

The Commodification of Nature, a Review in Social Sciences

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THE COMMODIFICATION OF NATURE, A REVIEW IN SOCIAL SCIENCES

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Abstract

The commodification of nature, through privatization, marketization, monetary valuation and other associated processes, has become a central topic in social sciences to examine the conditions and effects of the economic approaches for supporting conservation policies all around the world. The aim of this contribution is to delineate the current state of knowledge, within and beyond ecological economics, and to see, with some historical perspective, how commodification has been systematized in the literature. The results are as follows: (i) studies of commodification processes remain essentially critical, with a central role played by economists, political ecologists and geographers; (ii) over the past 15 years, we have seen more fragmentation than consolidation of the field; (iii) researchers avoid analytical shortcuts, but do not always well define what they mean by commodification. The construction of visual representations – we propose a 'commodification chain' – and the identification of decommodification opportunities are future lines of research that would be promising, particularly for the community of ecological economists.

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1. Introduction

Commodification processes have been studied by social scientists for some time. These processes relate to, and often link, various phenomena such as marketization, monetary valuation, privatization, financialization, etc., with emphasis put on the impact of the economic rationale on the idiosyncratic value of items initially considered as being outside the market realm. Commodification covers a wide range of subjects, from the human body (Radin, 1996; Wilkinson, 2003) to the Internet (Smyrnaios, 2018). The case of nature and the environment offers a fertile ground for commodification studies, because species, landscapes, ecosystems, climate balances and so on are all entities which can potentially be commodified, either for pure business reasons (e.g. trade of wild species) or for apparently noble causes (e.g. market-based instruments for conservation goals).

The discussion and controversies on the human economy's relation with the natural environment are as old as economics itself, and it is notably the epistemological disagreement on nature's economic valuation which made ecological economics emerge as a new critical social science in the 1980s (Gómez-Baggethun et al., 2010; Missemer, 2018). However, debates on these topics under the specific banner of 'commodification of nature' were initially held in the 2000s in a different epistemic community, that of critical geography (e.g. Robertson, 2002, 2004, 2006; Bakker, 2003, 2005, 2007; Castree, 2003a; McCarthy and Prudham, 2004; Mansfield, 2004; Heynen et al., 2007).[1] More recently, this vocabulary and corresponding debates have extended to other disciplines, including political ecology and ecological economics (e.g. Kosoy and Corbera, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011; Hahn et al., 2015; Thomas and Boisvert, 2015). Even if some scholars adopt a general definition of commodification, such as "the transformation of goods and services into objects meant for trading commodities" (Kosoy and Corbera, 2010, 1229), there does not seem to be a fully shared understanding of the term among researchers. Divergences also arise in the manifold ways relationships get articulated between commodification and related processes such as marketization, financialization, monetary valuation, and privatization. In addition, contrasting positions appear on the normative aspect of the research, for instance on the grounds on which commodification should or should not be resisted, or on the degree to which commodification is deemed an acceptable strategy to reach certain environmental goals.

Our article has been motivated by a double observation: (i) that no comprehensive state-of-the-art exists on debates on the commodification of nature, especially in ecological economics; and (ii) that lively debates on these topics seem to occur in other social sciences, seemingly without deep cross-fertilization and mutual recognition. As ecological economists, we sought to fill these two gaps, by providing the readers of this journal with a comprehensive synthesis of how debates on the commodification of nature are organized and have evolved in recent times, and by making bridges to other bodies of literature that emerged in our survey. We believe this exploration of the connections and diversity of the literature on commodification to be insightful for the community of ecological economists, both in their daily study of conservation strategies, and in the more reflective approach that characterize these scholars with regard to the vocabulary and tools they mobilize.

Through our examination of the literature, we do not pretend to bring out the best definitions of the commodication of nature or associated processes, nor do we aim to appreciate which process or institutional arrangement (taxes, market-based instruments, payment schemes, norms, etc.) could be seen as harmful tools of commodification. We remain in great part agnostic about the judgment made by the authors about the processes they look at. Our purpose is rather to characterize the stakeholders in the debates and to see how well the commodification

[1] Critical geography is a geographical scholarship that actively works toward social justice and liberation, including Marxist, feminist, queer, activist and post-structural viewpoints in its interpretation of the world (Gregory et al., 2009; Castree, 2000). Central themes to this discipline include a commitment to theory, to reveal processes producing inequalities, and to progressive practices, as well as an understanding of space as a critical tool and veil of power (Blomley, 2006).

of nature is conceptually delineated. We also wish to pay particular attention to the specific associated processes (privatization, monetary valuation, marketization, etc.), to find out if they are articulated with each other to form an overall commodification analysis grid.

In the early 2000s, when debates on commodification emerged, geographers such as Morgan M. Robertson (2002), Noel Castree (2003a) and Karen Bakker (2005) proposed such preliminary systematizations. [2] Fifteen years later, our objective is to check to what extent the debates have, or have not, followed on from these exercises, in particular with the appropriation of the commodification banner by ecological economists. With their own background and disciplinary perspective, the latter may have built their own systematizations.

Our paper is organized as follows. In the next section, we explain how we proceeded methodologically to construct the database used to carry out our survey. We also indicate the ways in which information was analyzed both quantitatively and qualitatively. Section 3 is concerned with a presentation of the insights gained throughout these analyses, both in terms of characterization of the literature (which disciplines? which institutions? which journals?) and in terms of systematization attempts. In Section 4 we discuss these findings and identify future lines of research to stimulate and structure the interdisciplinary discussion.

