Chapter 4: Water
Supplementary Material

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SM4.1 Methodological Developments in Climate and Hydrological Sciences since AR5

Since AR5, there have been methodological improvements in the climate change impact and hydrological studies, including advances in in-situ and satellite data applications, development of models and scenarios and detection and attribution studies. These methodological developments are aligned with the recently formulated priorities in climate and hydrological sciences (Cudennec et al., 2016; Blöschl et al., 2019a).

SM4.1.1 Advances in Detecting Hydrological Changes from In-Situ Measurements

Global investments in the in-situ monitoring infrastructure continue to decline, leading to consistently Decrease numbers of observation stations, especially in difficult-to-access environments (Fekete et al., 2015; Ceola et al., 2016; Feki et al., 2016). Such monitoring limitations impede advances in hydrological change and water security assessments (Blume et al., 2017; Young et al., 2019)(high confidence). Despite these limitations, there has been the development of novel experimental stations (e.g., Environment Change Network (Rennie et al., 2020) and TERENORur (Bogena et al., 2018) and observational techniques, resulting in new sources of information for a better understanding of the hydrological changes. These new methods include innovative approaches for high-resolution and low-cost estimation of rainfall (e.g. camera rain gauges (Allamano et al., 2015), moving car rain gauges (Rabiei et al., 2016), video analysis for deriving river stage fluctuations (Michelsen et al., 2016) and gauging extreme floods (Le Boursicaud et al., 2016), image-based techniques, such as particle tracking velocimetry (Tauro and Grimaldi, 2017), unmanned aerial vehicles flow tracking (Perks et al., 2016). In addition, the techniques rooted in open-source controllers are intensively elaborated (Cressey, 2017; Lettenmaier, 2017; Tauro et al., 2018). These combined efforts have promoted the implementation of public hydrological data collection platforms (Tauro et al., 2018) (Crowd Hydrology and OPEnS Lab are among the recent examples) within a framework of increased use of citizen science data in hydrological research. In this framework, novel tools for accumulating citizen-collected data of water insecurity measures are beginning to develop (Young et al., 2019).

SM4.1.2 Advances in Detecting Hydrological Changes from Satellite Data

Discharge estimation from altimetry (Zakharova et al., 2020) and optical/microwave detection of snow and ice cover (Tarpanelli et al., 2017) have helped improved understanding of past changes in the hydrological cycle at large scales, particularly in ungauged and poorly-gauged river basins (medium confidence). Progress has been made in algorithms and satellite product development relating to estimations of streamflow discharge (Durand et al., 2016; Sichangi et al., 2016), drainage network (Wang et al., 2021)and river channel surface area (Allen and Pavelsky, 2018; Wang et al., 2018c). Advancements in the processing of satellite data allow monitoring past changes in surface (Donchyts et al., 2016; Pekel et al., 2016; Busker et al., 2019), soil (Nicolai-Shaw et al., 2017; Deng et al., 2020), and the GRACE satellite-based total water storage (Rodell et al., 2018; Pokhrel et al., 2021) changes. Satellite-derived improved DEM together with new floodplain and river network products (Yamazaki et al., 2017; Nardi et al., 2019; Yamazaki et al., 2019) make it possible to obtain more realistic river routing at continental to global scales. Several space missions launched after AR5 provide new insights into changes in surface soil moisture (SMAP and Sentinel-1B), surface water elevation (Jason-3, ICESat-2), total water storage (GRACE-FO), etc. (McCabe et al., 2017). After AR5, a multi-satellite approach (Sichangi et al., 2016; Wang et al., 2017b; Zhang et al., 2019b) became a comprehensive tool for satellite-based detection of hydrological changes.

SM4.1.3 Advances in Hydrological Modelling for Impact Assessment

Until recently, approaches to the projections of hydrological consequences of climate change include (Kundzewicz et al., 2018): (1) climate models ensemble simulations (Koirala et al., 2014; Ficklin et al., 2018); (2) hydrological models simulations driven by the climate models ensemble projections (Krysanova et al., 2017; Zaherpour et al., 2018).

Following the climate model-hydrological model-impact assessment chain, a methodological shift has occurred after AR5. This shift involved moving away from using one hydrological model with a large ensemble of climate projections to use hydrological model sets (Hattermann et al., 2017). Even when driven by the same climate projections, different hydrological models can provide different results, so the impact assessments based on averaging over the hydrological model ensemble are assumed to be more credible than

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a single model-based assessment (Kundzewicz et al., 2018) (medium confidence), though possible extremes can be ubreasonably smoothed by averaging. Both global and regional (basin-scale) hydrological model sets have been Increasely used for impact studies, particularly within the Inter-Sectoral Impact Model Inter-comparison Project (see Box 4.S.1.1 ISIMIP). Global hydrological models show weaker performance in the historical period at the basin scale and provide more uncertain runoff projections than the regional models (Gosling and Arnell, 2016; Hattermann et al., 2017). Global hydrological models also demonstrate a more pronounced increase in impact uncertainty with time (robust evidence, medium agreement) (Hattermann et al., 2018). The difference in assessment uncertainty is due partly to the fact that global hydrological models are used without any calibration and testing, unlike regional hydrological models (Krysanova et al., 2018; Kundzewicz et al., 2018). It has been further demonstrated that climate projections are commonly the main source of uncertainty in hydrological impact assessments (Krysanova et al., 2016; Vetter et al., 2017; Joseph et al., 2018) (robust evidence, medium agreement). However, hydrological model-based uncertainty can also be notable for some variables (Hattermann et al., 2018) and basins (Giuntoli et al., 2015; Hattermann et al., 2018). Studies published after AR5 focused on quantifying the contribution of internal atmospheric variability in hydrological projection uncertainty (Seiller and Anctil, 2014; Gelfan et al., 2015). Computational cost reduction and advancement in computationally efficient schemes allow evaluation of hydrological models performance for different reference periods and more detailed assessment with higher spatial and temporal resolutions. Evaluation of hydrological models can also include multiple climate and socio-economic scenarios, attribution of impacts and accounting for complex water processes at regional and continental scales. Herewith, methodological differences can lead to markedly different outputs for several hydrological assessments of climate change (Koutroulis et al., 2018).
Accumulation of statistics on hazard, exposure and vulnerability has improved model-based estimation of impacts, loss and damage, and cost and benefit of adaptations to water-related disasters (medium agreement). For example, reported exposures caused by water-related disasters on databases such as EM-DAT and NatCat SERVICE had been used to calibrate modelled exposures or past trends in vulnerabilities (Jongman et al., 2015; Tanoue et al., 2016). In addition, current local resilience to hazard (e.g., flood protection standard (Scussolini et al., 2016) provides an initial condition and helps to quantify additional adaptations required to projected changes.

