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Aid, Water, and Peace: Assessing Foreign Assistance's Impact on Conflict in Water-Stressed India - A Spatial Grid Analysis

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Abstract

Using the grid analysis with fixed effects method, this paper investigates the effect of foreign aid project allocation on conflict onset in the context of varying water stress situations in India. The study finds out that allocating aid projects generally heightens the probability of conflict incidents. But if the projects are well-targeted within low and extreme water stress areas, it helps reduce conflict onset. We also tested this method in India's neighboring countries in South Asia. The heterogeneous patterns of the results for each country demonstrate that one has to take into account the particular situation of each country when interpreting the diverse result patterns. For broader context, under the trend of revising the foreign aid policy of donor countries to be more aligned with their interests, recipient countries should consolidate their efforts on developing their economy and tackling their social issues while leveraging decreasing external support to achieve sustainable progress and stability.

1 Introduction

1.1 Motivation

The aim of this study is to investigate the effect of foreign aid allocation on the onset of potential conflict, especially in the context of water stress in India, contributing to the literature by providing new insights into the spatial dynamics of aid and conflict under varying water stress conditions. This study uses the 50 by 50 km grid cell as the default unit of identification. Control variables such as GDP, population, representing economic growth and urbanization, and cropland percentage, representing the agriculture sector, and average temperature and monthly precipitation, representing natural conditions are included to enhance our understanding. The linear probability model was chosen for its simplicity in interpreting coefficients. In the main model, conflict is described by a dummy variable at the grid cell level, indicating whether conflict occurs (100) or not (0). The original dataset also provides a further breakdown into three subcategories of conflict and measures conflict intensity via casualties, which are also tested as dependent variables in this study. We observed the aid data on the annual basis from 1995 to 2014, based on the availability of the Aid Data 2017, allowing for control of fixed-effect at the grid cell- and regional-time trend levels. Standard error was being clustered at the grid cell level to rule out heterogeneity within each cell. Besides the main results of India, we also applied the same regressions to neighboring countries in the South Asia region to test the external validity of the previous findings. Additionally, we conducted robustness checks by running the regressions with smaller grid cell resolution.

The main result shows that an allocation of a foreign aid project in a grid cell accelerates the potential of conflict onset. But when those projects are placed within areas with the water stress level of category 1 (low-to-medium level of water stress) and category 4 (extreme level of water stress), then the chance of conflict happening significantly reduce, this reduction effect even outweighs the heightened effect of projects being allocated to a grid cell in general. And among the control variables, the statistical significance of the variable log of GDP showcases that a 1 % percent increase in economic growth translates to a decrease in the probability of having conflict by 0.3881 %. Overall, the main result gives us a clear picture for the foreign aid administrator about the importance of identifying resource-constrained areas when distributing aid resources. To interpret the result, in India, aid projects in low- to medium-water-stressed areas could be a tool, providing local communities with knowledge, training, and infrastructure as preventive measures in the future. On the other hand, projects in areas with extreme water stress provide immediate, targeted relief to deal with crises. Furthermore, it is suggested from the main result that effective governance and facilitation for economic growth from the local government reduce the likelihood of insurgency. Thus, alongside external aid, fostering local economic development emerges as a vital, organic strategy to lower conflict over time, offering a dual approach to peacebuilding in India.

1.2 Background

1.2.1 Water stress

Water stress, being defined as when the demand for water surpasses the available amount of water during a certain period of time, could lead to the deterioration of both the quantity and quality of water resources (WRI 2025). This phenomenon is widespread in many countries around the globe, with at least 50% of the global population (4 billion people) enduring the highly water-stressed conditions for at least one month in a year; 25% of the world experiences "extremely high" water stress situations, whereby they use over 80% of their annual renewable freshwater supply (UNESCO World Water Assessment Programme 2024). This phenomenon has been driven by both exacerbating natural events and the intensification of human activities. For instance, droughts are becoming increasingly common, intense and widespread. According to Zaveri, Damania, and Engle 2023, over the last 50 years, extreme dry rainfall shocks have increased by 233% on average. Similarly to droughts, it is also reported with high confidence that heavy precipitation events (floods) have become more frequent and intense over most land areas since the 1950s. Furthermore, climate change is only about to intensify the global water cycle, thus increasing the intensity and frequency of extreme hydro-meteorological events like droughts and floods, especially in already water-stressed regions (Seneviratne et al. 2021).

Under these circumstances stands the ever-intensifying human activities. Overall, the demand for water consists mostly of agriculture, which accounts for 70 % of freshwater withdrawals, around 20 % for industrial applications, and 10% for domestic usage. Particularly, the agriculture sector is susceptible to water risks, where dependence on rainfed crop could be severely punished during times of drought, and bad water governance on water usage for irrigation systems could undermine the food security for many countries. The latter two sectors are primarily increasing the demand for water because of the rapid industrialization and urbanization, hence the expansion of the water supply and sanitation system in many parts of the developing world. Depending on the assumed scenarios, the global water demand is forecasted to be heightened by between 20% and 33% by 2050 compared to 2010 (Burek et al. 2016, p.69). Water stress, as previously described, poses several challenges to be overcome. Firstly, the transboundary nature of water resources—where countries or regions share river basins or aquifers—can lead to social, economic, and political disputes over water rights, allocation, and management, occurring at either an inter-regional or international level. Secondly, the disparity in allocation of water access between urban and rural areas could create the division within one country or region, whereby demand for agricultural irrigation in the rural area could be subordinated to the domestic and industrial water usage for urban areas. Likewise, water stress could also drive migration from water-scared regions to more abundant resource ones, further stressing the infrastructure of the host regions, which could lead to social unrest and division between the newcomers and the host communities (UNESCO World Water Assessment Programme 2024, p.20). Finally, the convergence of water scarcity and climate change will only make the water governance a more difficult task.

1.2.2 Conflict

Conflicts can take the form of interpersonal disagreements to outright large-scale wars due to different reasons, from resource competition, political and ideological differences, racial and ethnic discrimination, or socio-economic disparities. Given the introduction to the problem of water stress in the first paragraph, it becomes possible that it could cause disputes or conflicts among the population over resource allocation and management. For instance, the competition for water resources in the Nile Basin has historically contributed to tensions between Egypt, Sudan, and Ethiopia, making the negotiations for water management between three countries challenging and sometimes leading to threats of conflicts (UN 2021). According to the report of UNESCO World Water Assessment Programme 2024, water scarcity often co-moves with other factors, which impacts the onset of potential conflicts, so the direct causal effect of water stress on conflicts is difficult to affirm. Likewise, regions with ongoing conflicts often lack a strong governance capability among the public institutions; essential infrastructure for water needs like irrigation systems for agriculture, as well as reservoirs, treatment plants, and distribution systems for industrial and domestic use could also be compromised. For example, after ten years of

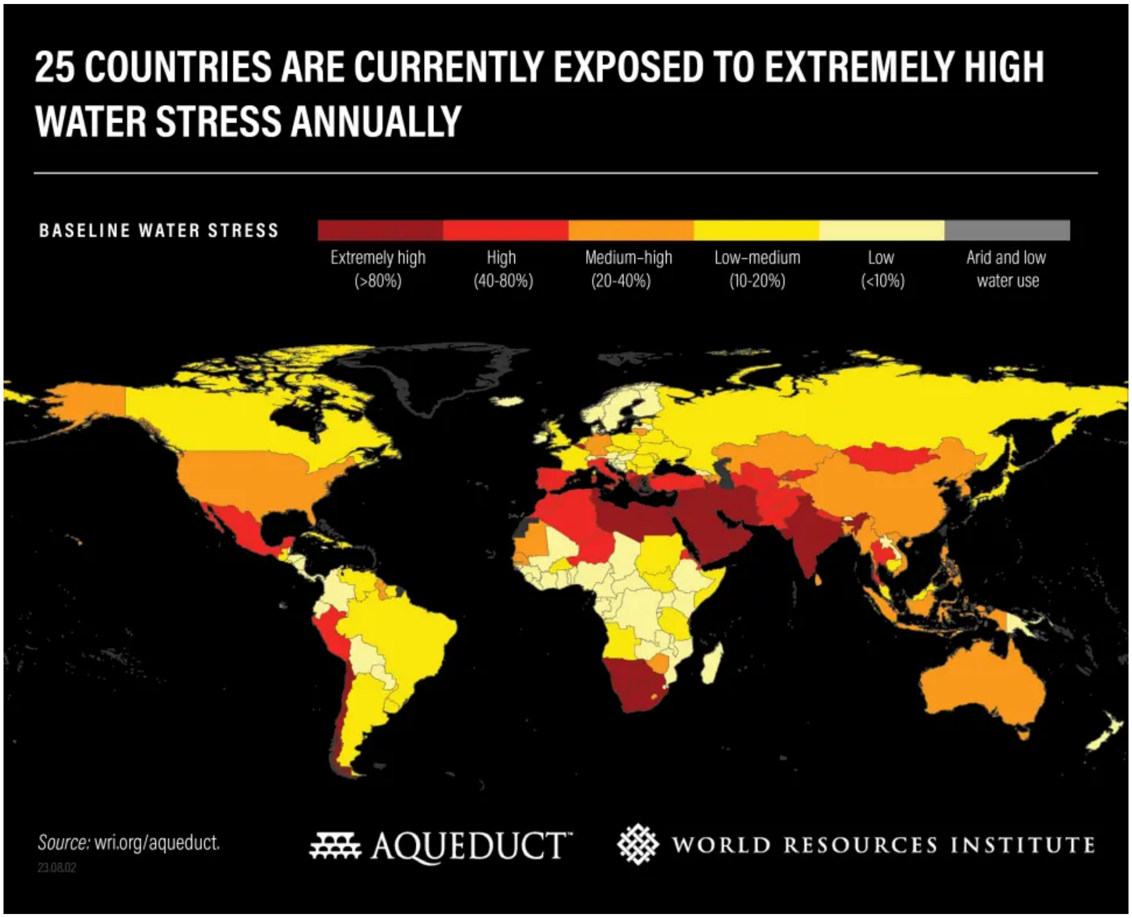

Figure 1: Visualization of water stress situation around the world

conflict in Syria, many water facilities were destroyed. As a consequence, it severely hinders the access of the population to essential services, including water. (International Committee of the Red Cross 2021). Therefore, examining general conflict data, regardless of the reported causes, could yield insightful results. Davies, Pettersson, and Oberg 2023 did a comprehensive report on the conflict dataset done by UCDP from 1989 to 2022, reporting the organized violence in terms of "events". They defined an event of organized violence in one calendar year as *"an incident where armed force was used by an organized actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date"*. Furthermore, conflict incidences were categorized into three types of organized violences: state-based armed conflicts, non-state conflicts, and one-sided conflicts, and a conflict is reported in those three cases when at least 25 people are dead in a calendar year. By analyzing the geographic and temporal distribution of conflicts, we can infer a potential relationship between water stress and conflicts, along with other variables. This data will be the main source to measure conflict and will be explained in further detail in the following chapter.

1.2.3 Foreign aid as a solution

To tackle the challenges mentioned above, a country or region might employ a range of strategies such as reforming and improving their governance, adopting innovative technologies, etc. Particularly, foreign aid, often offered by developed nations in the form of grants and loans to support the developing nations, stands out as a prominent tool. The motivation of this policy is driven by multiple factors, encompassing humanitarian concerns of improving lives for people with lesser privileges to strategic interests of exercising influence over recipient countries or fostering stability and preventing conflict spillover around the world. Major donors of foreign aid are the United States, the European Union, Japan, and China, as well as international bodies such as the World Bank, and the United Nations (OECD 2023). Foreign aid is often channelled through direct project funding. Aid projects being attributed to a country often cover a wide spectrum of sectors: government and civil services, other social infrastructure, transport and services, energy generation and supply, and banking and financial services. Among those, water-related initiatives are particularly relevant in the context of water stress. These projects may include building or upgrading critical infrastructure like water supply, sanitation, and irrigation systems, directly mitigating water stress by improving access to clean water for domestic use and boosting agricultural productivity and efficiency in water-scarce regions. Beyond infrastructure, foreign aid focuses on capacity building, enabling local communities and governments to address challenges by themselves. In the example of water-related issues, this could involve technical training in efficient water management practices, such as resource exploitation, recycling, and conservation. All of these potential contributions of foreign aid to local areas could have an effect on the onset of conflict.

1.2.4 Literature review and contribution of the paper

The literature on the impact of foreign aid shows no consensus on its effectiveness in mitigating conflict in recipient countries. Several studies indicate a positive effect, suggesting that aid can reduce conflict (Crost, Felter, and Johnston 2014; Nunn and Qian 2014; Dube and Naidu 2015; Troland et al. 2013). These authors argue that increased aid, which often are allocated to local authorities, may incentivize rival groups to sabotage aid programs, either with the goal of seizing recently arrived external resources or undermining the population's support for the authority. Crost et al. (2014) and Troland et al. (2013) further note that this dynamic is conditioned on the occurrence of pre-existing conflict in the area, which can expedite such sabotage efforts. On the contrary, other studies find no significant correlation between aid and conflict reduction (de Ree and Nillesen 2009; Beath, Christia, and Enikolopov 2017; Savun and Tirone 2011). These conclusions are dependent on the studied countries' circumstances, the type of aid provided, and the study's design—particularly if there are enough relevant variables to control for confounders. For instance, research by SzabÓ 2022 contends that the effect of foreign aid on conflict is contingent on the governance capacity of the recipient country. This perspective is complemented by Levi 2006, which summarizes the characteristics of an effective government. Together, they argue that a state can avoid conflict by leveraging its institutional strength to maintain stability, even when there are negative foreign aid shocks. Overall, these studies have one thing in common, that they often rely on cross-national or regional to assess the impact of aids to conflicts. Building on this foundation, this paper seeks to investigate the effect of foreign aid on conflict in the presence of water stress at a more granular level through grid cell analysis.

In this study, India was chosen as the main country of the study. In spite of abundant monsoon rainfall and major river systems such as the Ganges and Indus, India is still ranked in the "Extreme" category at the 24$^{\text{th}}$ place in the national water stress rankings(Kuzma et al. 2023). India's water demand is projected to increase significantly in the coming decades, especially from the manufacturing and domestic sectors (Vaibhav et al. 2022). Moreover, even though the dependence of India's economy on foreign aid has been decreasing in recent decades, with the aid inflows-to-GDP ratio of India declining from 7 % in the 1980s to under 1 % by 2014 (Aid Data 2012), foreign aid is still a prominent tool in addressing peculiar problems in many areas in India. Along with varied types of conflict happening in India, these factors make India an ideal case for examining the influence between foreign aid and conflict under varying water stress situations. For the organization of this paper, detailed information about the methodology and harmonization process of different data as well as the descriptive statistics of the final dataset will be mentioned in chapter 2. Chapter 3 consists of the main result along with robustness tests using finer grid resolution and some external validity tests using neighboring South Asian countries. In chapter 4, a brief summary of the results and implication of the results will be included. Other secondary results and graphs will be put in the chapter 5 and the separate document ***Appendix - continued***.

2 Methodology and Data

This chapter provides brief details on the data, as well as the extraction and harmonization methods in order to create final panel datasets for regressions (subsection 2.1). In the subsection 2.2, explanation about the regressions will be specified. Additionally, the project title analysis method will be mentioned as a supplementary tool for interpreting the regression results in the chapter 3.

2.1 Data

2.1.1 Conflict

As previously mentioned, the primary focus of this thesis is on the onset of conflict. To this end, we utilize detailed data from the Uppsala Conflict Data Program (UCDP) on conflict events spanning from 1989 to 2022 (Davies, Pettersson, and Oberg 2023). These events are geolocated with precise coordinates and categorized into three types: state-based, non-state, and one-sided conflicts, and they happen within a specific date within the calendar year. Each event's intensity is also documented, including various estimates of fatalities. For the main regression model detailed in equation 1, we employ a binary dummy variable (100 or 0) to signify the occurrence of conflict. Additionally, to gain deeper insights into how foreign aid influences conflict, we explore more granular variables that differentiate between conflict types and measure conflict casualty as dependent variables. Given that the original dataset records conflicts at the event level, we aggregate this information to construct our conflict dummies and the best estimate of fatality at the grid cell level on an annual basis by using the spatial join method between the conflict spatial dataset and the grid cells of India. For this study, only the data from 1995 to 2014 will be used, because of the limited availability of the foreign aid data.