2. Method and scope

To construct our review, we addressed four specific questions. (Q1) How has the literature evolved since the early 2000s? (Q2) Who is taking part in the academic discussions on the commodification of nature? (Q3) What commodification processes are being discussed? (Q4) How are these specific processes discussed and related to one another? The diversity of these questions implied that we had to apply different methodologies.

To address Q1 and Q2, the first phase aimed to get a global overview of the academic landscape. We used the Web of Science (WoS) citation indexing service to obtain a list of relevant peer-reviewed articles. Obviously, this excluded books and other publication formats not referenced by WoS, which may have an impact on our descriptive results, but we wanted to use a catalogue centered on academic writings, selected with uniform criteria regardless of the discipline.[3] We are aware that WoS is not a perfect source – some journals are not included, some disciplines are better represented than others, contributions not written in English are little referenced – but it was a second-best to provide relevant insights.

In WoS, we used a search query combining (i) keywords for processes related to commodification and (ii) keywords for biophysical or ecological proxies referring to nature. We started with general and intuitive keywords such as "privatization" and "marketization", combined with keywords such as "biodiversity" and "nature", and looked at the top-20 cited articles. [4] After examining these articles, we identified a wider list of 10 keywords for commodification processes, and 6 keywords for biophysical and ecological proxies, enabling a broader search query to constitute our full database.[5]

The initial result of 666 articles (April 2018) was refined by a manual selection of relevant

[2] Robertson (2002) defined at least four "significant moments of commodity production" (scientific abstraction, monetary valuation, spatial abstraction, exchange process). Castree (2003a) developed a model, so to speak, of capitalist commodification, comprising privatization, alienability, individuation, abstraction, valuation and displacement. Bakker (2005) insisted on three separate and articulated processes: commodification, privatization and commercialization.

[3] Books, reports and other supports are not necessarily peer-reviewed in all disciplines.

[4] These articles notably included Bakker, 2005, 2007; Castree, 2003a, 2008b, 2008a; Fairhead et al., 2012; Gómez-Baggethun et al., 2010; Kosoy and Corbera, 2010; McAfee, 2012; Robertson, 2006, 2012; Sullivan, 2013. Query launched in March 2018.

[5] The exact query was: TS = ((biodiversity OR ecosystem* OR "natural resource" OR nonhuman OR "biophysical environment*" OR "natural environment*") AND (neoliberali*ation OR privati*ation OR capitali*ation OR marketi*ation OR itemi*ation OR corporati*ation OR commodification OR commoditi*ation OR financiali*ation OR moneti*ation)). We decided not to include all terms linked to living organisms (genes, seeds, etc.) because it exploded the number of results on specific case studies, without more general reflection on commodification processes.

papers based on a detailed reading of the corresponding abstracts. In particular, we excluded papers only dealing with neoliberalism rather than commodification processes as such, that is, articles that discussed neoliberalism without focusing on the economy's interactions with nature. Obviously, a variety of critical social scientists has actively linked commodification with neoliberalization (Robertson, 2002, 2004, 2007, 2018; Bakker, 2005, 2007; Heynen et al., 2007; Igoe and Brockington, 2007; Castree, 2008b, 2008a; Spash, 2011; Thomas and Boisvert, 2015; Osborne and Shapiro-Garza, 2018). Discussions have been lively on the "the neoliberalization of nature and the nature of neoliberalism" (McCarthy and Prudham, 2004) and the need to de-essentialize a monolithic, hegemonic neoliberalism that would purportedly subsume the whole of nature in similar ways (Castree, 2006, 2008b, 2008a; Peck, 2013). A more truthful understanding of neoliberalism is pursued by studying various, multifaceted processes of neoliberalization and the historical-geographic specific outcomes of "actually existing neoliberalisms" (Peck and Tickell, 2002). These insightful debates and the different case studies they elaborate on have however been subject to constructive criticisms since the literature's early days (see Castree, 2008b, 2008a; Bakker, 2009, 2010; Bigger et al., 2018). Recurrent critiques focus on the difficulties of theoretical abstraction from dispersed, sector-specific, situated case studies under the general term "neoliberalization" (Bakker, 2007; Castree, 2008b), notably resulting in "an analytical sloppiness that diminishes our ability to correctly characterize the aims and trajectories of neoliberal projects of resource management reform" (Bakker, 2007, 436; see also Rodgers, 2018). In his systematic review, Castree (2008b) points to an insufficient articulation of the relationships between neoliberalization and the environment, in addition to the lack of terminological systematization. Bakker (2009) concurs with these observations, explaining that the most fundamental objection to these systematization efforts lies in the fact that:

> "the chain of causality in the study of environmental impacts arising from projects of neoliberalization is so attenuated, and the confounding variables so numerous (particularly given the multiple scales of regulation and resource production involved), that it is almost impossible to prove that the environmental 'impacts' we might identify do indeed arise from a particular strategy identified as neoliberal." (Bakker, 2009, 1785)

It is in order to avoid the risk of confusion between neoliberalization and commodification,[6] and not to enter into the political and ideological question that overwhelms the question of commodification processes, that we decided not to include in our review papers exclusively focused on neoliberalism and its relationship with the environment. This is certainly a limitation to our survey for covering the entire debates on commodification schemes, but it seemed to us necessary to dedicate our attention to the more specific processes involved by these schemes (privatization, marketization, etc.).

In addition to the exclusion of papers exclusively focused on neoliberalism, we also left aside contributions obviously irrelevant, e.g. on natural resource management without any link to commodification, on the Internet and technology (self-declared "digital ecosystems"). This first overall rejection concerned 312 articles.

