differences in the ranking of shampoos between both models. There is indeed a conceptual difference between the two models: in USEtox, the effect factor is based on average toxicity for all species taken together and not on the toxicity observed in the most sensitive species, like in CDV. USETox represents an average impact, while CDV estimates an impact on the most sensitive trophic level, thus aiming to protect aquatic food chains. The present study compares the results on cosmetic constituents and cosmetic formulae of the L'Oréal Group, obtained with three methodologies: USEtox, CDV and USETox with a recalculated effect factor, taking into account the most sensitive species.

MO363

Robust decision making on ecotoxicity of products: is USEtox ready for use or not?

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Nowadays it is widely accepted that decision making in sustainable product design should be based on a combination of economic, environmental and social indicators. Methods and databases underlying indicator results are still rapidly evolving. It is nevertheless paramount that decisions are based on robust information that is sufficiently stable over time. Decisions should be based on the latest science and data, as much as possible avoiding subjective decisions, taking uncertainty in the calculated scores into account. At the same time, the methods and data should be easy to apply and to communicate to decision makers. When evaluating the environmental footprint of products, normalization of indicators is a useful approach to benchmark vs. a reference situation. While normalization is not free of data gaps and uncertainty, a multi-indicator approach (vs. a single score) is maintained, which helps decision-makers set priorities. This poster illustrates these challenges on the freshwater toxicity indicator (USEtox) applied on a hand dishwashing product. While USEtox is a consensus method and offers a practical tool for calculation of characterization factors (CFs) for new chemicals, the method remains highly sensitive to input data interpretation and selection. Data sensitivity is demonstrated with effect data, in line with observations by Henderson et al (2011). The lack of uncertainty information on calculated USEtox CFs appears critical when formulations are compared which are composed of data rich and data poor ingredients. Results show that depending on data selected for the calculation of CFs, the product score ranges over 2 orders of magnitude. These constraints currently affect the application of USEtox for in market use, particularly when the most important decision (purchase intent) is based on such information.

MO364

Applicability of USEtox model for assessing ecotoxicity impact of copper as part of the product environmental footprint

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To overcome the fragmentation of the internal market as regards different available methods for measuring environmental performance, the European Commisssion recommends Product Environmental Footprint (PEF) methods based on existing, widely recognised methods. The USEtox model (Rosenbaum et al., 2008) is proposed to assess the ecotoxicity for aquatic fresh water. Ecotoxicity addresses the toxic impacts on an ecosystem, which damage individual species and change the structure and function of the ecosystem. In this poster, it is assessed whether USEtox is applicable to assess ecotoxicity impact of copper. Copper plays a crucial role in “closing” the loop and enabling Europe to move towards a circular economy. USETox has several similarities with ecotoxicity and exposure assessment principles from risk assessment. However, despite metal specific LCA development published in literature and high quality data sets generated under the REACH Regulation umbrella, the ecotoxicity data set underlying the effect factor, essentiality, natural background and bio-availability were found to be insufficiently covered in the current available USEtox version 1.01. As a consequence, environmental impact of copper is therefore insufficiently reliable for a comparative assessment of products.

MO365

Managing the integrated direct and indirect life-cycle impacts of sewers and WWTPs in Mediterranean and Atlantic cities