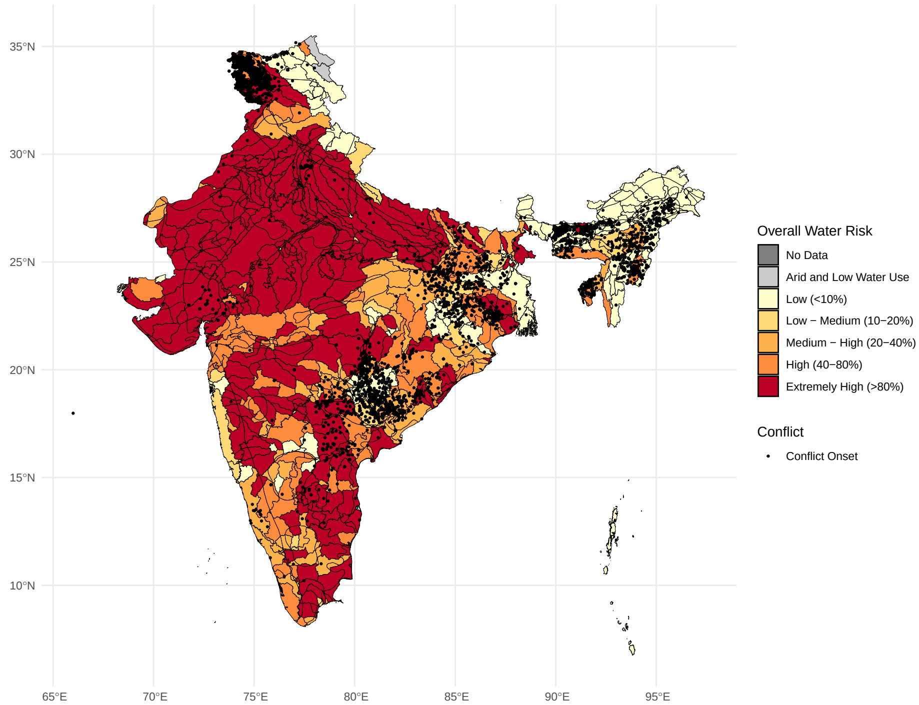

Figure 2: India's water stress with conflict locations from 1995 to 2014
with HydroBASINS level 6 as baseline map layer
Source: Aqueduct 4.0 by WRI and UCDP conflict dataset

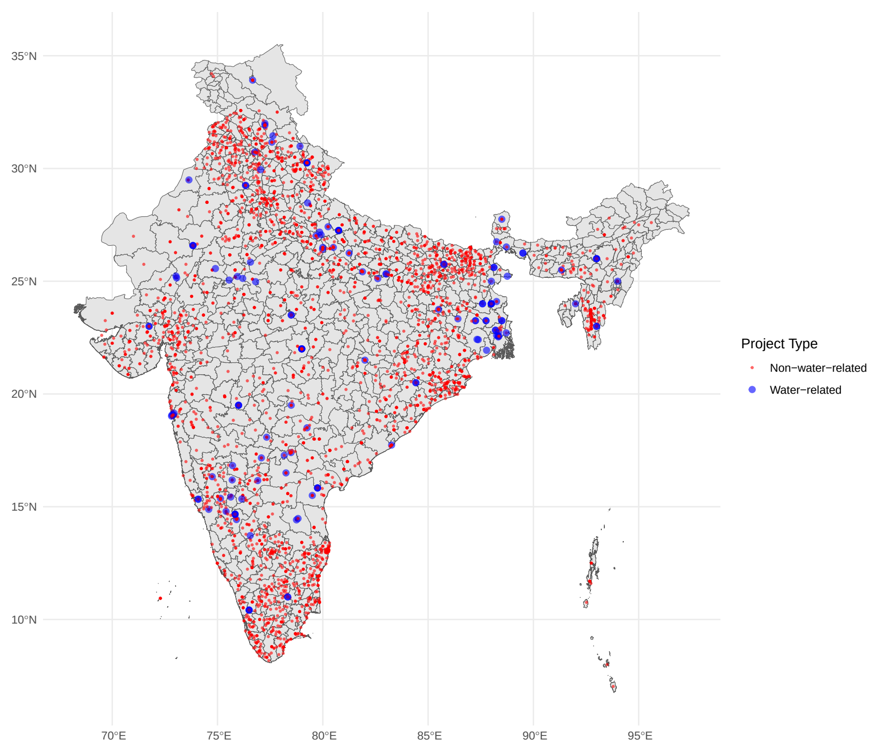

Figure 3: Distribution of World Bank Aid Project Locations from 1995 to 2014
with subdistricts (administrative level 2) as baseline map layer
Water-related sectors are agriculture, forestry, fishing, water supply and sanitation
Source: AidData — World Bank Geocoded Research Release, Version 1.4.2

2.1.2 World Bank aid projects

For this study, data on foreign aid was from the World Bank Geocoded Release by Aid Data 2017, which documents approved projects between 1995 and 2014 under the World Bank's IBRD/IDA lending instruments. This dataset contains precise location coordinates for each project, noting that one project might be operated in more than one location, along with the start and end years of the project's financial transactions and commitment and disbursement amounts. In our data manipulation process, we utilized the transaction start year as the starting point for each project, under the assumption that conflicts might arise as funds begin to flow into an area. For the allocation of foreign aid projects, we selected the project location count as our key variable. Although including commitment and disbursement amounts in the regressions could reveal the financial scale of aid's impact on conflict onset, our data skimming of AidData uncovered significant gaps in disbursement records. Additionally, as disbursements are often renegotiated on the basis of the reality on the grounds, commitment data does not accurately reflect resources that are locally delivered, (see figure 4). Consequently, we excluded these variables from the regression analysis.

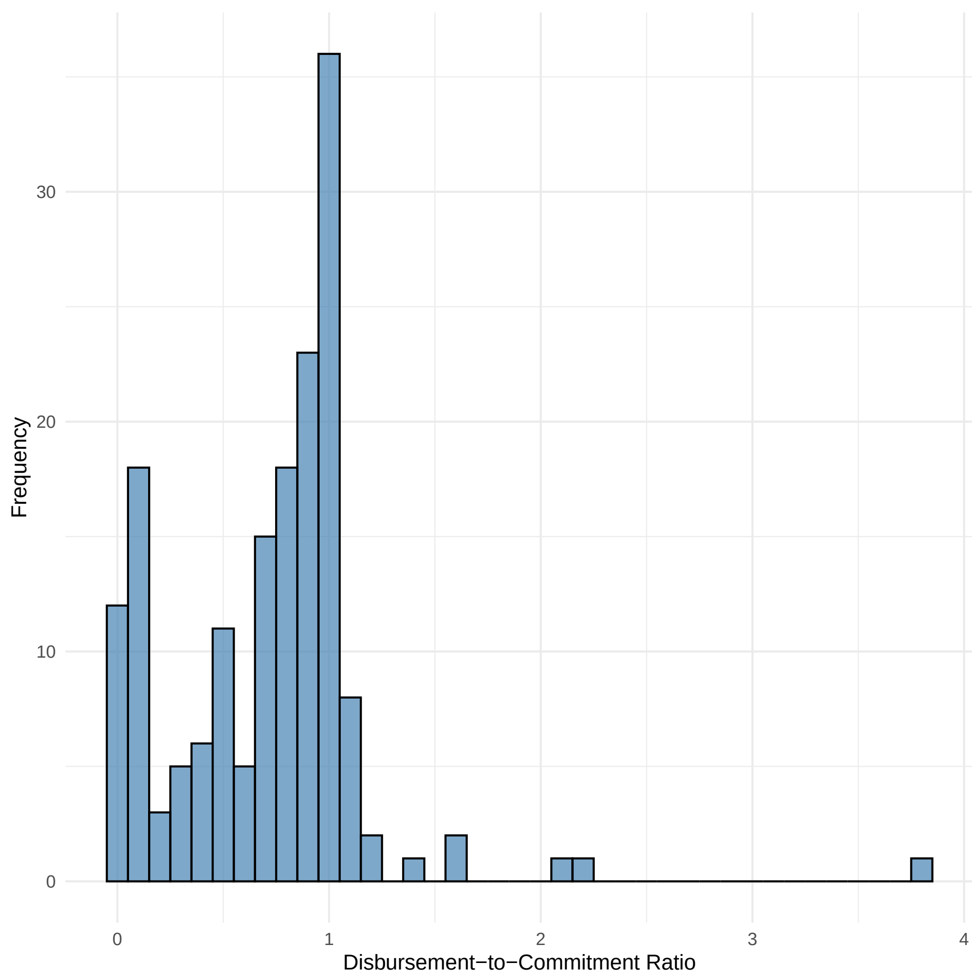

Figure 4: Disbursement-to-Commitment Ratio for World Bank Projects in India from 1995 to 2014
Source: AidData — World Bank Geocoded Research Release, Version 1.4.2

Regarding project sectors, we opted to include all projects in our analysis, irrespective of their specific sectors (see figure 5 for the distribution of project sectors across different levels of water stress). Focusing solely on aid projects related to water or any specific sector might overlook the broader socio-economic environment that influences conflict, because water scarcity is indicated by previous research as an indirect factor to the conflict onset (UNESCO World Water Assessment Programme 2024). Likewise, including projects from all sectors allows us to consider how aid could influence local economies, governance, and social services, all of which are interlinked with the probability of conflict onset. This analysis did not include the data on the Chinese aid. This choice was justified by the need for a uniform dataset for dependent variables. Chinese aid is also different compared to the World Bank's in terms of reporting standards. And their strategic goal often aligns with its geopolitical objectives rather than purely development goals. This is especially noticeable in the case of South Asia, where foreign aid for China has been a policy to counterbalance other geopolitical powers like India and the United States, accompanied by the raising issue of sustaining these development debts due to receiving Chinese foreign aid (US House Committee on Foreign Affairs 2022). This uniformity also simplifies the methodological approach and data harmonization process.

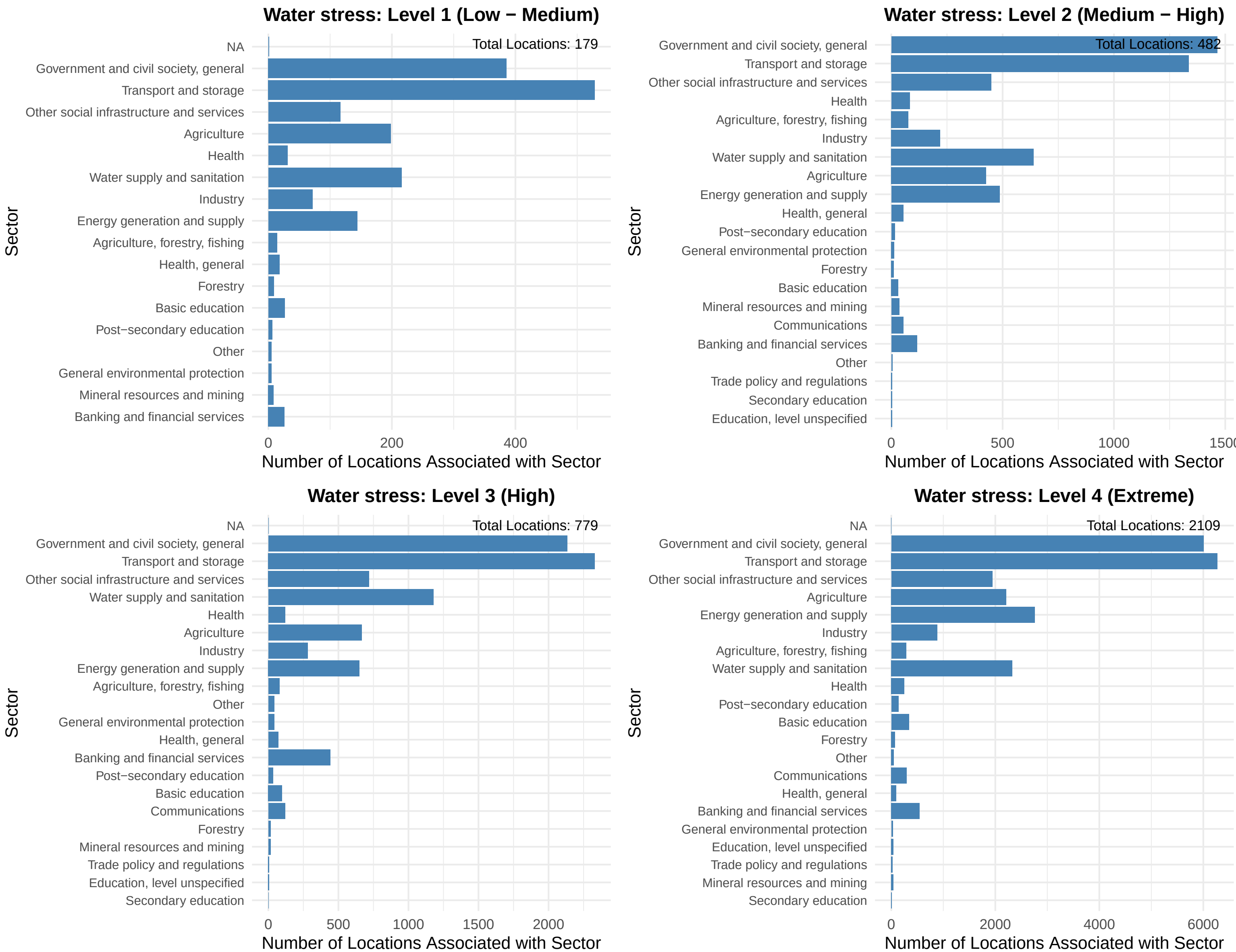

Figure 5: Distribution of World Bank Projects by Sector in India from 1995 to 2014
Note: Overlapping could happen because one project could be classified in several sectors
Source: AidData — World Bank Geocoded Research Release, Version 1.4.2

2.1.3 Water stress

To measure the water scarcity in the region, we use the water stress index from the Aqueduct project of the World Resource Institute (WRI) (WRI 2023). This index is a part of 13 indicators in the Aqueduct project to measure the water-related risks. According to the WRI, water stress is defined as the ratio of total water demand to available renewable surface and groundwater supplies and is averaged from 1979 to 2019 in version 4 of the Aqueduct data. Its calculation was based on the hydrological sub-basin at level 6 (there are 12 levels). To adapt for the baseline unit of this study, the recalibration of the index involved adjusting the value based on the weight of the surface area of HydroBASINS level 6 to that of the grid cell. Missing values in the original data were dropped. Furthermore, in some water basins, the available supply is nearly exhausted while the demand remains persistent, so the water stress index of those basins was reported as 9999. For the consistency of the data transformation, the water stress value of 9999 is converted to the next normal water stress value in the data set, which is 25.305. After the water stress value *bws_raw* transformation to grid cell is done, we constructed a categorical variable for the water stress. This variable follows the original construction of the variable *bws_cat*, which originally has 5 categories of risk—Low (0), Low-medium (1), Medium-high (2), High (3), Extremely High (4), Arid, and low water use (-1) (Kuzma et al. 2023, p.11). The category -1 was fused into category 0 because there is only one grid that falls into this category, plus it eliminates the problem of multicollinearity of potentially having other categories being removed in the regressions. The category 0 will be set as the reference for the water stress level variable. These attributed categories to each grid cell are constant across all temporal resolutions because the raw water stress value is an averaged value from the period between 1979 and 2019. As shown in the descriptive statistics in table 1, the vast majority of India's grid cells are classified under water stress level 4 (extreme), totaling 717 grid cells, followed by level 3 (high) with 210 grid cells, level 0 (low) with 157 grid cells, level 2 (medium-to-high) with 210 grid cells, and level 1 (low-to-medium) with 48 grid cells, covering a 20-year period from 1995 to 2014.

2.1.4 Temperature

Temperature is included to capture the average thermal conditions, which are critical in understanding the long-term weather patterns that affect agricultural productivity, water availability, and consequently, the livelihoods of local populations. We pulled the temperature data on from the Climatic Research Unit gridded Time Series (Harris et al. 2020). The data is in a gridded format spanning from 1901 to 2023 in very high resolution (0.5°) - which is around 5 by 5 km in India's geographical location, so much smaller than the study's grid resolution of 50 by 50 km. We proceeded with the data manipulation by cropping the original temperature raster data to the grid cell map of India. The temperature value for each of India's grids is then averaged from the original data of the raster. Moreover, because of the original monthly format of the temperature data, we averaged the monthly data of each year to produce the annual temperature value for each grid. Data from the descriptive statistics table 1 indicate that the median annual temperature in India is 26.166°C, underscoring its heightened vulnerability to drought and arid conditions.

2.1.5 Precipitation

Likewise, precipitation is also an integral variable in this study. It is used to account for the water cycle's regularity and the occurrence of extreme weather events like floods and droughts. This variable provides insight into the availability of water resources, which is pivotal in regions where water stress is a known factor. High precipitation might lead to flooding, causing immediate disruption and potential conflict over damaged infrastructure or displaced populations. Conversely, low precipitation can result in drought conditions, worsening the demand for water. The used data is from the Climate Hazards Center (Funk et al. 2015). It is also in the monthly gridded satellite-based data format with very high resolution (0.05°). The data manipulation process is also similar to the one for temperature, namely that the raw data of rasters within each grid is extracted and averaged; from this, we get the single mean monthly precipitation value for each grid cell for 12 months for all recorded years. Finally, for each grid cell, those 12 monthly mean precipitation values within a given year are averaged again to produce the average monthly precipitation for a specific grid cell in a specific year, expressed in millimeters (mm). Looking at the descriptive statistic table (table 1), India has the median average monthly precipitation of 86.44 mm, indicating moderate conditions for most grid years. The range from 3.264 mm (minimum) to 446.451 mm (maximum) highlights the presence of both extremely dry and extremely wet grid years, reflecting India's diverse climate. And with the moderate variation of 61.4121 mm for the interquartile value despite the extreme difference between maximum and minimum values, there is a good argument for including precipitation in our study's regressions as a control variable.

2.1.6 Cropland percentage

To control for the agricultural production and its land use within each grid cell, we incorporate cropland percentage as a control variable. According to the data source from Potapov et al. 2022, cropland percentage is defined as the percentage of land used for annual and perennial herbaceous crops for human consumption, forage (including hays). By including the proportion of land dedicated to crop production, we isolate and control for the socio-economic implications of agriculture on conflict dynamics, because increased agricultural activity could secure the food demand—reducing conflict potential or overstressing local resources, leading to conflict. This control is crucial since agriculture accounts for more than 70% of freshwater withdrawal (Vaibhav et al. 2022, p.43), and its demand is projected to even further increase in the future, directly linking it with temperature and precipitation variables that influence flood and drought risks.

The raw raster data has a very high resolution of approximately 1 km. It is available in four-year interval epochs, from 2003 to 2019, which makes it 5 observation points. Here we take the cropland percentage value for the beginning year of each epoch to be equal to the average of the epoch, i.e., the cropland percentage for 2003 is the average value of the epoch 2000-2003. This approach assumes that cropland percentage change is relatively stable within each epoch, which simplifies the extrapolation process. It is acknowledged that this method could smooth out the relative fluctuations that occurred during these periods, but because of the limitation of the raw data, we proceeded as mentioned above.

