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Community forestry research in Canada: A bibliometric perspective

Ryan Bullock *, Julia Lawler

Department of Environmental Studies & Sciences, Centre for Forest Interdisciplinary Research, The University of Winnipeg, 115 Portage Avenue, Winnipeg, Manitoba R3B 2E9, Canada

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ABSTRACT

A bibliometric analysis of community forestry research outputs in Canada was undertaken to 1) better understand the current status as well as spatial and temporal trends in research published in peer-reviewed journals, 2) identify gaps in the research literature, and 3) provide baseline data to inform future research. For each publication, information on several core metrics was gathered, for example: (i) year of publication, (ii) number of authors, (iii) author affiliation, (iv) gender and role, (v) journal title, (vi) citation count and (vii) keywords. Temporal and spatial trends were analysed to detect periods of heightened activity and geographical focus. Using a systematic and comprehensive approach we identified 85 papers published in peer-reviewed journals between 1935 and 2014. Research output during WWII and 1990 onwards corresponds with the implementation of provincial policy and programs initiated for conservation, economic development, and to resolve social unrest. Notably, most papers analysed originated from social science research, particularly geography, and not forestry or the biophysical sciences presenting a clear disciplinary gap. Findings portray the temporal, spatial, and thematic evolution of community forestry research and policy in Canada.

1. Introduction: community forestry in Canada

Community forestry is a globally established approach to managing publically accessible forests in order to benefit local constituents (Charnley and Poe, 2007; Maryudi et al., 2012; Pagdee et al., 2006; Robson, 2014; Teitelbaum, 2014). In Canada, as in many countries throughout the world, this has entailed devolving government control of forest lands and resources to citizens and local groups, as well as establishing new government programs, policies, legislation, organizations, and information to guide and support implementation. While the concept and practice of community forestry is not new in Canada, since about the 1990s practice and enabling policy have steadily evolved (Bullock and Hanna, 2012). For example, provincial policy changes have been made in the provinces of British Columbia, Quebec, Ontario, and most recently, Nova Scotia, to increase local and Aboriginal involvement in the forest sector (Benner et al., 2014; MacLellan and Duinker, 2012; Teitelbaum and Bullock, 2012). Such reforms have unfolded alongside lively public debates as well as a growing body of academic research intended to probe, influence and inform community forestry policy and practice at different levels of scale.

Gaining access to required information—whether through dispersed sources or via specialized databases of complete and organized information—remains a key challenge for community forestry researchers, practitioners, and policy makers (Bullock and Hanna, 2012; Bullock et al., 2009; Thomson, 2005). As a starting point, no comprehensive and systematic inventory of published community forestry research has ever been published.[1] Existing literature reviews of Canadian research are also now outdated (e.g. Duinker et al., 1994). Teitelbaum et al. (2006) observed an overemphasis of a select few "recycled" cases that have been revisited by researchers and analysts, even though a broader literature and portfolio of expertise exists. There is no complete record of previous work that could be usefully accessed to inform research during what is a significant period of forest policy change and debate in Canada (Haley and Nelson, 2007; Kant, 2009). Just as failing to reach out beyond conventional interests can limit the knowledge that gets incorporated into community forestry decision making (Reed and McIlveen, 2006), lack of attention and access to the full range of research could be constraining professional and public perspectives on community forestry in Canada and similar regions.

There is a need to inventory and scrutinize community forestry research outputs to address a significant void in the forest policy research literature. There are benefits for researchers, policy makers and practitioners in both Canada and internationally from a review of Canada's community forestry literature. Bibliometrics offers an appropriate analytical method to gauge research outputs. The main objectives of this study are to

* Corresponding author.

[1] Some bibliographies have been compiled however they are not widely known or readily available (e.g., Sherry et al., 2003).

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- better understand the status and trends of research and professional views published in journals;
- identify gaps in the community forestry literature, and;
- provide baseline data to inform future research.

The remaining sections of the paper are dedicated to 1) situating our study within the broader literature and outlining the methods we used for a bibliometric analysis of community forestry research, 2) presenting results from our analysis of a literature spanning 80 years, and 3) identifying research gaps and opportunities in the context of Canada's evolving forest politics.

2. Bibliometrics and community forestry research

The term 'bibliometrics' was first used in 1969 by Alan Pritchard to describe a method for analysing written information (Lawani, 1981). Bibliometric approaches to research evaluation have since become established and offer a useful tool to survey trends in entire disciplines as well as thematic areas of research. For example, bibliometric studies have been used to ambitiously investigate the thematic focus of entire fields, such as ecological economics (Castro e Silva and Teixeira, 2011), ecology (Neff and Corley, 2009) and, more specifically, forest ecology (Song and Zhao, 2013). Others have undertaken bibliometric analyses of thematic research areas such as green-roof development (Blank et al., 2013) and biodiversity (Liu et al., 2011). Leipold (2014) identified broad trends and gaps in international forest-related discourse research to note differences in methods and content.

Related to the current research, bibliometrics have been applied to forest research networks. Klenk et al. (2010) tracked the impact of the Sustainable Forest Management Network (SFMN) by assessing research outputs and citations. Their main findings demonstrated the areas of highest research output for the SFMN (i.e., economics, sociology, political science, and law), the significant influence of SFMN research in the development of the field of Aboriginal forestry, and that social science research funded by the SFMN achieved citation counts in keeping with international trends. Bonnell (2012) also used a bibliometrics approach to examine research trends within the Canadian Model Forest Network (CMFN). He found an increased thematic focus on the boreal, wildlife, and forest management within Model Forest research, as well as an overall focus on natural science research. Bonnell (2012) also noted a growing trend in national collaborative research by tracking relationships among researchers. As indicated by previous research, a main advantage of bibliometrics is the ability to select particular aspects of research outputs to assess and track over time, making it an ideal approach for analysing the status, gaps, and trends in a given area of research.

