Link Tagungsband: http://www.eurafagroforestry.eu/files/pub/docs/conference_book.pdf

DEVELOPMENT OF MULTI-USE CONCEPTS TO FIGHT AGAINST CLIMATE CHANGE IN THE PROJECT MUNTER

Wagener F[1*], Böhmer J[1], Seiler S[1], Thomas K[2], Plogmacher A[2]

*Correspondence author: f.wagener@umwelt-campus.de

(1) Institute for Applied Material Flow Management (IfaS), Environmental Campus Birkenfeld, Trier University of Applied Sciences, Birkenfeld, Germany (2) Department for Environmental Information Systems, Institute for Agroecology, RLP AgroScience GmbH, Neustadt/Weinstraße, Germany

Abstract

How can we make our landscapes resilient against climate change? And how can we even increase regional added value at the same time? How can village communities start over to manage these challenges commonly and not wait for the next problem to occur? Multifunctional land-use becomes feasible by regional economy and the development of individual solutions tailored to the local needs. The practical project MUNTER (funded by the EU and the state ministry MWVLW Rhineland-Palatinate through European Innovation Partnerships – 'Agricultural Productivity and Sustainability' – EIP agri, ELER) develops, implements and analyzes new land use options with energy crops that combine positive environmental effects with regional development aspects. One focus are agroforestry systems as a means of preventing erosion.

Keywords: agroforestry, energy crops, erosion prevention, climate protection, land use management, regional cooperation, material flow management

Introduction

For the people living in rural areas it is crucial that measures that contribute to environment and nature protection are not at the expense of regional economic cycles but ideally generate more added value and develop further opportunities for the region (Wagener et al. 2017). In the public discussion land-use-problems are often reduced to single factors. While the loss of biodiversity is repeatedly linked to the worldwide massive use of glyphosate, soil erosion is explained mainly through climate change and increased precipitation. The complexity of these issues remains unmentioned same on political level as well as in the media and in regional debates – the connection between geographical, technical, social and economic drivers in cultural landscape and their interactions are hardly ever explained in detail. However, in order to find sustainable solutions, it is necessary to take them into consideration. All this shows that a centralized common agricultural policy can only give a framework and not be seen as a guarantor for a regionally adapted sustainable land use. Solutions to regional land-use problems have to be found and implemented regionally. From the concern of individual municipalities and farmers, the practice project MUNTER[1] was born.

In most cases regional activities to counter floods and erosion are not pro-active and holistic. Involved key players rather tend to conform to their role and speak with a farmers or environmentalists voice than search for a common solution. The aim of MUNTER is to develop a management system for farmers and municipalities that allows for more environment and nature protection through an optimized energy plant cultivation. In concrete terms, tools for the strategic management of regional land use are developed by a cooperation of farmers, municipalities and other stakeholders. Partners at three project sites in two regions (Western Palatinate and

[1]"Development of a management system for farmers and municipalities for more environmental and nature conservation through optimized energy plant cultivation"

Vulkaneifel) in Rhineland-Palatinate are developing, implementing and improving multifunctional land use systems which offer ecological advantages and help to establish new value chains for regional bioenergy supply. The project team of three farmers, two institutes and one foundation together with the states´ water protection authorities design, implement and test big scale practical modifications in land use. Within the projects´ planning phase new land use and value chain options have been figured out in on site field workshops. Land use changes have been modelled in geographical information systems (GIS) and analyzed with regard to erosion protection. In the practical phase farmers, municipal representatives and experts put multi-use systems into place in such a way that they generate added value, that is being paid for (Wagener et al. 2017). These land use changes are monitored both ecologically and economically. An integrated material flow management makes sure that appropriate markets for the produced biomass can be established and generate local jobs and income.

So far the MUNTER team accompanies one location with an already established land use concept and two more that are going to be realized within the project. The synergies described can only be achieved through a moderated planning process. As a result, practical innovations in land use, taking social requirements into account, enable the development of new fields of business for agriculture at low social costs (Glemnitz and Wagener 2016).