Similarly to the two previous variables, we extracted and then applied the mean function to find out the cropland percentage value of each grid cell. Due to the limit of temporal observations (only 5 observation points), we tried to extrapolate the data to get the individual annual value of the cropland percentage from 1995 to 2014. Firstly, via the raw data, we calculated the four growth rates between each original observation point. The annual growth rate is then converted by taking the fourth root of the compound growth factor, since there are 4 years in each interval. To estimate cropland percentages for the years before the first data point of 2003, we used the converted annual growth rate in reverse. When looking at the literature review on the agricultural expansion of India, we see that the rate of change in cropland percentage was generally lower in the decades before the turn of the century due to less intensive mechanization, slower adoption of high-yield varieties, and different government policies focusing on land reforms rather than expansion. (Singh and Bhalla 2009). Therefore, we assume that the annual growth rate of cropland was about half or less of what we observed in the 2000s for the backward extrapolation. For the forward extrapolation from 2003 onwards, we used linear interpolation to estimate the cropland percentage based on the five known data points. In the descriptive statistic table (table 1), the cropland percentage of India's grid cells ranges from 0 % to 98.1 %, with a median of 35.8 % and an interquartile range of 50.9 %. This demonstrates a moderate but highly heterogeneous agricultural presence across India's territory. Indeed, India's diverse land use, from non-arable to intensive farming zone, makes a strong case for including the cropland percentage variable as one of the control variables. This reinforces the linkage between agricultural activity, water use, and conflict.

2.1.7 GDP

To control for economic activities and development within each grid, we utilized gridded GDP data from Gaffin et al. 2004, available via the Socioeconomic Data and Applications Center (SEDAC). This dataset provided GDP predictions for 2025 with a 1990 baseline, based on the Special Report on Emissions Scenarios (SRES) B2 scenario, which focuses on local solutions for sustainability, environmental protection, and social equity with slower technological and economic growth (Nakicenovic and Swart 2000). We extracted and recalibrated the GDP data for 1990 and 2025 to match our study's grid cells. Importantly, the result of this extraction process is the mean GDP for each grid cell, providing an average economic output per unit area. Additionally, we used a complementary dataset from the same source (SEDAC) to derive national annual growth rates from 5-year interval GDP predictions (1990-2100) under the B2 scenario (Findley et al. 2011). These deducted annual growth rates are then used to apply to the ensemble of the baseline grids' GDP for the extrapolation step. Due to the limited temporal coverage of the gridded data, we assumed homogeneous growth across all grids based on these national rates. For extrapolation, we created a comprehensive data frame for each grid cell, adjusting zero GDP values in 1990 to a minimal non-zero value to ensure computational consistency. We then apply the national annual growth rates generated above to the grid cell's initial GDP value of 1990 to project GDP values year by year up to 2025. Grid cells with zero GDP in both 1990 and 2025 are maintained at zero for all those in-between years. Finally, the extrapolated dataset is filtered to include only data from 1995 to 2014.

2.1.8 Population

Similar to the GDP data, we utilize gridded population counts from SEDAC (Center For International Earth Science Information Network-CIESIN-Columbia University 2018), at the resolution of 30 arc-seconds (roughly 1 km by 1 km at the equator). This data aggregates national census information from 2000 to 2020 in 5-year intervals through a gridding algorithm. Including population as a control variable is crucial for understanding the increased demand for water for domestic, industrial, and auxiliary uses, such as cooling in power plants, alongside population expansion. The extraction method of the raw data onto the baseline unit of this study is identical to the one of GDP data, by projecting the data from the original rasters to each grid cell and then calculating the mean of the original raster data within each grid cell. This approach yields the population density for each grid. As the aggregated data only has 5 observations for each grid from 2000 to 2020, we proceeded to extrapolate the population density data from 1989 to 1999 using a decreasing growth rate based on historical trends from UN data for India, accounting for the observed decreasing growth trend in this period (Department of Economic and Social Affairs Population Division 2024). From 2000 onwards, we employ linear interpolation between known census years (2000, 2005, 2010, 2015, and 2020) to fill in the population data gaps. Then, the final extrapolated data is filtered to include only the temporal resolution from 1995 to 2014.

2.1.9 Descriptive Statistics

	Descriptive Statistics							
	Obs	Mean	Std	Min	Q1	Median	Q3	Max
Conflict dummy	25340	8.074	27.244	0.000	0.000	0.000	0.000	100.000
State-based conflict dummy	25340	6.066	23.870	0.000	0.000	0.000	0.000	100.000
Non-state conflict dummy	25340	0.608	7.772	0.000	0.000	0.000	0.000	100.000
One-sided conflict dummy	25340	4.365	20.431	0.000	0.000	0.000	0.000	100.000
Project location count	25340	0.150	0.593	0.000	0.000	0.000	0.000	13.000
Best death estimate in log	25340	0.157	0.626	0.000	0.000	0.000	0.000	6.248
Water stress level 0	3140							
Water stress level 1	960							
Water stress level 2	2700							
Water stress level 3	4200							
Water stress level 4	14340							
GDP in log	25340	1.641	0.764	0.000	1.244	1.642	2.115	5.292
Population in log	25340	5.055	1.285	-0.866	4.729	5.218	5.779	9.161
Average temperature	25340	24.605	5.829	-7.040	25.146	26.166	27.096	30.093
Average monthly precipitation	25340	95.586	57.487	3.264	57.839	86.444	119.260	446.451
Cropland percentage	25340	0.389	0.288	0.000	0.125	0.358	0.634	0.981

Table 1: Descriptive statistics of Key Variables
Annual data for India's grid cells from 1995 to 2014

2.2 Methodology

$$\begin{aligned} P\{\text{Conflict}_{it} = 100\} \text{ or } \text{Conflict}_{it} = {} & \beta_1 \text{Aid}_{it} + \beta_2 (\text{Aid}_{it} \times \text{Water Stress}_i) \\ & + \beta_3' \mathbf{X}_{it} + \eta_{jt} + \tau_i + \epsilon_{it} \end{aligned} \tag{1}$$

The equations 1 above is the main regression equations of the study; the first dependent variable is for all conflict dummy variables, and the second dependent variable is for the conflict casualty variable. The identification of the study is being done at the grid cell level $\boldsymbol{i}$ by arbitrarily choosing the dimension of 50 by 50 km. After being created, its centroids are projected on the country map. Only the grids with the centroids being located inside the country's territory are then kept as the unit of the study (see figure 6). It is understandable that there would be grid cells that are not totally inside one country's territory; for example, they could entrench into the neighboring countries or the ocean. These differences among grid cells could be controlled via the inclusion of the grid cell fixed-effect. Furthermore, as a robustness check in chapter 3.2, we will utilize smaller grid cell dimensions as the base unit of our study. This adjustment aims to reduce the instances where grid cells extend into neighboring countries or over the ocean, thereby enhancing the precision of our geographical analysis. External validity tests were also conducted on some neighboring South Asian countries; the aim was to observe whether India's result pattern is applicable to its neighboring countries. And all the data for each variable are harmonized at the annual level $\boldsymbol{t}$, as discussed in the subsection 2.1.

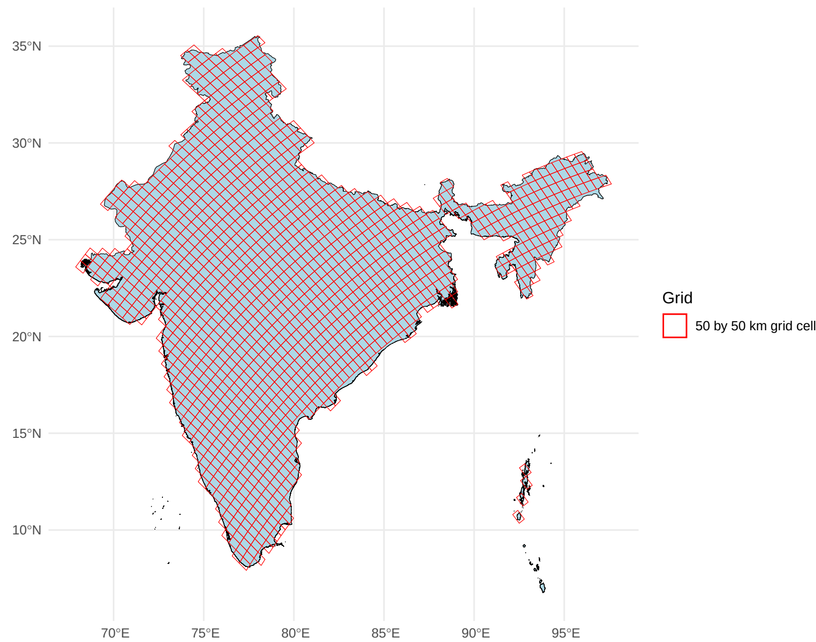

Figure 6: 50 by 50 km grid cells in India

The assumption in the equation is that foreign aid could have an effect on the onset of conflicts. Moreover, by allocating foreign aid projects in the water-scarce areas, the existing impact of foreign aid on conflict could be even further amplified or shift in the other direction; hence, the interaction term of foreign aid and water stress variables is included. Besides, control variables $\boldsymbol{X}$ such as the logarithm of GDP mean, the logarithm of population density, average temperature, average monthly precipitation, and cropland percentage were included to account for potential confounding factors like economic development, demographic pressures, climatic conditions, and agricultural land use that could otherwise obscure or bias the estimated relationship between foreign aid projects and conflict, especially in water-stressed areas. Because the final dataset used is a panel data, we have to control for the time- and entity-fixed effects. Here, we choose to take into account the grid cell fixed effect (denoted τ_i), capturing the time-invariant difference between grid cells, and the regional time trend fixed-effect capturing the dynamic of subdistrict characteristics evolving over time (denoted η_{jt}). Finally, the standard error is clustered at the grid cell $\boldsymbol{i}$ level in order to take into consideration heteroskedasticity and for arbitrary autocorrelation within an entity but treat the errors as uncorrelated across grid cells (Watson and Stock 2018, p.376).

Noticeably, the regression model specified in equation 1 employs a linear probability model (LPM) when the conflict-related dependent variable is binary, taking values of 0 or 100. This approach facilitates straightforward interpretation of the coefficients. However, treating the binary dependent variable as continuous in the LPM can result in predicted probabilities falling outside the [0,100] range. This contrasts with probit or logit models, which constrain prediction values within the predefined range. As a solution, predicted values below 0 can be interpreted as 0, and those above 100 as 100. Conversely, when the conflict-related dependent variable is continuous in equation 1, the regression results provide insights into how foreign aid affects the intensity of conflicts, namely the best casualty count. Regarding the unit of study, using grid cells as the primary unit differentiates this research from other studies on the same topic. While many studies of the same topic might adopt a regional or cross-national approach, analyzing at the grid cell level could reveal how geographical and environmental factors, like water stress, interact with aid at a very specific level, enhancing our understanding of aid's impact on conflict dynamics.

Because the project-related variable of our study is only the project location count in each grid cell, to better interpret this variable and its interactions with different water stress levels, we will also do a separate project title analysis as well as look at the project's sector distribution for each level of water stress. To do the project's title analysis, individual project titles for each water stress category will be scanned, categorized into key themes, and examined to identify patterns. It is acknowledged that one could just use the already existing *ad_sector_codes* variable of AidData dataset that is attributed to each project. Nevertheless, we argue that looking at both the project titles and its default sector distribution will provide more nuances and insights into the nature of an aid allocated into an area, like the fact that a project could be an emergency measure for the distressed situation of an area, or a project could be aimed within a small-scale and narrowly-defined goal. This element is not documented in the sector code but rather in the project title itself. The categorization of the project title will be done as follows:

- Agriculture: Projects supporting agricultural development and food security.
- Community cohesion: Projects that are focused on strengthening the social linkage of the community.
- Education: Projects aiming at improving educational access and quality.
- Emergency Response: Projects addressing disaster recovery and emergency relief.
- Finance: Projects related to financial services, microfinance, and economic development.
- Governance: Projects improving governance, legal systems, and public administration.
- Health: Projects focusing on healthcare, nutrition, and disease prevention.
- Infrastructure: Projects involving transportation, energy, and urban development.
- Security: Projects that are involved with peacebuilding and conflict resolution.
- Small scale: Projects that are focused on small, rural communities.
- Water Management: Projects relating to water supply, sanitation, irrigation, and resource management.

For each category, several keywords are associated for the scanning. If one project's title matches one keyword in a particular category, then the project is assigned to that category. In case a project's title is matched to several categories, the count will be done more than once accordingly. This matches the categorization method of AidData where one project could be in several sectors. The graphs from the project title analysis will be provided in the section 5. Sector distribution graphs for each water stress category are provided in figure 5.

3 Analytical results

3.1 Main results

3.1.1 Conflict Dummy

50 by 50 km grid cells	
Dependent Variable:	Conflict Dummy
Model:	(1)
Variables	
Project Location Count	2.983*
	(1.625)
Project Location Count × Water Stress Level 1	-5.882*
	(3.018)
Project Location Count × Water Stress Level 2	-2.131
	(2.357)
Project Location Count × Water Stress Level 3	-2.734·
	(1.721)
Project Location Count × Water Stress Level 4	-2.944*
	(1.692)
Log GDP	-38.81***
	(13.45)
Log Population	5.899
	(21.22)
Average Temperature	8.154·
	(5.191)
Average Precipitation	0.0538·
	(0.0380)
Cropland Percentage	-6.992
	(12.33)
Fixed-effects	
Grid Cell	Yes
Subdistrict * Year	Yes
Fit statistics	
Observations	25,340
R^2	0.79814
Within R^2	0.00381

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

Table 2: Main result with conflict dummy as the dependent variable for India

The primary finding of the study is presented in Table 2, where the dependent variable, a conflict dummy, takes a value of 0 or 100 to indicate the absence or presence of conflict, respectively. The nature of the foreign aid is that one project could be operated within more than one location. Therefore, the variable "project location count" accounts for the number of total locations of projects within each grid, no matter if they are under the umbrella of one project or not. At 10 % of statistical significance, one additional location of aid project location increases the probability of conflict happening by 2.983 percentage points, suggesting that foreign aid projects generally heighten tensions in local areas. However, the interaction terms between project location count and water stress categories—using water stress level 0 as the reference—reveal a different dynamic. Projects located in areas with low-to-medium water stress (level 1) and extreme water stress (level 4) significantly reduce the probability of conflict, with coefficients of -5.882 and -2.944, respectively (both at 10 % statistical significance). These effects outweigh the standalone positive effect of water locations (2.983), indicating that a well-targeted aid can mitigate conflict. In low-to-medium water stress areas of India, projects could prevent conflict by enhancing resilience through small-scale interventions like irrigation, fostering community cohesion, and avoiding competition over resources. Looking at the actual projects being allocated in water stress level 1 areas, we confirm the prevalence of the above-mentioned purpose among these 66 projects (see figure 7). With both water-related and non-water-related projects, one can observe the efforts on solving the basic water problems as well as a broader attempt to stabilize the areas with projects in infrastructure, health, and education. This aligns with CEPR's findings that aid is effective in stable contexts with a narrowly defined goal that helps to promote social stability (Troland et al. 2013).

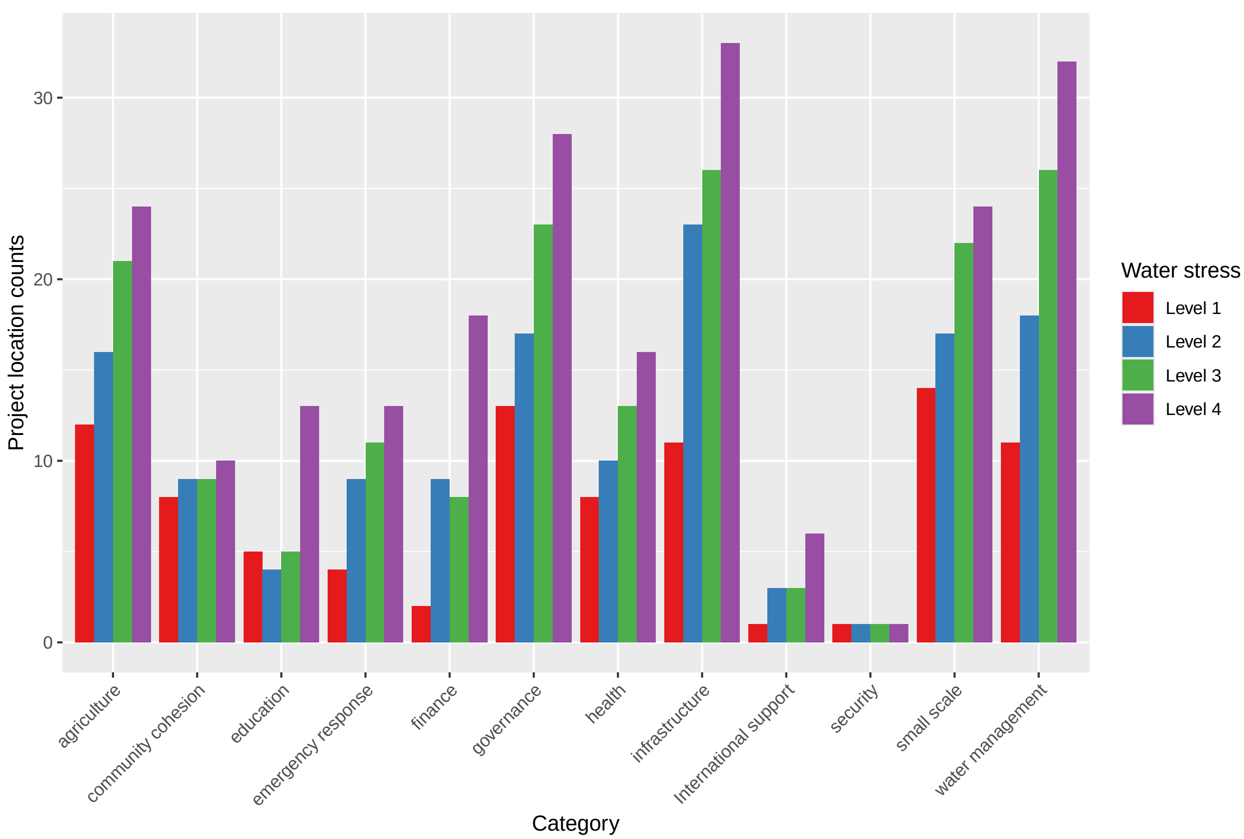

Figure 7: Project Title Analysis for India
Note: one project could be categorized in more than one category and could have more than one location

In extreme water-stressed areas, aid could serve as a critical intervention, addressing survival needs, reducing desperation and resource-based tensions, and giving a positive outlook to the communities in difficulty. Among 193 projects being allocated to these areas, one could also confirm the presence of those-above-mentioned elements, along with very high number of projects related to water management and governance (figure 7). This mechanism is supported by literature on aid's effectiveness in crisis situations (Perrin 1998) and studies that demonstrate the role of aid in stabilizing crisis zones that have water infrastructure deficiency (Al-Saidi, Roach, and Al-Saeedi 2020). Conversely, the non-significant effects in medium-to-high and high water stress areas suggest that aid's impact is less consistent, potentially due to increased competition or complex needs that require more nuanced interventions. When scanning through the titles of projects that are allocated to these areas, one could understand why aid's impact on conflict is less consistent. Water-related projects there are targeted at diverse populations, spanning urban water supply, rural sanitation, and agriculture, thereby increasing the competition for water resources. Furthermore, projects like dams and irrigation schemes can exacerbate competition, creating winners and losers in water distribution. Researchers concur that water stress is rather an indirect factor that often interacts with contextual elements of one area, such as power symmetries between different players, ineffective governance, and economic inequalities to create various combinations of circumstances that may catalyze conflict (Michel 2024). Projects in states like Andhra Pradesh, Tamil Nadu, and Karnataka that are known for water governance challenges are likely to face these above-mentioned issues, making the allocated foreign aid projects less effective due to the complexity on the ground.

