counter expansion plans the group researched and referenced government studies some dating back to the 1930s that profiled and examined the natural history of the valley. These documents were mostly authored by the MNR and provincial conservation authorities and served a critical role in highlighting the ecology of the valley.

One prominent document used by SRVS was the *Rouge-Duffins-Highland-Petticoat conservation report* (1950), which represented the first comprehensive planning study laying out the plans for growth of the area and highlighted areas that should remain undeveloped. A follow-up publication, titled *Report on the conservation of the Rouge Valley, Duffin's Creek, Highland Creek and Petticoat Creek* (1956), further reinforced the need for conservation and concluded that a large portion of the valley required formal protection based on both their natural and cultural landscape features and to further ensure public safety during seasonal floods.

SRVS member Lois James explained that 'the *Rouge-Duffins-Highland-Petticoat Conservation Report* was simply the most useful plan as it showed us why protecting the Rouge was important' (personal communication, August 10, 2010). She explained that having scientific evidence produced by official government agencies validated the group's claims and was vital when deliberating with elected officials. The group believed that those scientific arguments, grounded in nature and the ecology of the watershed, were most easily understood and accepted by both the media and the public. Thus, it built its case on the ecological significance of the Rouge by promoting and imagining the landscape as a potential 'ecological bridge' that would connect Lake Ontario to the Oak Ridges Moraine (Lois James, personal communication, August 10, 2010). The group backed their idea with several MNR studies showing the watershed was distinctive since it contained unique geology, Carolinian forests, and regionally rare species. These reports were critical in validating SRVS's claims to their community and became a dominant theme by hundreds of citizens protesting and demonstrating in the lead up to several key Scarborough Council meetings in the fall of 1987 when key planning/growth decisions were to be made (James, 1987; Robb et al., 2014).

In the 1983 Centennial Swamp case study, Scarborough developers required the draining and filling of a local wetland in order to build a subdivision of single-family housing. In this planning issue several local and regional civil society groups formed a coalition opposing the development, which included, SRVS, Federation of Ontario Naturalists (now Ontario Nature), Toronto Zoo, Nature Conservancy of Canada, and WWF Canada. From the onset, the development was

opposed by the coalition and many of them presented their concerns during numerous public meetings. The groups argued that the site represented an opportunity to preserve an ecosystem that would be considered unique for Scarborough, and future uses could incorporate an outdoor ecology/education centre. Despite a last minute proposition to buy the land outright by the Nature Conservancy of Canada, the wetland was eventually drained, filled in, and developed.

More recently, civil society groups were also involved in negotiations to include the Duffins–Rouge Agricultural Preserve (DRAP) to Ontario's Greenbelt. The DRAP is located east of Toronto in the Regional Municipality of Durham and contains approximately 3000 ha that was originally expropriated for development for the proposed Pickering Airport. In 2000, Friends of the Rouge Watershed (FRW) and the Rouge–Duffins Greenspace Coalition (RDGC) lobbied elected officials to establish formal protection for the preserve. FRW interviewees explain that during the early to the mid-2000s there was a heightened regional awareness of environmental issues because of a political shift and change in provincial governments, which culminated in the establishment of key environmental legislation. During this period the province was able to pass the *Oak Ridges Moraine Conservation Act* (2001), *Greenbelt Act* (2005), and the *Places to Grow Act* (2005). Interviewees from RDGC believed that ecologically based arguments (i.e. protecting the biodiversity) that they used were most significant in that they mirrored those that were being espoused for the protection of the moraine and the Greenbelt. Namely, that adding the DRAP to the Greenbelt represented a once in a lifetime opportunity to permanently expand and protect a massive swath of greenspace in southern Ontario. The campaign included the publication of several scientific reports and accompanying media releases. After years of lobbying to the RPA and other provincial agencies, the province enacted Bill 16 to restore the agricultural easements on the DRAP. In the end, the legislation was able to provide protection of the greenspace despite continuous attempts to develop these lands.