Because we had in mind research questions related to *processes* and *systematization attempts*, we then excluded contributions only mentioning commodification in passing, without discussing or defining what was considered as commodification. This final selection phase reduced the total number of articles to 153.[7]

In a last stage, we completed our dataset with additional information so as to enable a significant descriptive analysis. This concerned information on the authors, their scientific disciplines and institutional afiliations. To complete these headings, we looked at article signatures, personal webpages and social network profiles, limiting our analysis to the first

[6] One may however note efforts to bring more conceptual clarity into the debate (e.g. Bakker, 2010, 723–25).
[7] The final list of articles, sorted by number of citations, is available in the Supplementary material.

author of each contribution.[8] Basic statistics and bibliometrics, using VosViewer mapping, provided us with results about the network of actors involved in the debate.

Regarding Q3 and Q4, knowing what exactly is being talked about is a precondition for understanding the core questions and connections in the debate. We aimed at gaining insight in this question at a double level: at the level of the entire dataset first, and at a sub-sample level next, in order to carry out a more in-depth analysis.

For the first step, we used NVivo's "basic queries" and "compound queries" to carry out lexicographic analyses, notably for providing information on keyword occurrences and combinations.

For the second step, we randomly selected 30 articles from the overall sample, respecting disciplinary proportions to get a fairly representative picture of the literature (full list available in the Appendix A).[9] Then we carried out an in-depth qualitative analysis of these papers in order to identify how authors deploy specific concepts and arguments related to commodification processes (marketization, privatization, etc.). This method provided us with insights not only into the varying degrees to which these processes are actually defined and discussed but also into the ways they are connected (or not) to one another.

We finally constructed a classification of the papers reviewed, according to their degrees of systematization. The objective of this classification was to see if and how the literature today is engaged in a general discourse on commodification.

3. Results

3.1. How has the literature evolved and who is taking part in the discussion?

The 153-article dataset allowed us to describe the web of actors (authors, journals, institutions) involved in the debate on the commodification of nature. A first observation concerns the overall evolution of the literature since the early 2000s, marked by a strong increase in the number of publications in the decade 2010 (Fig. 1).[10] More than half of the articles referenced in WoS and selected for our dataset were published after 2013.

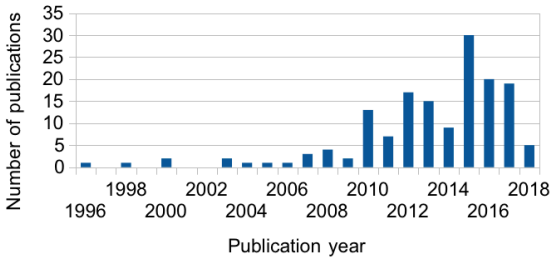


Fig. 1. Evolution of the number of publications in the 153-article dataset. (Source of data: WoS, April 2018.)

This evolution reveals that the literature on the commodification of nature has become more abundant in the last years, with some irregularities, but with a global increasing trend. This increase can be due to the publication, early on in this period, of several reports regarding the economic and social benefits coming from nature, both on a global (TEEB, 2010) and a more regional or national scale (Chevassus-au-Louis et al., 2009; EPA, 2009; UK National Ecosystem Assessment, 2011). The emergence of initiatives explicitly addressing the preservation of the environment through an economic perspective (e.g. Natural Capital Coalition, Business and Biodiversity (B@B) of the European Commission) certainly also offered opportunities for discussion in the recent years.

The distribution of those publications among academic disciplines, identified from first authors' declarations, appears both varied and significant. Considering that one scholar can be the first author of several publications, we have 127 first authors including 22 for whom we were unable to determine the discipline (even if we kept an "interdisciplinary" category). Among the

[8] We did not use the specific information for each article provided by WoS because its classifications, extended keywords and journal fields were not fully reliable.

[9] We considered this 20% sampling as the best solution to go into the detail of the papers without ending up with an analysis grid that would have been too heterogeneous to be informative.

[10] The evolution of the number of journals and articles referenced in WoS has only a small impact on this observation. It might play a more important role for the period prior to the 2000s.

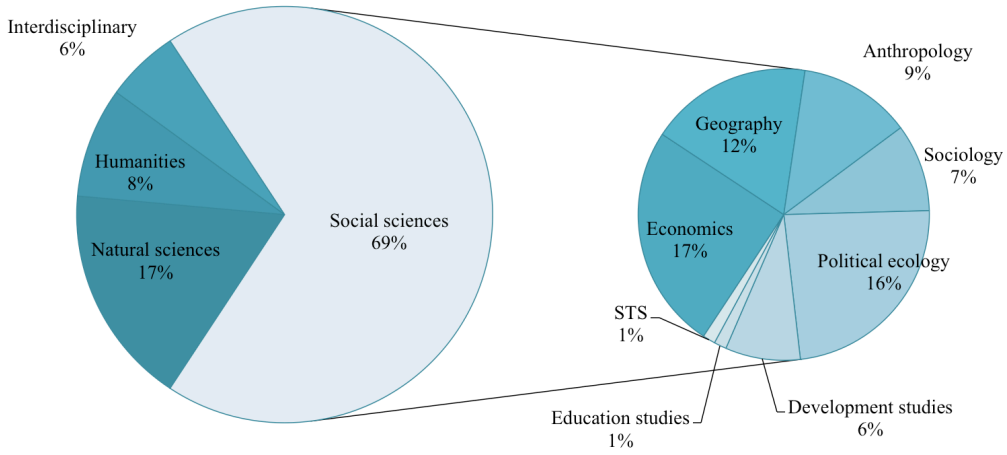


Fig. 2. Field distribution of publications. (Source of data: WoS and manual research, April 2018.)