Bibliometrics research uses specific measures to focus on citation and impact factor evaluations, as well as to detect changes and trends in the conduct and content of research (Klenk et al., 2010; Liu et al., 2011). The most common metric is *year of publication*, which indicates changes in research activity, interest, and even funding availability as a field of research evolves (Blank et al., 2013; Hu et al., 2010; Klenk et al., 2010; Liu et al., 2011). The number of articles published, themes addressed, and questions explored through time may reflect developments in government policy, non-governmental initiatives, or other relevant areas. Observing trends in the *number of authors* on publications, whether papers are collaboratively (across geographical and organizational scales) or individually authored, points to the mode of research and level of collegial involvement (Nederhof, 2006). Collaborative research is frequently associated with the "team oriented" approach of the natural sciences, while an individual or "single scholar" approach to research is more characteristic of the social sciences (Klenk et al., 2010; Nederhof, 2006). When authorship is coupled with information about affiliations, this can also speak to the degree of interdisciplinarity on a research team and number of researchers dedicated to the research area. The *affiliation* of authors is a metric frequently analysed at regional, national, and international scales (Zhang et al., 2010). Affiliation can indicate the number and types of institutions involved in research output, geographic regions of focus, and emerging authorship patterns. Affiliation also tells something about the researchers as author names and affiliation can, with verification, indicate professional *role* and *gender*. Diversity of *journal titles* can outline the breadth of prospective audiences and readership (Bonnell, 2012). Highly active journals also represent where the research is being directed as well as the leading publication sources or core journals for a field (Hu et al., 2010). *Citation counts* demonstrate the potential influence and impact of research articles (Klenk et al., 2010). *Keywords* provide insight into the evolution of a subject as an "overview of trends" is demonstrated through keyword selection and frequency of use (Leipold, 2014; Liu et al., 2011). Keywords may also be used to predict future research directions (Hu et al., 2010). Likewise, emergent themes can indicate where research is heading, the most prominent research topics, and the breadth of the existing body of research (Bonnell, 2012; Castro e Silva and Teixeira, 2011).

There are also confounding factors, most notably larger changes in societal and professional norms that have taken place over the almost eight decades this study covers. There have been changes in both the format and peer-review process of academic papers. The structure, length, and number of references in articles have grown and the peer-review process itself has slowed down and become more rigorous (Ellison, 2002, 2009). In addition, Persson et al. (2004) note that collaboration, co-authorship, the number of publications and citations have all increased. Of particular relevance to our research, the number of forestry journals has also increased (Malesios and Arabatzis, 2012). Widespread use of the internet now also provides alternative opportunities for knowledge dissemination (i.e., e-publication) (Ellison, 2009; van Raan, 2005). Our findings must be viewed with acknowledgement of the changing context for research. Below, we present how the above measures were applied to analyse community forestry research.

3. Methods

Community forestry articles were collected from ISI Web of Science, EBSCO Academic Premier, and Science Direct. ISI Web of Science is considered to be one of the most comprehensive and extensively used academic databases for literature reviews and research analysis (Cañas-Guerrero et al., 2013; Klenk et al., 2010; Liu et al., 2011; Nederhof, 2006). However, to maximize survey comprehensiveness, additional searches were conducted using EBSCO Academic Premier and Science Direct. Search terms were selected in accordance with previous bibliometric studies of a similar nature, accounting for plural and hyphenated phrases as well as use of acronyms. Search terms included: "community fores*", "county fores*", "town fores*", "ecofores*", "community-based resource-management", "community-based environmental-management", and "municipal fores*", used in combination with "Canada" and the names of Canadian provinces and territories to identify publications that contained these phrases in their titles, keywords, or abstracts. Search terms were selected to account for terminology changes surrounding the community forestry concept over time (Teitelbaum and Bullock, 2012).

A snowball approach was used to collect possible additional articles from the reference lists of searched articles that did not appear in the initial database searches (after Leipold, 2014). In total, 142 articles were found. Search results were sent to leading academic and government community forestry researchers to confirm the appropriateness of the articles found and to identify possible omissions. Each article had to satisfy one or more of the following criteria to be included: 1) contain direct references to community forestry in Canada in the title, keywords, or abstract; 2) the study had been undertaken in or was funded by a Canadian community forest, and/or; 3) article content had to explicitly focus on Canadian community forestry concepts and experience.

Based on our searches, eligibility criteria and vetting procedure, 57 articles were dropped from the initial sample. Most articles deemed unsuitable had an international focus. Others discussed concepts related to community forestry principles (e.g. forest industry public advisory committees) but in a different context and without explicitly dealing with community forestry, while others focused on related forms of forest development such as Aboriginal Forestry[2] or private woodlot management. Once papers were fully verified for inclusion, document information based on established core metrics (Section 2) was gathered to produce a robust database (Bonnell, 2012; Klenk et al., 2010). This included the (i) year of publication, (ii) number of authors, (iii) author affiliation, (iv) gender and role, (v) journal titles, (vi) citation counts, and (vii) keywords.

For consistency, citation count data was collected from Google Scholar citation reports due to inconsistent citation numbers reported across databases. Articles where the author affiliation could not be identified were labelled "unknown". As well, for the 41 papers that did not include author-identified keywords (e.g. papers published prior to keyword use as common practice), three keywords were identified based on the title of the article or from keywords provided by the search databases.

In keeping with established bibliometric research this study focuses on papers published in academic journals appearing in major research databases (Blank et al., 2013; Klenk et al., 2010; Liu et al., 2011; Malesios and Arabatzis, 2012). A base assumption of bibliometrics is that important research findings appear in 'serial' periodicals (van Leeuwen, 2004; van Raan, 2003, 2005). Although books, reports, websites, conference proceedings, and other sources provide valuable information on community forestry, journal articles within research databases allow for a thorough systematic search to be conducted.