The Production of Their Own Scientific Reports

The second manner in which civil society groups enforced a conservation narrative was by authoring and disseminating their own ecology and planning reports. Several groups found key support by partnering with other already established environmental NGOs and this sharing of expertise enabled civil society to broaden the distribution of their ideas and ultimately expanded their volunteer and donor base.

One example can be witnessed in the once proposed Metro East Transportation Corridor. The proposal by the Ontario Ministry of Transportation (MTO) consisted of a major north–south expressway that would have necessitated the construction of several overpasses spanning the Rouge Valley (Abbate, 1985). In order to support its case, SRVS solicited its own expertise and published its own report countering several aspects of the proposal. Despite financial challenges of acquiring the professional/technical experts, the group managed to find volunteers with planning and engineering expertise within their own community to produce its own planning report. As a result, SRVS published the 'LAARLE Report' (Limits Access Arterial Road Lane Equivalent) with the main goal of challenging MTO's growth projections for Scarborough and thus the requirement for a new expressway. The 25-page report included detailed maps, and corresponding data from existing government publications from the

Toronto and Region Conservation Authority (TRCA) and the MNR. The report highlighted several transportation growth scenarios and also included material from Scarborough's own planning documents. Producing the LAARLE Report served two goals. First, it raised important questions about how growth and infrastructure development could be envisioned by Scarborough, Metro, and the province. It also shed light on the short- and long-term economic and ecological impacts that a large infrastructure development could have on the watershed. Second, the report helped set the tone and validate the position of SRVS to the community and Scarborough's elected officials. Producing the report legitimized SRVS and proved to their critics that they could assemble the technical expertise to back their claims. Interestingly, some of the proposed buffers/boundaries surrounding several natural areas in the valley, which were highlighted by SRVS in their LAARLE report, were eventually included into early drafts of Scarborough's Official Plan. More importantly, the LAARLE report concretized the role and expertise of planners, ecologists, and engineers throughout this municipal policy debate. This issue shows how experts came to the forefront of rulemaking in that civil society utilized science to counter and provide alternative options to the MTO proposal, and in this manner science was fundamental in the conservation narrative.

In another case study, the York Durham Sewer System (YDSS) expansion also shows how civil society countered municipal plans with their own science. The YDSS, also known as the 'Big Pipe' is a sewer system located in the northern GTA that eventually ends up at a sewage treatment plant located in the Region of Durham. Several portions of the sewer cross the Rouge watershed and its expansion required the pumping up of groundwater to enable its safe construction. A coalition of civil society groups spearheaded by FRW raised concern over the vast amount of groundwater that was being pumped up and released into adjacent streams near construction sites. FRW claimed that the dewatering was causing local wells to dry up, and that the groundwater released into several tributaries of the Rouge were causing destructive impacts due to the cold temperature and the concentration of pollutants. The group solicited their own hydrogeology expert and produced several technical bulletins to support their observations. Despite several attempts, FRW was unsuccessful in securing permission from the RPA to let their expert present the findings during any public meetings, and construction of the YDSS is ongoing (Macaraig & Sandberg, 2009).

In the case of the Morningside Tributary, development plans by the Region of York called for significant channelling and diversion of a small stream located in the Rouge Park. FRW opposed the stream re-alignment, based on their belief that it would cause significant long-term damage to riparian habitat. FRW claimed that the stream contained viable populations of Redside Dace (*Clinostomus elongates*), a colourful coldwater minnow classified as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and protected by the provincial *Endangered Species Act* (2007). The claim was eventually confirmed by the TRCA and the Federal Department of Fisheries. FRW immediately began a community-based monitoring programme of the stream, and published their conclusions in several reports. Despite the positive identification of Redside Dace, the TRCA permitted the diversion over a period of 16 months. During this period FRW continued its monitoring and concluded that the construction resulted in several major negative impacts to the stream.