Among the control variables, the logarithm of GDP is significant at 1 % level, showing that a 1 % increase in GDP will decrease the chance of conflict onset by 0.3881 percentage point, underscoring the crucial role of economic development in stabilizing India and directly reducing conflict risk during this period. One might ask whether the foreign aid itself contributes to the economic growth of India. In reality, India has been less dependent on foreign aid over time when verifying the aid-GDP ratio. Nevertheless, aid can still play a targeted role in specific sectors or regions, as the result told us above. In the regression function, the GDP and foreign variables are both included. Therefore, one could attribute the statistical significance effect of GDP on mitigating conflicts to India's own efforts on industrialization, technological advancements, and a burgeoning service sector.

3.1.2 Other auxiliary dependent variables

50 by 50 km grid cells				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	2.816**	2.667	-0.6337	0.0973·
	(1.380)	(2.165)	(0.4948)	(0.0718)
Project Location Count × Water Stress Level 1	-4.717·	-5.696*	1.206·	-0.1680*
	(2.906)	(3.252)	(0.9039)	(0.0940)
Project Location Count × Water Stress Level 2	-2.511	-1.038	0.5357	-0.0803
	(1.993)	(2.581)	(0.5054)	(0.0737)
Project Location Count × Water Stress Level 3	-2.256·	-2.775·	0.4259	-0.0791
	(1.541)	(2.140)	(0.4995)	(0.0702)
Project Location Count × Water Stress Level 4	-2.264·	-3.182·	0.4896	-0.0921·
	(1.457)	(2.171)	(0.5175)	(0.0714)
Log GDP	-36.40***	-21.24*	-2.335·	-0.8222***
	(11.78)	(10.99)	(1.541)	(0.2761)
Log Population	-3.120	14.39	11.85·	0.1135
	(14.75)	(16.14)	(8.264)	(0.4300)
Average Temperature	3.391	4.508	0.3826	0.2018·
	(5.143)	(4.819)	(1.239)	(0.1301)
Average Precipitation	0.0345	0.0243	-0.0071	0.0008
	(0.0347)	(0.0271)	(0.0086)	(0.0007)
Cropland Percentage	-8.564	-8.743	1.064	-0.2358
	(10.88)	(9.001)	(2.698)	(0.2143)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	25,340	25,340	25,340	25,340
R^2	0.78199	0.76908	0.82035	0.85987
Within R^2	0.00367	0.00312	0.00210	0.00550

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

Table 3: Regressions with other auxiliary variables of conflict as dependent variables for India

The table 3 categorizes conflict into three subcategories—state-based, non-state-based, and one-sided violence—as defined by Davies, Pettersson, and Oberg 2023. We constructed three dummy variables to indicate the occurrence of each violence type: each variable takes a value of 0 if no incident occurs and 100 if an incident occurs, enabling a clear assessment of conflict prevalence. Besides that, the logarithm of the best death estimate was also tested as a dependent variable to measure the magnitude of the incidence. Looking at the results, we see that foreign aid does affect the onset of state-based conflict, with the coefficient of 2.816 at 5 % of statistical significance. Once an aid project got introduced into the local areas, one observed the increase in the resources available for the local government. This shifts the power dynamics between the state and the excluded groups. Coupled with diverse governance capability in a country like India to manage these external resources, rebel groups could escalate conflicts to challenge the state out of grievance of being excluded. On the other hand, the fact that projects are put in water stress areas at any level does not influence the onset of state-based conflict. And similarly to the main result using the conflict dummy, GDP represented in logarithmic form heavily influences the outcome of state-based conflict.

As for non-state conflict, aid projects in general and their interaction term with the water stress categories of each grid cell do not influence the outcome of the conflict. This indicates that conflicts between non-state actors are not influenced by aid allocation, likely because they are driven by internal group dynamics that are rooted in existing ethnic and religious differences or prior territorial and power disputes. For the dummy of one-sided conflict, only when the aid projects that are allocated in low-to-medium water stress level (level 1) contribute to reducing the potential of one-sided conflict, with the coefficient of -5.696 at 10 % of statistical significance. Similar to the main result, local areas with water stress level 1 do not face alarming resource scarcity, so the presence of aid projects could ease the desperation of resource constraint among groups that might otherwise target civilians for resource grabs. Beyond this level of resource constraint (level 2 and above), the aid projects might be insufficient to address the deeper scarcity. Moreover, GDP also contributes to mitigating the onset of one-sided conflict, though at a lower magnitude when compared to the state-based conflict, with a 1 % increase in GDP lowering the probability of conflict by -0.2124 percentage point. Finally, looking at the best death estimate in logarithmic as the dependent variable, we observe that allocation of the foreign aid project in areas with low-to-medium water stress levels reduces the fatality count of conflict events by 16.8 %. And economic development helps to reduce the conflict fatality as well, with a 1 % increase in GDP lowering the fatality of conflict events by -0.8222 %.

The main results demonstrate a complex picture of the foreign aid-conflict dynamic under water stress in India by breaking down the initial conflict dummy into its three subcategories of violence dummy variables. The conflict onset depends very much on the local actors at play, its resource situation and power dynamic, as well as the water stress level of the local areas in some situations. In the next subchapter, we will present the main regressions again, but by modifying the baseline unit of the study to a 25 by 25 km grid cell to serve as robustness tests.

3.2 Robustness tests

25 by 25 km grid cells for India					
Dependent Variables:	Conflict Dummy	State-based dummy	Non-state dummy	One-sided dummy	Log Best Death Count
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Project Location Count	0.9662	1.010	0.0346	0.7552	0.0607*
	(0.9129)	(0.8185)	(0.2986)	(0.9356)	(0.0332)
Project Location Count	-0.5727	-2.447.	0.8778	-1.490	-0.0821**
× Water Stress Level 1	(1.602)	(1.516)	(0.9011)	(1.490)	(0.0413)
Project Location Count	-1.784.	-2.449**	0.1074	-0.3276	-0.0725**
× Water Stress Level 2	(1.222)	(1.090)	(0.3165)	(1.067)	(0.0348)
Project Location Count	-1.025	-0.7143	-0.2510	-0.5931	-0.0639*
× Water Stress Level 3	(1.096)	(0.8926)	(0.3496)	(1.067)	(0.0342)
Project Location Count	-1.141	-1.033	-0.2677	-0.7996	-0.0598*
× Water Stress Level 4	(0.9719)	(0.8419)	(0.3455)	(0.9491)	(0.0336)
Log GDP	-13.05***	-7.184**	-2.456***	-7.799***	-0.2145***
	(3.326)	(2.889)	(0.9392)	(2.513)	(0.0749)
Log Population	-1.771	-1.780	-0.3136	-0.1683	-0.0640
	(5.839)	(4.857)	(2.500)	(3.343)	(0.1069)
Average Temperature	1.983	0.2922	-0.0964	0.9487	0.0527*
	(1.680)	(1.494)	(0.4083)	(1.211)	(0.0301)
Average Precipitation	0.0358***	0.0315***	-0.0006	0.0123.	0.0006***
	(0.0100)	(0.0087)	(0.0022)	(0.0079)	(0.0002)
Cropland Percentage	-4.823**	-1.336	-0.1928	-3.430*	-0.0428
	(2.436)	(1.899)	(0.4456)	(1.809)	(0.0403)
Fixed-effects					
Grid Cell	Yes	Yes	Yes	Yes	Yes
GID_2-year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	100,880	100,880	100,880	100,880	100,880
R^2	0.56642	0.55901	0.48972	0.48750	0.67022
Within R^2	0.00080	0.00057	0.00052	0.00045	0.00099

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

Table 4: Robustness check for regression results of India

The table 4 above is the robustness check of the main results by choosing 25 by 25 km grid cells as the unit of study. This grid is four times smaller than the original grid cell of 50 by 50 km. Consequently, this adjustment yields more observations for the study—now exceeding 100,000 compared to roughly 25,000 with the 50 by 50 km grids. The structure of some key variables also shifts, as we now focus on units that better capture micro-level variations in water stress, aid project locations, and conflict incidents.

The results tell us different pictures when taking the conflict dummy or its three subcategories as dummies. There are no statistical significance for the presence of projects in general or in any water stress level areas specifically when we investigate the general conflict dummy, the non-state, or one-sided conflict dummies. Only regression with a state-based dummy as a dependent variable that allocated projects in water stress level 2 areas (medium-to-high) shows a negative effect on the conflict onset. Similar to coefficients of GDP in the regressions using the 50 by 50 km grid cells, it also has a negative effect on the conflict onset. Interestingly, other control variables in this time are also statistically significant. Cropland percentage in models (1) and (4) induces a negative effect on the onset of conflict, indicating that well-spread agricultural landmass and production could cool down the tension between different parties by providing enough food security to the civilians in local areas. Average monthly precipitation of a given year in models (1) and (2) has positive effects towards conflict onset, alluding to the fact that excessive rain could increase flood risk, leading to population displacement, resource competition, and social tension that sparks conflicts. This is appropriate for the case of India, which has a monsoon season in various regions that brings heavy rainfalls.

The model (5) with the log of the best estimate of casualty offers the most complete picture of the aid projects-conflict under water stress dynamics. All the project-related variables are statistically significant, and they follow the patterns of the model using the default grid cell size of 50 by 50 km. Namely, the presence of a project location in the local area increases the casualty when conflict happens by 6.07 %. But its allocation to water stress areas at all levels significantly reduces the conflict casualty, totaling 27 % lowering the casualty count. Like the previous 50 by 50 km grid cell analysis, the effects of these interaction terms outweigh the one from the project location count when it stands alone. Apart from that, control variables like temperature and precipitation are also statistically significant with a positive on the conflict casualty, possibly due to heightened aggression and resource competition due to heat and flood risks. GDP, like the previous regressions, has the negative effect towards conflict casualty. While the main result from the 50 by 50 km grid analysis—showing a significant effect of aid projects on conflict onset—was not replicated in the 25 by 25 km grid for the conflict dummy, the robustness test offers a compelling alternative insight. It suggests that, at finer spatial scales, aid may not consistently affect whether conflicts arise but plays a critical role in shaping their severity. The finer spatial scale also uncovers nuanced environmental influences on the conflict dynamics through the control variables like temperature, precipitation, and cropland percentage.

3.3 External validity

50 by 50 km grid cells				
Dependent variable: Conflict Dummy				
Country:	Afghanistan	Bangladesh	Nepal	Pakistan
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	20.53	-3.065***	-3.883**	3.379·
	(23.39)	(0.9285)	(1.530)	(2.539)
Project Location Count × Water Stress Level 1	-21.24	12.39***	2.422·	-6.223*
	(22.62)	(2.545)	(1.778)	(3.190)
Project Location Count × Water Stress Level 2	-28.38	3.404	4.230***	-4.590·
	(24.89)	(3.672)	(1.472)	(3.399)
Project Location Count × Water Stress Level 3	-16.68	4.877**	1.477	-4.196·
	(26.58)	(2.274)	(2.058)	(2.929)
Project Location Count × Water Stress Level 4	-23.45	4.267*	0.7950	-1.304
	(23.75)	(2.213)	(2.516)	(2.851)
Log GDP	-23.45	-174.2·	-29.82	47.29***
	(61.33)	(105.8)	(30.01)	(15.76)
Log Population	20.80	47.75	4.210	15.24·
	(40.80)	(111.6)	(9.961)	(10.37)
Average Temperature	-0.6177	-87.96	2.496	0.0933
	(23.74)	(91.03)	(27.31)	(3.343)
Average Precipitation	2.219**	-0.1297	0.2614**	0.3479***
	(0.9119)	(0.3519)	(0.1177)	(0.1037)
Cropland Percentage	487.7	229.7	85.65	-25.60
	(503.5)	(259.6)	(176.5)	(27.28)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	5,160	1,100	1,260	7,000
R^2	0.88559	0.90069	0.76128	0.55020
Within R^2	0.01950	0.09459	0.01802	0.01454

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

Table 5: External validity with other South Asian countries

To assess the external validity of the study, we run our models on the neighboring countries of India in the South Asia region. Most countries in South Asia also have the problem of water stress. And besides unique cases like Bhutan or the small island of the Maldives, all the other countries are flooded with violence and conflicts. At the same time, those countries also receive flows of foreign aid across many different sectors. The region of South Asia consists of eight countries, including India, but only four countries were chosen to be reported in the table 5 - Afghanistan, Bangladesh, Nepal, and Pakistan. Sri Lanka was excluded in the 50 by 50 km grid analysis because of multicollinearity; Bhutan and the island of the Maldives do not have many conflict incidents to be qualified for the external validity tests. Robustness checks that are run at a final spatial resolution of 25 by 25 km will be reported in the separate document ***Appendix - continued***. For the interpretability of the variable project location count, we look at the project sector distribution for each water stress level based on the variable *ad_sector_codes* and the project title analyses. These graphs are available in the separate document ***Appendix - continued***.

Overall, the results from these four countries reveal different patterns when being compared to those observed in India. Looking at Afghanistan, aid project locations and allocation exhibit no statistically significant effects on conflict onset in the 50 by 50 grid analysis. And by doing the project title analysis, we found out that most of the foreign aid projects in Afghanistan are concentrated on emergency response to the infrastructural deficiency problem (figure 10). This finding is unsurprising in a war-torn country like Afghanistan, where chronic conflicts that are driven by political instability, ethnic tensions, and geopolitical influences likely overpower the contribution effect of foreign aid projects and water stress problems. The country's prolonged instability is likely a hindrance where development initiatives face substantial challenges, such as logistical difficulties, which could diminish their effectiveness at this coarser grid cell resolution. Furthermore, the by-default 50 by 50 km grid cell resolution may aggregate data across broad areas, thereby obscuring the more variations in how aid influences conflict locally. However, when a robustness check for the external validity test (see subsection 2.2.1 in the separate document ***Appendix - continued***) is conducted using a finer 25 by 25 km grid, aid projects begin to show a discernible effect on conflict dynamics. This finding suggests that for the case of Afghanistan, the influence of foreign aid on conflict is more distinguishable at a more granular level, indicating a very localized interplay between aid, water stress, and conflict in this country's complex situation.

The result for Bangladesh depicts an opposite picture compared to India's and has more statistically significant coefficients than Afghanistan's. An allocation of a project location lowers the chance of conflict onset of 3.065 percentage points. On the contrary, planning project locations in water stress areas at levels 1, 3, and 4—low-to-medium, medium-high, and extreme, respectively—significantly increases the conflict onset. Being 12.39, 4.877, and 4.267 at 1 %, 5 % and 10 % statistical significance, respectively, the effects of these interaction terms exceed the one of project location on conflict onset when standing alone. As a country, Bangladesh faces a moderate water stress situation, being placed among the least water-stressed countries globally (Islam and Ali 2019). Nevertheless, Bangladesh faces specific challenges, such as salinity intrusion in the coastal areas and seasonal water availability issues, particularly during the dry seasons, affecting agriculture and drinking water (Hedrick 2025), while India faces widespread water quantity shortages and over-exploitation of groundwater (UNESCO World Water Assessment Programme 2024). By inspecting the conflict, project location allocations, and the water stress maps of Bangladesh (figure 15), we observe that the aid project distribution is widespread across Bangladesh, with a noticeable concentration in the central and northern parts of the country, while conflicts are only concentrated in some regions—western, central, and southern areas. Among all the projects, water-related projects are also widespread across the country, but the intensity of the distribution at the local region is much less, plus those projects are not the majority of the allocated aid projects in Bangladesh. Doing the project title analysis also confirms the fact that foreign aid projects in Bangladesh are dominated by infrastructure, education, and governance projects (figure 14). This may explain why the aid reduces conflict overall but increases the conflict probability in water-stressed zones, whereby water-stress-related disputes are probably not fully addressed.