[START BOX SM4.1 HERE]

Box SM4. 1: Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP)

ISI-MIP is a community-driven activity bringing together impact modellers to create a framework for multi-model climate-impact simulations across sectors and scales. Following the first ISI-MIP involving 28 global impact models from five sectors: water, agriculture, biomes, health, coastal systems (Warszawski et al., 2014) and aimed at providing outcomes for AR5, the current longer-term phase incorporates regional impact models, additional eight sectors (regional water, fisheries and marine ecosystems, permafrost, terrestrial biodiversity, regional forests, agro-economies, lakes, and energy), and involves more than 100 modelling groups. The main output of ISI-MIP is an open-access archive (isimip.org/gettingstarted/data-access/#for-external-non-participant-users) of simulations.

The key research results obtained within the ISI-MIP Water sector can be broadly divided into the following three groups:

Evaluation of regional hydrological models (rHMs) and rHMs-based impact assessment: Comprehensive studies were carried out for 12 large river basins worldwide using nine calibrated rHMs driven by five climate projections for four RCPs (see synthesis in (Krysanova et al., 2017). The models' performance evaluated with 14 criteria was suitable for the monthly and seasonal dynamics and high flow but weaker for low flow indicators. Total contribution of GCMs and RCPs to mean annual and high flows projections uncertainty turned out to be five times greater than the contribution of rHMs.
Evaluation of global hydrological models (gHMs): An ensemble of six gHMs for 40 large river basins worldwide was evaluated (Zaherpour et al., 2018). The gHMs models generally perform better in the wetter equatorial and northern hydro belts than in drier southern hydro belts for monthly runoff. Nevertheless, the authors found a general trend towards overestimating mean annual runoff and

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indicators of upper and lower extremes for most models. In several cases, gHMs failed to capture the timing and magnitude of the seasonal runoff cycle. The study highlights the need for improvement of gHMs and models weighting based upon their performance.

Cross-scale comparison of performance and impacts: A cross-scale intercomparison of performances in the reference period and simulated climate impacts was performed using nine rHMs (calibrated) and nine gHMs (not calibrated except one) for 11 large river basins (see synthesis in (Hattermann et al., 2017). In the reference conditions, gHMs often show considerable biases in mean monthly and annual discharges and incorrect seasonality, whereas rHMs show a much better reproduction of discharge.

[END BOX SM4.1 HERE]

SM4.1.4 Detection and Attribution: How Much of the Changes are Attributable to Climate Change?

Since AR5, tracing the effects of human influence on extreme weather events has become a major emerging area of enquiry (Scott and Sugg, 2015; Easterling et al., 2016). Following an impactful extreme event such as a heatwave, wildfire, drought, or flood, the demand for information about the role of climate change is intensified mainly from the media, regional disaster risk managers, insurance industry, litigators, and policymakers. Furthermore, planning for disaster risk management requires reassessments of the magnitude of impact-related variables expected to be experienced at different likelihood levels. Attribution of hydrometeorological impacts to anthropogenic climate change consists of two steps: attribution of impacts to climate change, regardless of the cause, and attribution to anthropogenic causes. (Cramer et al., 2014)Cramer et al., 2014, presented evidence that several water-related impacts could be attributed to climate change, but with little attribution to drivers of climate change, whether anthropogenic or natural. However, (Bindoff et al., 2013a)Bindoff et al., 2013a presented new, stronger evidence that hydrometeorological changes could be attributed to anthropogenic influence through Increase radiative forcing by greenhouse gas (GHG) and aerosol emissions, and also presented emerging evidence that some aspects of land hydrological change could be attributed to the anthropogenic influence of atmospheric CO2 concentrations acting on land ecosystems. Most attribution studies assessed in WGI focused on long-term trends, with a few on extreme events.

The techniques for detecting and attributing extreme weather events have improved substantially since the AR5 (Bindoff et al., 2013b). An event attribution (EA) statement is based on a specific metric that characterizes the extreme nature of the event in question, rendering relevance for the occurrence of similar types of events in the future. The change in the likelihood of an extreme event due to human influences on the climate is usually expressed in terms of the fraction of attributable risk (FAR) (Allen, 2003) or the probability ratio.

Different event attribution approaches have been developed. For example, coupled Model Approaches extracts large samples of the impact-related climatic variable from general circulation model (GCM) ensembles of the factual and counterfactual (a world that might have been without human influences) worlds to estimate the probabilities of the event of interest under both scenarios, from which estimates of the FAR or Relative Risk (RR) are obtained. For such attribution assessments, the models must be rigorously evaluated against long term observational data (Perkins et al., 2014).

Sea Surface Temperature Forced Atmosphere Only Model Approaches are similar to the GCM approach but uses atmosphere-only climate model (AGCM) with simulations representing the factual world conditioned on the observed evolution of sea surface temperature (SST) and ice cover, and simulations of the counterfactual world conditioned on SSTs and ice cover of a ‘world that might have been,’ had there been no human influence on climate (Ciavarella et al., 2018). Prescribed SSTs

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in an AGCM are used rather than coupled models, as this can reduce model biases and enable more ensemble members to be simulated. This is because atmosphere-only simulations are less computationally expensive. This approach potentially results in a better representation of extreme events and an improved signal-to-noise ratio. However, the lack of atmosphere-ocean coupling could lead to a less accurate representation of extreme events strongly affected by atmosphere-ocean interactions (Stott et al., 2016). While removing the anthropogenic GHG forcing from the modelled atmosphere is straightforward, estimating the pattern of warming to be removed from the observed SSTs and sea ice is the largest source of uncertainty in this approach that cannot be evaluated against observations.

Confidence in the attribution of water-related extremes (extreme precipitation events, droughts, and storms) can sometimes be lower than for extreme temperature events (Stott et al., 2016). The observational basis is regarded as less secure, and climate models may not always perform well in capturing relevant features of the events. Confidence depends on the processes involved. (Seneviratne et al., 2021) draw an important distinction between dynamic (atmospheric circulation) and thermodynamic (energy balance, including evaporation) effects. (Seneviratne et al., 2021) assign high confidence to thermodynamic contributions to Increase drought severity from greenhouse forcing but low confidence to dynamic contributions. They also assign high confidence to anthropogenic contributions to the increased intensification of precipitation, dominated by thermodynamic effects with some dynamic contributions. Confidence in attribution results increases if independent methods lead to similar conclusions. For example, the consensus among different process-based models can increase confidence and explain well-founded conceptual models.