The Practice and Hands-on Application of Science

A third way in which civil society upheld and validated the significance of scientific expertise was through their hands-on involvement in improving the ecological integrity of the watershed. These groups working in the watershed take part in a variety of activities that include both small- and large-scale ecological restoration and monitoring initiatives. After the park's opening, some of SRVS's members created new environmental groups or became involved with others, and this increase in the number of civil society organizations helped create awareness and publicize the greenspace. In the decade after the opening, numerous organizations were established, some of which are FRW; Citizen Scientists; 10,000 Trees for the Rouge; Rouge Valley Naturalists; and Ontario Streams. This network of like-minded organizations remains active and has partnered with the RPA and other government agencies on projects such as ecological monitoring; tree, shrub and wildflower plantings; habitat restoration; and even environmental education and visitor engagement. Interviewees state that the data collected and observations reported are used both internally to help inform their own individual efforts and also the work done by others. Interestingly, these data are regularly shared with Rouge Park staff and are presented and made public during RPA meetings.

One group, FRW, has promoted the merits of citizen-led conservation programmes and has initiated several projects with the goal of improving ecological integrity. One noteworthy achievement is the reclamation and eventual rehabilitation of the Beare Road Landfill, eventually leading to the creation of the Beare Wetland. After the closure of the landfill, FRW submitted a multi-year proposal to the RPA to reforest and create a wetland at the site. In addition, FRW coordinated several university-affiliated projects to document changes to the biodiversity. The monitoring studies reveal that more than 100 native flora and fauna species have become established at the site. More recently and following the success of the Beare Wetland, FRW submitted another multi-year plan to rehabilitate/transform former agricultural land on the Reesor Farm into a new wetland. Work is currently ongoing and like the Beare Wetland case study, the project incorporates high levels of volunteer involvement and citizen-led monitoring initiatives.

Another group, 10,000 Trees for the Rouge, has also played a significant role in protecting and increasing the biodiversity though its coordination of a large Earth Day planting event, which draws over 1000 residents. The group was established in 1989 during a period when the future of the valley was still being debated, and the organization's primary goal was to restore habitats with a special emphasis on the establishment of naturalized links and wildlife corridors. Through their efforts the organization has helped reforest several hectares throughout the watershed, and has also started yearly maintenance and monitoring programmes of their former planting sites.

A final example of a group that has placed a focus on the role of ecological expertise is Citizen Scientists, whose activities include stream and habitat monitoring. Notably, the group has taken an additional step of providing its volunteers with provincial certification through the Ontario Stream Assessment Protocol (OSAP), which is offered by the MNR. The OSAP is a series of standardized assessment methodologies used to help with the identification of fish populations, appropriate habitat, and benthic macro invertebrates in streams. The benefits of certification are that it provides standardized methods that ensure repeatability and provides valu-

able baseline data on the overall health of the watershed (Stanfield, 2007). Having provincial certification validates and lends credence to the data and observations gathered and ultimately play a significant role in legitimizing the results and thus support the conservation efforts of the many organizations working in the watershed. On a broader level, this type of citizen science can provide a glimpse into how environmental policy decisions may play out on the ground.

This high level of civil society involvement has been mostly enabled through the governance scheme and structure of the RPA and through its funding of various programmes. These funds to improve the ecological integrity have served a pivotal role in establishing the broader discourse of science within the RPA itself and its civil society partners. This relationship and sharing of data have resulted in several scientific bulletins and reports that have been made available to the public. Some of these reports have gained the attention from academia and have resulted in new collaborations for research in the watershed between civil society and post-secondary institutions. As the primary source of funding, the RPA played a significant role in how the public views and values the greenspace. By funding the groups working on ecological integrity, the RPA builds credibility 'indirectly' for its civil society partners, and in doing so greatly facilitates the role of experts.

