GSI Technical Paper 3: Water Risks in Agricultural supply chains - Methodology for catchment prioritization to guide company action

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Water risks in agricultural supply chains

Water risk is the possibility of an entity experiencing a water-related threat, either directly or indirectly. Water risks can be higher or lower depending on the likelihood of a threat occurring, its intensity, and the degree of vulnerability (CEO Water Mandate, 2019). In agricultural supply chains, water risks are mostly related to the sites where the primary products are produced. As a result, it is in the interest of all parts of the supply chain – from retailer to trader to producer- to decrease the water risks associated with production sites.

Companies with global agricultural supply chains experience fundamental challenges in managing water risks. Supply chains are inherently complex as products are sourced from many locations, and each have their own reality in terms of water. If water risks are addressed from a global perspective alone, actions to manage water risks will not be effective as they disregard key characteristics of the local reality. If risks are fully addressed at the local scale however, too many resources may be needed.

To help addressing these challenges, a systematic and practical methodology is proposed to support global companies in effectively understanding and acting on water risks in their agricultural supply chains. The methodology combines a top down global approach to prioritize catchments with a bottom up local approach to validate risk score results obtained for the prioritized catchments and move towards action.

This paper presents the main components of the methodology. It first introduces the main water risk categories, then presents the methodology for catchment prioritization, and finally, a summary of main learnings is given. The methodology constitutes steps 1 to 4 of the WaterData4Action approach to create sustainable water use in agricultural supply chains[d].

Agricultural Water Risks

There are different categories when talking about water risks in agriculture (CEO Water Mandate, 2019):

- Physical risks comprise sub-topics related to **water scarcity** (water stress, aridity, droughts, impacts of climate change…), **water quality**, **water overabundance** (floods) or **ecosystem**

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[d]http://www.goodstuffinternational.com/images/PDF/GSI_Tech_paper_2_Sustainable_water_use_in_agri_supply_chains_WD4A.pdf

threats. They are considered as the primary risks in the present methodology, as they have a direct physical impact on the agricultural activity.

- Regulatory risks are risks associated with the legal and regulatory environment for water in a place. Examples of these risk can be low levels of law enforcement or non-existence of water governance institutions.

- Reputational risks refer to risks that originate from the cultural importance of water, biodiversity and landscape status, exposure to media or water conflicts.

In the context of this paper, regulatory and reputational risks are considered as secondary since they derive from physical primary risks.

Methodology for agricultural supply chain risk assessment

1. Create national or regional catchment water risk maps

For the methodology, it is assumed that a company is sourcing a substantial volume of agricultural produce from a certain country or region. This country or region is the geographic scope of the risk assessment.

- **Country or regional catchment mapping:** Download shapefiles for all catchments in the country or region and load into a Geographic information System (GIS)[e]. It is recommended to use sub-basin delineations from official institutions (e.g.: National environment ministries, River basin authorities)[f].

- **Global risk data** for the country or region in question is downloaded and mapped onto the country or regional catchments through spatial aggregation using the GIS (figures 1-A to 1-D). When available, groundwater maps are included in the GIS project. The two global risk datasets that can be used are the WWF Water Risk Filter (WWF, 2019) and the World Resources Institute Aqueduct (WRI, 2019).