105 remaining authors, papers developing social science analyses of commodification processes are distributed as follows (Fig. 2). Unsurprisingly, the vast majority (68.5%) of papers are published by social scientists, especially economists (17.1%), [11] political ecologists (16.2%) and geographers (12.4%).[12] 18 articles (17.1%) were published by natural scientists as first authors, including 11 ecologists (10.5%). Note that 36 authors mention several disciplines to define their background, but from the description of their work we were able to assign most of them to a specific category (e.g. scholars engaged with development economics and geography could be considered as researchers in "development studies"). 6 authors (5.7%) were labeled as "interdisciplinary researchers", since they only define themselves as such. 36% of first authors are female and 64% are male, which is in line with the results observed for the entire academic world (Larivière et al., 2013).

In contrast with the early 2000s, the literature on the commodication of nature appears fragmented between various disciplines in social sciences. Economists are the most represented group of scholars, essentially through contributions by ecological economists and political economists, but they do not represent an overwhelming majority. Political ecologists and geographers are the other main voices in today's debate. Discussions on commodification, as encompassing various economic phenomena (monetary valuation, marketization, etc.), are thus moderated by researchers with different backgrounds.

In terms of journals, (critical) geography remains the most represented field in the debate. Among the 153 articles in our dataset, 15 (9.8%) were published in *Geoforum*, 9 (5.9%) in *Antipode*, 9 (5.9%) in *Environment and Planning A*, and 7 (4.5%) in the *Annals of the American Association of Geographers*. Only *Ecological Economics* is part of the top-5 with 9 articles (5.9%) as well. The discussion on the commodification of nature does not take place in a single journal, but the field of geography plays an important role, more significantly so than in the distribution of first authors. While researchers engaged in commodification debates are more diverse today than in the past, they seem to identify the geography literature as the most accurate place for discussion.

This result needs to be examined in the light of cross-citation practices among communities. Using VosViewer, we built a co-citation map of the journals in which the articles were published (Fig. 3). Each circle represents a journal, the size

[11] This category comprises self-declared ecological economists, environmental economists (mainstream) and political economists. Environmental economists constitute a minority.

[12] This category comprises self-declared critical geographers, radical geographers, human geographers and economic geographers.

measuring the number of publications. The distances between journals translate the number of co-citations: the smaller the distance, the higher the number of co-citations. We represented the journals being cited at least 20 times (a total of 54 journals), as well as the 100 strongest co-citation links between journals. Three clusters appear: (i) a cluster of geographical journals, (ii) a cluster in economics and environmental studies, and (iii) a smaller miscellaneous cluster. This suggests than even if the debate is multidisciplinary, there are two main scientific communities working in parallel on this topic: on the one side, geographers; on the other, economists and environmental scientists.

Moving back to the authors, the identification of their afiliations provides information on the countries where these debates occur. The distribution (Table 1) reveals the weight of Northern and Western countries in this sample (the only developing country is India), in particular English-speaking areas (75% of the literature).[13] This distribution can be explained by the location of research institutes (mainly in Northern and Western countries), but also by the fact that there is, in English-speaking countries, a long cultural tradition of using and discussing economic rationality and instruments when dealing with the management of natural resources and pollution. As early as at the turn of the 20th century, the first conservation movement of Gifford Pinchot was rooted in a utilitarian rationale, in connection with economic theory (Smith, 1982; Ramos Gorostiza, 2003; Missemer, 2017). Forms of monetary valuation already existed in the United States at the time, in particular in economic ornithology (Kronenberg, 2014). Market-based instruments for environmental policies have also historically been designed in (Pigou, 1924; Dales, 1968), and promoted by, Northern and Western countries, in particular from the 1980s onwards with the strengthening of the contract-based logic dear to the Reagan administration (Portney, 1984; Pestre, 2014). The English-speaking bias of WoS thus probably explains just part of the pre-eminence of English-speaking countries in the mapping of commodification debates. Cultural factors are certainly an important explanation as well.

At the institutional level, a contrasting result appears with respect to the country distribution. The most represented institution in our full dataset is the Universitat Autònoma de Barcelona in Spain, with 6 contributions (3.9%) and 3 distinct first authors. Then come the University of Manchester (UK) with 5 contributions (3.3%) and 3 distinct first authors, the University of Wisconsin-Madison (USA) with 5 articles as well (3.3%) and 5 distinct first authors, and the University of California (USA) also with 5 articles (3.3%) and 4 distinct first authors. The complete list may not be of that much interest, but what is remarkable again is the fragmentation of the debate. The fact that the most represented institution gathers less than 5% of the total confirms that the web of actors is today particularly rich. Interestingly, the Universitat Autònoma de Barcelona (Spain) emerges as a peculiar place, since it is not located in an English-speaking country, but takes a significant part in the debate.

Note however that a distinction should be made between the total number of articles originating from an institution, and the number of distinct first authors. There is a difference between three publications from the same person (e.g. K. McAfee at San Francisco State University) and three publications from three distinct first authors (e.g. K. Bakker, J. Dempsey and A. Bumpus at the University of British Columbia). The first example shows a single person (or first author) publishing multiple articles, which may be less relevant to draw conclusions on the vitality of the debate within the institution, while the second example may suggest interactions or collaborations between different researchers located in the same place.