Nepal's result shares a similar pattern to Bangladesh, with the presence of an aid project location decreasing the conflict probability of 3.883 %. And an allocation of a project location in the water stress level 2 area (medium-high) increases the probability of conflict of 4.23 %. In comparison to other countries in the region, Nepal is endowed with abundant water resources, with rivers sustained by meltwater from Himalayan glaciers and underground aquifers replenished by rainfall. Nevertheless, Nepal is ranked high in the baseline water stress by the World Resource Institute (WRI). This is due to several factors like the widespread contamination of the water source for domestic use, inadequate infrastructure like malfunctioning water supply and irrigation systems, and heightened vulnerability from poverty and natural disasters (Suwal 2025; Udmale et al. 2016). Therefore, the presence of aid projects overall could help stabilize the infrastructure deficit and address the vulnerability due to lack of access to clean water; hence, it reduces the chance of conflict onset. On the other hand, in medium-to-high water stress areas (level 2), the overwhelming majority of projects are related to water supply and sanitation (see figure A.4 - chapter 1 in the separate document ***Appendix - continued***). This is much more iconoclastic compared to other areas with different water stress levels because areas with other water stress levels also have more proportional projects in other sectors like transport and storage, general government and civil society, as well as agriculture. The project title analysis also has the above observation (figure 18). Our speculation here is that because of the peculiar water problem of Nepal with deficiency in multiple fronts, an over-concentration of water supply and sanitation aid projects without the balance of projects from other equally important sectors destabilizes the areas even more, making it possible for resource grabs and disputes.

With Pakistan, only projects that are allocated to the low-to-medium water stress level has a statistically significant effect that lowers the conflict onset; one additional project location in these areas lowers the probability of conflict onset by 6.233 %. When standing alone, projects do not have any significant effect on conflict onset. Beside the project, GDP has an exacerbating effect on conflict, with a 1 % increase in GDP raising the conflict onset probability by 0.4729 percent. This direction of the coefficient is the opposite of the result of India, as normally economic development would ease the tension by improving the living standards. Besides that, the precipitation variable is also statistically significant and follows the direction of its counterpart in other countries, being positive and conflict-inducing. Pakistan is ranked by the WRI among the countries with a high national level of baseline water stress. Despite having quite significant water resources like the Indus River Basin, the country faces challenges due to outdated and poor condition water infrastructures, poor governance, and the threat of drought due to lack of rain (Sleet 2019). With only the interaction term between project location and water stress level 1 being negatively significant, it could mean that aid projects that are well-targeted could lower the probability of conflict. One can also observe with the sector distribution graphs that in the areas of water stress level 1, projects are more well distributed in different crucial sectors, unlike projects in other water stress levels with an overfocus on general government and civil society (see figure A.5 in the separate document ***Appendix - continued***). And the fact that projects in general do not have a significant effect indicates that problems in a higher level of water stress could be more severe and complex to be solved alone by the existing allocated aid projects. Economically, despite moderate growth, Pakistan does not have its economy grow relatively even. Its inequality is reflected with the Gini index as the worst in the South Asia region, being 29.6 as against 32.4 and 35.7 for Bangladesh and India, respectively (Burki 2023). These unique characteristics of Pakistan could explain the surprising direction of the logarithmic of GDP coefficient when compared to India.

4 Conclusion

To summarize the paper, we aimed to investigate the effect of foreign aid project allocation on the onset of local conflict, particularly under varying water stress conditions in the areas. Using the 50 by 50 km grid cell as the baseline unit of the study and the temporal resolution of 1995 to 2014 and taking into account entity- and time-fixed effects, we applied the grid cell to the country of India. We also checked for the robustness of the result at a finer grid cell resolution of 25 by 25 km and did the external validity for South Asian neighbors.

The primary finding reveals that while foreign aid projects generally increase conflict probability by 2.983 percentage points per additional location (Table 2), this effect is reversed in areas with low-to-medium (category 1) and extreme (category 4) water stress, where aid reduces conflict by 5.882 and 2.944 points, respectively. Furthermore, economic growth, measured by the logarithm of GDP, lowers the conflict onset probability of 0.3881 point per 1 % increase, underscoring the peacebuilding role by improving the living standard for the general population. The extension of the study to the three sub-categories of conflict and the logarithm of the best death estimate as dependent variables provides less complete result interpretations compared to the general conflict dummy (Section 3.1.2). Adjusting the study's baseline unit to a 25 by 25 km grid for a robustness check altered the spatial dynamics, resulting in differences in the magnitude of the robustness results compared to the default findings. However, the direction of the effects and the overall conclusions remained consistent between the two analyses. For the literature contribution, this paper contributes to the existing foreign aid - conflict nexus with the unique approach of grid analysis for each individual country and the focus on the water stress to represent a prominent resource constraint in many countries around the globe.

For policy implications of India, aid should be administered in areas with low-to-medium water stress, where resource scarcity is not yet a critical issue, to strengthen community resilience. Alternatively, aid can be distributed to regions facing urgent needs, providing immediate relief to mitigate crises. Furthermore, the local authority could level the benefit of external resources received from foreign aid with its own efforts of developing the local economy. Regionally, while India benefits from targeted aid based on the resource constraint, different result patterns for Afghanistan, Bangladesh, Nepal, and Pakistan (Section 3.3) recommend that administrators should assess carefully the conditions of each country as well as its local communities and allocate the projects accordingly.

Nevertheless, this study is not without default. Firstly, the data of this study is only for the 20-year period from 1995 to 2014, mainly because of the limited temporal resolution of the AidData dataset. And while India is not a big recipient of Chinese aid, the inclusion of Chinese aid to both India and other South Asian countries could improve the power of explanation of the study. And the data extrapolation of some variables due to temporal resolution constraints is an element of contention that the study does not have the precise data on some variables. The arbitrary choice of 50 by 50 km grid for the baseline unit of study or the 25 by 25 km grid cells of the robustness check could be replaced and tested with a different approach that explains relevant characteristics to the water stress situation. For example, the transboundary nature of water resources across and regions as mentioned in subsection 1.2.1 could be somehow included to the base unit of the study. Finally, we recognize that readers should be cautioned to generalize the result pattern of India to other countries because of the limited external validity tests.

At the time of writing this paper (March 2025), the foreign aid sector is undergoing a significant reform. The US government has just launched a comprehensive audit and structural overhaul into the United States Agency for International Development (USAID) (The White House 2025). Discussions about revising foreign aid policies are also happening in other Western countries. With the trend of realignment of foreign aid policies with the interests of donor countries, it could force aid-recipient nations to prioritize their own nation-building efforts and gradually reduce the importance of foreign aids in its economy. Intriguingly, India— being a big recipient of foreign aid— has emerged as a donor country through its own foreign assistance program, providing financial support to neighboring countries in South Asia, as well as nations in Africa and beyond (Ammar Nainar 2024). This aid policy does not only strengthens India's foreign relations but also serves as a counterweight to Chinese influence in the region. Besides, one certain thing is that, development problems such as water stress, will continue to exist in the future, as highlighted by WRI 2023. While recipient countries can still benefit from foreign assistance, they should focus more on building and improving their own institutions to tackle current and future problems. This dual strategy of taking advantage of external support while making more effort independently on nation building will be essential for achieving sustainable progress and stability in the future.

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5 Appendix

5.1 External validity - 25 by 25 km grid cells

25 by 25 km grid cells Dependent Variable: Conflict Dummy Country:	Afghanistan	Bangladesh	Nepal	Pakistan	Sri Lanka
Variables					
Project Location Count	-4.705**	-0.1142	-7.517***	-3.671**	-27.58*
	(2.052)	(0.8602)	(0.9957)	(1.635)	(16.03)
Project Location Count × Water Stress Level 1	3.394	2.480*	0.6588	7.376*	
	(3.231)	(1.312)	(1.887)	(4.159)	
Project Location Count × Water Stress Level 2	2.829	-0.0576	0.1427	0.0233	22.74.
	(3.225)	(1.275)	(2.836)	(2.670)	(17.52)
Project Location Count × Water Stress Level 3	7.681.	0.9759	1.935	4.583**	
	(5.570)	(1.202)	(2.131)	(2.227)	
Project Location Count × Water Stress Level 4	6.207**	0.5056	2.982.	4.557**	
	(2.881)	(1.003)	(1.812)	(2.015)	
Log GDP	-0.0904	-27.66*	-18.05*	35.49***	530.8
	(11.86)	(14.39)	(9.301)	(6.706)	(624.0)
Log Population	29.56**	-33.38.	1.538	6.292	31.26
	(14.62)	(21.41)	(3.681)	(8.123)	(38.01)
Average Temperature	6.742.	-13.08	1.635	1.342	-208.0
	(5.082)	(17.39)	(10.55)	(1.188)	(1,025.6)
Average Precipitation	0.0912	-0.0402	0.1283**	0.1114***	-0.4933
	(0.1687)	(0.0525)	(0.0622)	(0.0366)	(1.136)
Cropland Percentage	325.2***	-15.46	-117.5*	-0.2630	-147.5
	(51.16)	(22.13)	(66.71)	(11.11)	(1,020.9)
Fixed-effects					
Grid Cell	Yes	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	20,600	4,480	4,740	27,920	2,140
R^2	0.70485	0.49381	0.50051	0.47144	0.95190
Within R^2	0.02204	0.00257	0.02258	0.01059	0.05971

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

Table 6: Robustness for external validity tests of South Asian countries

With the finer grid cell resolution (25 by 25 km), results of other South Asian countries have more statistically significant coefficients for the case of Afghanistan, Pakistan, and Sri Lanka, when compared to the default 50 by 50 km grid cells in subsection 3.3. Except for Bangladesh, the project location count in general for all countries have significant effects, reducing the probability of conflict onset.

The effects are especially outstanding for Nepal and Sri Lanka, with one additional project location being allocated in the area decreasing conflict onset probability by 7.517 and 27.58 percentage points, respectively. Nevertheless, the interaction term of aid project location with water stress level 2 area loses its significance when compared to the default result with 50 by 50 grid cells for Nepal. Pakistan's result offers the most complete picture of the effect of projects in general as well as their allocation into different water stress level areas; administering projects in areas with low-to-medium, high, and extreme water stress results in a heightened probability of conflict onset, and it outweighs the benefit of projects in reducing conflict onset in general. In essence, the robustness check of the external validity reaffirms again the relative trade-off between a coarser level of the study unit with higher explanatory power (the R^2) overall and the more granular grid cell resolution with more nuances being unveiled in a more localized manner.

5.2 Maps and graphs of other South Asian countries

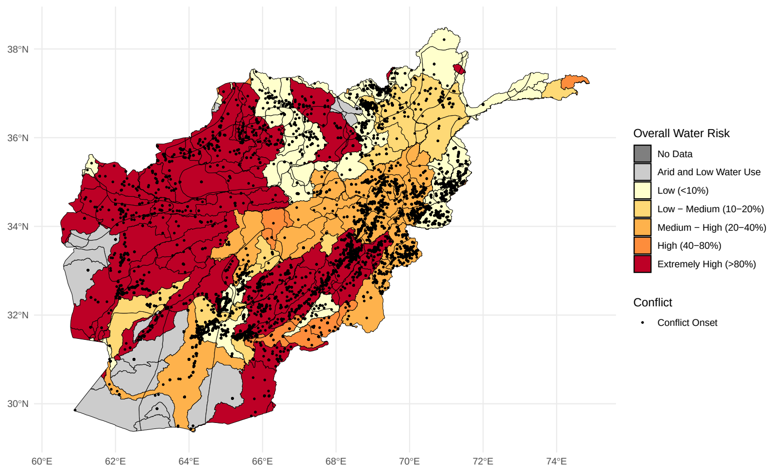

Figure 8: Water Stress and Conflict Locations in Afghanistan

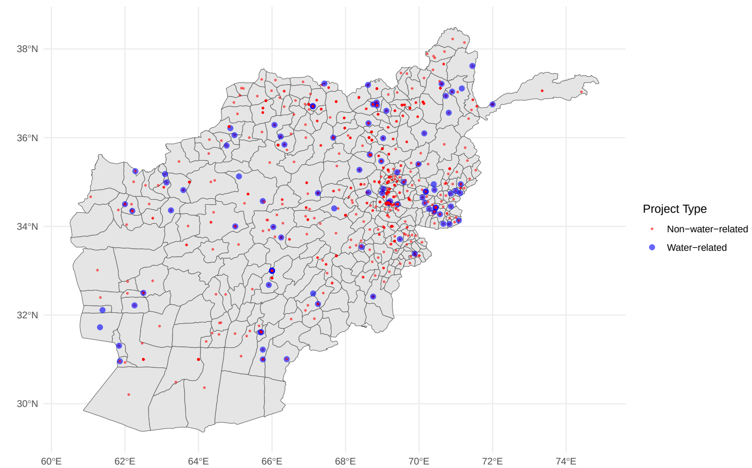

Figure 9: World Bank Aid Projects in Afghanistan from 1995 to 2014

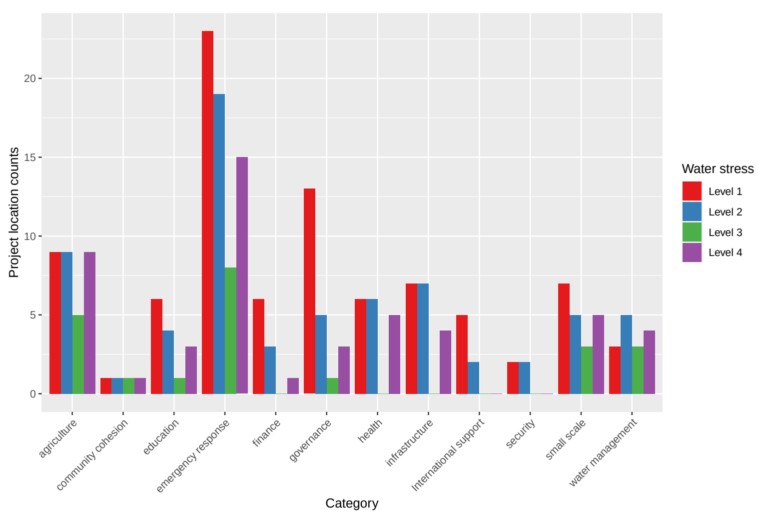

Figure 10: Project Title Analysis for Afghanistan
Note: one project could be categorized in more than one category and could have more than one location

Figure 11: Overview of Water Stress, Conflict, and World Bank Projects in Afghanistan

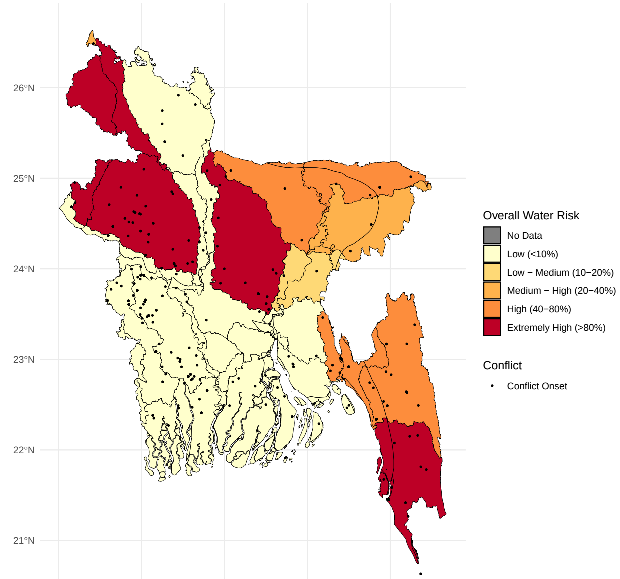

Figure 12: Water Stress and Conflict Locations in Bangladesh

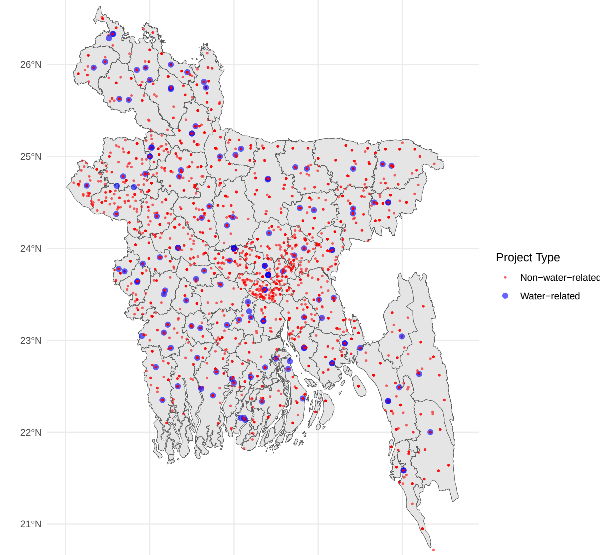

Figure 13: World Bank Aid Projects in Bangladesh from 1995 to 2014

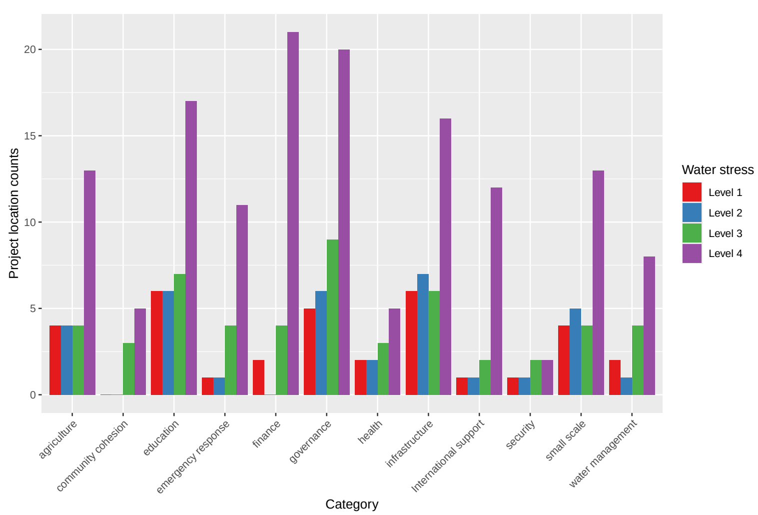

Figure 14: Project Title Analysis for Bangladesh
Note: one project could be categorized in more than one category and could have more than one location