4. Results and discussion

A total of 85 papers on community forestry in Canada were identified from 1935–2014 coming from 34 journals, 27 of which were peer-reviewed and seven were not peer-reviewed. Given that peer-reviewed journals also publish non-reviewed papers, we manually reviewed journal details and conducted UlrichsWEB Global Serials Directory searches to determine whether each journal and each paper was/was not peer-reviewed. We confirmed that 43 papers were externally peer-reviewed research articles, 21 papers were at least editorially reviewed, and 21 papers were not reviewed (i.e., appeared in non-reviewed publications and were not verifiable as editorially reviewed).

4.1. Publication year

The earliest paper found on community forestry in Canada was published in 1935. Spanning eight decades, there appears to have been two main periods of journal publication activity, 1935 to 1944 and 1986 to 2014 (Fig. 1). After the initial series of publications during period one, there was a gap of 40 years between 1944 and 1985 in which no community forestry articles could be identified. In period two there were five distinct years of increased publication activity, all falling within the last two decades, which included 2007 as the peak year: 1994 (6); 1998 (6); 2002 (7); 2007 (10); and, 2008 (6). When divided by decade, 2006–2015 saw the highest number of publications (37), followed by 1996–2005 (25). The final decade of highest productivity (2006–2015) saw more articles published per year with articles published each year, indicating an increased and steady output overall with fewer peaks. It remains unclear as to why there was such a large gap between the identified major periods of interest in community forestry.

[2] This field of research falls beyond the scope of the current study as it is unique and requires its own focus and treatment. For an authoritative review see Wyatt, 2008.

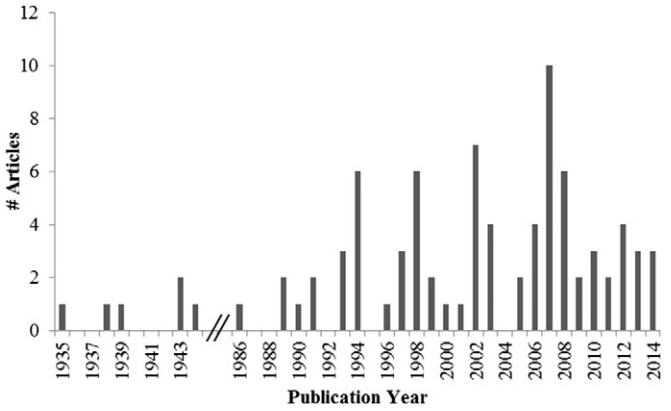

Fig. 1. Number of articles by date of publication.

Periods of increased activity can be explained by the emergence of formal provincial community forest programs and initiatives related to larger social and ecological contextual factors. In particular, research outputs surrounding World War II are linked to the Agreement Forest, County Forest, and Veteran Rehabilitation programs as well as the then new Conservation Authority program in Ontario—all of which were being discussed by foresters and government officials to provide employment to troops returning from overseas (see Wilson, 1943; Auden, 1944; Mitchell and Shrubsole, 1992). There were also concerns for the need to reforest barren agricultural lands in order to conserve soil and water, and community forests were to have a central role.

The increase in research output beginning in 1986 and continuing through the 1990s corresponds with public unrest and introduction of provincial community forestry pilot projects, first in Ontario and shortly thereafter in British Columbia (BC). Formation of the conflict-induced Wendaban Stewardship Authority (est. 1990), Community Forest Pilot Program (est. 1991) and Westwind Stewardship Inc. (est. 1996) in Ontario all generated scholarly attention (e.g., Dunster, 1989; Matakala, 1993; Duinker et al., 1994; Beckley, 1998). One outcome of the "war in the woods" in BC was the introduction of the 1998 provincial Community Forest Pilot Project, which was aimed to increase local management and community participation. This program would see the creation of a new form of tenure specified for community forests—Community Forest Agreements—and both the program and community involvement processes were initially fueled by and garnered scholarly attention (e.g., Burda and M'Gonigle, 1996; Burda et al., 1998), which has continued through until the present day (see Benner et al., 2014; Ambus and Hoberg, 2011; Bullock et al., 2009). In 2007, the year with the highest number of publications, four articles on small forest tenure agreements in BC were published—a direct reflection of policy changes during that time (see Ambus et al., 2007a; Ambus et al., 2007b; Cathro et al., 2007; Tyler et al., 2007).

4.2. Author affiliation

Author affiliation was tracked to determine research output by both institutional and geographical origin. British Columbia and Ontario emerged as research hotspots based on the location of author-affiliated institutions (Figs. 2 and 3). Overall, the top five academic institutions for publication output included: Simon Fraser University (SFU), University of British Columbia (UBC), Lakehead University (LU), University of Northern British Columbia (UNBC), and University of Victoria (UV). These findings are congruent with Benner et al.'s (2014) observation that community forestry in BC has increasingly received national and international attention, and in turn has received more scholarly attention. Private companies also accounted for a notable portion (10) of author affiliations, primarily originating from BC (7), followed by Ontario (1) and New Brunswick (1).