Europe, North America, Australasia, and Asia currently have a disproportional amount of published EA studies. Among other publications, annual reports of the Bulletin of the American Meteorological Society (BAMS) on explaining extreme events of the previous year from a climate perspective have been published since 2012 (Peterson et al., 2012) and contributed to the increase in the geographical coverage of event attribution studies. However, given the regional differences in modes of climate variability, such as El Niño / Southern Oscillation, and responses to external climate forcings, it is important to close gaps in global coverage (Central and South America, Africa, West Asia and Eastern Europe) of detection and attribution studies.

In general, studies have shown clear evidence that human influence has increased the likelihood of many extremely warm seasonal temperatures and reduced the likelihood of extremely cold seasonal temperatures in many parts of the world. The influence on the probability of extreme precipitation events, droughts, and storms is less evident, but some evidence is emerging for some cases. Most of the published studies have focused on the meteorological nature of events rather than their impacts which would in many cases require the consideration of additional geophysical and socio-economic (e.g., exposure and vulnerability to natural hazards) processes. For instance, stream flows computed using hydrological models come closer to the drivers of flood or drought impacts on people. As the attribution techniques are extended to account for additional impact-relevant variables, it is expected that the results will become more suitable for regional to local decision making on management of water resources and disasters risk.

SM4.1.5 Scenarios for Projecting Change – RCPs and SSPs

The Representative Concentration Pathways (RCPs) and the Shared Socioeconomic Pathways (SSPs) provide scenarios of future changes in climate forcings and socio-economic changes. They are used, among other things, to quantify the water-related impacts of climate change. Differences in climate model responses to RCP forcing lead to significant uncertainties in projected regional water impacts. Projected risks for people and society also depend very strongly on the choice of socio-economic scenario. For example, the risk of water insecurity depends not only on the limited availability of freshwater but also on the number of people exposed to this and their sensitivity to reduced water availability. These, in turn, depend on socio-

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economic factors such as population size and demographics, local infrastructure, the character and state of the economy, and other factors that affect access to water.

RCPs are primarily defined in terms of the concentrations of CO2, other GHGs and short-lived forcing agents such as ozone and aerosols, and in CMIP5-based research assessed in AR5, the RCPs were also accompanied by standardized scenarios of land use and land cover change (van Vuuren et al., 2011). One development since AR5 is the inclusion of different mixes of CO2 and other forcing agents for a given radiative forcing, which could potentially affect hydrological cycle processes sensitive to the concentration of CO2 and/or the geographical pattern of radiative forcing or land use (see 4.1.3). Another development is that the RCPs used in the 6th Coupled Model Intercomparison Project (CMIP6) climate models are paired with specific SSPs, including land-use scenarios associated with that SSP.

SSPs provide quantitative scenarios of the key characteristic of human society over the 21st century (O'Neill et al., 2017). These consist of quantified scenarios and accompanying narratives representing possible future trends in large-scale (global and world regional) societal character and natural systems over the 21st century. The five SSPs are designed to cover diverging sets of societal conditions representing combinations of high and low challenges to climate change mitigation and adaptation. They are quantified in terms of demographics (Jones and O'Neill, 2016), economic development, welfare, environmental and ecological factors, resources, metrics for governance, technological development, policies (excluding climate policy) and broader societal factors, and feature narratives describing the scenario of the evolution of these pathways. These pathways affect the exposure and vulnerability of people to hydrological hazards and hence affects the risks and impacts of climate change relating to water.

SM4.2 Methodological Note on Measuring Benefits of Observed Adaptation, and Effectiveness of Projected Adaptation

SM4.2.1 Measuring Benefits of Current (Observed) Adaptation

The current (observed) adaptation assessment focuses on measuring outcomes (positive or negative) of water-related adaptation responses across several dimensions. We define water-related adaptation as a response if the hazard or the adaptation intervention is water-related. For example, any response to water induced hazards like floods, droughts, groundwater depletion, melting of the cryosphere, soil moisture depletion etc., is counted as a water-related adaptation. Similarly, water specific adaptation response (e.g., irrigation, water "saving" technologies, rainwater harvesting, soil moisture conservation etc.), irrespective of the nature of the hazard, is also considered water-related adaptation.

For assessing the outcomes (both positive and negative) of current adaptation responses, we use a database of 1819 documented case studies of adaptation across all sectors published since 2014. Of these, 1682 papers are from the Global Adaptation Mapping Initiative (GAMI) database (Berrang-Ford et al., 2021), and the remaining 137 papers are cited in relevant adaptation sections of this chapter (Section 4.6). Of these, only 359 (19.7%) case studies measure outcomes of water-related adaptation responses in concrete ways. Since a single paper often dealt with more than one adaptation, a total of 1038 responses were coded from these 359 papers. Therefore, we only include studies that measure outcomes of adaptation response by using one or multiple indicators. We define any current adaptation response to be beneficial if it leads to positive outcomes. Of the 359 articles, as many as 319 articles document (88.8%) show positive outcomes. An adaptation is deemed to be beneficial when any outcomes in any of these categories is positive:

- Economic and financial indicators, such as improvements in crop yields and resulting incomes; increase in profits, greater savings, or decreased losses from hazards, etc.;
- Impacts on vulnerable people, e.g., on women, children; Indigenous Peoples;
- Water-related impacts, e.g., improved water use efficiency, water saving, reduction in water withdrawals and application, etc.;
- Ecological and environmental impacts such as lesser energy use, better soil structures, and better thermal comfort, etc.;

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- Institutional and socio-cultural impacts such as better group dynamics and action, better bargaining power among vulnerable people; and strengthening of local institutions or national policies; and
- Any other positive outcomes not captured by the above five indicators.

Given the focus on measuring outcomes of water-related adaptations, our inclusion criteria were:

- The article was about water-related adaptation;
- The article documents implemented case study of water-related adaptation responses as opposed to responses planned for the future;
- The article documents outcomes of adaptation in measurable ways;
- The article includes at least one tangible (either quantitative or qualitative) indicator of outcomes. Those indicators could be economic/financial indicators; indicators on impacts on vulnerable people; water-related indicators, environmental and ecological indicators; socio-political indicators; or any other indicators not captured by the above categories;
- The article was published in, or after 2014;
- The paper contained enough data about the water-related adaptation response/intervention that is being coded.