Materials and methods

Starting point for MUNTER were the results of the previous project "Null-Emissions-Gemeinden" (“Zero Emission Municipalities”) funded by the German Ministry of Education and Research (BMBF). As a result of a heavy rainfall event in 2014, considerable flood damage occurred in the municipality of Bisterschied (Western Palatinate). Two years earlier, a farmer had planted a small short rotation plantation in the surrounding lagerly cleared farmland above the village. After the flood it became obvious that the water runoff and soil discharge in this area was significantly reduced compared to the neighbouring fields. At the same time there was a discussion in the village about the renewal of the heating systems of several public buildings and the possible connection with other private households to a common energy supply. The idea to combine erosion protection, biomass production and climate protection in the village was started. In order to develop an integrated land use concept, the historical and current land use, the ownership structure of the agricultural areas, the water and biotope structures around Bisterschied were evaluated. On the other hand, the possibilities for a biomass-based joint district heating system or even a bioenergy village were discussed with municipal representatives. In a material flow analysis, initial calculations were made on achievable yields, raw material and heat demand.

In the following MUNTER project these results were taken up and continued. In addition to Bisterschied, the round of participants was extended by two further locations and numerous experts. This enables the consortium to benefit from an in-depth exchange of experience. Furthermore an extended research program is realized in MUNTER. Improved modelling of erosion protection effects with GIS helps in the targeted placement of new land use systems, mainly permanent crops for the production of energy wood and biogas substrates.

The GIS analyses on surface runoff and erosion effects of the agroforestry measures were conducted using terrain-based hydrological models. Agroforestry strips were implemented in GIS by modification of a high resolution (1 m) digital elevation model (DEM) representing semipermeable relief barriers, which hold off runoff water and improve infiltration of water into the soil. Surface runoff was approximated by calculation of the specific catchment area, which is the accumulated contributing area of inflow for each of the DEM’s raster cells. Runoff was calculated with and without consideration of the planned agroforestry measures. Comparison of those simulated values resulted in the measures‘ potential reduction effect on runoff processes.