This typology of case studies indicates that when the RPA and its civil society partners place a deliberate focus on the ecology of the park, it has the potential to provide an ardent rallying point for elected officials, the broader public, and other civil society organizations to become involved. The actions of civil society ultimately serve to enable the participation of others while facilitating other participatory processes. On a broader scale, this study echoes some of the findings of Sorensen and Sagaris's (2010) work examining the importance of having enduring civil society organizations that are engaged and committed to long-term projects. Specifically, the participation and creation of this network of groups may serve as a learned behaviour or model for others and can help facilitate the development of civil society groups with institutional memory and self-governance capacity. New groups see older ones in action, build on their previous work, and emulate their efforts and take on new challenges and activities. Although these observations may prove difficult to quantify, in the Rouge Park, there is a clear synergism between several groups working in the park. These organizations draw from a similar set of volunteers, resources, and even third-party scientific expertise, and such cooperation undoubtedly elevates the level of real and imagined stewardship on various levels. This research indicates that these groups have embodied a clear stewardship role and have become experts at the end of this process. Science was important to establish the park and it figures prominently in its current and future protection. In this respect, science, its methods and methodologies, becomes more than just a mere component of the policy formation process, but it also serves to legitimize both authority and power.

A Discourse of Conservation

In the case studies examined in the typology, the claims made by civil society illustrate the importance of scientific evidence in conservation movements. Claims by mainstream environmental organizations are often picked up and reported on by the media, and thus become a part of the popular discourse. It is well accepted that the media plays a role in influencing public opinion, and ongoing coverage of

political events and controversies influences how the public thinks about certain issues since it plays a crucial role in helping individuals to construct their opinions (Cohen, 1963; Lippman, 1922).

Although a discourse/content analysis of media coverage was not a part of this research, the construction and facilitation of narratives in the broader discourse has clearly played a role in the establishment and protection of the Rouge Park. Information collected through field notes, RPA meetings, and other public symposia, combined with interview data, point to a theme of conservation based on ecological arguments first and foremost. Specifically, the call for conservation began with recognition that nature found in the watershed was distinctive for both its biological and intrinsic attributes.

Research by Edey, Seasons, and Whitelaw (2006) examining the success of the conservation agenda in Ontario's Oak Ridges Moraine planning issue supports some of the observations in this case study. Particularly, the significant role civil society actors can have in framing an issue with respect to policy deliberations. Although the movement to protect the Rouge precedes the Oak Ridges Moraine case study by several years, there are some notable similarities. In both cases, a conservation narrative was centred and built on scientific studies examining particular biological and ecological features of the local environs. In the moraine planning issue, civil society groups brought attention to the once obscure Jefferson Salamander (*Ambystoma jeffersonianum*), a threatened species protected by Ontario's *Endangered Species Act*, whose range was threatened by development. The plight of the salamander became a regular feature in news stories and it eventually aided in the overall protection of the wide swaths of greenspaces in Ontario with the enactment of the *Oak Ridges Moraine Conservation Act/Plan* and the even more comprehensive *Greenbelt Act* (Macaraig & Sandberg, 2009; McElhinny, 2006).

In the Rouge case study, civil society highlighted the importance of preserving the regionally rare Carolinian forests and wildlife such as the Redside Dace. Preserving nature for 'nature sake' was a strong and keynote argument relied on and espoused continuously by all groups interviewed. Two groups in particular, SRVS and FRW, both imagined the watershed in two fundamental ways. First, they viewed the entire watershed as an environmentally sensitive landform. They invoked the idea that the river was distinctive and the surrounding habitats were ecologically important. Lois James of SRVS explained that residents believed that the biodiversity and overall 'wildness' was not just an observation but also one that was supported by scientific studies published by the province. Second, they considered the landform valuable for its potential to serve as a natural barrier to the rapidly developing fringe of Metro Toronto. James explains, that since most of the valley was not suitable for development due to flooding and soil erosion, her group campaigned that protecting it would help counter the urban development plans of Metro Toronto officials who viewed Scarborough as the 'last frontier' for development (Allemang, 1984; Page, 1987a, 1987b; Stein, 1987).