In summary, on descriptive grounds, our full 153-article dataset on the commodification of nature and the environment shows a fragmentation in disciplines and institutions, and also in journals (geography prevailing) and locations (majority of Northern and Western English-speaking countries), albeit less pronounced. Economists and political ecologists have proportionally become the most important

[13] As mentioned in the methodological section, the bias toward English-speaking countries may result, at least partially, from the characteristics of WoS, almost exclusively referencing English-language journals.

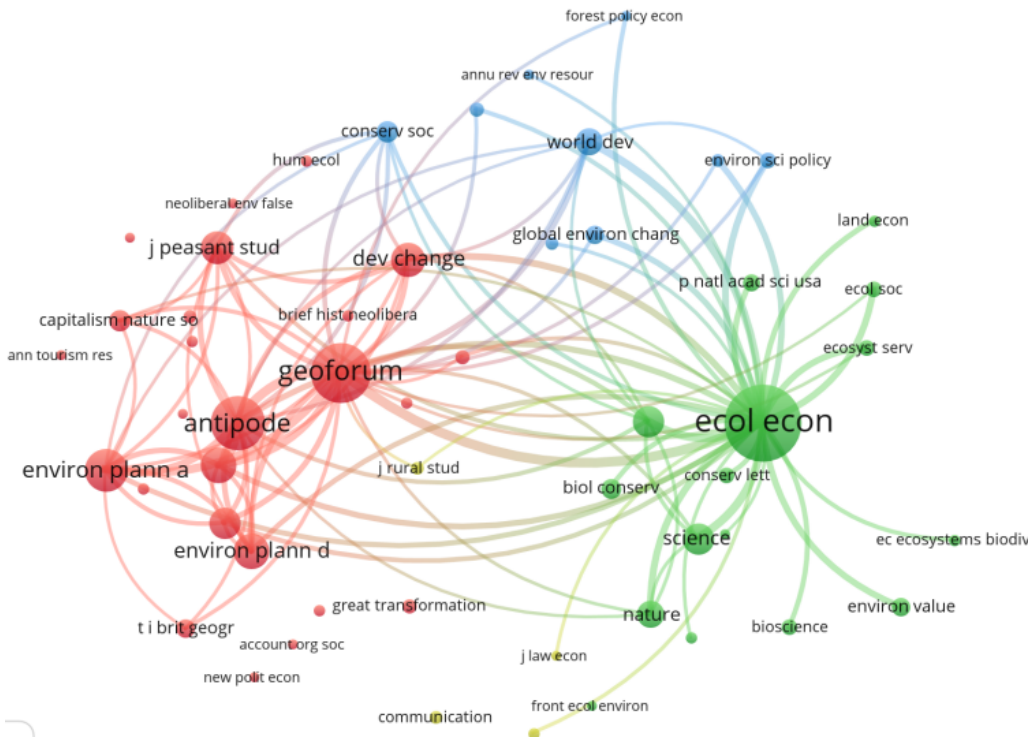


Fig. 3. Journal mapping by co-citations. (Source: VosViewer from our dataset, May 2018.)

Table 1
Country distribution of publications.

Country	Nb articles	%	Country	Nb articles	%
USA	49	32.0%	France	7	4.6%
UK	41	26.8%	Norway	5	3.3%
Canada	18	11.8%	Belgium	4	2.6%
Australia	12	7.8%	India	4	2.6%
Germany	11	7.2%	Switzerland	4	2.6%
Spain	11	7.2%	(Cut at 3)	/	/
Netherlands	9	5.9%			

contributors to the debate, yet geography periodicals remain a central place of publication, even if separate clusters co-exist in the literature.

3.2. What are the commodification processes discussed?

As mentioned in the introduction, commodification is a general term that is related to a large variety of phenomena: monetization, privatization, nancialization, marketization, itemization, etc. These phenomena could, in some instances, be considered different dimensions of commodification, albeit not necessarily with the same status or relevance according to the case studies. We carried out a lexicographic analysis on the whole dataset, then used the 30-article subsample for an in-depth qualitative examination, to gain a better understanding of which concrete forms of commodification are debated by social scientists.

From the reading of the abstracts of the full 153-article dataset, complemented with the 30-article sample detailed review, the first result is that commodification processes are almost exclusively addressed in a critical way. Most of the contributions denounce the excessive print of the economic rationale on environmental policies, both at global and local scales. The effects of commodification on the environment quality (e.g. Bakker, 2005), on institutions (e.g. Brown et al., 2014; Pröpper, 2015), and on populations (e.g. Erickson, 2010; Holmes and Cavanagh, 2016) are examined, with conclusions that question the efficiency and desirability of economic tools and – in the eyes of the authors – their perverse effects on wellbeing and self-determination of people in the good management of their resources, ecosystems and surroundings.

Another general lesson is that when case studies are discussed, the majority deal with

phenomena occurring in the global South (32% against 20% in the global North), whether it is a question of natural parks (e.g. Ojeda, 2012), of resource and space management (e.g. Bollig, 2016; Green and Adams, 2015), or of privatization of land (e.g. Benjaminsen and Bryceson, 2012; McElwee, 2012). What is puzzling is that, as we observed, the researchers involved in commodification debates are mainly located in the global North. This reveals an asymmetry between the actors and the objects of the debate, also reflecting the fact that many Northern-countries NGOs (studied by Northern-countries scholars) develop conservation projects in Southern countries on the basis of market-based instruments (Hrabanski et al., 2013).