Each paper was coded for roughly 100 variables. The first was the inclusion/exclusion criteria mentioned above. To be included, an article had to meet all six inclusion criteria mentioned above. The second section coded the nature of adaptation response. This included: category of water adaptation response (coded across 16 categories); water use sub-sectors in which adaptation was taking place (all water-use sections in this chapter); the scale of intervention (local, national, regional, and global); geographic location (country and continent); details about the initiator of adaptation (government, civil society, private companies etc.) and whether adaptation response included Indigenous Knowledge and local knowledge. The 16 adaptation categories were:

- Improved cultivars and agronomic practices
- Changes in cropping pattern and crop systems
- On-farm irrigation and water management
- Water and soil moisture conservation
- Collective action, policies, institutions
- Migration & off-farm diversification
- Economic/financial incentives
- Training and capacity building
- Agro-forestry and forestry interventions
- Flood risk reduction measures
- Livestock and Fishery related
- IK and LK based adaptations
- Urban water management
- Energy-related adaptations
- WaSH related adaptations
- Any other (includes coping)

The third section of the protocol coded hazards (e.g., floods, droughts, extreme rainfall, groundwater depletion, melting of the cryosphere, etc.), vulnerability (how did the communities experience vulnerability), and risk. Here 11 risk categories were defined. Section four coded evidence on the outcomes of adaptation, including maladaptation and co-benefits. Studies were coded on six outcome parameters mentioned earlier, and these were used to understand beneficial (or indifferent, detrimental and maladaptive) outcomes of adaptation across different parameters. Finally, we classified the studies in terms of confidence with which adaptation responses were linked to adaptation outcomes and accordingly, studies were classified into three categories:

- studies that establish causal linkages between the adaptation response and outcomes;
- studies that show a correlation between the adaptation response and outcome but does not necessarily establish causality;

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- Studies neither establish causality nor show any correlation between adaptation response and outcomes in tangible ways.

In addition to answering the question, coders were required to copy and paste relevant text from the papers to support their answers. Two or more coders coded each article, and inconsistency was checked and resolved.

We used the online SysREV platform for coding the papers. This online tool enables multiple coders to code simultaneously, and all results are saved on the SysREV server as .csv files. Cleaned data were analyzed using Excel, R (R Core Team), and Stata software. (Further details about the protocol can be found in (Mukherji et al., Accepted), and the database is available at https://doi.org/10.5337/2021.220)

SM4.2.2 Projected Effectiveness of Adaptation

The assessment of future adaptation effectiveness focuses on the ability of a given adaptation response option to return the system under analysis to the baseline state as defined within each study, relative to a projected climate change hazard or risk. For example, projections within a given study might indicate yield reduction at a given point in the future and assess whether Increase irrigation efficiency under a study-specific implementation is able to compensate for the yield reduction relative to the baseline conditions. Effectiveness is here defined as the degree to which the assessed option is able to compensate projected losses. To compare effectiveness across different studies and timeframes, we calculate the effectiveness as a percentage of the risk that the option is able to reduce. We further translate the study-specific scenario and assessment timeframes into Global Warming Levels (GWL) relative to an 1850-1900 baseline.

Studies for the assessment were selected based on several criteria:

- the provision of quantitative projections of climate risk for a given sector, including specification of baseline and scenario timeframes
- the provision of a quantitative assessment of the effectiveness of a specific water-related adaptation option
- clear identification of timeframes for baseline and future projections as well as identification of scenarios (SRES, RCP etc.) and climate models
- an assessment of counterfactuals: impacts without adaptation vs with adaptation; values for baseline state.

A total of 45 studies were identified as suitable for inclusion (see data table in Supplementary Table SM4.7). For each study, all discrete combinations of scenarios, timeframes and adaptation options were treated as an individual data point, leading to several data points from each study and a total of 450 data points for assessment. To make studies comparable across different scenarios and timeframes, we converted each study into a representation of GWL (http://wlcalc.climateanalytics.org), relative to an 1850-1900 baseline, based on the HadCrut4 dataset. We then rounded temperature change to classify each study within the ranges of policy-relevant temperature classes of 1.5°C, 2°C, 3°C and 4°C:

- 1.5°C = below 1.5° up to 1.75°C
- 2°C = above 1.75°C and up to 2.5°C
- 3°C = above 2.5 °C and up to 3.5°C
- 4°C = above 3.5°C

For each study, we assessed the potential for the adaptation option to return the system to baseline conditions relative to the projected climate risk under consideration, assuming that current conditions represent a desirable state. Since units across options are not comparable, we used the percentage change as an indicator. Therefore, we defined each option's effectiveness as a per cent reduction of the risk (projected risk with adaptation - projected risk without adaptation) relative to the overall projected risk (projected risk without adaptation – baseline state).

We only included data points where either the adaptation option or the measured unit of effectiveness were related to freshwater-related issues. We then grouped the studies based on the core focus of the intervention identified:

- Improved cultivars and agronomic practices (Option 1)

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- Changes in cropping pattern and crop systems (Option 2)
- On-farm irrigation and water management (Option 3)
- Water and soil moisture conservation (Option 4)
- Multiple agricultural adaptation options (Option 5)
- Agro-forestry and forestry (Option 6)
- Flood risk reduction measures (Option 7)
- Urban water (Option 8)
- Energy-related adaptation (Option 9).

We defined Multiple agricultural adaptation options (Option 5) as any combination of at least two of the other agricultural-related options (Option 1-4).

Each data point is classified according to the effectiveness of the measure:

- Effectiveness
  - Above 100% = Co-Benefits
  - 80 to 100% = Large
  - 50 to 80% = Moderate
  - 30 to 50% = Small
  - Below 30% = Insufficient

Here, co-benefits means that adaptation reduces projected impacts and leads to an overall improvement relative to the baseline state.

We further assessed the residual impact after adaptation as percent of remaining impact after adaptation has been implemented (100% - Effectiveness in %):

- Residual impact
  - Below 5% = Negligible
  - 5 to 30% = Small
  - 30 to 50% = Moderate
  - Above 50% = Large
  - Above 100% = Maladaptation

Here, maladaptation means that adaptation is disadvantageous and leads to an overall deterioration relative to the baseline state and the projected impact without adaptation.