Figure 15: Overview of Water Stress, Conflict, and World Bank Projects in Bangladesh

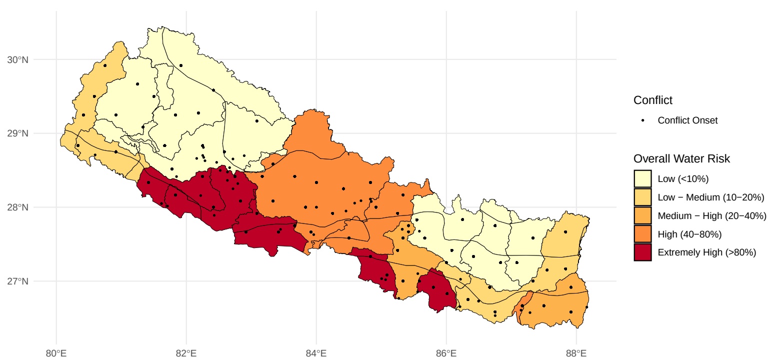

Figure 16: Water Stress and Conflict Locations in Nepal

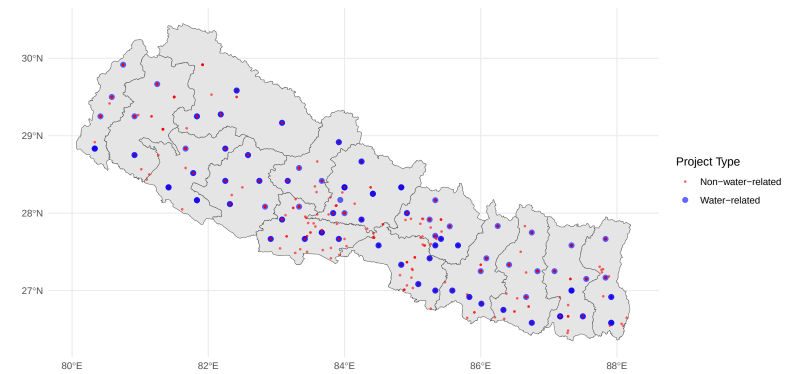

Figure 17: World Bank Aid Projects in Nepal from 1995 to 2014

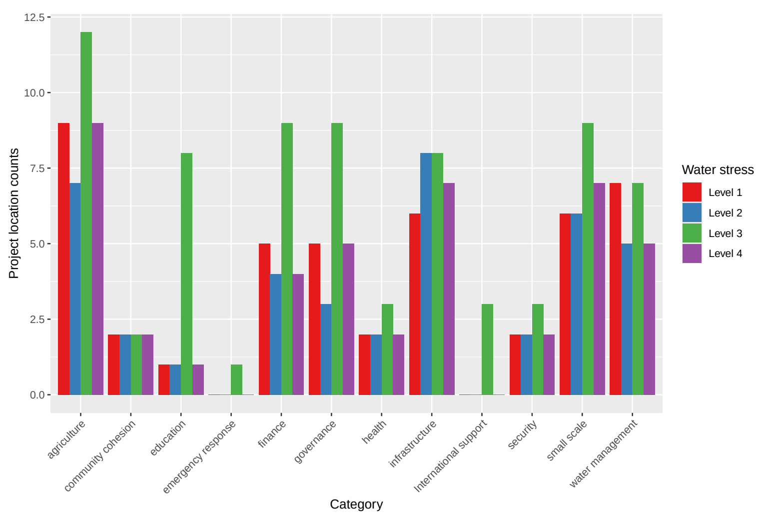

Figure 18: Project Title Analysis for Nepal
Note: one project could be categorized in more than one category and could have more than one location

Figure 19: Overview of Water Stress, Conflict, and World Bank Projects in Nepal

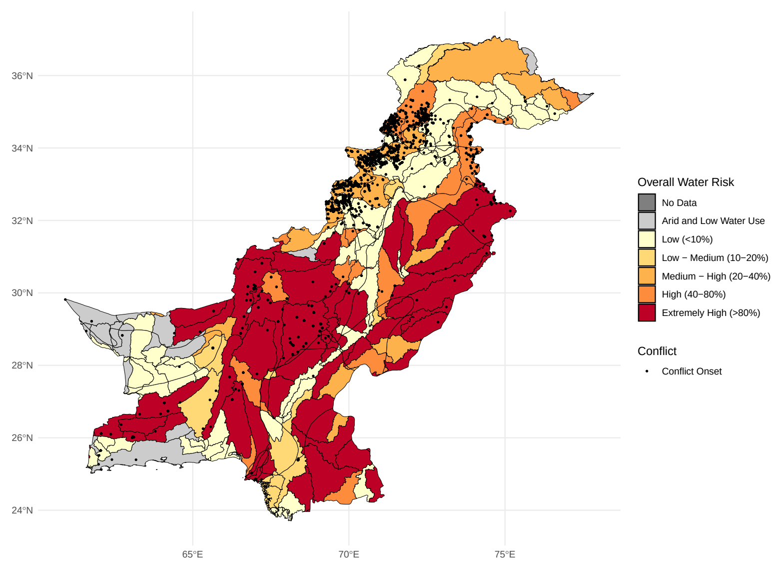

Figure 20: Water Stress and Conflict Locations in Pakistan

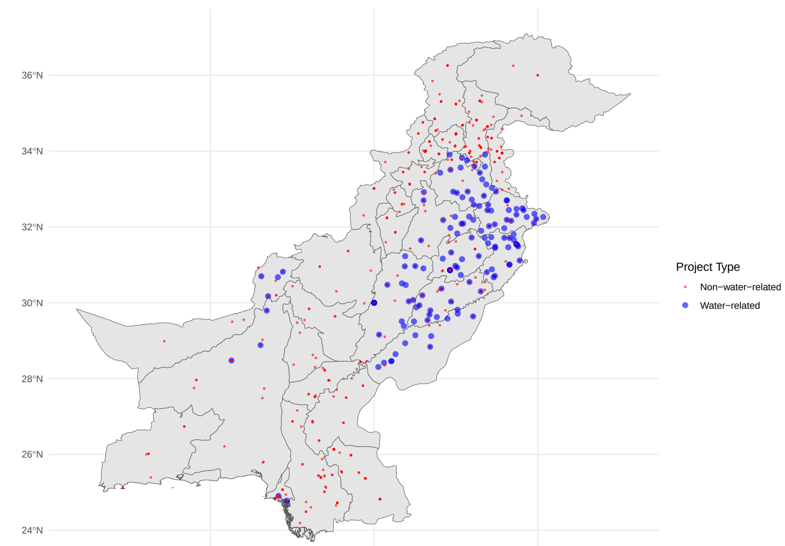

Figure 21: World Bank Aid Projects in Pakistan from 1995 to 2014

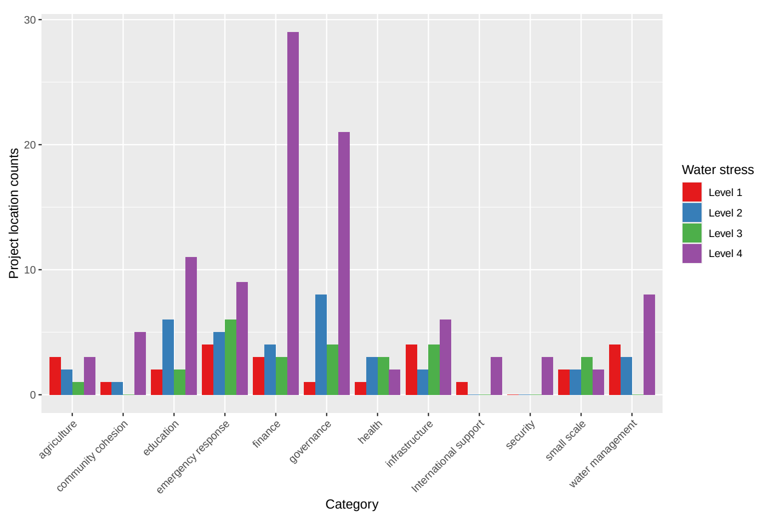

Figure 22: Project Title Analysis for Pakistan
Note: one project could be categorized in more than one category and could have more than one location

Figure 23: Overview of Water Stress, Conflict, and World Bank Projects in Pakistan

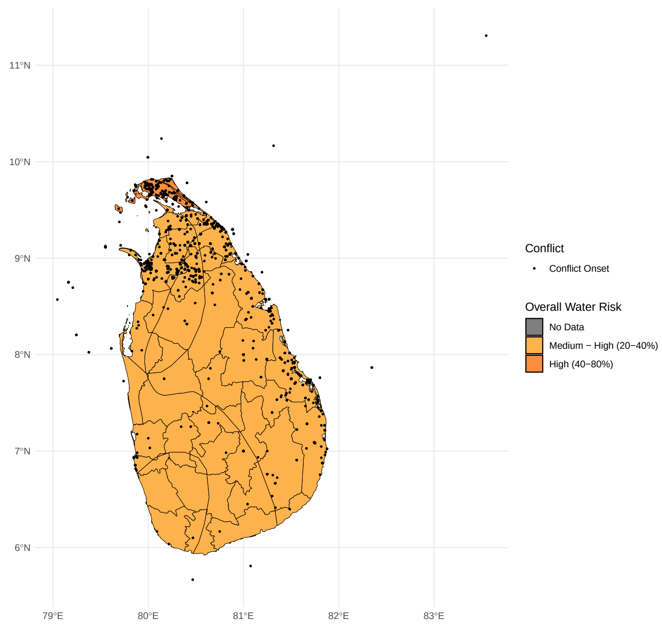

Figure 24: Water Stress and Conflict Locations in Sri Lanka

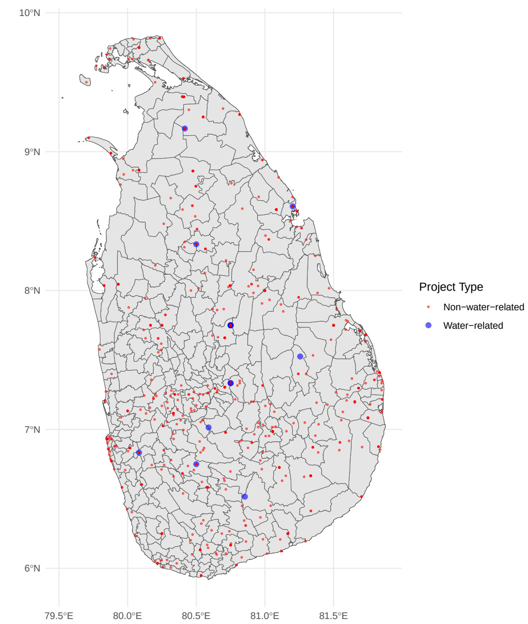

Figure 25: World Bank Aid Projects in Sri Lanka from 1995 to 2014

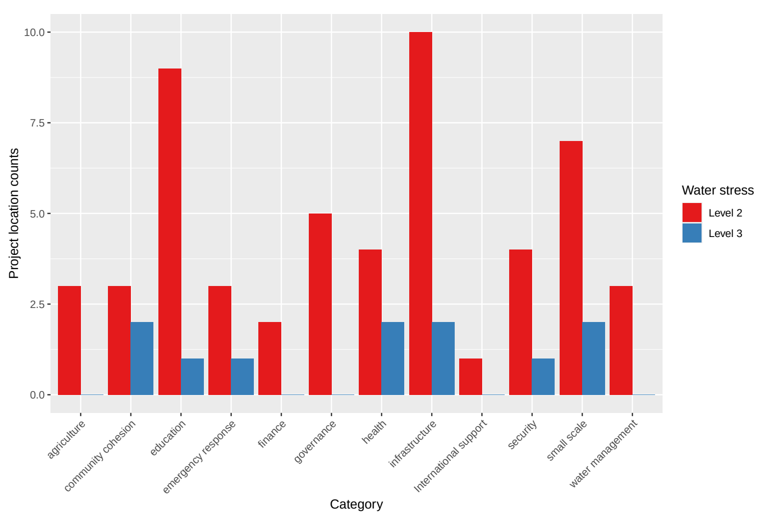

Figure 26: Project Title Analysis for Sri Lanka
Note: one project could be categorized in more than one category and could have more than one location

Figure 27: Overview of Water Stress, Conflict, and World Bank Projects in Sri Lanka

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Appendix - Continued: Additional Graphs for "Aid, Water, and Peace: Assessing Foreign Assistance's Impact on Conflict in Water-Stressed India - A Spatial Grid Analysis"

Lê Minh Hoàng

August 27, 2025

This document contains additional graphs referenced in the master thesis titled "Aid, Water, and Peace: Assessing Foreign Assistance's Impact on Conflict in Water-Stressed India (1995–2014) - A Spatiotemporal Grid Analysis" by Lê Minh Hoàng.

6 Additional regressions

6.1 50 by 50 km grid cell

Down below are the results of the regression for the external validity test countries with the other auxiliary dependent variables. In a nutshell, at this coarser level of grid cell resolution, Afghanistan's results do not tell us many meaningful pictures, while Bangladesh's significant result with the conflict dummy does translate into its regression with the subcategory breakdown of the conflict variable, namely the state-based and one-sided conflict types. For Nepal, the significant result from the general conflict dummy variable is only reproduced in the one-sided conflict dummy. Pakistan's case also follows Nepal's pattern.

50 by 50 km grid cells - Afghanistan				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	22.74	-1.090	-0.6827	0.0297
	(26.40)	(1.645)	(1.474)	(0.1082)
Project Location Count × Water Stress Level 1	-24.13	1.002	1.672	0.0132
	(25.56)	(1.596)	(1.639)	(0.1444)
Project Location Count × Water Stress Level 2	-30.97	-14.49**	1.030	-0.0655
	(27.79)	(5.985)	(1.615)	(0.2778)
Project Location Count × Water Stress Level 3	-18.96	7.974	0.7908	0.1681
	(29.23)	(8.360)	(1.470)	(0.3667)
Project Location Count × Water Stress Level 4	-27.24	-0.8965	1.579	-0.1290
	(26.76)	(3.070)	(2.036)	(0.1465)
Log GDP	-24.25	-27.93$^{\cdot}$	-3.201	-0.6248
	(59.68)	(21.70)	(3.027)	(1.867)
Log Population	22.41	-15.54	-2.246	0.0256
	(41.27)	(13.74)	(3.982)	(1.221)
Average Temperature	-3.398	10.38$^{\cdot}$	2.173	0.2613
	(24.58)	(8.014)	(2.499)	(0.7075)
Average Precipitation	1.876**	0.5018	-0.0464	0.0556*
	(0.8643)	(0.5286)	(0.2698)	(0.0323)
Cropland Percentage	566.7	500.9**	10.09	29.34
	(473.6)	(240.4)	(23.95)	(25.15)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	5,160	5,160	5,160	5,160
R^2	0.88547	0.89638	0.89466	0.92793
Within R^2	0.02221	0.04008	0.00221	0.04581

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

50 by 50 km grid cells - Bangladesh				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-1.481·	-0.6719**	-1.255	-0.0277*
	(1.041)	(0.3341)	(1.137)	(0.0162)
Project Location Count × Water Stress Level 1	8.198***	2.088***	2.498·	0.0090
	(2.703)	(0.6588)	(1.831)	(0.0305)
Project Location Count × Water Stress Level 2	1.404·	0.3778	1.619	0.0215
	(0.9095)	(1.216)	(3.205)	(0.0229)
Project Location Count × Water Stress Level 3	1.703	0.7618	2.558	0.0361
	(1.700)	(1.081)	(2.005)	(0.0321)
Project Location Count × Water Stress Level 4	3.130·	0.6804	0.8387	0.0298
	(2.251)	(0.5600)	(1.624)	(0.0274)
Log GDP	-96.57	11.24	-74.02	-3.896*
	(139.9)	(108.2)	(144.9)	(1.961)
Log Population	-0.4783	1.999	44.37	-0.6989
	(33.13)	(27.05)	(102.3)	(1.346)
Average Temperature	-19.14	-45.91	-43.16	-1.783
	(74.35)	(40.55)	(46.78)	(2.103)
Average Precipitation	-0.1064	-0.0739	-0.0462	1.29×10^{-5}
	(0.2323)	(0.2245)	(0.2183)	(0.0033)
Cropland Percentage	-13.58	1.846	212.7	-2.283
	(284.2)	(92.38)	(276.9)	(4.244)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,100	1,100	1,100	1,100
R^2	0.90511	0.89532	0.87586	0.89148
Within R^2	0.05227	0.02482	0.03677	0.03693