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Managing sanitation infrastructures is of paramount importance in order to meet the demand of an increasing urban population. From a life-cycle perspective, the operation stage of the wastewater collection and treatment results in 2 different types of contributions to the Global Warming Potential (GWP). On the one hand, the indirect impacts consist of the energy, chemicals and materials required to pump and treat wastewater in sewers and Wastewater Treatment Plants (WWTP), respectively. On the other hand, the direct impacts of the system result from the gas emissions deriving from the wastewater degradation and sludge treatment. Among these gases, methane (CH_4) and nitrous oxide (N_2O) are crucial because their GWP is 25 and 298 times greater than that of CO_2, respectively. So far, GHG emissions have been primarily assessed in WWTPs, but biological processes leading to wastewater degradation in sewers and, thus, emissions can potentially occur under certain conditions (e.g., aerobic/anaerobic/anoxic). The aim of this study is to quantify and compare the emissions that take place in WWTPs and sewers during different times of the year and in different climatic regions. To do so, 2 Spanish case study cities were analysed in the framework of the LIFE Aquaenvec project (LIFE10/ENV/ES/520): Calafell (Catalonia, Mediterranean climate) and Betanzos (Galicia, Atlantic climate). Sampling campaigns were conducted during summer and winter in all treatment stages of the WWTPs and 4 representative sites of the sewers. This analysis will help to determine and compare the relative contribution of the GHG emissions produced in sewers with respect to those produced in WWTPs. From a life-cycle perspective, these direct emissions will be integrated to the operation phase of both systems and compared with the energetic requirements of sewers and WWTPs. Hence, these results can assist urban planners in the design of future sanitation systems and reduce the carbon footprint of the system.

MO366

Integrated assessment of wastewater treatment technologies including their water consumption impacts at the endpoint level. Application of the water stress indicator at 3 contrasted locations

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Environmental impact assessment models are readily available for the assessment of pollution-related impacts in life cycle assessment (LCA). These models have led to an increased focus on water pollution issues resulting in numerous LCA studies to date. Recently, there have been significant developments in methods assessing freshwater use. These improvements widen the scope for the assessment of wastewater treatment (WWT) technologies, now allowing the first ever combination of operation (energy and chemicals use), qualitative (environmental pollution) and quantitative (water deprivation) issues in wastewater treatment. This enables us to address the following question: Is water consumption during wastewater treatment environmentally significant compared to other impacts? To answer this question, a classical life cycle inventory (LCI) was performed with a focus on consumptive water uses at plant level for several WWT technologies operating under different climatic conditions. The impacts of water consumption were assessed by integrating regionalized characterization factors for water deprivation within an existing life cycle impact assessment (LCIA) method. Results at the midpoint level, show that water deprivation impacts are highly variable depending of WWT technology (water volume used) and of WWTP location (local water scarcity). At the endpoint level, water deprivation impacts on ecosystem quality and on the resources damage categories are significant for WWT technologies with great water uses in water-scarce areas. Therefore the consideration of water consumption-related impacts is important and motivates a greater understanding of the water consumption impactsfrom WWT systems. This knowledge will help water managers better mitigate local water deprivation impacts, especially in selecting WWT technologies suitable for arid and semi-arid areas.

MO367

Gas emissions in municipal sewer networks in two climatic regions

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A sewer network can be considered as a biological reactor where each constructive element can lead to different environmental conditions. Depending on these conditions, several biological reactions could take place resulting in gas formation, such as nitrous oxide (N_2O), methane (CH_4) and hydrogen sulphide (H_2S). Problems like corrosion and odour are related to the presence of H_2S in sewers. While, N_2O and CH_4 contribute to greenhouse effect, as their Global Warming Potential (GWP) is 298 and 25 times greater than that of CO_2. Despite the importance of N_2O in terms of GWP, very few studies have paid attention to its formation in sewers and none of them has assessed the three gases simultaneously. In addition, of the entire urban water cycle, most attention has been placed on gaseous emissions from wastewater treatment plants (WWTPs). In the framework of the LIFE Aquaenvec project (LIFE10/ENV/ES/520), Calafell (Catalonia, Mediterranean climate) and Betanzos (Galicia, Atlantic climate) were the cities selected for the assessing of these gases formation. Sampling campaigns were accomplished during summer and winter in four selected points along the sewer network of each city. The purpose of this investigation was to study N_2O, CH_4 and H_2S formation, to identify the possible hot-spots of the network quantifying the concentrations and to establish measurement methodologies. The results show that high temperature favours gas production, as the highest concentrations were measured during summer and in Calafell: 316.7 µg L^{-1} of methane, 18.3 µg L^{-1} of nitrous oxide and 3.4 µg L^{-1} of H_2S. In addition, wet wells were found to have the highest concentrations of methane, as they have more turbulence than other sampling points, and can become anaerobic environments between breathing cycles. This research will highlight the contribution of these gases to the entire water cycle and it will help to apply Life Cycle Assessment for environmental analysis of the wastewater networks in order to improve the wastewater management and contribute to more sustainable cities.