We grouped the data points according to their IPCC region (Africa, Asia, Australasia, Central and South America, Europe, North America) or Global. For the location of each data point (see Figure 1 in Section 4.7.2 Projected effectiveness of adaptation options), we used the given coordinates from each study or an approximation from the given location. If a study assessed an adaptation option over a region or area, we positioned the data point in the geographic center of the given region or area.

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Table SM4.1: Observed Changes to the Hydrological Cyle Across Eegions

Region	Contry(ies)	Hydrological Component	Which Component of the hydrological component is Impacted	Observed trend with quantitative estimates	Time Period	Dataset e.g. observation station, gridded datasets, reanalysis	References
Global		Precipitation	Mean precipitation	No trend	1979-2014	Observation stations	(Adler et al., 2017)
		Precipitation	Mean precipitation	**Increase.**	1901-2018	Observation stations	(Dunn et al., 2020)
	Global	Precipitation	Extreme precipitation	**Increase.** The contribution from very wet days (days exceeding the 95th percentile of daily precipitation) is Increase globally, with now an extra 2% of precipitation falling during very wet days. Maximum 1day precipitation, Rx1day, shows strong increases of around 2 mm per decade in the eastern half of North America, as well as the eastern parts of southern South America, parts of India, and China. Smaller increases are seen over Europe. This is reflected in the global time series with around 2 mm more falling in recent years than in 1961-1990..	1901-2018	Observation stations	(Hawkins et al., 2020)
	Global	Precipitation	Extreme precipitation	**Increase.** The findings imply that what was a 1-in-1000 day heavy rainfall in 1951-1980 occurred about 45% more often in the 1981- 2013 period, a frequency change consistent in sign but much more pronounced than a global model-based estimate. The increase in heavy precipitation days is substantially larger than expected from internal variability only	1951-1980	Mixed methods	(Fischer and Knutti, 2016)
	Global	Precipitation	Precipitation	**Both increase and decrease.** Precipitation increases in the Northern Hemisphere (NH) mid- to high-latitude lands observed in GPCC can also be found in RECONS and model simulations. Over tropical/subtropical land areas, precipitation reductions generally appear in all products, but with large discrepancies on regional scales. Over ocean, consistent spatial structures of precipitation change also exist between RECONS and models. It is further found that these long-term changes/trends might be due to both anthropogenic GHG and aerosols.	1901-2010	Observation stations	(Gu and Adler, 2015)

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	UK	Precipitation	Extreme precipitation	**Both increase and decrease.** Precipitation signals are emerging in several regions when considering observed rainfall changes, particularly West Africa, parts of South America, and northern Eurasia. Some regions in South America and central Africa exhibit simultaneously high S/N for temperature (S/N > 4) and significantly drier precipitation (S/N < 1) which may compound impacts. As a demonstration of the methods in a data rich region, and over a range of spatial scales, our analysis shows that there are clear shifts toward more annual rainfall over the United Kingdom, focused over northern and western areas. Significant increases in extreme heavy rainfall are emerging over large parts of the United Kingdom and are emerging more quickly than changes in mean rainfall in some places. The magnitude of the increase in extreme rainfall (~8% per K of local temperature change) is approximately consistent with expectations from the Clausius-Clapeyron relationship.	1901-2018	Observation stations	(Hawkins et al., 2020)
	Global	Precipitation	Precipitation	**Both increase and decrease.** Globally, precipitation trends are distributed (spatially) at about zero in both the models and in the observations. There are large uncertainties in the simulation of regional-/local-scale temperature and precipitation trends	1930-2004	Observation and Model	(Kumar et al., 2013)
	Global	Precipitation	Precipitation and Heavy Precipitation	**Increase.** There is significant increase in total precipitation, number of wet days and heavy events over land. Decrease of light/medium precipitation coupled with heavy precipitation increase was detected in a small fraction of the land area. Precipitation declines over the atmospheric divergence zones but heterogeneously	1979-2016	Observation stations	(Markonis et al., 2019)
	Global	Precipitation	Extreme precipitation	**Increase.** Extreme precipitation events occurring on average twice per decade will increase in frequency by 1-2 events per decade per degree of warming. Thus, for a 2K global mean surface warming, the frequency of these events would double or triple. Observations indicate that the total precipitation from extreme events occurring once per decade may increase on the order of 10 times more than when considering intensity increases alone.	1951-1980; 1984-2013	Mixed methods	(Myhre et al., 2019)

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Global	Precipitation	Extreme precipitation	**Increase.** Most of the observed Increase trends in extreme precipitation are found to be explained by anthropogenic greenhouse gas forcing with anthropogenic aerosols and natural forcings having marginal influences. Further, the greenhouse gas, induced changes are consistent with the expected physical mechanism of extreme precipitation intensification following atmospheric moisture increase under warming via the C- relation.	1951-2015	Observation and Model	(Paik et al., 2020)
Global	Precipitation	Frequency of extreme precipitation	**Increase.** For frequency, most regions of the world have a larger number of stations with positive trends than negative, with a global positive/negative ratio equal to 1.5. In Eurasia (NE zone) this ratio is 2.8 with 74% of records showing positive trends. The ratio of significant-positive to significant-negative trends, however, is much higher, with a global value of 2.4 and reaching up to 7.0 for the NE zone. Globally, 66.4% show positive changes. For magnitude, analysis of the stations indicates that Increase trends are slightly more frequent than Decrease; that is, the global positive/negative trends ratio is 1.1. The significant-positive to significant-negative trends ratio is higher (1.3 for the globe), yet it does reveal a striking difference.	1964-2013	Observation stations	(Papalexiou and Montanari, 2019)
Global	Precipitation	Mean precipitation	**Both increase and decrease.**	1961-1990; 1951-2005	Observation and Model	(Sarojini et al., 2016)
Global	Precipitation	Mean precipitation	**Constant.** The comparisons of precipitation for the consecutive 30-year reference periods from 1931-1960 up to 1981-2010 revealed no significant overall trend. After a slight increase in annual precipitation from the early periods 1931-1960 and 1941-1970 with 784.6 and 781.2 mm, respectively, to 791.2 mm in 1961-1990, the annual precipitation decreased over the recent reference periods to 786.4 mm (1971-2000) and only 776.9 mm in 1981-2010	1951-2000	Observation stations	(Schneider et al., 2017)
Global	Precipitation	Heavy precipitation	**Both increase and decrease.** The global median sensitivity, percentage change in extreme precipitation per 1 K increase in GMST is 6.6% (5.1% to 8.2%; 5%,Äì95% confidence interval) for Rx1day and is slightly smaller at 5.7% (5.0% to 8.0%) for Rx5day.	1950-2018	Observation stations	(Sun et al., 2020)

