Using Water Footprint and Valuation tools to support Reciprocal Watershed Agreements

ABSTRACT

Worldwide water issues have been largely mediatized in the past few years. We observed that despite the increase of initiatives and tools in the field of water management, synergies between stakeholders are required to allow transformations to happen. This project aims at linking three existing tools that were rarely used together. The tools are: water footprint, water valuation (ecosystem services valuation) and reciprocal watershed agreements. A case study was developed in Santa Cruz (Bolivia). We were able to calculate the water footprint for soybean and beef farmers and to value this ecosystem service provided by forests. Values ranged from 0.01 to 0.07 for rainfall and from 0.2 to 3 USD/m^3 for freshwater. Those results were used to test scenarios of the impact of deforestation, highlighting quantitatively the relationship between stakeholders. This type of analysis has the potential to play an important role into the implementation of reciprocal watershed agreements.

Introduction

Worldwide water issues have been largely mediatized in the past few years. Many initiatives have been created around NGOs, private companies and the public sector to improve the way we manage water and to provide tools and solutions. Still, water is a complex sector where different stakeholders from different backgrounds are only now starting to work together. Synergies between those stakeholders are required to better address water issues and allows transformations to happen in the management of water.

This project aims at linking three existing tools that were rarely used together in the past. The tools are: water footprint, water valuation (ecosystem services valuation) and reciprocal watershed agreements[1]. The authors believe that the data and information provided by the water footprint and water valuation methods are key to supporting the establishment of a reciprocal watershed agreements. Water footprints studies are numerous and cover a wide range of topics. They allows to quantify the reliance of our economy on water, but not in economic terms. This latter point is important to allow more relevant management solutions of water resources and this is where water valuation can play an important role.

The reciprocal watershed agreement is established through an engagement with a range of stakeholders at local levels. It requires discussing and agreeing on the services provided by ecosystems and on a way to maintain this service through a financial participation of the local stakeholders benefiting from it. Metrics to quantify the benefit from the ecosystems are obviously key to support the discussion and lead to an agreement.

The project was developed to support the work of a NGO called Fundacion Batura Bolivia active in the region of Santa Cruz, Bolivia. Its mission is to support communities in protecting their water sources by conserving their forests through the implementation of reciprocal watershed agreements (RWA). The project was realized in collaboration with Forest Trends and Quantis, as well as with the support of the Swiss Agency for Development and Cooperation.

[1] Also called payment for watershed services

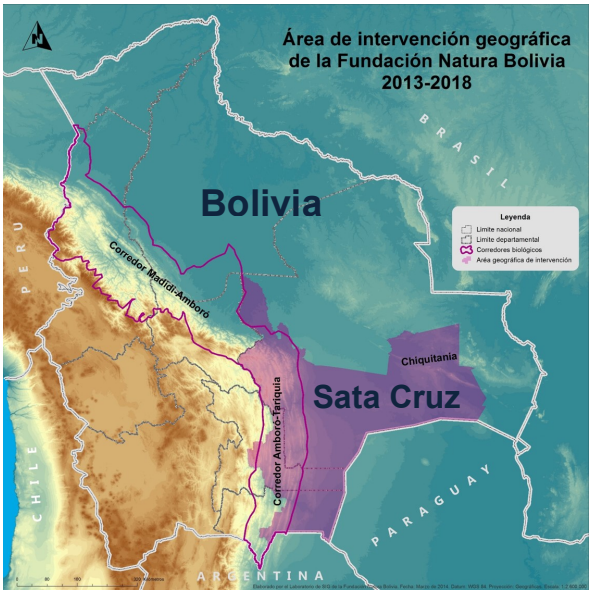

Figure 1 – Zone of activity of Fundacion Natura Bolivia in Santa Cruz, Bolivia.

Method and results

Natura Bolivia is already participating to the implementation of a RWA for the city of Santa Cruz, however it is willing to extent the use of this tool to other water users in the region, in particular within the agricultural sector. We targeted primarily the soy producers and the cattle farms as they are (and were) the main drivers for deforestation in the region.

The water footprint methodology was developed initially by the Water Footprint Network, a NGO, in 2008. This methodology allows the quantification of human water appropriation for producing good and services. The assessment can be done at product, company or regional level. It provides indicators covering three distinct issues related to water use categorized by water types (named by colors): *Blue water* is the water abstracted by humans and not returned to the same watershed, thus potentially depriving other users of this water resource; *Green water* is the water from natural moisture and rain evapo-transpirated by crops; *Grey water* is the volume of water polluted at a defined threshold.

We calculated the water footprint of the agricultural sector of Santa Cruz, of crops and animals farming separately. First, we found that the agricultural sector is relying mostly on rainwater rather than irrigation. And second, soy and beef production are the main consumers of water resources as you can see in figure 2 and 3.