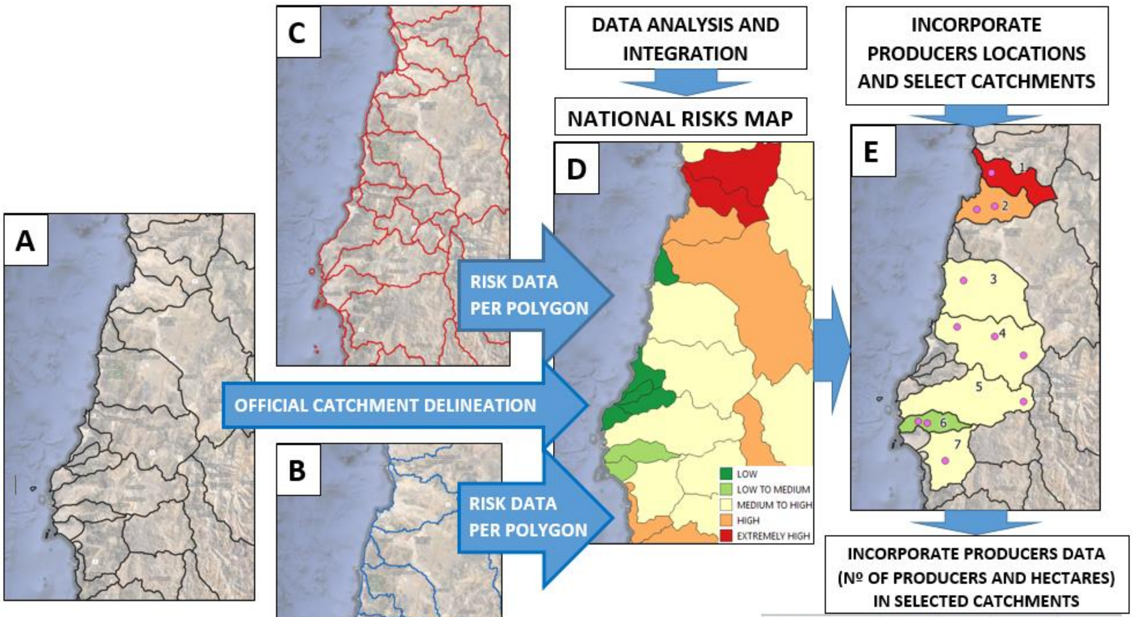
- **Data analysis and quality control**: Data from global sources are analyzed in detail to ensure quality and relevance. Outdated, non-relevant or too generic indicators are not selected. Indicators are selected and grouped into three main physical water risk groups: water scarcity, water quality and floods. At this stage, the remaining risk categories are left out of the grouping process and stored in a base GIS layer for potential later use in the assessment.

[e] The open source QGIS (QGIS, 2018) can be used for this: www.qgis.org

[f] In absence of official delineations, global catchment delineations can be used, like the one used by WWF (2018) in their Water Risk Filter: www.hydrosheds.org. Contact alex@goodstuffinternational.com to learn more about data integration and spatial aggregation at the catchment level.

2. Prioritization of catchments for company's action

- **Select company producer catchments**: Producer locations (lat/lon coordinates), the productive areas and number of hectares (or volume of produce) are gathered. The producers are mapped in the GIS in a producer layer that is overlapped with the risk data layer at the catchment level. A new layer is created that only shows the catchments with producers and their productive areas in hectares within each catchment (figure 1-E).



SUB_BASIN	RISK_SC	RISK_QUAL	RISK_FLD	PRODUCERS	HECTARES
1	5	2	1	1	1500
2	4	3	3	2	4200
3	3	1	2	1	450
4	3	5	4	3	1000
5	3	2	3	1	1200
6	2	3	3	2	420
7	3	5	2	1	300

Figure 1. Global catchment delineations from global datasets (here we assume two global risk datasets, B and C) including risk data for each polygon, are integrated into the national catchment delineation (A), resulting in a national risks map (D). Later on, producer's data are incorporated to identify the relevant catchments (E) and associated data on risks and productive surfaces. Each polygon has grouped indicators for scarcity, quality and floods categories. The number of producers per catchment and hectares are a theoretical fictitious example created for this paper.

- **Rank company producer catchments:** Four rankings for all relevant catchments are produced based on risk scores and the number of hectares per catchment. The four rankings are: (1) water scarcity, (2) water quality, (3) floods, and (4) an aggregation (average) of the three of them. The results are analyzed for the four rankings separately to determine: 1- the catchments that feature most prominently in the individual physical water risks categories (taking into account the number of hectares) and 2- the catchments that have the highest aggregated average of the three risk categories (also taking into account the number of hectares). For example, there might be catchments that do not rank top for each individual category, but that have a relatively prominent rank in all of the three risk categories. Therefore, this catchment would rank higher in the fourth rank group, the aggregated one.

The experience is that by only looking at the aggregated risk category, valuable information for the company is lost, since individual risks are obscured by the averaging process. Thus the importance of looking at both the individual risk ranks and the aggregated one. In this way, the company obtains a good overview on the different relative catchment situations, based on the information provided by the global risk data.

- **Select priority catchments for the company:** A screening of all other risk categories that were initially left out from the initial grouping process (section 1 of the methodology) is conducted. This includes secondary risks and is done to back up or complement the findings from the previous section on physical risks. Available background information such as specific country regulations or bad press from the company itself or other sources is used to complement the global information on prioritized catchments. All data, results and findings are presented to and discussed with the company to ensure the inclusion of any additional specific interests and information. The objective is to best inform the company in the selection of the priority catchments for the next phase.