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Global	Precipitation	Annual precipitation	**Constant.** The global changes in precipitation over the Earth's land mass excluding Antarctica relative to 1961 were estimated to be: -1.2 ¬± 1.7, 2.6 ¬± 2.5 and -5.4 ¬± 8.1% per century for the periods 1850-2000, 1900-2000 and 1950-2000, respectively. A change of 1% per century corresponds to a precipitation change of 0.09 mm/year	1961-90	Observation stations	(van Wijngaarden and Syed, 2015) (Bernacchi and VanLoocke, 2015)
	ET	Evapotranspiration	**Decrease.** ET is on average 6 % lower for plants grown in elevated CO2 relative to ambient conditions.			(Bernacchi and VanLoocke, 2015)
	ET	Global Evapotranspiration	**Increase.** Global ET increase over land between early 1980s and late 1990s.	early 1980s	Observations	(Hartmann, 2013)
	ET	Evapotranspiration	**Increase.** Observation-based ET trend estimate 1982 to 2010 is 1.18 mmyr-2, and modelled trend is 0.93 +/- 0.31 mmyr.-2.	1982-2010	Observations	(Mao et al., 2015)
Global	ET	Evapotranspiration	**Increase.** Positive ET trends are found for 62 % of the continental surface. The global trend is slightly positive but not significant.	1980-2011	GLEAM model	(Miralles et al., 2013)
Global	ET	Evapotranspiration	**Increase.** An ensemble of ET reconstructions suggests an increase of 7.65 mm per year per decade. More than 50% attributed to vegetation greening.	1982-2011	Satellite observations	(Zeng Z et al., 2018)
Global	ET	Evapotranspiration	**Increase.** Global Increase trend in ET (1982 - 2013) of 0.88 mm yr-2	1982-2011	Satellite observations	(Zhang K et al., 2015; Zhang et al., 2016a)
Global	ET	Evapotranspiration	**Increase.** Estimate of global ET trend from 1981 to 2012 is +0.54 mm/year-2	1981-2012	Satellite observations	(Zhang et al., 2016a)
Global	Soil moisture	Soil moisture	**Decrease** of approximately 1.4 x 10-3 m3/m3	1979-2017	Observed quantitative (satellite remote sensing) and reanalysis	(Deng et al., 2020)
Global	Soil moisture	Soil moisture	**Decrease** over 22% of global land, **increase** over 7% **of global land**	1979-2013	Observed (satellite remote sensing)	(Feng and Zhang, 2015)
	Streamflow	Mean runoff simulated	**Decreased.** by 1.3%	1971-2001	WATCH Forcing Data	(Asadieh et al., 2016)

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						based simulation	
		Sreamflow	Trends in wetting and drying over land	**Both increase and decrease.** Changes towards more arid conditions (red/orange) are found in many parts of Africa, especially in the Sahel and eastern Africa, eastern Asia, eastern Australia and partly in the westernMediterranean and northeastern Brazil. In contrast, drying trends in the northern Mediterranean and small parts of the Sahel are due to changes in the water availability (pink/green). Note	1948-2005	observation station	(Greve et al., 2018)
		Streamflow	River flow trends	**Increase.** in WNA, AMZ, NEU, CEU. Decrease in ENA, NER:,SSA,MED,SAS.	1971-2010	observation station	(Gudmundsson et al., 2019b)
		Streamflow	Runoff to Precipitation ratio	**Both increase and decrease**	1901-2000	WATCH model ensemble data	(Berghuijs et al., 2017b)
		Streamflow	Runoff relative anomalies	**Both increase and decrease.** Decrease in Africa, Increase in Asia, North America, South America, Austria	1958-2004	observation station	(Alkama et al., 2013)
		Streamflow	Mean runoff simulated	**Both increase and decrease**	1948-2012	observation station	(Dai, 2016)
		Streamflow	Asian rivers' contribution on streamflow trends for world's large rivers over past decade	**Both increase and decrease**		observation station	(Li et al., 2020c)
		Cryosphere	Carbon Stocks and Fluxes	**Decrease**. A gradual and prolonged release of greenhouse gas emissions in a warming climate within Arctic and sub-Arctic permafrostregions	N/A	Literature review	(Schuur et al., 2015; Allchin and Déry, 2017)
		Cryosphere	Snow Cover	**Both increase and decrease**	1971-2014	Satellite Observations	(Allchin and Déry, 2017)
		Cryosphere	Snow Cover	**Decrease.** But no quantitative trend.	1971-2014	Satellite Observations	(Hernández-Henríquez et al., 2015)
		Cryosphere	Permafrost temperature	**Increase**, 0.29 oC	2007-2016	Observations	(Biskaborn et al., 2019)
	Cryosphere	Cryosphere	Snow metrics	**Decrease.** But no quantitative trend.	N/A	Literature review	(Thackeray et al., 2019)
		Cryosphere	Snow cover extent, snowfall	**Decrease.** But no quantitative trend.	1960-2015	Observations	(Kunkel et al., 2016)