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

50 by 50 km grid cells - Nepal				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-1.734$^{\cdot}$	-2.923**	-0.2242	-0.0342
	(1.183)	(1.226)	(0.3105)	(0.0338)
Project Location Count × Water Stress Level 1	-0.6341	1.005	0.1926	-0.0349
	(1.257)	(1.559)	(0.2467)	(0.0484)
Project Location Count × Water Stress Level 2	-1.807$^{\cdot}$	3.577**	0.2256	-0.0416
	(1.385)	(1.424)	(0.3064)	(0.0366)
Project Location Count × Water Stress Level 3	0.7031	-0.7963	0.1784	-0.0122
	(1.534)	(1.980)	(0.2247)	(0.0455)
Project Location Count × Water Stress Level 4	-0.9189	1.014	0.5759	0.0440
	(1.574)	(2.508)	(0.4786)	(0.0497)
Log GDP	-5.643	-15.78	-0.3689	-0.1702
	(29.00)	(31.49)	(0.5955)	(0.8802)
Log Population	1.342	-0.5616	-0.1408	0.1943
	(10.00)	(11.99)	(0.2599)	(0.3117)
Average Temperature	34.33$^{\cdot}$	-6.368	-1.691	1.407$^{\cdot}$
	(25.31)	(26.05)	(1.810)	(0.8484)
Average Precipitation	0.0456	0.2132*	0.0126	-0.0005
	(0.0908)	(0.1174)	(0.0188)	(0.0035)
Cropland Percentage	158.6	68.58	23.90	0.7838
	(155.7)	(160.6)	(29.19)	(4.218)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,260	1,260	1,260	1,260
R^2	0.75589	0.71371	0.24337	0.79474
Within R^2	0.01277	0.01205	0.00602	0.01037

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

50 by 50 km grid cells - Pakistan				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	4.501·	1.506	-0.4457	0.0720
	(2.815)	(2.386)	(0.4214)	(0.0656)
Project Location Count × Water Stress Level 1	-2.327	-8.621**	0.5002	-0.1314·
	(3.538)	(3.428)	(1.515)	(0.0863)
Project Location Count × Water Stress Level 2	-4.012	-3.328·	0.0650	-0.0965
	(3.646)	(2.287)	(0.4496)	(0.1035)
Project Location Count × Water Stress Level 3	-5.124·	-2.969	0.3332	-0.0816
	(3.271)	(2.602)	(0.4260)	(0.0741)
Project Location Count × Water Stress Level 4	-3.136	-1.040	0.3369	-0.0481
	(3.005)	(2.508)	(0.4246)	(0.0703)
Log GDP	45.27***	26.92**	7.889**	1.735***
	(15.08)	(11.84)	(3.795)	(0.5945)
Log Population	18.00*	5.911	0.3684	0.4964
	(9.343)	(7.396)	(5.523)	(0.4541)
Average Temperature	1.784	2.544	0.2755	0.1285·
	(2.938)	(2.011)	(1.074)	(0.0977)
Average Precipitation	0.2856***	0.0738	0.0287	0.0065**
	(0.1017)	(0.0695)	(0.0319)	(0.0028)
Cropland Percentage	-32.90·	1.878	0.8649	-0.5371
	(23.94)	(14.55)	(7.653)	(0.7193)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	7,000	7,000	7,000	7,000
R^2	0.55540	0.50477	0.58426	0.67816
Within R^2	0.01447	0.01293	0.00273	0.02013

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

6.2 25 by 25 km grid cell

Comparably to the robustness check of the external validity test by using the 25 by 25 km grid cell resolution, we also discover many interesting results with the subcategory breakdown of the conflict variable and the best estimate of fatality in logarithmic. For Afghanistan, conflicts among civilians (the non-state dummy variable) are apparently sensitive to the introduction of foreign aid projects - aid projects generally reduce its onset probability, but putting projects in water stress level 1, 2, and 3 areas worsens the situation, especially for water stress level 4 areas. As for Bangladesh, putting foreign aid projects in water stress level 1 areas generally worsens the conflict onset probability, just like it results using 50 by 50 km grid cells, despite the slightly lower magnitude of the coefficients. The results for Nepal with the breakdown of conflict subcategory share a similar pattern to the general conflict dummy variable when switching from the default grid resolution to a finer one. Using finer grid cells also uncovers nuance for the conflict casualty, with one additional project location being distributed in the areas lowering the conflict fatality of 12.45 %. And most interestingly, Pakistan's results reveal a lot of subtleties for the state-based and non-state conflicts as well as the casualty of conflicts; its robust result for the general conflict dummy translates very much similarly to the state-based dummy, alluding to the fact that the state and its stability are especially sensitive to foreign aid allocation, this goes the same for foreign aid's influence on the conflict fatality. Lastly, Sri Lanka's significant result with the general conflict dummy is largely reiterated in the regression with the state-based conflict dummy. Furthermore, despite the fatality-inducing effect of projects when being distributed to areas with water stress level 2, it is outmatched by the foreign aid's role in lowering the conflict fatality in general.

25 by 25 km grid cells - Afghanistan				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-3.098·	1.404	-1.391**	-0.1965***
	(2.219)	(1.543)	(0.6095)	(0.0649)
Project Location Count × Water Stress Level 1	1.880	-1.788	1.386**	0.1248
	(3.273)	(1.748)	(0.6097)	(0.1023)
Project Location Count × Water Stress Level 2	1.275	-2.304	1.203*	0.0899
	(3.330)	(2.600)	(0.6487)	(0.1010)
Project Location Count × Water Stress Level 3	7.901·	-8.297**	0.3168	0.2577**
	(5.804)	(3.234)	(1.277)	(0.1253)
Project Location Count × Water Stress Level 4	2.110	-0.4948	3.114***	0.1064
	(3.266)	(2.091)	(1.092)	(0.1041)
Log GDP	-0.4628	0.7441	0.7319·	0.3740
	(11.83)	(2.557)	(0.5664)	(0.2984)
Log Population	32.51**	4.250·	-0.0291	1.246**
	(14.12)	(3.307)	(0.5209)	(0.4971)
Average Temperature	6.633·	3.497*	-1.519**	0.1928·
	(5.067)	(2.052)	(0.6209)	(0.1399)
Average Precipitation	0.1299	0.0885	-0.0789*	-0.0017
	(0.1598)	(0.0737)	(0.0414)	(0.0050)
Cropland Percentage	334.3***	75.19***	-3.711	10.77***
	(50.54)	(22.30)	(4.156)	(1.637)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	20,600	20,600	20,600	20,600
R^2	0.70760	0.59041	0.58435	0.74043
Within R^2	0.02442	0.00597	0.00387	0.03442

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

25 by 25 km grid cells - Bangladesh				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-0.1226	0.0887	0.1422	-0.0049
	(0.5716)	(0.1873)	(0.7308)	(0.0059)
Project Location Count × Water Stress Level 1	2.780*	5.157*	-0.4481	0.0857*
	(1.560)	(2.774)	(1.095)	(0.0436)
Project Location Count × Water Stress Level 2	-0.3431	-0.0627	-0.0145	0.0047
	(0.5943)	(0.3337)	(1.086)	(0.0088)
Project Location Count × Water Stress Level 3	0.7254	-0.3019	0.2336	0.0104
	(0.6977)	(0.2962)	(0.9861)	(0.0120)
Project Location Count × Water Stress Level 4	0.6002	-0.9254**	0.1621	-0.0087
	(0.7636)	(0.4021)	(0.7417)	(0.0084)
Log GDP	-15.51*	-0.6292	-15.09·	-0.2050
	(8.385)	(6.197)	(10.94)	(0.2007)
Log Population	11.09·	5.688	-49.25***	-0.4475·
	(7.632)	(6.643)	(18.57)	(0.3424)
Average Temperature	-9.857	-0.4872	-2.689	-0.1353
	(10.32)	(5.955)	(13.83)	(0.1811)
Average Precipitation	0.0658**	-0.0189	-0.0755**	-0.0003
	(0.0329)	(0.0257)	(0.0369)	(0.0005)
Cropland Percentage	7.924	-7.101·	-27.92·	-0.0874
	(12.74)	(5.079)	(17.55)	(0.2390)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	4,480	4,480	4,480	4,480
R^2	0.49526	0.40178	0.47259	0.50271
Within R^2	0.00382	0.01064	0.00520	0.00452

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

25 by 25 km grid cells - Nepal				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-5.691***	-5.036***	0.0110	-0.1245***
	(1.104)	(1.176)	(0.0164)	(0.0374)
Project Location Count × Water Stress Level 1	1.367	0.3501	-0.0950	0.0247
	(1.661)	(2.149)	(0.0879)	(0.0502)
Project Location Count × Water Stress Level 2	0.1952	0.4158	-0.0905	0.0561
	(2.464)	(2.765)	(0.1073)	(0.0609)
Project Location Count × Water Stress Level 3	0.6443	1.531	-0.0409	0.0244
	(1.839)	(2.200)	(0.0326)	(0.0538)
Project Location Count × Water Stress Level 4	2.508	2.115	-0.1123	0.0596
	(2.050)	(2.040)	(0.1117)	(0.0809)
Log GDP	-12.95·	-10.10	-0.1885	-0.2402
	(8.853)	(8.750)	(0.1605)	(0.2535)
Log Population	0.8628	2.124	0.0546	0.0645
	(3.269)	(3.387)	(0.0720)	(0.1012)
Average Temperature	12.15	7.651	-1.912	0.6394*
	(10.26)	(10.72)	(1.793)	(0.3295)
Average Precipitation	0.0390	0.0733	0.0083·	0.0009
	(0.0505)	(0.0583)	(0.0059)	(0.0017)
Cropland Percentage	-35.78	-116.5*	1.638	-1.754
	(58.64)	(60.93)	(3.756)	(1.650)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	4,740	4,740	4,740	4,740
R^2	0.48260	0.45199	0.11622	0.47783
Within R^2	0.01347	0.01124	0.00227	0.00824

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

25 by 25 km grid cells - Pakistan				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-3.317**	-0.8974	-0.4408**	-0.0708**
	(1.448)	(0.7383)	(0.1942)	(0.0325)
Project Location Count × Water Stress Level 1	9.341*	-0.8152	0.5715	0.2705*
	(5.292)	(1.149)	(0.8403)	(0.1585)
Project Location Count × Water Stress Level 2	0.7120	-1.591	-1.141	-0.0700
	(2.650)	(1.889)	(1.486)	(0.0760)
Project Location Count × Water Stress Level 3	4.777**	-0.0732	0.0821	0.0747·
	(1.990)	(1.113)	(0.3791)	(0.0530)
Project Location Count × Water Stress Level 4	3.732**	1.458·	0.2905	0.0845**
	(1.815)	(0.9216)	(0.2300)	(0.0389)
Log GDP	31.11***	14.21***	3.542***	1.003***
	(6.380)	(4.144)	(1.292)	(0.2173)
Log Population	6.793	0.5198	-1.955	0.0383
	(6.623)	(5.166)	(2.394)	(0.2706)
Average Temperature	2.100*	0.3607	0.2875	0.1053***
	(1.091)	(0.6622)	(0.3540)	(0.0349)
Average Precipitation	0.0998***	0.0353·	0.0172	0.0034***
	(0.0356)	(0.0221)	(0.0154)	(0.0011)
Cropland Percentage	-2.631	-4.923	0.6871	-0.2713
	(9.208)	(5.166)	(2.085)	(0.2809)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	27,920	27,920	27,920	27,920
R^2	0.47137	0.28938	0.31579	0.52500
Within R^2	0.00955	0.00445	0.00136	0.01191

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

25 by 25 km grid cells - Sri Lanka				
Dependent Variables:	State-based dummy	One-sided dummy	Non-state dummy	Log Of Best Death Count
Model:	(1)	(2)	(3)	(4)
Variables				
Project Location Count	-28.89*	-8.963	0.7525	-1.678***
	(16.85)	(19.08)	(1.691)	(0.5590)
Project Location Count × Water Stress Level 2	23.54·	7.981	-1.724	1.482***
	(16.79)	(17.87)	(3.368)	(0.5251)
Log GDP	450.2	188.4	9.157	14.90
	(522.2)	(346.1)	(23.04)	(20.91)
Log Population	31.69	15.78	-1.176	2.787*
	(39.23)	(55.94)	(2.665)	(1.525)
Average Temperature	-221.5	-202.0	30.48	3.380
	(755.6)	(539.1)	(58.47)	(38.47)
Average Precipitation	0.0449	-0.3955	-0.1945	0.0153
	(1.018)	(0.5928)	(0.4382)	(0.0483)
Cropland Percentage	-247.6	258.3	21.73	-5.040
	(1,101.2)	(472.5)	(53.55)	(28.61)
Fixed-effects				
Grid Cell	Yes	Yes	Yes	Yes
Subdistrict * Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	2,140	2,140	2,140	2,140
R^2	0.95635	0.94420	0.98272	0.95315
Within R^2	0.06474	0.04387	0.03039	0.10964

Clustered (grid_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, .: 0.2*

7 Graphs for Chapter 3.3 - External validity

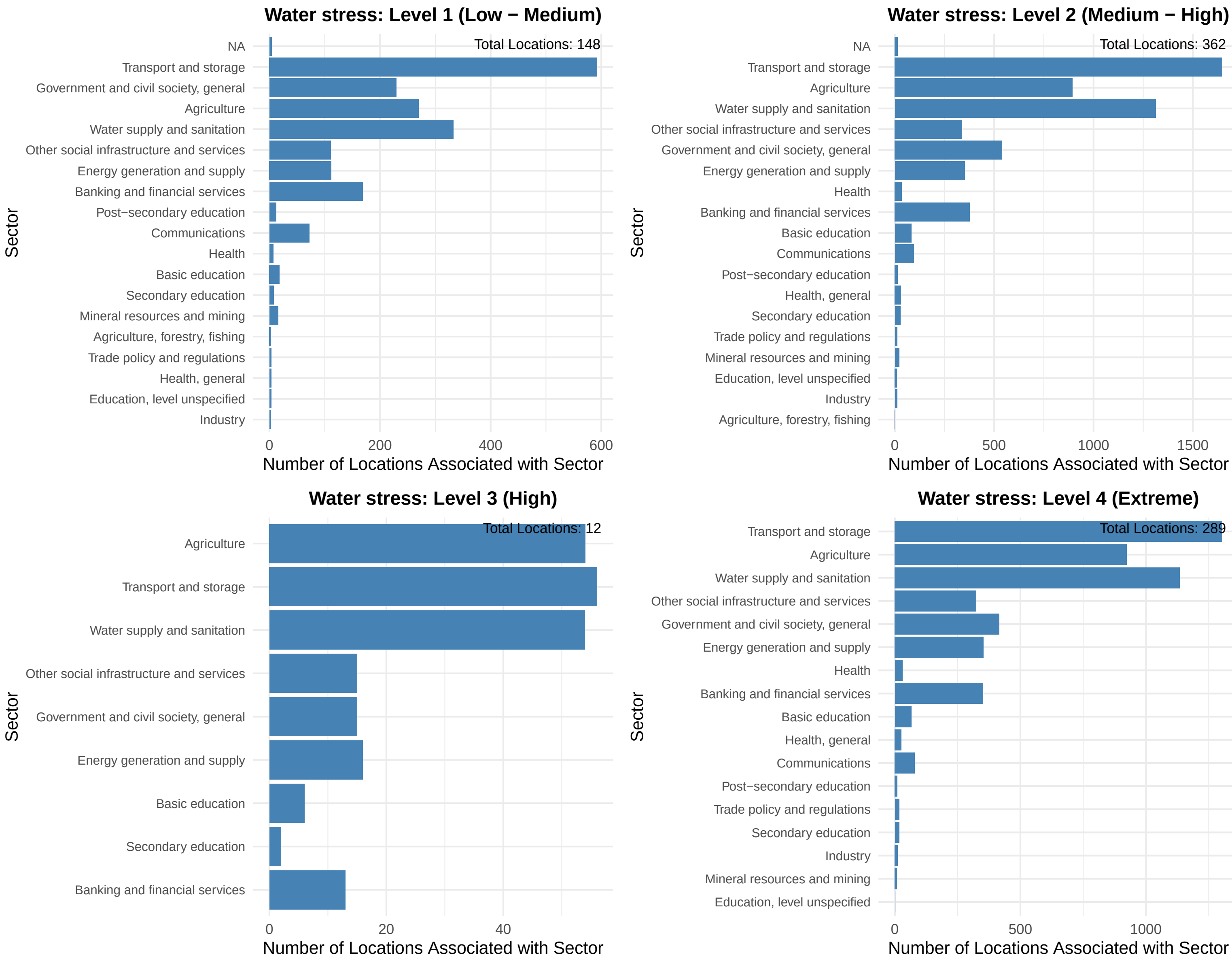

Figure 28: Distribution of Project Locations by Sector in Afghanistan
Note: Overlapping occurs because one (project) location can be classified in multiple sectors

