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Research paper

# Burning roots: Stakeholder arguments and media representations on the sustainability of tree stump extraction in Finland

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ABSTRACT

The sustainable use of forest resources is an intensively debated topic, raising environmental, socio-cultural and economic concerns. The debate culminates around forest bioenergy. The bioenergy debate has been characterized by a strong polarisation between different perspectives on environmental impacts. In particular, the claims about carbon sequestration have been contrasted with other ecological impacts. This article focuses on the debate over the use of tree stumps as a relatively novel source of forest bioenergy. To shed light on the constellation of the different arguments and actors in the debate on the sustainability of forest bioenergy, we conducted an empirical qualitative analysis of Finnish argumentation on tree stump removal, using media and interview data and relating the emerging sustainability arguments to the dimensions debated in the EU biofuel sustainability policy. The analysis shows the variation of views across Finnish expert stakeholders and the fora where the arguments are made. Climate impacts dominate the media discussion, while other sustainability dimensions are covered in expert discussion. Our findings have implications for the interpretation and use of scientific arguments in energy debates, in particular regarding environmental sustainability.

## 1. Introduction

The sustainability of the use of forest resources has been debated in science and policy for decades, but the aim to substitute fossil fuels with renewable energy has intensified this debate significantly, raising further environmental, socio-cultural and economic arguments [1,2]. Forest bioenergy is currently the largest source of renewable energy in Europe [3,4], and its increasing use has been justified by environmental and sustainability arguments. These arguments have emphasised in particular the renewable character of the energy source and possibilities to reduce carbon emissions to the atmosphere [5–7]. On the other hand, concerns have been voiced about biodiversity loss and other harmful environmental impacts of forestry [8]. Consequently, the policy debate over forest-based bioenergy has been characterized by a relatively strong polarisation between different perspectives on sustainability impacts. The polarisation may hide the different dimensions of sustainability and the nuances that stem from the specific ecological and socio-cultural contexts [1,9].

Forest bioenergy in European countries usually originates from stems, tree tops and branches from logging residues from final and intermediate harvests [10]. In addition to the above-ground tree biomass, also tree stumps and roots can be used as an energy source. Stump extraction and energy use have been rather modest in Europe, with only Finland, Sweden and United Kingdom having actively taken up the practice [11,12]. Because of increasing demand for renewable energy, a shift towards increasing utilisation of stumps has been anticipated [13,14].

Although tree stumps can be considered yet another renewable woody biomass resource in the forest, recent studies show that stump removal may cause distinctive environmental impacts and reduce ecosystem services [15–18]. Removal of harvest residues has been criticized because it reduces water and nutrient retention [19,20] and coarse dead wood [18,21] that constitutes a habitat for coarse woody dependent species [22,23]. The harvesting of logging residue and stump may also decrease spruce productivity [24]. In essence, the provision of renewable energy faces trade-offs with carbon, nutrient and hydrological regulation and biodiversity conservation as well as recreation aesthetic ecosystem services [17,25–27].

Due to the relatively recent uptake of large-scale stump removing practice, there are limited comprehensive long-term data or thorough life-cycle assessments [16,28], which results in uncertainty about the impacts of the practice [14,29]. The climate benefits of forest bioenergy have been internationally debated [e.g. [30], [31]]. Scientific studies have resulted in different conclusions on the magnitude and timing of possible climate benefits of using stumps for bioenergy [6,16,32–34]. Selective use of such scientific results can effectively fuel the arguments

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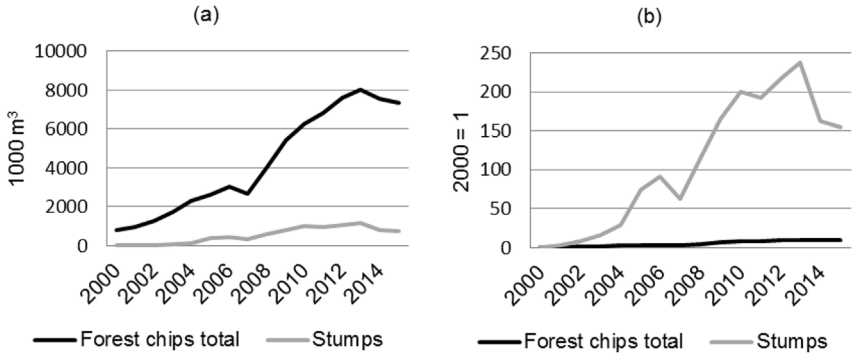


**Fig. 1.** Total forest chips' (comprising of small-sized trees, logging residues, stumps and large-size timber) and stumps' energy use in Finland 2000–2015 (a) in absolute numbers (1000 $m^3$) and (b) normalized so that the year 2000 = 1 [52,53].

serving the interests of opposing parties in public and policy debates.