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	Cryosphere	Glacier mass change	**Decrease.** -0.54 m w.e. a-1 for the period of 2001-2010	2001-2010	World Glacier Monitoring Service	(Zemp et al., 2015a)
	Cryosphere	Glacial loss	**Decrease.** 0.1 metres to 1.2 metres of water equivalent per year, resulting in a global sea-level contribution of 0.92 ¬± 0.39 millimetres, per year	1961-2016	Glaciological and Geodetic observations	(Zemp et al., 2019)
	Cryosphere	Snow cover extent	**Decrease**	1981-2010	Gridded datasets	(Mudryk et al., 2017)
	Cryosphere	Sea level rise	**No trend**	1992-2011	Modelled	(Rye et al., 2014)
	Cryosphere	snow persistence	**Both increase and decrease.** Areas with Decrease SP trends cover 5.8% of snow zone areas, whereas those with Increase trends cover 1.0% of this area	2001-2016	Observations	(Hammond et al., 2018)
	Cryosphere	snow extent (SE) and snow mass (SM)	**Decrease.** Snow extent trend = - 50 × 103 km2 yr-1 (November to May), Snow mass trends = -5 Gt yr-1 (December to May).	1981-2018	Observations	(Mudryk et al., 2020)
	Cryosphere	glacier mass	**Decarese.** Glaciers lost a mass of 267 ± 16 gigatonnes per year	2000-2019	Satellite Observations	(Hugonnet et al., 2021)
	Cryosphere	global glacier lake volume, number, area	**Increase.** 48% (lake volume), 53% (lake number), 51% (lake area)	1990-2018	Satellite Observations	(Shugar et al., 2020)
	Cryosphere	annual glacier mass balance	**Decrease.** the mean annual mass balance was -0.90 m w.e. per year. This is 20% more negative than the mean annual mass balance for the first decade of the 21st century (2001–2010: -0.76 m w.e. per year)	2013-2015	Observations	(Zemp et al., 2015b)
Global	Floods	Frequency and ruation of flooding	**Both increase and decrease.**	1985-2015	Observation stations, Satellite observations	(Najibi and Devineni, 2018)
Global	Groundwater	Groundwater depletion	**Increase.** Depletion rate of groundwater resources has increased during the last decades.	Variable but most from 2000 to 2013	Both observed and simulated	(Bierkens and Wada, 2019)
Various regions	Groundwater	Groundwater depletion	**Increase.** 77.4 km3/year depletion	2003-13	GRACE-derived total terrestrial water storage changes	(Famiglietti, 2014)
Endorheic basins across globe	Groundwater	Groundwater depletion	**Increase.** ~40 (±17.6) Gt/year	2002-16	GRACE-derived total terrestrial water storage changes	(Wang et al., 2018a)

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Global	Groundwater	Groundwater storage	**Both trends** (trends values were not reported; non-linear trends were characterised)	August 2002 to July 2016	Satellite and model data	(Shamsudduha and Taylor, 2020)
Global	Groundwater	A review study covering various aspects of aquifer hydrology, groundwater-surface water interactions, GW recharge and ecosystems in cold climate environments	**No trend reported**	Studies conducted between 1973 and 2016, but majority of them in the 2000s	A review analysis of a range of literature that employed observed and simulated data	(Vincent et al., 2019)
Global	Groundwater	Environmental flow loss due to groundwater depletion	**Negative.**	1960-2100	Observational and simulated data	(de Graaf et al., 2019)
	Water quality	Different parameters	**Both increase and decrease.** No Quantitative Trend	N/A	Literature review	(Mosley, 2015)
	Water quality	Dissolved organic carbon (DOC), particulate organic carbon (POC), total mercury (THg) and methylmercury (MeHg)	**No trend**	2003-2017	Observations	(Mu et al., 2019)
	Water quality	Fossil fuel combustion, chlor-alkali production, waste incineration, and mining	**Increase.** No quantitative Trend	1850-2010	Observations	(Horowitz et al., 2014)
	Water quality		**Both increase and decrease**	N/A	Observations	(Khan et al., 2017)
	Water quality	Water-related disease	**Increase.** No quantitative Trend	N/A	Observations	(Nichols et al., 2018)

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	Antarctica	Water quality	Coastal Benthos	**Increase.** No quantitative Trend	1994, 1998, and 2010	Benthos Community Surveys	(Sahade et al., 2015)Sahade et al 2015
		SESL	Soil Erosion	**Both increase and decrease.** generally follow the trend of precipitation	N/A	Metaanalysis of soil erosion studies	(Garcia and Sheehan, 2015)
		SESL	Sediment flux	**Decrease.** 20.8%	N/A	Observation stations	(Li et al., 2020b)
Africa		Precipitation	Mean precipitation	Both increase and decrease.	1979-2008	Observation and Model	(Alter et al., 2015)
		Precipitation	Extreme precipitation	**Increase.** At a threshold of 0.70C, the trend at 1800 utc amounts to a remarkable 3.5-fold increase over 35 years, or a 3.7-fold increase over 35 years when averaged over 24hours. The rise in intense MCS frequency is driven by a downward trend in MCS mean temperature (0.78 C per decade for 0.40C systems.	1982-2016	Observation stations	(Taylor et al., 2017)
	Sahel	Soil moisture	P-ET	**Mostly increase** of up to 6 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	North Africa including Sahara and Sahel	Soil moisture	Soil moisture	**Mostly decrease** except for parts of western Africa	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
	Horn of Africa	Soil moisture	P-ET	**Decrease** of up to 4 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	Central Africa	Soil moisture	P-ET	**Decrease** of up to 4 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	South-eastern Africa	Soil moisture	P-ET	**Mostly increase** of up to 6 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	Easy Africa and central southern Africa	Soil moisture	Soil moisture	**Mostly increase.**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
	Sahel zone (Niger River Basin)	Floods	Annual maximum streamflow	**Increase.** gradients 0.87, 1.61,2.37 and 2.42.	1950-2005	Model	(Aich et al., 2015)

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11 catchments in West Africa	Floods	Aannual maximum discharge	**Increase.** Significant Both increase and decrease signal by Mann-Kendall test	1970-2010	Observation stations	(Nka et al., 2015)
1907 stations around the world	Floods	Annual maximum streamflow	**Both increase and decrease.**	1955-2014	Observation stations	(Do et al., 2017)
over 30,000 sites around the world.	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000 and 1971-2010).	Observation stations	(Gudmundsson et al., 2019a)
5317 stations around the world	Floods	99 percentile of peak streamflow	**Both increase and decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
East Africa (Kenya, Somalia, Ethiopia)	Drought	Rainfall, evapotranspiration, soil moisture	**Decrease.**	1900-2014	Observation stations	(Funk et al., 2015)
Southern Africa	Drought	Rainfall	**N/A** - Significant reduction during 2016 El Nino	1981-2016	Observation stations	(Funk et al., 2018)
South Africa (Western cape)	Drought	Rainfall (SPI-12)	**Increase** - Increase the risk of long-lasting drought	1933-2017	Observation stations and Satellite observations	(Kam et al.)
Southern Africa	Drought	Rainfall and Nino 3.4	**N/A -** Stronger drought signal during strong El Nino	1921-2016	Observation stations	(Funk et al., 2015)
Easthern Africa	Drought	Rainfall	**Increase -** More drought risk of seasonal and decadal time scales	1900-2017	Observation stations	(Funk et al., 2019)
West Africa	Drought	Drought intensity /frequency	**Increase.**	1951-2016	Observation-based gridded data	(Spinoni et al., 2019)
Alegeria, Libya, Tunisia	Groundwater	Groundwater depletion	**Increase**. 2.7 km3/yr	2003-2012	GRACE-derived total terrestrial water storage changes	(Richey et al., 2015)
North Africa, Saharan Aquifer	Groundwater	Groundwater storage and recharge	**Decrease.** Mainly Decrease trends (20 mm/year in North-Western Sahara aquifer (North Africa),	Present (1981-2010) and future (2041-2070)	Simulated	(Herbert and Döll, 2019)