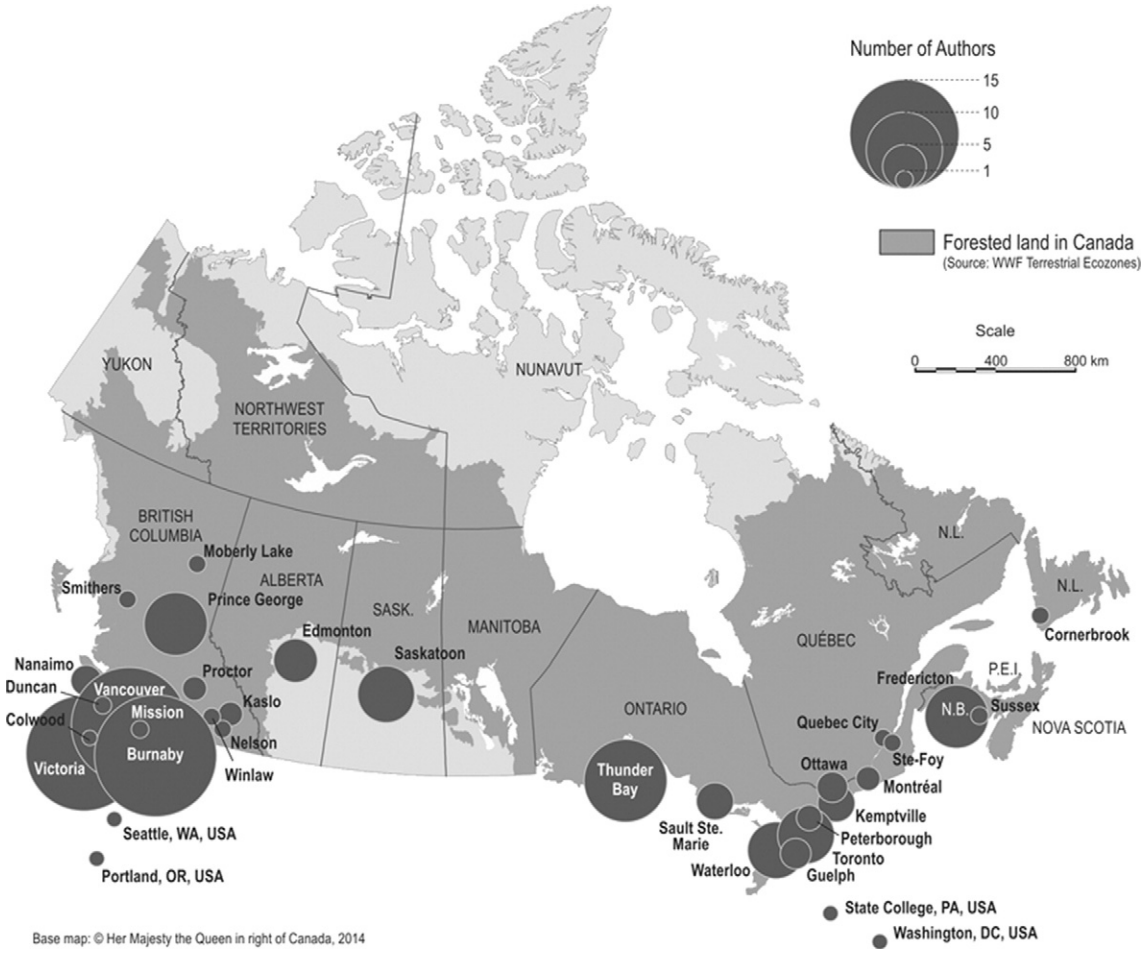

Fig. 2. Total research output by location of author affiliated institution.

Canadian regions absent include the Northwest Territories, Nunavut and the Yukon, and the provinces of Prince Edward Island and Manitoba. Prince Edward Island may be absent due to the small size of the island (5684 km^2) and very high proportion of forests under private ownership (88%) which limit community forestry prospects (PEIDAF, 2014). Conversely, the territories, being located in Canada's far north, do not have a substantial forest industry. This is exemplified by the fact that the combined total value of domestic exports from forestry in the territories was just over $250,000 in 2013 (NRCAN, 2014). While

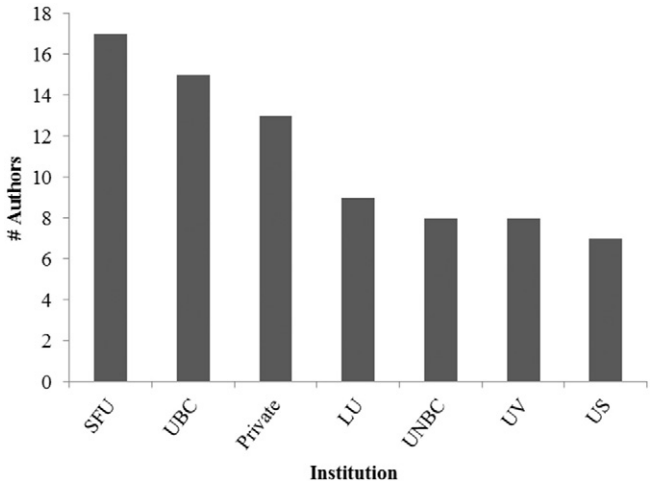

Fig. 3. Number of publications by author affiliated institution.

few articles focus on the Prairie Provinces, authors affiliated with academic institutions such as the University of Saskatchewan (US) and University of Alberta (UA) have contributed to the research. The relative absence of community forestry research and practice in Manitoba has been identified by previous researchers (see Parkins et al., 2013). It is a notable void perhaps given that over half of Manitoba is forested and there are many communities located within the boreal forest that could benefit from increasing "co-management, employment and economic development opportunities", in keeping with provincial forest policy priorities (see Manitoba Conservation, 2002: 6).

Fig. 4 illustrates evolving spatial distributions of research output through time by approximately 10 year periods. When research output is viewed as separate periods it becomes clear that most research was initially coming from Ontario, followed by BC several years after, with increasing numbers of researchers affiliated with organizations around BC and Ontario. Spatial and temporal analysis also indicates the growth of US interest in community forestry in Canada during the last decade, indicating that Canadian experiences are gaining attention from international scholars. Quebec has many community forests, strong university research capacity, and a supporting policy framework, but is less active in community forestry research.