In order to better circumscribe the terms of the debate, we used the NVivo software to conduct a lexicographic analysis of the whole dataset. Table 2 represents relevant results (number of articles higher than 20) for keywords associated with commodification. [14] "Privatization" seems to be the most discussed process in the literature, with 94 articles mentioning it, for an average use of 6.02 per article. Following are "commodification", then "marketization" and "capitalization". While monetary valuation occupies an important place in economic debates related to ecosystem services and resource management (Heal, 2000), "monetization" actually appears to be at the background of the discussion on the commodication of nature.

Table 2
Mention of commodification processes.

Keyword	Nb articles mentioning	Total mentions	Average mentions	Median mentions
Privatization	94	566	6.02	3
Commodification	52	609	11.71	5
Marketization	48	160	3.33	1.5
Capitalization	33	41	1.24	1
Financialization	24	100	4.17	2
Monetization	22	97	4.41	3.5
Commoditization	22	47	2.14	2

[14] Note that NVivo considers whole documents, including the references section. This is a bias, especially for those articles that only mention a concept a few times. However, while general terms, as "commodification" or "neoliberalization" (the latter excluded here), sometimes appear in the references list, occurrences for more specific terms, as "marketization" or "financialization", are more rare, which reduces the bias.

The difference between average mentions and median mentions requires some comment. When the difference is high, the distribution of the mentions is more unequal than when it is low. This means that contributions dealing with "monetization" form a denser group of analyses on this particular subject than articles studying "privatization" or "commodification" in general, in which the processes are sometimes much discussed, and sometimes, on the contrary, probably only briefly mentioned.

Going one step further, we examined the presence of multiple keywords in the same article, using NVivo again. The one-to-one crossing allowed us to construct the following matrix (Table 3), in which the number of articles is presented per keyword intersection. Some couples of words seem particularly strong, taking into account their total occurrences: "privatization" and "marketization", "marketization" and "financialization". Other couples provide no result or a very few: "capitalization" and "financialization", "commoditization" and "monetization". There are no clear explanations for all these couples, but some associations are meaningful. For instance the connection between "privatization" and "marketization" can be explained by the fact that, in economic theory, the existence of markets often requires well defined private property rights to make these markets work properly (Coase, 1960). A reflection on commodification therefore tends to associate phenomena related to property rights (i.e. privatization) and the creation of markets.

The limitation of this matrix is that it only informs us on the number of articles in which two terms co-occur, and not on the relative weights of the keywords within an article. For instance, the articles that NVivo selects for the search query "commodification AND privatization" give rise to contrasting results: on the one hand it selects Büscher (2016), with 24 occurrences for "commodification" and only one for "privatization", while on the other hand selecting Barney (2009), with one occurrence for each of the two keywords only.

A more detailed analysis can be conducted by searching, via NVivo again, the co-occurrences of keywords in a same paragraph, to obtain an approximation of the potential connections made

between concepts (Table 4).[15] The co-occurrence of terms is less frequent here than for overall articles. The association between "privatization" and "marketization", potentially related to economic theory, is confirmed, whereas other couples, such as "financialization" and "marketization" are less strong than in the previous table. This suggests that keywords related to commodification are not much articulated with each other in the analyses, except for the link between private property rights and the creation of markets. This result needs to be checked by means of a more qualitative analysis of the 30-article sample.

3.3. Commodification systems and conceptual frameworks

The fragmentation of the literature in terms of disciplines, journals and institutions is reflected in the diversity of treatments of commodification processes. As the lexicographic analysis has just suggested, conceptualizations of a '*global system*' of commodification are rare. What appears more common is the development of *sub-systems* associating two or three specific processes (e.g. privatization, marketization and financialization). We also encountered articles discussing only one process without reflection about potential articulation with others.

One article offers an exercise of 'complete systematization', namely Hahn et al. (2015). In their analysis, the authors develop a comprehensive framework linking commodification with different ecosystem services policies. Focusing on the institutional design of different instruments, they distinguish between six degrees of "complete commodification" (78). The reason why we speak of a commodification *system* here is because the authors explicitly reflect on the way different processes are related to one another. The system is considered *complete* in the sense that the authors aim at covering all kinds of commodification phenomena. The fact that they use the notion of "degree of commodification" (77) suggests that they have a conception of these processes as taking various combinations reinforcing, or weakening, the strength of commodification.

In order to obtain a comprehensive view of the ways commodification processes are conceived and articulated (or not) in the dedicated literature, we propose the following classification (Table 5). A first level of distinction is the number of processes that are discussed: one (line 1), two (line 2), or more than two (lines 3 to 5). When only one process (e.g. privatization, financialization) is mentioned, we consider that commodification is not studied in its complexity, but only through one of its concrete forms (e.g. Baveye et al., 2013 dealing with monetization).[16] When two processes are discussed and articulated, we conclude there is a *sub-system* of commodification, focusing on one interrelation highlighting causal, reciprocal or systemic effects (e.g. Prudham, 2007 articulating commodification, as a global movement, with privatization). When more than two processes are articulated, we assume it is possible to speak of a commodification *system*, albeit not necessarily *complete* as in the case of Hahn et al. (2015).

The result of our classification is that a large part of the contributions (12 of 30) propose *incomplete systems* of commodification, linking together more than two processes, but not always accompanied by in-depth discussion of the links between these processes. This can be seen in Table 5 where the sub-categories of lines 3 to 5 show the different degrees of discussion in the articulation of concepts: mention but no discussion, discussion for incomplete systems, discussion for complete systems.