MO368

SewageLCI 1.0 - A first generation inventory model for quantification of chemical emissions via sewage systems. Application on chemicals of concern

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Lack of inventory data on chemical emissions often forces life cycle assessors to rely on crude emissions estimates (e.g. 100 % of the applied chemical mass is assumed emitted) or in the worst case to omit chemical emissions due to lack of emission data. The inventory model SewageLCI 1.0, provides a mean for assessors to obtain fractions of chemicals emitted to the environment via waste water collection and treatment systems. SewageLCI 1.0 is based on existing models capable of estimating chemical degradation in waste water collection and treatment systems and also on national European statistics concerning waste water treatment systems. By combining readily available statistics and models stemming from environmental chemistry and waste water treatment science, the SewageLCI 1.0 model was built to simulate national specific average waste water collection and treatment systems and the model is hence capable of estimating the national specific average emissions fractions for organic chemicals. In order to illustrate the applicability, versatility and the general use of SewageLCI 1.0, a case study set of 6 organic chemicals was assessed in 15 national waste water different treatment grids. The results obtained applying SewageLCI 1.0 model reveal that it's possible to account for many of the variations in emission quantities of chemicals, caused by variations in the chemical fate properties and in the composition of national waste water treatment grids. The results indicate that the total emission fraction of a chemical may vary as much as up to one order of magnitude across the 15 countries included in the case study. Further, the case study reveals that for most of the chemicals considered, the dominant emission route after transport in waste water collection systems and potentially waste water treatment is emission to surface water recipients, other environmental compartments such as agricultural soil may receive considerable loads of chemicals emitted by the national specific waste water grids. The SewageLCI 1.0 presentation and case study reveal how broad inclusion of chemicals emitted to the environment via waste water treatment grids ideally should be captured by LCA. Despite SewageLCI 1.0 simulates national and hence theoretical average European waste water treatment grids and thus can't be validated, it is concluded that the model provides the best possible general mean for including emissions of chemicals with wide and dispersive use in LCAs.

MO369

Accounting for land use change emissions and their timing for purpose-grown biomass in the energy sector: Review of best practices and application to a generic case study

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Life cycle assessment and carbon footprint studies traditionally do not account for biogenic carbon, because it is considered neutral for global warming in a long-term perspective. However, experts have recently shown that biogenic carbon neutrality may lead to accounting errors and biased conclusions, raising the need to develop accounting methodologies that consider biogenic carbon emissions. We have identified two issues related to the consideration of biogenic carbon for purposed-grown short-rotation biomass in the energy sector: (1) quantification of land use change (LUC) emissions, and (2) treatment of temporal aspects. Within this study, we have investigated and compared methodological recommendations for quantifying and considering the temporal aspects of LUC emissions from several international standards, guidelines, governmental policies, and research papers. From this critical review, we have identified best practices and applied them to a generic case study addressing very-short-rotation poplar and miscanthus crops grown in different European countries. The first step was to determine what types of land have been converted after the increase in biomass production to identify whether direct (dLUC) or indirect (iLUC) emissions must be considered. Different scenarios have been developed using local data and statistics. Then, the quantity of carbon emitted during land conversion for each of these scenarios has been estimated using IPCC guidelines for dLUC, and a study performed by the European Commission for iLUC. The second step was to account for the warming effect of LUC emissions during their payback time. Usually, biogenic carbon emissions are amortized uniformly over the average number of years of the rotation period or over a fixed time horizon. However, as shown by some researchers, this leads to an underestimation of the global warming impact of biogenic carbon emissions associated with LUC. We have used a Time Correction Factor (TCF) to take into account the warming impact of LUC emissions over time. For very-short-rotation poplar and miscanthus, the most likely scenario (use of abandoned agricultural lands) does not lead to LUC emissions, while the less likely scenario (use of forested lands) leads to LUC emissions of 100 gCO_2-eq/MJ for poplar, and 18 to 49 gCO_2-eq/MJ for miscanthus if amortized according to IPCC guidelines. If a TCF is used, these emissions become 178 gCO_2-eq/MJ for poplar, and 32 to 87 gCO_2-eq/MJ for miscanthus.