4.3. Authorship, role and gender

Within the dataset of 85 articles, 44 were published by single authors, and 41 were published by two or more authors (to a maximum of four), indicating a close balance of single-author and multi-authored papers. The number of articles with two authors (25) was higher than articles with three (12) or four (4) authors. These findings

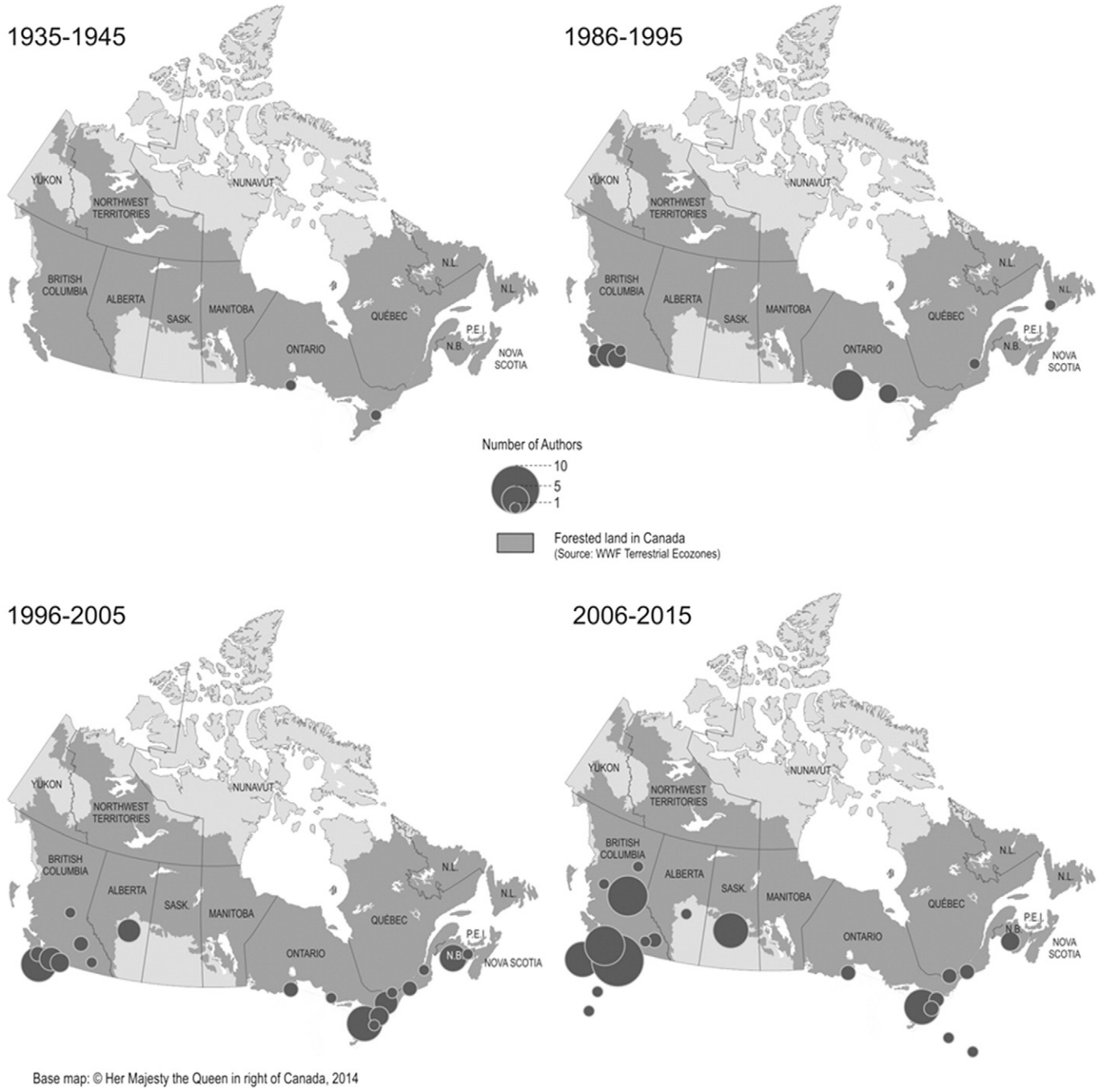

Fig. 4. Main periods of research output by location of author affiliated institution.

show that both team-oriented and single-scholar research is common and indicates the collaborative and interdisciplinary nature of research in this field (Nederhof, 2006). Moreover, the dataset contained 99 individual authors, 23 of which contributed more than one article.

When total authorship is considered by role, a different perspective is gained with respect to research involvement and contribution (Fig. 5). Professors (50) represent the largest author group; however, graduate students (37) comprise the second largest group.[3] Two other groups made notable contributions, consultants and technical advisors (17) and government researchers (13), followed by non-government analysts and representatives (10). Others affiliated with academic and research organizations included postdocs (7), research associates (6) and college instructors (4). Two other authors were classified as "unknown". Authorship by role illustrates a higher level of involvement and leadership provided by post-secondary researchers and teams relative to government, consultants and non-government organizations, and private groups. A lower level of involvement from private forest companies was noted. This could be related to the fact that experimentation with alternative forest tenures has often been met with resistance from conventional interests (Nelson, 2008). It could also indicate that research by forest companies focuses on product, processing and marketing innovation (e.g., either directly or through not-for-profit industry and government sponsored research accelerators such as FP Innovations) whereas public universities and community groups have taken

[3] While it was not possible to fully break out doctoral and master's student authors given data limitations, we could confirm 2 master's and 12 doctoral.