From this classification, it results that less than half of the contributions in our sample engage in fully discussing the interactions between processes entangled with commodification. In contrast, more than half of the articles take part in the commodification discussion by limiting themselves to the mention of a few specific processes. Let us be clear that

[15] NVivo considers the references section as a single paragraph. In order to avoid irrelevant counts, we corrected manually the numbers in Table 4 to subtract the co-occurrences in the references list.

[16] Despite our careful selection of articles for the constitution of the 153-article dataset, in-depth analysis led us to notice one contribution in the 30-article sample only peripherally addressing commodification processes (He and Tu, 2015). In our classification, it falls quite naturally in the 1-process category.

Table 3
Keywords crossing (number of articles).

Keyword	Privatization	Commodification	Marketization	Capitalization	Financialization	Monetization	Commoditization
Privatization	/	33	37	20	12	11	15
Commodification	/	/	13	15	9	1	8
Marketization	/	/	/	11	12	6	6
Capitalization	/	/	/	/	0	6	6
Financialization	/	/	/	/	/	4	2
Monetization	/	/	/	/	/	/	1
Commoditization	/	/	/	/	/	/	/

Table 4
Keywords paragraph crossing (number of articles).

Keyword	Privatization	Commodification	Marketization	Capitalization	Financialization	Monetization	Commoditization
Privatization	/	12	20	2	1	2	4
Commodification	/	/	1	2	1	1	2
Marketization	/	/	/	0	1	1	2
Capitalization	/	/	/	/	0	0	0
Financialization	/	/	/	/	/	0	0
Monetization	/	/	/	/	/	/	0
Commoditization	/	/	/	/	/	/	/

Table 5
Classification of contributions by degree of systematization.

Articles engaging with 1 process (no systems)		12	Barua, 2017; Baveye et al., 2013; Castree, 2003b, 2008a; He and Tu, 2015; Kay, 2017; Lalancette, 2017; Lobo and Jacques, 2017; Quastel, 2016; Reid, 2013; Rossi, 2013; Wynne-Jones, 2012
Articles engaging with 2 processes (sub-systems)		5	Prudham, 2007; Reis, 2017; Tamminen and Brown, 2011; Vetter, 2010; Zinda, 2017
Articles engaged with 2+ processes	Incomplete systems (links not discussed)	3	Boehnert, 2015; Muradian and Gómez-Baggethun, 2013; Polishchuk and Rauschmayer, 2012
	Incomplete systems (links discussed)	9	Apostolopoulou and Adams, 2015; Bracking, 2012; Fairhead et al., 2012; Green and Adams, 2015; Kosoy and Corbera, 2010; McAfee and Shapiro, 2010; McElwee, 2012; Osborne and Shapiro-Garza, 2018; Robertson, 2007
	Complete systems (discussed)	1	Hahn et al., 2015

this does not in any way imply that these analyses lack precision or robustness in the denition of concepts – for instance privatization can be the only keyword used albeit well defined. Neither does it mean that there is no conceptualization at all in these studies – e.g. Barua (2017), Rossi (2013) and Quastel (2016) propose complex and nuanced examinations of "commodification", not mentioning any process per se. Yet it does suggest that the fragmentation of the literature does not only concern disciplines, authors and journals, but also case studies and specific processes themselves, which often are not articulated in a global framework.

Regarding the definition of concepts, what comes out of our qualitative analysis are also unequal treatments. Most of the time, specific processes (e.g. privatization, monetization) are well defined: for instance Fairhead et al. (2012) define "financialization" as the "drawing into financial circulation of aspects of life that previously lay outside it" (243). In contrast, the use of the term "commodification" itself seems more uncertain: sometimes it is considered as close to "marketization" (e.g. Zinda, 2017); sometimes it is rather perceived as a more general phenomenon involving several sub-processes (e.g. Kosoy and Corbera, 2010); and Hahn et al. (2015, 75) broadly define it as "the expansion of market trade to previously non-marketed areas of the environment" before providing a detailed analysis of different possible degrees of commodification and their links with policy integration. These diverging treatments and uses of the concept reveal that commodification is a multidimensional, situated subject, for which specific keywords are usually well defined, but broader concepts less delineated.[17]

[17] This statement can readily be compared to a lucid comment by Castree (2003a, 294), stating that "[...] claims about the capitalist commodification of nature [...] are only viable at a high level of theoretical abstraction".

4. Discussion and conclusion

This paper has addressed four main questions. (1) How has the academic literature on the commodification of nature and the environment evolved since the early 2000s? (2) What are the main scientific communities working on this topic? (3) What are the processes associated to the commodification of nature, and how are they defined and analyzed in the relevant literature? (4) How are these processes related to one another in conceptual frameworks reflecting (or not) a systematization of the analysis regarding the commodification of nature?

Summarizing, the answers to these questions are as follows. The quantity of publications has increased considerably. Commodification studies are primarily carried out by economists, political ecologists and geographers located in Northern and Western English-speaking countries but dealing with Southern-countries case studies. Privatization (often associated to marketization) and commodification in general (not always well defined) are the main processes discussed. There are attempts at *complete* systematization of commodification schemes yielding a comprehensive view of the subject. Most publications, however, focus on one process in particular, without examination of the commodification dynamics as a whole.

The fact that the literature has quantitatively increased is not surprising, since the market-based instruments approach has been supported by many institutions since 2005 (publication of the Millennium Ecosystem Assessment report with the support of the United Nations) and 2010 (TEEB report with the support of the European Commission), thus offering opportunities for discussion on the legitimacy and efficiency of such instruments.