The policy discussion around stump removals has gained media attention in Finland, portraying the above-mentioned various science-based environmental arguments. Yet, as is the tendency in media coverage [35], the reporting picks the catchy arguments, such as the newspaper headline: “It turns out that burning stumps is a sin” (Helsingin Sanomat, 3.12.2010). The bioenergy media discussion has been mainly centred on climate change impacts and related research findings, which has also been observed in other energy debates in the media [7,36,37]. However, science is not the only source of information for the media reporting on sustainability issues. Policymakers, business representatives and other elite stakeholders hold a key position, as news sources and some news reports seek to balance the elite views and scientific reasoning with timely grass-root level experiences and views of lay people. For example, the news reporting of forest fires in Indonesia has been shown to rely more on non-scientist views [38]. In line with the observation of the polarisation and reliance on science in the Finnish media, public views on stump harvesting have also been shown to be polarised, particularly among people with much knowledge on the matter [39].

Even when different forest-related stakeholders have access to the same scientific information, their perceptions might differ based on their interests, values and emotional bonds [40–42]. Lindahl and Westholm [41] argue that stakeholders conceptualise new issues in ways that are compatible with their deeply rooted forest-related conceptual frames and action strategies. Alternatively, new issues could open possibilities for reframing old stakeholder positions. Stakeholder groups with differing interests play an important role in forest policy and management [43,44], so understanding stakeholder views and framing in energy wood policy design is crucial [40]. Indeed, building on their understanding of public views, Rahman et al. [39] call for a study on experts' perceptions and attitudes related to stump harvesting.

In this paper, we shed empirical light on the sustainability debate around bioenergy use by analysing expert stakeholder arguments on stump extraction in Finland. With our qualitative analysis, we seek to elucidate the role of sustainability knowledge claims made by different stakeholders and the prevalence of different arguments in different fora. We combine sets of media data and expert interviews to identify and compare the focus on sustainability concerns and different arguments expressed in the public discussion in (1) the media and (2) in the expert-level discussion that is less visible to the public.

Specifically, our research questions are: (1) How do stakeholders view the sustainability dimensions of stump removals in Finland? (2) What are the differences between (a) different stakeholders' arguments and (b) the fora where the arguments are made, i.e. media debate and expert argumentation? In the following, we first describe the policy setting of bioenergy and stump removal. Based on the results, we discuss the implications on the use of science and knowledge claims about environmental sustainability in energy debates.

## 2. Stump extraction and bioenergy policies in Finland and the EU

Fuelwood is the world's largest forest product type. In 2011, wood removals amounted to 3.0 billion $m^3$ globally, of which 49% were for wood fuel [45]. Finland provides a particularly interesting case to study forest bioenergy and tree stump removal. In the EU climate and energy burden sharing, Finland's share of renewable energy must be at least 38% of the final energy consumption by 2020. Finland has committed to meeting about 80% of the target with bioenergy, which comprises mainly forest bioenergy [46,47]. Furthermore, there are other recent policy initiatives that directly or indirectly target (or contradict) forest bioenergy. For example, one of the five strategic priorities in the current Finnish government program, ‘Bioeconomy and clean solutions’, aims at increasing the uses of renewable resources for the production of bio-based products, food, feed, energy and services [48]. At the same time, there is a strong plea for a circular economy that aims to maximize the circulation of products, components and materials, and minimize raw material consumption and waste [49].

In addition to general policy goals, Finland's forest-based bioenergy production and use are promoted through a range of policy instruments [26]. As for promoting stump use, the most relevant subsidy has been the feed-in premium for electricity production from renewable sources in combined heat and power (CHP) plants. These CHP plants usually mix different solid fuels (wood, peat or coal), and the policy is aimed at increasing the share of bioenergy in the mix [50]. Stumps bring impurities (e.g. stones and sand) with them, so their use requires appropriate technology and causes extra maintenance costs for the power plants.

As a result of Finland's bioenergy promoting policies [26,51], the use of forest-based biomass in energy production has increased rapidly in Finland (see Fig. 1). For stumps, the increase was even faster; their use in energy production multiplied by 240 times during the years 2000–2013 [52]. However, stump use decreased during 2014–2015.

Finnish silviculture is primarily governed by the Forest Act (1997, amended in 2013). The Act is operationalised in practice through nationally applied voluntary forest management guidelines, which guide tree stump extraction as well [54]. Although the guidelines align the best sustainable practice for silvicultural operations in general, they do not set limits for large-scale tree stump extraction. The main forest certification scheme in Finland, namely the Programme for the Endorsement of Forest Certification (PEFC), and also the Forest Stewardship Council (FSC) allow stump extraction [55,56]. The stump extraction rules in these certification schemes differ from similar schemes in neighbouring contexts, as for example the Swedish FSC certificate strongly limits stump extraction [57].

To capture the environmental and sustainability concerns in a comprehensive manner at the EU level, the introduction of specific sustainability criteria or standards has been a key effort, drawing on scientific evidence and political iteration. The EU has set sustainability