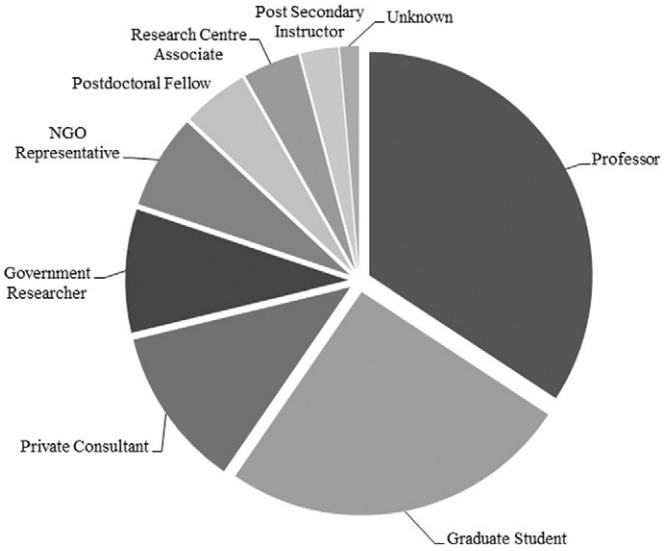

Fig. 5. Authorship by role.

on developing new community-based governance models for sustainably managing Crown forests.

Author gender was determined by given name.[4] Of 97 total authors identified, 62 were male and 36 were female. Male authors led 51 (60%) of the 85 papers analysed, which is roughly proportionate to total gender representation. The number of female authors has also greatly increased overtime since Evelyn Pinkerton (1993) published the first female-authored paper on community forestry in Canada. Female authorship increased from only 2 during the 1986–1995 period, to 14 and 40 in subsequent decades (2006–2015 and 1996–2005, respectively). In addition, three of the seven authors with the highest research output in this field were females, and four of the top 10 cited papers (Section 4.4) were led by female authors, indicating the relative contribution and importance of research contributed by female authors.

4.4. Number of times cited

The most published authors were not necessarily the most impactful when Google Scholar citation counts were taken into account. As well, there was not a clear temporal relationship between the date of publication and the number of times cited, that is, several recent papers were cited more than older papers that have circulated longer. Authors of the top 10 most cited papers (Table 1) are primarily from social science disciplines [i.e., human geography (4), anthropology (2), and sociology (2)] or affiliated with forestry departments and researching the socio-economic aspects of forestry (2). In terms of journal outlet, it is noteworthy that four of the top 10 most cited papers were published in *The Forestry Chronicle*. However, the most cited papers within the top 10 appear in interdisciplinary and international social science journals. The latter point suggests that publishing in international and interdisciplinary journals can increase community forestry research impact by reaching wider and larger audiences. However, it could be argued that Canadian community forestry research might best serve domestic issues, participants, and audiences by being published in national journals.

Citation count data is considered closely linked with number of authors (i.e., more authors, more cites) and journal of publication (i.e., reputation), and highly cited publications and scientists tend to get cited more frequently (Bornmann and Daniel, 2008). We found that the 10 most cited papers were mostly led by established scholars, although student authors (5) and non-academics (2) also contributed to these noted publications.

Our findings appear to contest previous studies (Bonnell, 2012; Klenk et al., 2010; Liu et al., 2011; Nederhof, 2006) that found that collaborative research tends to be cited more frequently, because seven of the 10 most cited papers were single authored, with four being top five most cited. Bornmann and Daniel (2008) demonstrate that smaller speciality fields of research, such as community forestry in Canada, usually draw fewer citations than broader fields. Our findings indicate that indeed six of 10 most cited papers are conceptualized broadly (i.e., framed to address overarching issues using community forestry as an example), which could perhaps increase their appeal.

4.5. Journal

The Forestry Chronicle, published by the well-established Canadian Institute of Forestry, was the main outlet, accounting for just over 30% of articles. This could be due to the Journal's focus on domestic audiences and practitioners. *The Forestry Chronicle* is not a traditional social science journal, though it has increasingly reached beyond forestry, forest economics, and forest science. Given the prominence of social science researchers working on community forestry and higher citation counts garnered in more international and interdisciplinary journals (Section 4.4), other venues might also provide suitable outlets for community forestry research in terms of achieving greater scholarly dissemination and impact. Additionally, *Society and Natural Resources* (8), *Ecoforestry* (6), and the *British Columbia Journal of Ecosystems and Management* (5) were common journal outlets (Table 2). In terms of geographical focus, seven of the 34 journals were explicitly national or regional in scope (e.g., *BC Studies*, *Canadian Geographer*, and *Canadian Journal of Sociology*). That approximately 80% of journals publishing papers on community forestry in Canada have an international focus indicates Canadian community forestry has a presence in international scholarly dialogue. Most journals were associated with the social sciences (e.g., anthropology, human geography, environment resource policy), consequently, there was a distinct lack of articles in natural science journals. If biophysical scientists are doing community forestry research, they are perhaps not identifying it as such or they are not publishing it in peer-reviewed journals—the latter of which seems unlikely. This finding indicates a significant gap as community forestry practice (e.g., silviculture, harvesting methods, endangered species and water management) continues to evolve and there is much to be learned.

4.6. Keywords

A total of 179 unique keywords were identified. Top keywords (i.e., those that appeared 10 or more times) included generic terms such as: “community forestry”, “British Columbia”, “Forest Management”, “Canada”, “Community Forest(s)”, and “Ontario” (Fig. 6). The keywords “community forestry” and “community forest(s)' were used frequently. However, “community forest(s)” appeared first in 1986 and has been used 21 times in total, while “community forestry” appears to be the preferred term, used 38 times (nearly twice as much) since its appearance in 1989. Marshall's (1986) discussion on “community forest licences” was the first appearance of “community forest” within Canadian peer-reviewed journals. Three years later, “community forestry” was used by Roy (1989) to describe practices in Newfoundland, and by Dunster (1989) to explain core concepts in the context of a developed country.

The earliest papers (1935–1945) addressed general forestry issues, reforestation, and wartime service work, specifically in Ontario. This is reflected through the use of “Ontario”, “forestry”, “reforestation”, “relief”, and “forest policy” as keywords during this time. Focus later shifted to key policy areas (e.g., tenure and land claims) and prominent concepts (e.g., participation and sustainability). The frequent occurrence of the keywords “British Columbia” and “Ontario” also demonstrate

[4] We acknowledge that determining gender by given name has important limitations. The nature of the study did not permit contacting authors directly for self-identification. Given names provide a very general assessment of authorship by gender.