Discussion: Science as a Strategy for Civil Society

It has been recognized that civil society actors represent an important stakeholder in managing local-level urban change (Douglass & Friedmann, 1998; Hall, 1995; Innes & Booher, 2004; Sorensen, Koizumi, & Miyamoto, 2009) Likewise, in disciplines such as urban planning, policy studies, and protected area management

there is a long history that recognizes civil society participation as a key facet of achieving robust and balanced policy. However, both civil society and municipal governments may typically hold less power and draw from a limited set of resources as compared to the upper levels of government or other private special interests. This is especially true in Canada's federal system where provincial governments exert strong influence over their municipal counterparts (Sancton, 2005). For such reasons, it is important to understand the processes and specific circumstances/factors that facilitate the success of local-level social movements to achieve their goal in shaping their communities.

In environmental controversies, the manner in which an issue is framed can play a significant role in the end result. Competing interests will inevitably select, develop, and facilitate the most suitable and favourable narrative to support their cause. Stakeholders will utilize various strategies and invoke different arguments in order to explain their position and bring understanding to the issue. The lay public will rely on science to provide facts in order to rationalize their understanding of an issue, and for most, it represents an objective voice throughout the policy process. This research shows that locally based movements (i.e. the involvement of local civil society groups) can play a pivotal factor in policy deliberations. However, the manner in which these organizations choose to frame both their position and the issue at-large is critical. In the case studies examined, civil society employed and invoked ecologically based arguments from the onset, and thus was mostly successful in setting the overall policy agenda, and in broader terms this grounded the conservation narrative. Furthermore this focus on ecology put the onus on competing stakeholders to advance and advocate their own science-based criteria for why growth and development should be permitted. This is relevant because it has the potential to greatly shape the opinion of both the public and elected officials. However, what is less studied and understood are the immediate and long-term effects of relying heavily on scientific experts and on the actions of other stakeholders operating at larger scales. This case study indicates that within the context of a local-level conservation movement, employing narratives grounded in science presents both challenges and opportunities.

First, civil society organizations utilizing ecologically based arguments are likely to be called upon to produce their own expertise, not only to validate their own views but also to counter, refute, and provide alternatives to competing positions. This study shows that civil society groups working in the watershed were mostly successful on all these fronts. These groups made use of and referenced publications from provincial/federal agencies and, when required, were able to solicit and produce alternate plans and visions countering those of Scarborough, Metro Toronto, and the province. However, this competition between competing scientific experts can also present tangible hurdles for civil society who in most instances have limited resources to draw on and rely heavily on volunteerism. Obtaining professional expertise can be cost prohibitive especially when it is required repeatedly throughout a policy campaign lasting several years. This expense can serve as a major pitfall for civil society working to gain the attention of both the public and the government. Moreover, following this path presents no guarantees and may prove ineffective as competing stakeholders may simply counter civil society's claims with their own expert(s) and studies.

Second, when civil society groups make use of scientific arguments to ground their case for conservation, citizen science may serve as a powerful, yet 'low

barrier' for inclusion in policy deliberations. Specifically, this research shows that despite the sometimes-high monetary costs of soliciting scientific expertise, in relative terms the actions, scientific data and broader results produced by these groups are completed at a low cost. Groups working on improving the ecological integrity of the watershed have been successful in promoting their initiatives all within a wider framework of 'improving the ecology' for the betterment of the park. This case study shows that science can also serve as a robust long-term mobilization strategy for civil society, especially when the public/volunteers are involved in practical science-based stewardship activities. For example, monitoring either biotic/abiotic or qualitative/quantitative ecological parameters is an activity that can be done at relatively low cost, requires minimal training for volunteers, and can be conducted year round. Considering the low cost of entry to collect such data, the results produced from it may serve to bring attention to and document changes that are occurring in the environment and perhaps more importantly justify a policy response.

Simply put, when residents take part in local citizen science projects, it has the potential to increase levels of community stewardship over the resource. This observation is supported through this case study when examining the relative successes of the many civil society groups who are able to leverage the work hours of thousands of volunteers into tangible stewardship goals. Interviewees from FRW and 10,000 Trees for the Rouge support this observation, and have clearly stated that their original motivations were conceived and grounded in improving ecological integrity, but has also developed into a much larger goal of strengthening and empowering the communities they serve.