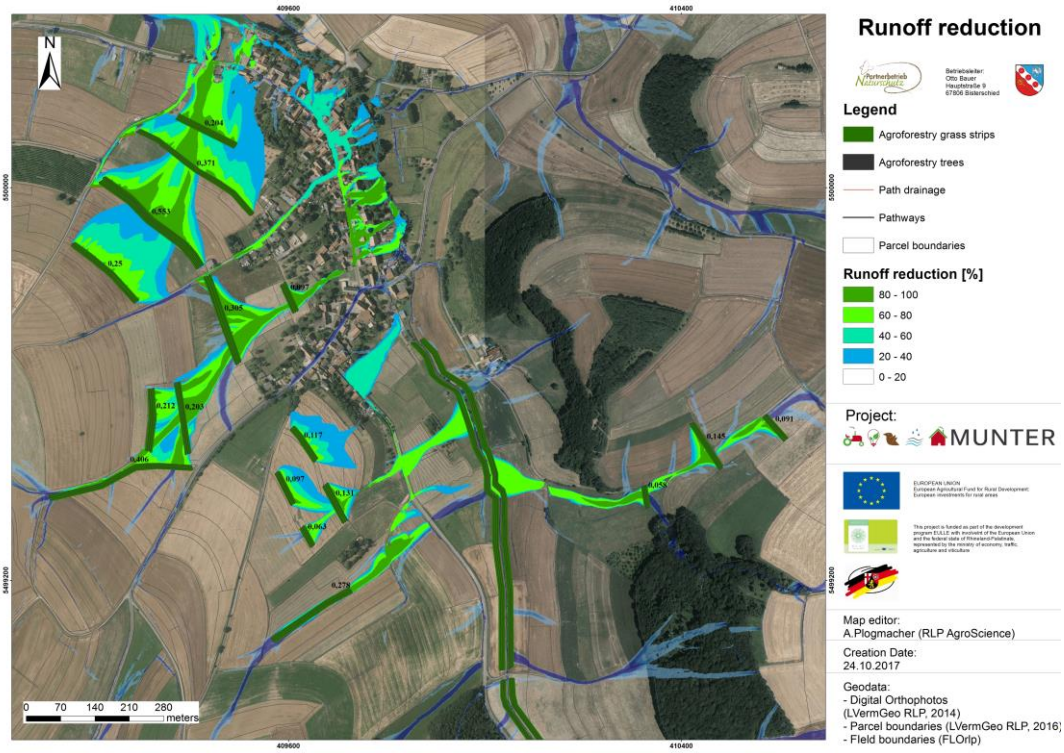

Figure 1: Drainage reduction through the cultivation of agroforestry strips around Bisterschied.

Agroforestry systems to protect Bisterschied (Western Palatinate)

The plantation of agro-wood strips has been evaluated in terms of their effectiveness to reduce erosion by a newly developed GIS-simulation for Bisterschied (Figure 1). An inspection of the site where different scenarios were applied was undertaken together with farmers to fit the agro-wood strips into the existing management structures. As a result, a map was created that shows the reduction of the runoff and therefore allows for a theoretical assessment and outlook in terms of the effectiveness of the energy hedges.

The community is now driving forward the development of the bioenergy village Bisterschied with these new wood potentials (Heck et al. 2014). The farmers shall gain an attractive price for the wood and the heat supply of the village shall be provided by renewable energies. If this connection works, climate protection and the adaption to climate change will be put into practice at the same time. The monetary resources of the village will stay within the village and will lead to an improved regional added value compared to a fossil-based energy supply (Wagener et al. 2016a).

Agroforestry systems to protect Rockeskyll (Vulkaneifel)

An agro-forestry system is being developed in Rockeskyll which is similar to the one in Bisterschied but will additionally contain a wild herb mixture at the lower part of the slope (Figure 2). This measure is necessary to achieve an additional reduction of erosion before the borders of the village.