Reasons for the Northern and Western countries bias of the analyses have already been provided. The fact that economists are not an overwhelming majority in the discussion is probably that they came more recently than other social scientists into the debate. Rhetorically speaking also, most economists certainly do not express themselves in terms of commodification when they deal with market-based instruments and environmental policies. This could mean that many of them have escaped our detection, and it could also explain why the literature reviewed appears so critical: those who promote market-based instruments, private property rights and financial tools probably do not talk about commodification, marketization, privatization and so on. While this is certainly a limitation to our survey, it does not prevent us from proposing some diagnoses, at least for the literature that explicitly refers to the commodification of nature.

Hahn et al. (2015), who published their paper in *Ecosystem Services*, provide us with an interesting systematization exercise that explicitly builds on recent work in ecological economics (notably Kosoy and Corbera, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011), showing that general grids of analysis can emerge in our field, and not solely in other disciplines – Hahn et al. surprisingly do not explicitly pay tribute to the previously mentioned conceptual works by geographers (Robertson, 2002; Castree, 2003a; Bakker, 2005), which highlights the relative fragmentation that has been described in our results. Ecological economists would undoubtedly benefit from going beyond their disciplinary boundaries on commodification issues, given the abundance of literature identified by our survey.

Obviously, we do not need tens of competing global frameworks to obtain a comprehensive overview of the diversity of commodification processes. Some intellectual trends are also more acquainted with systematization attempts and general schemes (e.g. post-Marxist political ecology) than others (e.g. applied ecological economics), which explains why the recent diversification of commodification studies brought more case studies and sub-system analysis than general arguments on the logics of the commodification of nature. Yet there is probably further room for research with respect to the articulation of scattered sub-systems to better understand commodification dynamics. Combined with thorough analysis of case studies, such articulations could help to identify where specific counter-forces would actually be able to jeopardize market-based instruments – i.e. they would provide better insights in the possibilities for enacting *decommodification*

processes (Gerber and Gerber, 2017). We believe that what could especially be useful would be visual representations of the commodication dynamics of nature, to be discussed, contested, contextualized, improved and enriched by different scholars from various disciplines.

For instance, we could use a "commodification chain" representation, articulating (1) the use of an economic lexicon to deal with natural entities,[18] (2) its implication in terms of an instrumental view of nature, (3) the tendency towards (monetary) valuation and measurements, (4) facilitating the emergence of private property rights, (5) sooner or later tradable on markets, (6) opening the road to the creation of financial instruments. In this visual representation (Fig. 4), commodification in the narrow sense would comprise processes 3, 4 and 5.

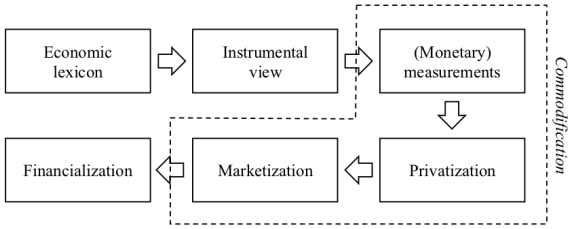


Fig. 4. Chain of the commodification of nature.
(Source: Levrel and Missemer (2019, 102).)

Undoubtedly, this commodication chain is subject to discussion, should be reorganized, or may not even make sense in the first place, since it is widely agreed commodification processes are neither linear, nor irreversible, nor unidirectional (Bakker, 2005; Kosoy and Corbera, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011; Hahn et al., 2015; Levrel and Missemer, 2019, 2020). It is precisely this kind of questions and controversies that such representations can raise, for the sake of a better analytical understanding of these critical contemporary processes.

Our review of the literature in social sciences dealing with the commodification of nature and the environment has showed the fragmentation and diversification of academic studies. It is important to keep in mind the limitations to our inquiry: the WoS database excludes books, and articles not written in English, which is a bias for referencing the works of those publishing in other formats than English-language peer-reviewed articles. In particular, sociology and ethnology, which have developed a criticism of commodification processes and capitalism for a long time, are probably under-represented in our sample. The overall relation between commodification schemes and neoliberalism, kept outside the scope of the present review, would require further examination. Our main results (fragmentation, call for visual representations and the identification of decommodification opportunities) nonetheless provide a fresh look at the current state of the art, and draw possible future lines of research.

Supplementary data to this article can be found online.

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Appendix A. 30-Article sample

Apostolopoulou and Adams, 2015; Barua, 2017; Baveye et al., 2013; Boehnert, 2015; Bracking, 2012; Castree, 2003, 2008; Fairhead et al., 2012; Green and Adams, 2015; Hahn et al., 2015; He and Tu, 2015; Kay, 2017; Kosoy and Corbera, 2010; Lalancette, 2017; Lobo and Jacques, 2017; McAfee and Shapiro, 2010; McElwee, 2012; Muradian and Gómez-Baggethun, 2013; Osborne and Shapiro-Garza, 2018; Polishchuk and Rauschmayer, 2012; Prudham, 2007;

[18] See the expressions "ecosystem services" (Gómez-Baggethun et al., 2010) and "natural capital" (Akerman, 2003; Nadal, 2016; Missemer, 2018).

Quastel, 2016; Reid, 2013; Reis, 2017; Robertson, 2007; Rossi, 2013; Tamminen and Brown, 2011; Vetter, 2010; Wynne-Jones, 2012; Zinda, 2017.

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