Table 1
Top 10 most cited articles.

# cites	Articles
135	Bradshaw, B. 2003. Questioning the credibility and capacity of community-based resource management. Canadian Geographer, 47(2), 137–150.
128	McCarthy, J. 2006. Neoliberalism and the politics of alternatives: community forestry in British Columbia and the united states. Annals of the Association of American Geographers, 96(1), 84–104.
122	Charnley, S., & Poe, M. R. 2007. Community forestry in theory and practice: where are we now? Annual Review of Anthropology, 36, 301–336.
109	Hayter, R. 2003. "The war in the woods": post-fordist restructuring, globalization, and the contested remapping of British Columbia's forest economy. Annals of the Association of American Geographers, 93, 706–729.
70	Beckley, T. M. 1998. Moving toward consensus-based forest management: a comparison of industrial, co-managed, community and small private forests in Canada. Forestry Chronicle, 74(5), 736–744.
48	Duinker, P., Matakala, P., Chege, F., & Bouthillier, L. 1994. Community forests in Canada — an overview. Forestry Chronicle, 70(6), 711–720.
46	Pinkerton, E. 1993. Co-management efforts as social movements: the tin wis coalition and the drive for forest practices legislation in British Columbia. Alternatives, 19(3), 33–38.
42	Reed, M. G., & McIlveen, K. 2006. Toward a pluralistic civic science? Assessing community forestry. Society and Natural Resources, 19(7), 591–607.
28	Teitelbaum, S., Beckley, T., & Nadeau, S. 2006. A national portrait of community forestry on public land in Canada. Forestry Chronicle, 82(3), 416–428.
28	Allan, K., & Frank, D. 1994. Community forests in British Columbia - models that work. Forestry Chronicle, 70(6), 721–724.

the main regions of research focus. This is not surprising as British Columbia and Ontario have large forest sectors (NRCAN, 2014) and have had a sustained level of grassroots interest in community forestry programming. Research has also been continually supported through certain academic institutions (i.e., Lakehead University, Simon Fraser University, University of Victoria) and non-government organizations (i.e., British Columbia Community Forests Association; Dogwood Initiative; Northern Ontario Sustainable Communities Partnership) in these regions (Section 4.2).

The number and breadth of community forestry related issues has expanded over time with a steady increase in unique keywords each decade [1935–1945 (11), 1986–1995 (38), 1996–2005 (61), 2006–2014 (99)]. Findings highlight the ongoing discussions regarding accurate and appropriate terminology surrounding community forestry, such as "community-based forestry", "community-based forest management", "community-based environmental management", and "community-based natural resource management". Ongoing attempts by scholars, advocates and policy makers to conceptualize community forestry and develop an appropriate language through academic and political debate in also evident. Broader terms began appearing as keywords within the last decade, and preferences for certain terms may still be developing. Co-management, joint venture, and collaboration are also closely associated with community forestry, however these terms made fewer appearances, with co-management being the most common of the three. It is important to note that increases in keywords could also be linked to the growing practice of using author-identified keywords; however, this measure does provide clear indication of the range of keywords mobilized through time. Fig. 6 illustrates the range and relative importance of keywords employed amid what is an ever-evolving community forestry research agenda connected to broader political-economic contexts.

Table 2
Number of articles published by journal.

Journal	# of articles
Forestry Chronicle	27
Society & Natural Resources	8
Ecoforestry (Formerly: International Journal of Ecoforestry)	6
British Columbia Journal of Ecosystems and Management	5
Forest Planning Canada	4
Alternatives	3
Annals of the Association of American Geographers; Environments; Journal of the Association of BC Forest Professionals; Making Waves	2
Annual Review of Anthropology; Anthropologica; BC Studies; Canadian Geographer; Canadian Journal of Forest Research; Canadian Journal of Sociology; Capitalism, Nature, Socialism; Computers & Electronics in Agriculture; Ecology and Society; Environment and Planning D: Society and Space; Forests Trees People Newsletter; Forests, Human Ecology; International Journal of Regional & Local Studies; Journal of Environmental Management; Journal of Rural Studies; Journal of Soil and Water Conservation; Land Use Policy; Local Environment; Natural Areas Journal; Natural Resources Forum; Scandinavian Journal of Forest Research; Social Science Journal; Studies in Political Economy; Western Geography	1

5. Conclusions

This study illustrates the development of community forestry research in Canada over the past 80 years. By analysing journal publications in the context of changing policy conditions, our aim was to inventory community forestry research to identify existing information and knowledge resources, and provide a foundation and direction for future research. Below we offer several conclusions based on our analysis and highlight key research gaps that could be usefully addressed.

Community forestry is a steadily growing area of research, with significant growth over the past three decades. Based on the date of publications, after an early period of activity, there were some sporadic yet peak output years, which levelled out to more steady and similar numbers of outputs distributed across years. This is perhaps indicative that a now distinct research subfield and associated supporting network of researchers, professionals, and students dedicated to this research has emerged. Scholars, students, and other professionals are now regularly involved in community forestry research and practice. This bodes well for addressing the longstanding need to develop frameworks, metrics and information necessary for not only conceptualizing community

Fig. 6. Relative importance of keywords as indicated by size based upon frequency.

forestry, but bridging theory and practice to actually measure performance and outcomes (Beckley, 1998). Benner et al. (2014), Pinkerton and Benner (2013), Teitelbaum (2014), Teitelbaum and Bullock (2012) provide recent notable examples in this regard.

With respect to the number of publications released each year, there tends to be higher research output and interest when government initiatives are implemented and by extension when there is increased public debate. Academics, particularly in BC and Ontario, have contributed significantly to informing community forestry (see Teitelbaum et al., 2006) and this in turn builds interest in community forestry programs and research. Without a doubt BC remains most active and has received the most attention, domestically and internationally, confirming observations from recent research (Benner et al., 2014).