MO370

Spatial analysis of fertilizers application on agricultural land: a case study for Luxembourg

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Agricultural soil is a major source of nitrous oxide (N_2O), nitric oxide (NO) and ammonia (NH_3). NO_x and ammonia play a key role in atmospheric chemistry, but little information is available on emissions of these gases from soils amended with organic fertilizers at different soil water contents. In this study fertilizers emissions to soil, surface and groundwater and air have been calculated for the country of Luxembourg based on data collected from national statistics and elaborated using the PestLCI 2.0 tool [1]. The spatial distribution of the crops is known for the entire country on a GIS support, therefore it was possible to spatialize also the related fertilizers emissions and characterize the territory of each commune from the point of view of environmental contamination. An Ascendant Hierarchical Clustering (HAC) algorithm has been used to classify the communes on the basis of their contamination level [2]. The determination of the centre of gravity of each cluster allowed the definition of 5 profiles of environmental contamination conditioned to the spatial distribution of the polluting substances, thus identifying spatial patterns of dishomogeneity. The most contaminated communes resulted to be Wincrange, Rambrouch and Junglinster. The KHI2 null hypothesis of independence between the spatial distribution of the contamination profiles and the spatial distribution of the profiles of human presence has been rejected with a p-value of 0.0084. This value has been confirmed by a p.value.mc=0.015 computed with the Monte-Carlo method with 2000 runs [3]. Therefore it is not possible to establish a correlation between fertilizers emissions and human presence. In future research, data on pesticides emissions will also be used to carry out a similar analysis, also exploring the correlation with other spatially distributed variables, such as access to healthcare facilities, economic conditions of the inhabitants, incidence of diseases, etc. *Acknowledgement*– The authors wish to thank Dr. Ian Vázquez Rowe (Pontificia Universidad Católica del Perú) for his contribution to data preparation.
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Investigating the characterization and weighting schemes for footprinting

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This investigation is intended not only to show the hidden characterization and weighting elements in footprint analysis, but also to discuss the implications for classification and integration of multiple footprints. Our results demonstrate that each of the carbon, water, land and material footprints has two fundamentally different versions, addressing elementary flows on the impact assessment or inventory level. The impact-oriented footprints based on characterization models allow a variety of elementary flows to be characterized in a way that is scientifically robust and environmentally meaningful, while the pressure-oriented footprints based on subjective weighting factors contribute to inventory analysis with the aim of maintaining the physical meaning of elementary flows which in aggregate correspond to the pressure exerted by human activities. These two footprint categories have their own pros and cons, and thus are not substitutes but complements. The findings conclude that while value-based weighting is unavoidable when integrating a suite of footprints into a single composite metric, the impact-oriented footprints have the potential to prevent the integrated footprint family from double weighting through the use of characterization factors for each of the footprints prior to weighting them. Following the general weighting procedure for life cycle assessment (LCA), we formulate a calculation framework for integrating a footprint family consisting of a suite of the impact-oriented footprints into an aggregated footprint index. Not only would this footprint index assist decision makers in better understanding the life cycle environmental performance of a product, which is the central element of product LCA, it would also provide an overall picture of a citizen, a company, a city, a country or the whole economy with its reliance on the planet's environment. This paper in our view can serve as a starting point for clearing the footprint jungle and, more importantly, for further scientific discussions and development of the footprint family. **P.S. We would appreciate it if you could let us know your decision on our submission by 5 January 2015, as Leiden University Funds**