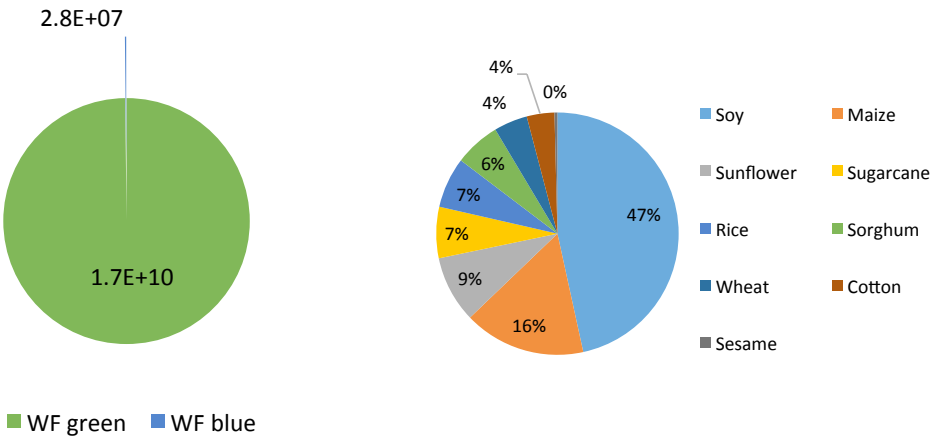

Figure 2 – Blue and Green water footprint results of crops production in Santa Cruz, Bolivia in m^3 on the left and split per crop on the right.

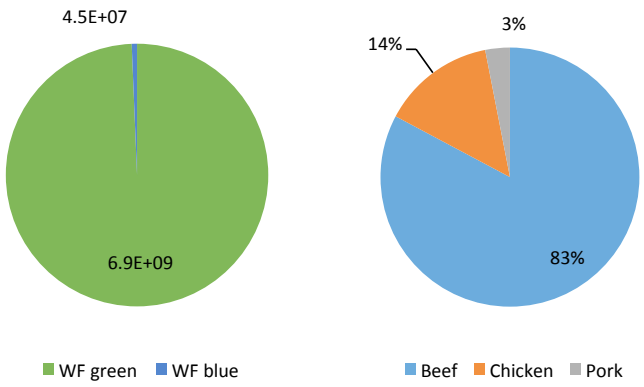

Figure 3 – Blue and Green water footprint results of animal production in Santa Cruz, Bolivia in m^3 on the left and split per animal type on the right.

The water footprint results shows that the reliance of the agricultural sector on natural rainfall and natural water cycle is important. Moreover forests has been shown to play a key role in supplying clean freshwater, but also to regulate local climate and rainfall. Assessing the value of water, rainfall to be more precise, for soybean and beef farmers is key in understanding the link between farmers and forests.
Based on a production function approach and market prices, we valued water provided by rainfall to soybean and beef farmers. Statistics on production per region, rainfall and climatic data, water footprint results (presented above), cost of production and market prices were used to define this value. We obtained ranges of values depending on sub-regions.
Overall, the value of rain water for soybeans and beef production range from 0.01 to 0.07 USD/m^3. This value can be seen as quite low, however this sector is relying on great amount of water from 3'000 m^3/ton of soybean to up to 90'000 m^3/ton of beef depending on the region. The value of water for beef production is lower compared to soybean production, as beef relies on much more water for its production. Related to the market price of those goods, the rainfall value is low. We estimated as well the option value of freshwater used for irrigation, which ranged from 0.2 to up to 3 USD/m^3. Targeted use of water (in time and place) is thus much more interesting for farmers.
As most of this water provision (rainfall and freshwater) is relying on forests, we estimated as well the potential impact of deforestation for farmers in the region. Although the value of water per m^3 is low, the overall value of the ecosystem service provided by forests is much more important. Based on deforestation projections and on causal link between forests and local climate and rainfall, we calculated that soybean farmers could loose up to 30 millions USD per year of productivity if deforestation continues. Beef production on the other end could benefit from 26 millions USD of added revenue if water was better used for supporting the production of feed.

Discussion and conclusion

Additional analyses were made to highlight the relationship between farmers and the forest ecosystems through the local climate and freshwater provision services. Thanks to the water footprint methodology and water valuation techniques, we were able to show the links explicitly and quantitatively. This supports the engagement of Natura Bolivia with a range of stakeholders, from farmers to association of producers, authorities and communities to establish reciprocal watershed agreement. The engagement period and establishment of RWA is long and is still on going so we cannot within this paper report on the potential success of such tool. However, discussing on the basis on metrics showing the inter-relationship between various stakeholders within watersheds is already seen to be key to move forward the RWA tool.

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