3. Local Validation of results for the selected catchments

- **Local data desktop review and generation of a catchment water risk profile:** Once the company has prioritized certain catchments, a validation of the water risk catchment scores is conducted per prioritized catchment. This is done through a desktop review of publicly available local data and information. Some examples of the data and information that could be found are: data on the evolution of groundwater levels during the last years available on the website of the local water authority, reports or scientific publications on climate change impacts on precipitation levels for the catchment of interest, news on water scarcity and quality, press and media reports, online reports by NGO's, policy research, recent regulation changes or policy and legal papers by governments. Data and information are processed and summarized in the form of a "**catchment water risk profile**"[g] for each prioritized catchment.

  This profile consists of a frame to incorporate quantitative or qualitative detailed data from local sources following the structure outlined in table 1. Findings are incorporated in a narrative way, using bullet points and graphs, maps, tables, figures and references; developing a robust, concrete and clear risk profile based on local data findings. In each section of the water risk profile, a conclusion is given on the validation of the risks score obtained from global databases. The catchment water risk profile should also include, if possible, potential initiatives or groups (such as the creation of a water council) for improved water management in the catchment of interest.

[g] © Good Stuff International

Table 1: Catchment water risk profile structure

Introduction **Detailed maps, Risk scores and findings from the global analysis**
Water Scarcity **Water balance data and information, including the groundwater situation (when relevant) also incorporating climate change impacts.**
Water Quality **Recent information of surface and groundwater quality status and potential threats**
Floods **Occurrence of floods in the last 10 years, flood prone areas, extreme events and climate change forecasts.**
Reputation **Communication outings by local, national and international media that could damage reputation of growers and other supply chain partners.**
Regulation **The regulatory frameworks in place and development of those, recent changes, level of enforcement, existing local platforms, and the space for engagement in regulation.**
References **Proper reference to all documents cited, including Newspapers, websites and official documents.**

- **Ground-truthing:** In a constructive way, catchment water risk profiles are explained and discussed with producers. This will help them to better understand their catchment situation, and also to contribute by providing the perception from the ground, and set the basis for developing appropriate actions.

- **Final validation:** Incorporate additional findings and update catchment water risk profiles if need be, and finalize the risk profile by giving recommendations for decision-making towards effective and appropriate action in the selected catchments.

Throughout this process, collaboration between both sides of the supply chain is established. Contact with producers is established to transmit the benefits of addressing water risks at the catchment level. This supports the creation of a collaborative environment that fosters transparency, information exchange and sets the ground for efficient and adequate solutions.

Summary of main learnings

- A Geographic Information System approach is key for mapping and understanding global water risk data, as well as the global agricultural supply chain of a company (producers' locations and hectares). The geographic approach is the most effective way to conduct a company catchment prioritization for water risk mitigation.

- Global Water risk data is an excellent starting point to conduct a global water risk assessment. Nevertheless, any global data need to be critically revised and quality controlled using expert water knowledge. For example, global data do not take into account topics like the groundwater situation nor inter-basin transfers.

- Best is to work with disaggregated risk data. Aggregated risk scores based for example on the physical water risk category, which includes water scarcity, water quality, floods and threats to ecosystems may provide a misleading catchment prioritization. For example, a catchment may have a water scarcity score of 5 (the highest) and a flood score of 1 (the lowest). The aggregated water risk score for that catchment will be an average and by using the average the catchment will rank lower. However, the catchment may have serious water scarcity issues, which are obscured by the aggregation. It is best to look at the categories water scarcity, water quality and floods separately.

- Regulation and reputational risks in the global risk databases provide general guidance only. For example, in the global databases, regulation risk scores often remain the same for all the catchments within a country. It is thus important to validate results using local data and information.

- The risk score validation process for prioritized catchments is a key step in the process, providing a consolidation of results in a scientific way. Joined with the ground-truthing process, in which the point of view of the farmers is incorporated, the discussion for potential solutions and key stakeholders starts immediately.

- The “catchment risk profile” of a prioritized catchment is a solid and practical tool that enables communication and effective transfer of results internally (to the different departments of the company, for example from the sustainability department to procurement) and externally (to producers).

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Fernández Poulussen, A. Zarate, E. and Kuiper, D. 2019. Water Risks in Agricultural Supply chains – Methodology for catchment prioritization to guide company action.

References and further reading:

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