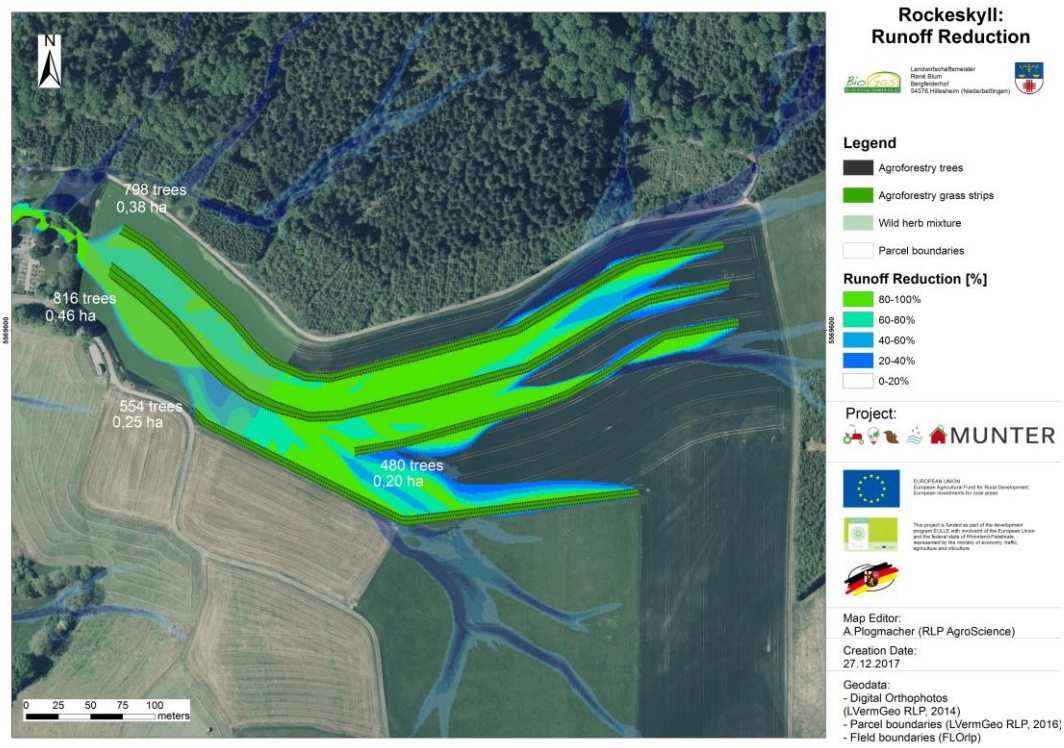

Figure 2: Drainage reduction through the cultivation of agro-wood strips und wild herb mixture

Wood and wild herb mixture are used for the heat provision of the existing neighboring bioenergy village Niederbettingen, too. The heat for the village is generated by a biogas plant and a woodchip heating system. At the moment first consultations are taking place in the neighboring Rockeskyll to inform the village about its possibilities of becoming a bioenergy village, too.

Water body restoration at Ingweiler Hof (Region of Westpfalz)

A former agricultural area in valley location of Ingweiler Hof has been transformed in the context of a water-management compensation measure. On the one hand, the course of the stream itself got restored and on the other hand, a cluster of agro-wood and a flood channel was implemented on the field (Figure 3). The flood channel breaks the dangerous flood peak of the stream. The poplars increase the pore volume and therefore enhance the absorption capacity of the agricultural area. The wider plantation spacing and individual gaps allow for the immigration of further tree species like black alder, birch, sycamore and oak. The biodiversity therefore increases and shall be evaluated in detail during the years 2019 and 2020 using different indicators of flora and fauna (Glemnitz et al. 2013, Wagener et al. 2016b).

The wood is used for providing a retirement home with heat. This measure again puts climate protection and the adaption to climate change into practice. Furthermore the biodiversity within and around the water body is increased without having to take agricultural land out of usage (Böhmer & Wagener 2013, Wagener et al. 2016). As a result, compensation measures can be developed that realize a high multifunctionality and regional added value by agricultural resource production (Böhmer and Wagener 2013, Wagener et al. 2013).