Conclusions

In terms of a strategic action plan for civil society, this research shows that citizen science presents a 'high value tactic/narrative' and is a formidable 'legitimizing agent'. Particularly, the observations collected and the knowledge created through the practical application of science show its significance as a unique discursive strategy. By taking part in citizen-based projects spanning two decades, civil society helped legitimize both themselves and their cause. They themselves became the experts and strengthened their credibility. Moreover, by continually reporting their findings at public meetings and publishing reports, they have succeeded in building and legitimizing a long-term conservation narrative. These activities have provided a self-reinforcing strategy for volunteers, civil society as a whole, and the movement's current and future trajectory. A key achievement of this conservation movement is that it has helped establish a broad coalition of like-minded civil society groups that have shown high levels of independence, networking skills, and self-governing capacity. This research also reveals that neighbourhood scale activism has given rise to important spaces for civil society to engage and challenge the growth aspirations of local and regional governments, and through such actions civil society has fundamentally influenced the greenspace planning of the eastern GTA.

On the other hand, when stakeholders place a focus on ecology first and foremost, it may ultimately mask other equally important human, existential, economic, and socio-cultural dimensions of environmental controversies. Research by Sandilands (2013) examining human–nature relations in the Rouge River Valley has also argued that both park managers and the community at large should consider other biopolitical discourses such as invasive species management and

further challenge the connection between nature, nation, and what the park's identity should be. The author states that, 'applying the mandate of ecological integrity would not only be very difficult, if not downright impossible, but it would also be astronomically expensive' (Sandilands, 2013, p. 96). In these situations, qualitative ideas on 'how' or 'when' should development occur, may be put aside and eventually dismissed when science becomes the dominant frame of rulemaking. Through this narrow discourse, policy-makers may become entangled with politicking and calculating various risk scenarios and debating whether or not appropriate technology can mitigate any environmental consequences.

Science represents merely one part of the broader mobilization strategy employed by civil society; however, it may ultimately serve to be the most crucial. In this study, having scientific evidence, either self-published or published by a government agency, proved to be critical factor for residents and the conservation narrative during the struggle to establish the park, and also in the decade after when land was being added to the greenspace. After the park's establishment, the conservation narrative was ultimately sustained and further advanced by new organizations focused on improving the ecological integrity of the watershed. Overall, civil society groups were successful in promoting and publicizing their particular vision of how and why, the valley and its accompanying wildlife merited protection.

This research shows that for community-level environmental controversies, science represents a powerful tool for civil society in the planning and land management regime in Ontario. Clearly, governments and their related agencies play a significant role in establishing and promoting science as a neutral arbiter through their ability to fund agencies that initiate and complete scientific studies. The publication of government sponsored science beginning in the 1950s proved to be truly useful for citizens in that they were able to use these studies to support their conservation goals. Furthermore, in the same manner that the lay public recognizes the importance of facts, civil society can build and facilitate the significance of science through their actions and political self-determination. All things considered, despite formidable growth and development pressures of the GTA, the case study of the Rouge watershed tells a story of how a community-level conservation movement will lead to the eventual establishment of the Rouge National Urban Park and the protection of a significant amount of greenspace in Canada's largest urbanized region.

Acknowledgements

I would like to thank my interviewees who shared their many experiences working in the Rouge River watershed. Thanks to Richard Scott of Parks Canada for his help with the map. Finally, I must thank this journal, the editors, and the two anonymous referees for their insightful and constructive feedback.

Note

1. The RPA transferred its management duties to the Toronto and Region Conservation Authority in 2012, as a result of plans to convert the greenspace into the Rouge National Urban Park. The former RPA consists of one representative from each of the following groups; the federal government, the government of Ontario, Regional Municipality of Durham, Regional Municipality of York, Town of Markham, City of Pickering, Town of Richmond Hill, City of Toronto, Town of Whitchurch-Stouffville, Toronto and Region Conservation Authority, Toronto Zoo, Waterfront Regeneration Trust Corporation, and Save the Rouge Valley System.

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