It should not be surprising that most research has come from organizations in provinces with larger forest sectors that also have ongoing community forest programs. Quebec, however, remains an outlier in this respect. Some Prairie and Maritime researchers have become involved in community forestry research and isolated opportunities to observe practice have emerged on occasion, whether created through new small-scale volume-based fibre allocations or more formal agreements with communities (see Parkins et al., 2013). From a knowledge transfer and collaborative research perspective, this demonstrated research capacity and interest could provide support to advocates and policy makers that might be searching for viable governance and business models. Opportunities may be found where there are presently unallocated or unmanaged forests, and where communities are in need of economic development and resource management planning ideas. It will be interesting to observe whether universities and government agencies increase research output in response to possible local information and training demands and opportunities in regions with new or changing programs, such as that underway in Nova Scotia (see MacLellan and Duinker, 2012).

In terms of the number of active authors and total research output, community forestry remains an area of research advanced primarily by universities, and to a lesser extent governments and consultants. Keeping in mind that the current study deals specifically with journal publications, forest companies did not play a large role in research, nor did advocacy groups. In some ways this is exactly what might be expected—universities doing research—while the inquiries of other groups are likely focussed on activities and channels more suited to their day to day interests, for example, public awareness campaigns in the case of non-government organizations or product innovation in the case of private firms. As research evolves, however, more multi-sectoral research collaboration holds potential benefit. In particular, having company input into market and product development could assist development of community forestry brands, markets, and logistical efficiencies (Markey et al., 2012). Likewise this could help 'export' or transfer domestic lessons from community forestry research beyond Canadian jurisdictions. Advocacy input can help craft policies and decisions that align with public values, mitigating social conflict along the way in keeping with the need to uphold the social license to practice in today's forest sector (Haley and Nelson, 2007).

Alongside broader societal and professional trends, an increase in research led by female researchers as well as collaboration among colleagues holding various professional roles are positive signs that research is becoming more inclusive. Forestry has been a traditionally male-dominated industry and discipline (see Reed, 2003). It would be useful for future studies to explore whether researchers representing different genders pursue different research questions and methods, as well as gendered perspectives on community forestry practice in general.

Furthermore, a systematic and in-depth analysis of research impact is warranted as it fell beyond the scope of this study. Yet our study does raise the question of research outlet choice and it is interesting to consider whether community forestry scholars are looking to reach who they see as being the "right" audience (e.g., policy makers, planners, managers) to affect change through their research, or whether scholars are simply trying to broaden and maximize dissemination. Clearly, the choice of journal is related to the disciplinary background of the contributors; in the case of community forestry research since the 1990s at least, it is difficult to ignore the dominance of the social sciences (i.e., *not* forestry or biophysical science) in shaping scholarly dialogue and the course for research. This is appropriate given the suitability of disciplines such as human geography, environmental studies, and anthropology and sociology to, for example, rural, political economic, natural resource and land use analyses (e.g. Parkins and Reed, 2013), as well as to analysing local institutions and environmental governance (e.g. Armitage et al., 2012; Lemos and Agrawal, 2006). The prominence of social science also makes sense given that early on there would have been a need to figure out how to 'do' community forestry involving many stakeholders and complex land arrangements. Research focus was placed on first conceptualizing and describing community forestry (e.g. Dunster, 1989; Duinker et al., 1994) and describing policy, programming and operational arrangements (e.g. Allan and Frank, 1994; Harvey and Hillier, 1994). All of these were important considerations necessary for the establishment of community forests. However, our analysis shows that minimal natural science research has been pursued with direct regard to community forestry, which presents a clear disciplinary and knowledge gap. While broad appeals for ecosystem-based forestry have been widely articulated and societal preferences for minimizing clear-cut logging have been assessed (Bullock et al., 2009; Robinson et al., 2001), it is problematic that no scientific studies in for example biology, ecology, hydrology, or in particular, forestry, have been undertaken explicitly to evaluate community forestry outcomes for ecosystems. Without such research, the popular assumption that local control of forests will lead to better practices that protect the environment cannot be substantiated using current evidence from practice (Bullock and Hanna, 2012).

With the dominance of social science in mind, it is somewhat ironic that so much research and debate has occurred in *The Forestry Chronicle* when it is traditionally more of a forest science and industry-focussed journal. Without a doubt, *The Forestry Chronicle* has been the main forum for much of the scholarly debate and dissemination of findings from community forestry research in Canada, which is appropriate for a national journal. We found that interdisciplinary, international social science journals were also prominent forums for Canadian community forestry research, indicating that this research has a wider reach.

The terminology of community forestry continues to evolve. One challenge of using a conventional bibliometric analysis is that researchers sometimes equate community forestry with other terms, and certain ill-defined buzzwords can be employed haphazardly. Nonetheless, 'community forestry' has emerged as a main keyword. Also, keywords are increasing in both number and variety, signifying the development of a richer dialogue and more nuanced research literature, and of course simply the increased use of keywords in journals as common practice. With each new paper published there are new keywords representing new issues. This in and of itself speaks to the growth of community forestry as an area of scholarly interest.

Perhaps the next test of the global profile of Canada's community forestry research and experience will be if and when it garners attention from researchers in other countries beyond North America. As shown here, there has been growing interest, mostly from the United States. The research presented here offers a metric set and methodology that could be replicated to conduct a regional comparative study analysing research from the United States and Europe to begin with, but also other regions where community forests may exist. Canada has benefitted from the much larger body of international community forestry research produced in and on other regions. An advantage of comparative analysis would be to fully document the status of community forestry research and glean insights from across more and less developed regions where there is a longer experience with practice. Addressing such research opportunities would help meet the need for information and research infrastructure (i.e., databases, networks) to support community forestry practice worldwide.

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