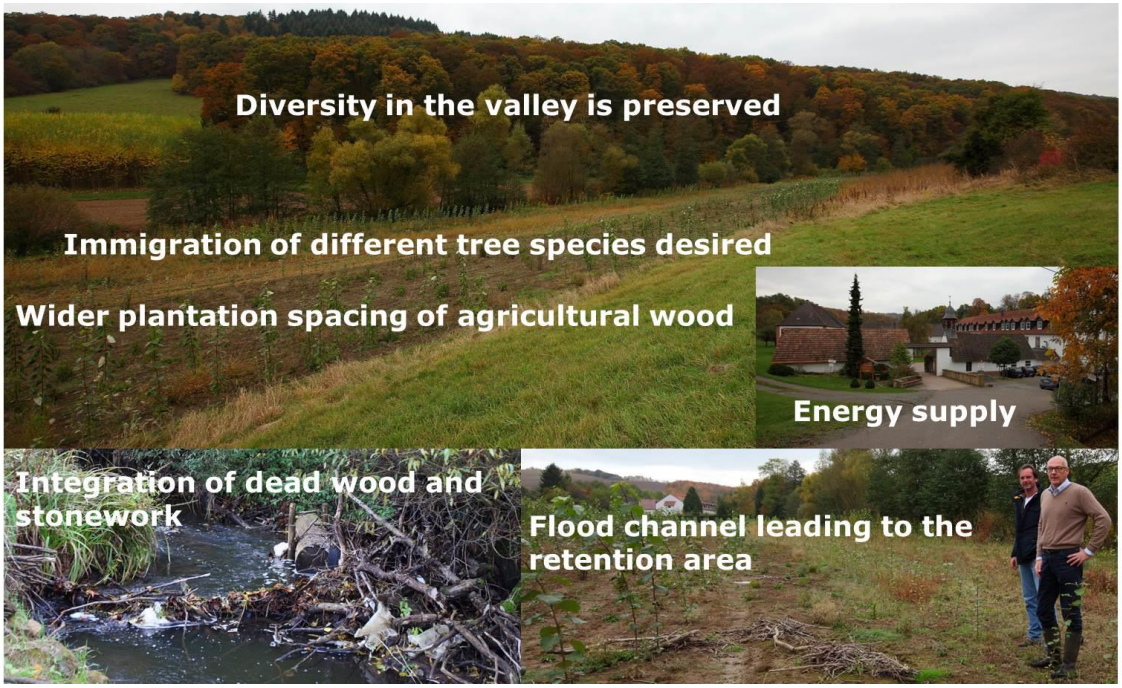

Figure 3: Water Compensation Measure in Germany

References

Böhmer J, Wagener F (2013): Agroforstsysteme als Kompensationsmaßnahmen – Ergebnisse aus drei Jahren Praxisforschung im Bundesverbundprojekt ELKE. In: Mitteilungen der Gesellschaft für Pflanzenbauwissenschaften (ed) Band 25. Verlag Liddy Halm, Göttingen, pp. 182–183.

Glemnitz M, Platen R, Krechel R, Konrad J, Wagener F (2013): Can short-rotation coppice strips compensate structural deficits in agrarian landscapes? In: Aspects of Applied Biology 118, Environmental management on farmland, pp. 153-161.

Glemnitz M, Wagener F (2016): Win-Win zwischen Energieproduktion und Naturschutz. In: Naturkapital Deutschland – TEEB DE (2016): Ökosystemleistungen in ländlichen Räumen – Grundlage für menschliches Wohlergehen und nachhaltige wirtschaftliche Entwicklung. Herausgeber Christina von Haaren und Christian Albert. Leibniz Universität Hannover, Helmholtz- Zentrum für Umweltforschung – UFZ. Hannover, Leipzig, pp. 138-141.

Heck P, Anton T, Böhmer J, Huwig P, Meisberger J, Pietz C, Reis A, Schierz S, Synwoldt C, Wagener F, Wangert S (2014): Bioenergiedörfer - Leitfaden für eine praxisnahe Umsetzung. Fachagentur Nachwachsende Rohstoffe e.V. (ed), Gülzow, 172. http://mediathek.fnr.de/leitfaden-bioenergiedorfer.html (accessed 18/04/2018).

Wagener F, Heck P, Böhmer J (Hrsg. 2013): Schlussbericht „Entwicklung extensiver Landnutzungskonzepte für die Produktion nachwachsender Rohstoffe als mögliche Ausgleichs- und Ersatzmaßnahmen (ELKE) – Phase III – Umsetzung praxisbasierter Feldmodellprojekte, Forschungsvorhaben gefördert durch das BMELV über die FNR, FKZ 22007709, Umwelt-Campus Birkenfeld, 802. http://www.landnutzungsstrategie.de/elke/ergebnisse/phase-iii-umsetzung-erprobung-und-erforschung/ (accessed 18/04/2018).

Wagener F, Böhmer J, Heck P (2016a): Multifunktionale Landnutzungskonzepte. In: Deutsche Landeskulturgesellschaft (Hrsg.): Flächenkonkurrenz entschärfen: gemeinsam –maßvoll – zukunftsfähig. Schriftenreihe der Deutschen Landeskulturgesellschaft 14: pp. 53-73.

Wagener F, Böhmer J, Heck P (2016b): Produktionsintegrierter Naturschutz mit nachwachsenden Rohstoffen - Leitfaden für die Praxis. Natur und Text, Rangsdorf. 112.

Wagener F, Böhmer J, Heck P (2017): Entwicklung eines Managementsystems für Landwirte und Kommunen für mehr Umwelt- und Naturschutz durch einen optimierten Energiepflanzenanbau. In: Böhm C. (ed) Tagungsband 5. Forum Agroforstsysteme. Cottbus, pp. 175-184. http://nbn-resolving.de/urn:nbn:de:kobv:co1-opus4-41487 (accessed 18/04/2018).