Residual biomass from riverine areas – transition from waste to ecosystem service

Astrid E. Bout[a*], Swinda F. Pfau[a], Erwin van der Krabben[b], Antoine J.M. Smits[a], Ben Dankbaar[a,b]
[a]*Institute for Science, Innovation and Society, Faculty of Science, Radboud University Nijmegen, P.O. Box 9010, Nijmegen 6500 GL, The Netherlands*
[b]*Institute for Management Research, Radboud University Nijmegen, P.O. Box 9108, Nijmegen 6500HK, The Netherlands*

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Introduction

In recent years, the use of biomass for various uses, such as energy and materials, has received increasing attention. The upcoming bio-economy is stimulated by various drivers, such as the need to reduce our dependence on fossil resources, the goal to reduce greenhouse gas (GHG) emissions, environmental concerns and an increasing demand for sustainable products (Pfau et al. 2014). Replacing fossil resources with biomass in the production of energy and materials is expected to improve the sustainability of these products, but the contribution is not self-evident (ibid.). One strategy that is often suggested to increase sustainability, is the use of residual biomass (van Dam et al. 2005; Jenkins 2008; Osseweijer et al. 2010; Hatti-Kaul 2010; Landeweerd et al. 2011; Centi et al. 2011; Voll and Marquardt 2012; Keijsers et al. 2013). The use of such residues makes it possible to re-use materials, that would otherwise be waste, as input for new production chains. Four types if residual biomass can be distinguished: agricultural residues, animal manure, organic waste and landscape residues (Hoogwijk 2004; Pfau 2015). Landscape residues may include biomass released during landscape maintenance activities in various types of landscapes, such as forests, roadside vegetation, pastures and half-natural landscapes such as floodplains (Pfau 2015). Recently, there is a change in the perception of landscape residues, from a waste product towards a useful, natural resource. Especially in the case of necessary vegetation management in landscapes, such as roadside vegetation and floodplains, the provision of biomass is now often viewed as an ecosystem service.

An interesting case for the change of perception of residual biomass is the vegetation management in riverine areas in the Netherlands. Large parts of the Netherlands are located in the delta of three major rivers (the Rhine, the Meuse, and the Scheldt). This delta area is densely populated and especially vulnerable to peak discharges, which are predicted to occur more frequently in the future due to climate change, causing an increased flood risk (Middelkoop et al. 2001; Kabat et al. 2005; Albers et al. 2015). One important measure to manage flood risks is vegetation management. Since 2014, a new vegetation norm determines the permitted vegetation height per area, based on water safety considerations (Rijkswaterstaat 2014). Vegetation has to be removed regularly to achieve the envisioned safety standard, which requires costly maintenance measures. This has given rise to the idea of using biomass released during maintenance measures, thereby (partly) re-paying the management costs and at the same time providing a valuable resource. Perception of landscape residues thus changed from a waste stream towards a potential ecosystem service.

In this paper, we explore the transition from waste to ecosystem service of residual biomass in Dutch water management organisations and the potential new market for residual biomass. We focus especially on the drivers of the water management organisations to engage in such a market environment, adapting vegetation management practices and engaging in the use of biomass as ecosystem service.

The research questions to be answered in this paper are:

1. What is the current practice regarding vegetation management and the provision of residual biomass in Dutch water management?
2. What are the drivers for biomass use and a change of perception of biomass as ecosystem service?

Method

To achieve the goal of this study, we evaluated the use of biomass in current water management practices. We contacted various people engaged in vegetation management at

* Corresponding author
Email address: astrid.bout@ru.nl (A.E. Bout)

all water boards in the Netherlands, Rijkswaterstaat and the State Forestry Service and created a database of vegetation management practices in these organisations, containing details about the organisation of vegetation management and biomass use. We were able to gather information from 19 water boards, three units of Rijkswaterstaat and five units of the State Forestry Service. We then analysed the organisational structures of vegetation management in these practices. To enable a closer look at both the organisation and the drivers behind biomass use, we conducted in-depth analyses of exemplary cases. We conducted 13 semi-structured interviews with employees responsible for vegetation management within their organisation. During the interviews, we gathered information on the current uses of residual biomass from riverine areas and details on the organisation of both vegetation management and biomass use. We furthermore discussed the objectives, considerations, drivers and outcomes of vegetation management and biomass use. We analysed the interviews using qualitative data assessment (QDA) software atlas.ti to allow for a structured analysis of the respondents comments.

Results

We describe 13 applications of biomass that are currently realised. Furthermore, we identified and describe six ‘organisation mechanisms’ based on the organisation of both the execution of vegetation management and the use of residual biomass. Most importantly, we found nine different drivers for biomass use of the water management organisations. Examples are:

1. Nature / Ecology: extraction of biomass from system to reduce nutrients
2. Tradition: “we have always done it this way”
3. Value of biomass: use biomass for something “valuable” or “useful”

Discussion

In several instances, costs and value of biomass uses are confused in the approaches of the water management organisations. While the driver for certain uses is to achieve a higher societal value, the choice is in practice made based on lower costs. A lack of scientific consensus on sustainable uses of biomass becomes evident, which results in vague and uniformalised decision criteria applied to decide between different uses of biomass.

Extraction of biomass seems to be preferred by most, but is often hindered by a discrepancy between the benefits of current biomass uses and the negative impacts of collecting and transporting biomass. However, extraction could provide additional functions next to the provision of biomass: several interviewees describe that it is better for ecosystem functioning and water management goals, such as water discharge.

Our initial assumption was that the main driver behind the transition from regarding biomass as a waste product to seeing it as an ecosystem service is an expected win-win situation for public organisations: using biomass for something useful and getting some money for it. We found, however, that this win-win is not necessarily the most important driver. Multiple drivers were observed; money is currently not very influential, though an increase in value is expected in the future. Using biomass for something “valuable” or “societally responsible” is, however, observed as driver.

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