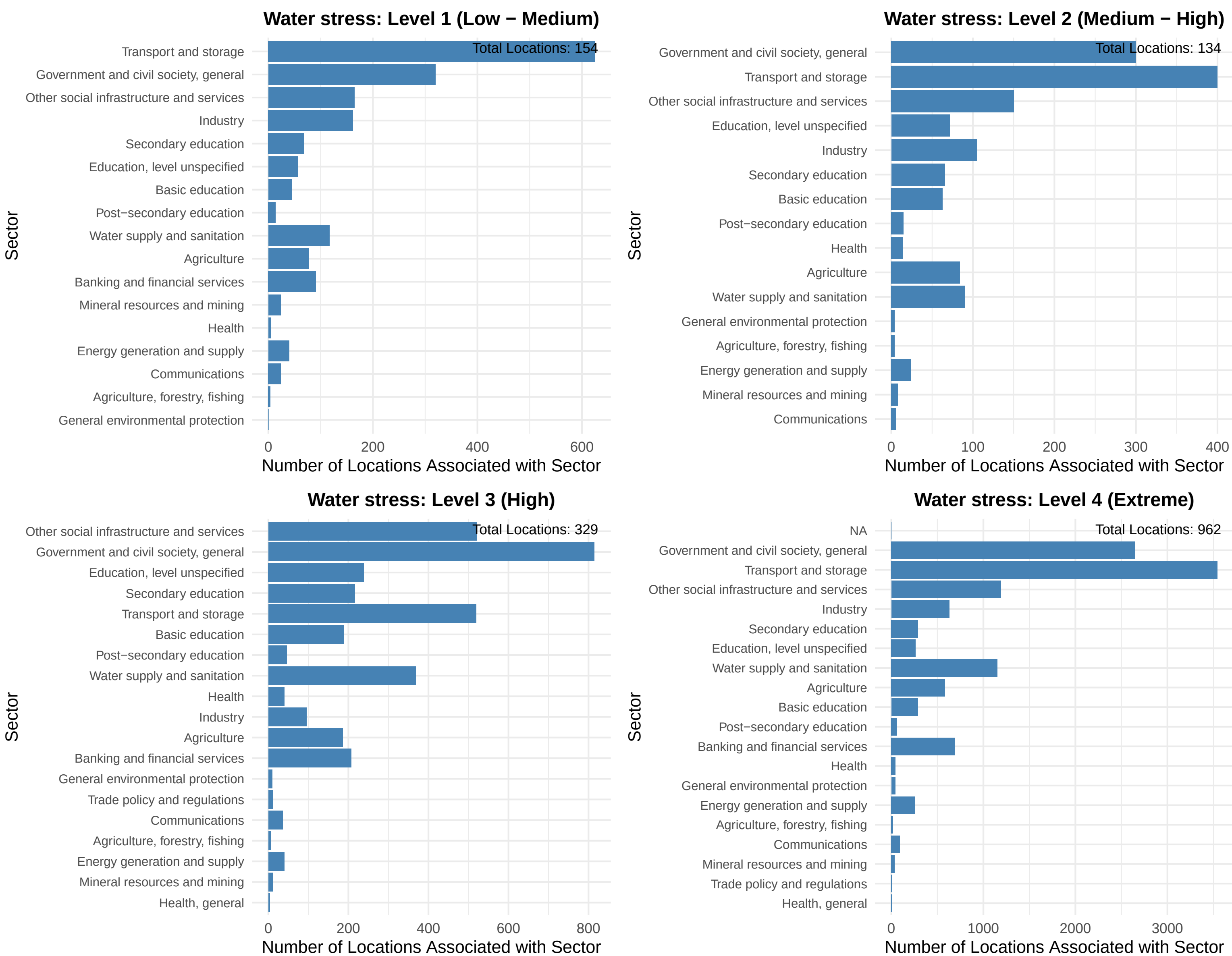

Figure 29: Distribution of Project Locations by Sector in Bangladesh
Note: Overlapping occurs because one (project) location can be classified in multiple sectors

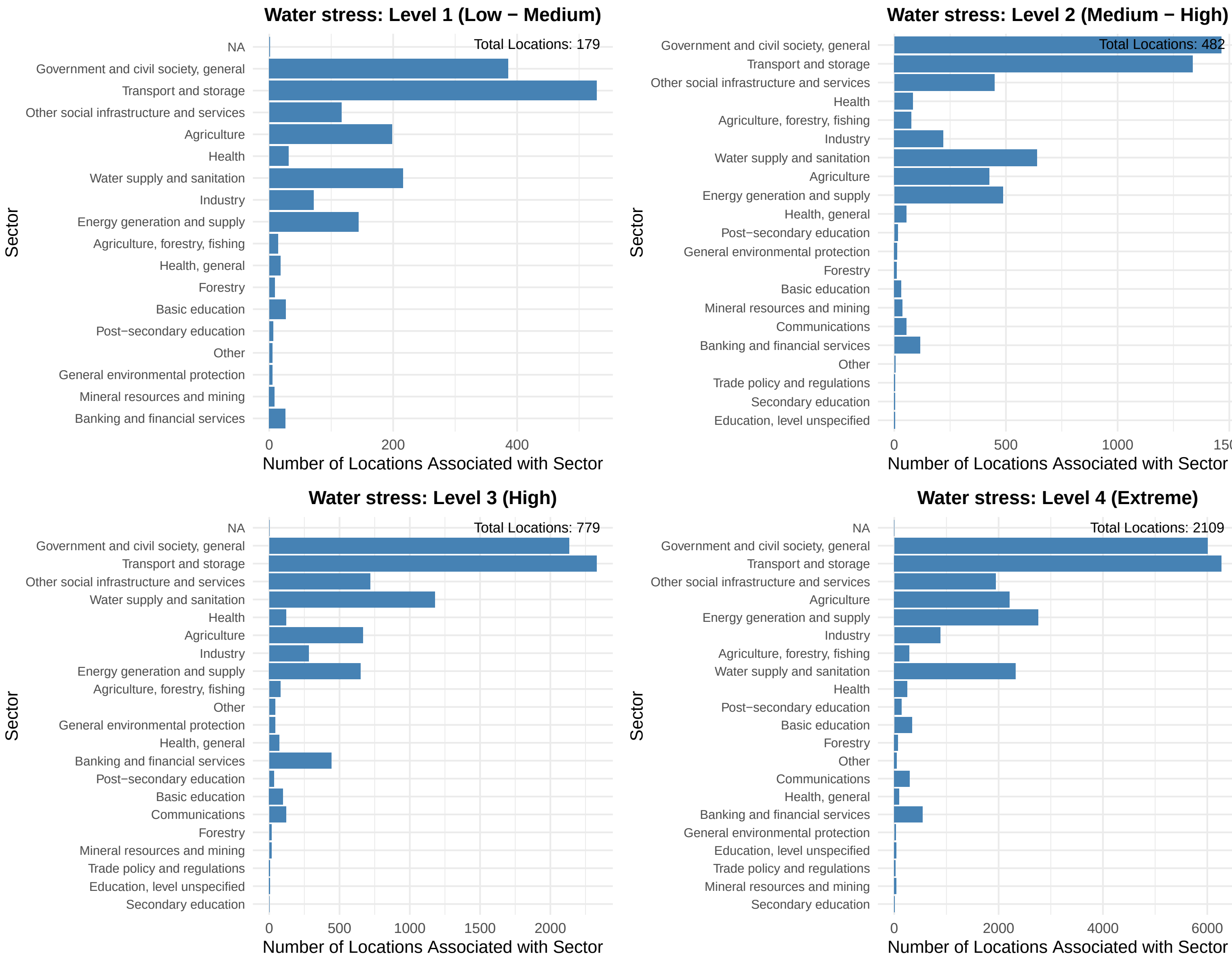

Figure 30: Distribution of Project Locations by Sector in India
Note: Overlapping occurs because one (project) location can be classified in multiple sectors

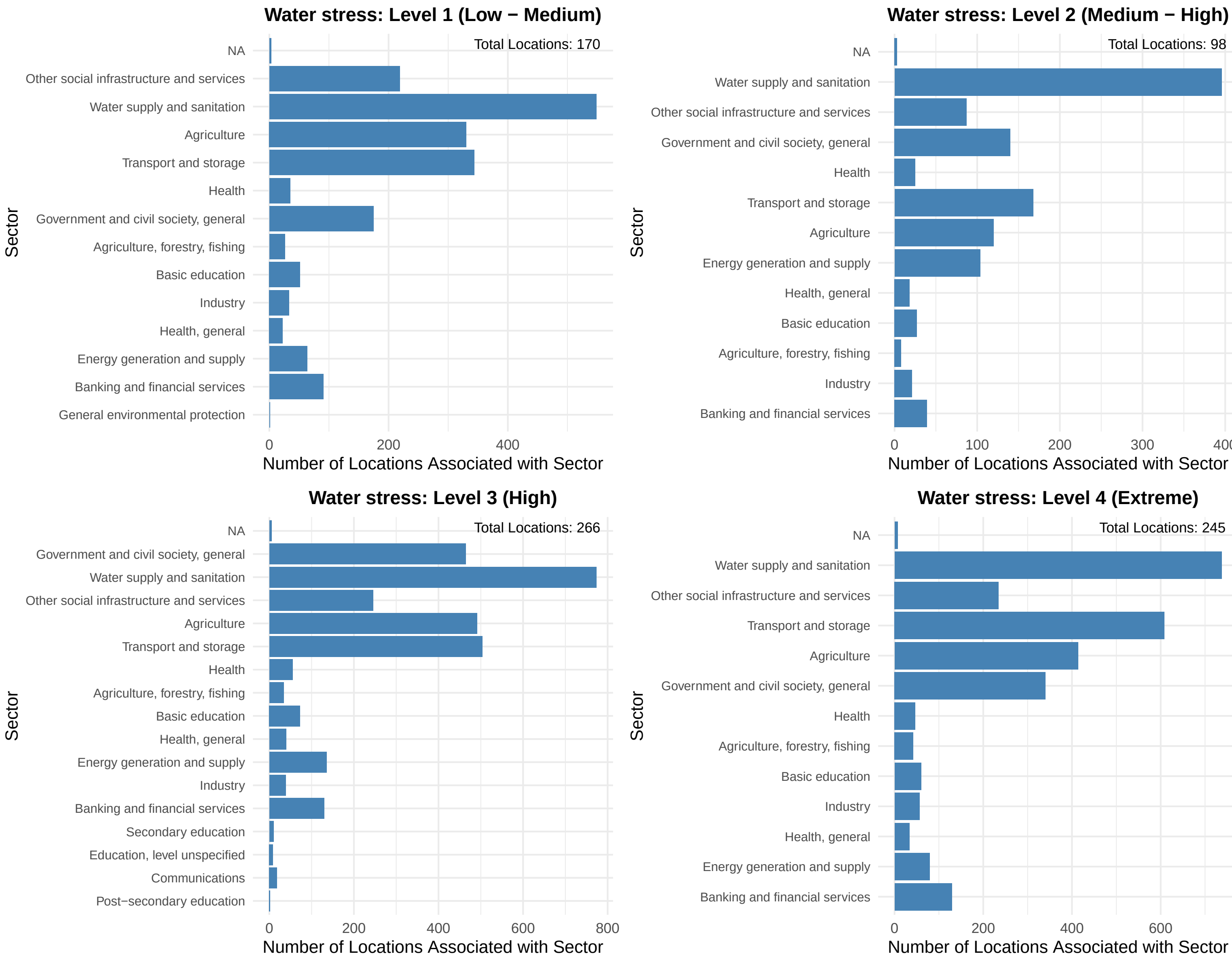

Figure 31: Distribution of Project Locations by Sector in Nepal
Note: Overlapping occurs because one (project) location can be classified in multiple sectors

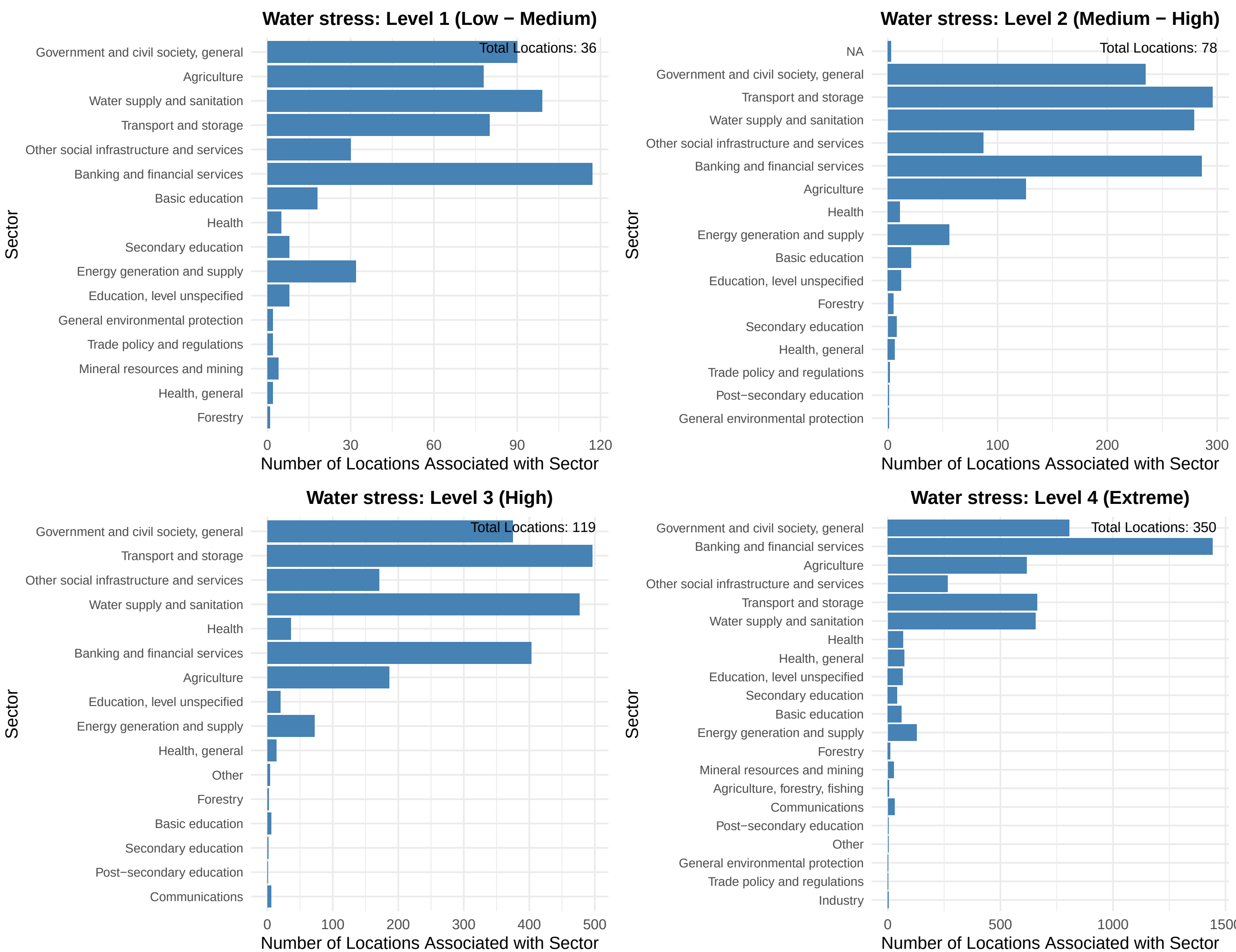

Figure 32: Distribution of Project Locations by Sector in Pakistan
Note: Overlapping occurs because one (project) location can be classified in multiple sectors

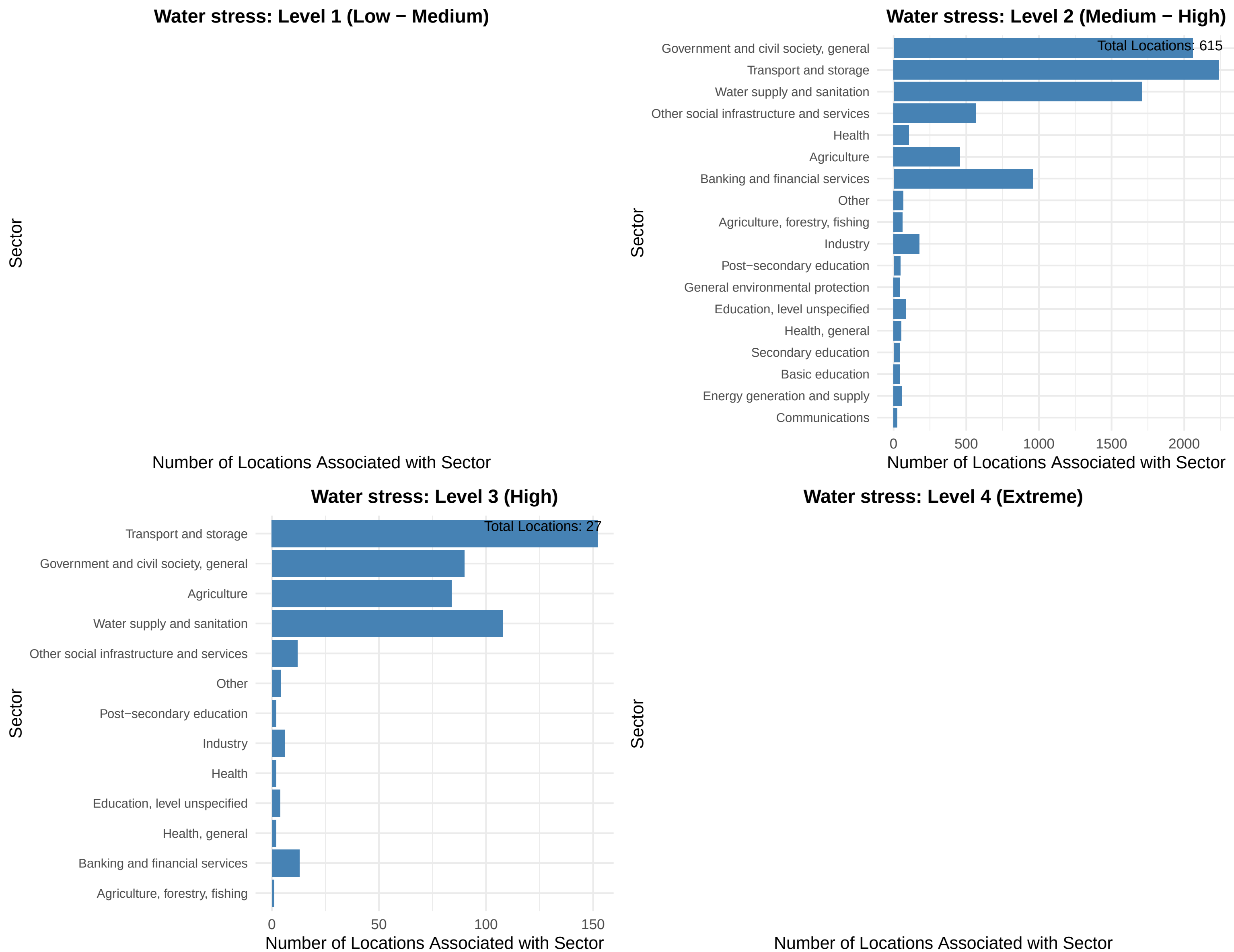

Figure 33: Distribution of Project Locations by Sector in Sri Lanka
Note: Overlapping occurs because one (project) location can be classified in multiple sectors. Sri Lanka only has water stress level 2 (Medium-High) and level 3 (High) areas