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	Tanzania	Groundwater	Groundwater levels and recharge	**No trend.** Episodic nature of recharge detected	1955-2010	Observational and climate data	(Taylor et al., 2013)
	Kongo (Lake Tanganyika)	Water quality	Potential fishery production	**Decrease.** Reductions in lake mixing have depressed algal production and shrunk the oxygenated benthic habitat by 38% in our study areas, yielding fish and mollusc declines	Paleoclimate and instrumental records: 1400 to 2000	Paleoclimate and instrumental records	(Cohen-Shacham et al., 2016)
	Algeria	SESL	Sediment load	**Increase.** Doubled	1970-2010	Observation stations	(Achite and Ouillon, 2016)
	682 catchments	SESL	Sediment Yield	**Both increase and decrease**	N/A	Literature review	(Vanmaercke et al., 2014)
Asia		Precipitation	Snowfall and snow height	**Not assessed.** Snow height at the end of the summer is higher in central Karakoram when irrigation is increased (+6 cm) , due to an increase in snowfall in September (+10% of total September snowfall,	1979-2009	Model	(de Kok et al., 2018)
		Precipitation	Precipitation and Monsoon onset date	**Both increase and decrease.** Over the Indian peninsula where irrigation is high during winter and spring, a delay of 6 days is found for the mean monsoon onset date when irrigation is activated, leading to a significant decrease in precipitation during May to July	1850-2018	Model	(Guimberteau et al., 2012)
		Precipitation	Heavy precipitation	**Increase.** Using daily rainfall from observations and LMDZ4 simulations, we counted the number of heavyprecipitation events over Central India having rainfall intensity 100 mm day, The counts were determined for the JJAS season (122 days) of each year, so as to produce year-wise time-series of frequency-count of heavy-precipitation events over Central India (Fig. 1c). An assessment of linear trends in these time-series during 1951-2005 and their statistical significance is presented in Table 4 (see Auxiliary Fig. A1). Significant ($P < 0.01$) increases in the frequency of heavy-precipitation occurrences are seen in observations (~30 %) and the HIST1 (~30 %) and HIST2 (~42 %) simulations; but not in HISTNAT1 and HISTNAT2. Also the future projection under RCP4.5 shows further increase in the frequency of such heavy-precipitation events.	1951-2005	Mixed method	(Krishnan et al., 2016)

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	Precipitation	Precipitation	**Both increase and decrease.** Results show that no significant progress has been achieved in our ability to simulate basic quantities like observed seasonal mean and trend, and hence to project the regional climate system, namely CIM, with reasonable certainty.	1951-2005	Mixed methods	(Ramesh and Goswami, 2014)
	Precipitation	Indian Summer Monsoon Rainfall	**Decrease.** We find that, majority of new generation climate models from Coupled Model Intercomparison Project phase5 (CMIP5) fail to simulate the post-1950 Decrease trend of Indian Summer Monsoon Rainfall.	1950-2005	Model	(Saha et al., 2014)
Northern Asia	Soil moisture	P-ET	**Mostly decrease** of up to 5 mm / month except for parts of Arctic with **increase** of up to 5 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
South-west Asia including Middle East	Soil moisture	P-ET	**Mostly decrease** of up to 5 mm / month but with some regions with **increase** of up to 1 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
South-East Asia	Soil moisture	P-ET	**Mostly increase** of over 6 mm / month but with some regions with **decrease** of up to 5 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
Central Asia	Soil moisture	Soil moisture	**Both increase and decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
China	Soil moisture	Soil moisture	**Both increase and decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
China	Soil moisture	Soil moisture	**Both increase and decrease**	1996-2010	Observed Quantitative; Observed Reconstructed; Mixed methods; Observed RS&GIS	(Qiu et al., 2016)
Indian Subcontinent	Soil moisture	Soil moisture	**Increase**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
China	Streamflow	Total flow	**Increased.** by 2.18 ×109 m3	1960-2010	observation station	(Zang and Liu, 2013)
China	Streamflow		**Increase**	1965-2013	Inter-Sectoral Impact Model Intercomparison	(Zhou et al., 2012)

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					Project (ISIMIP)	
High Mountain Asia	Cryosphere	Snow Water Equivalent	**Decrease**.−10.60 mm/year (average, −0.3%)	1987-2009	Satellite Observations	(Smith and Bookhagen, 2018)
Tien Shan	Cryosphere	Glacial contribution to streamflow	**Decrease.** But no quantitative trend.	N/A	Literature review	(Sorg et al., 2012)
Tien Shan Mountains	Cryosphere	Glacier area	**Decrease.** A glacier area loss of 23% in total	1970-2007	Observations	(Kriegel et al., 2013)
High Mountain Asia	Cryosphere	Glacier mass	**Decrease.** A total mass change of −16.3 ± 3.5 Gt yr−1 (−0.18 ± 0.04 m w.e. yr−1) between 2000 and 2016	2000-2016	Observations	(Brun et al., 2017)
China	Cryosphere	Snow cover period	**Decrease.** 3.5 ± 1.2 days/decade	1961-2010	Observations	(Xu et al., 2017)
High Mountain Asia	Cryosphere	Maximum snow cover fraction	**Decrease.** The maximum snow cover fraction decreased at a rate of −0.17%/a over the past 10 years	2003-2013	Satellite Observations	(Li et al., 2020c)
China, India, Pakistan	Cryosphere	Glacier mass	**Both increase and decrease.** (Eastern Pamir and the northern part of Karakoram experienced a clear mass gain of 0.043±0.078 / yr. The Karakoram showed a near-stable mass balance in its western part 0.020±0.064/ yr, while the Eastern Karakoram showed mass loss (0.101±0.058/yr)	2011-2014	Remote sensing observations and Modelling	(Lin et al., 2017)
Central and Eastern Karakoram	Cryosphere	glacier mass	**Both.** The mass budget of Central Karakoram glaciers was slightly positive (0.12 ± 0.14 m w.e. a−1) while eastern Karakoram glaciers lost mass (−0.24 ± 0.12 m w.e. a−1)	2008-2016	Satellite data	(Berthier and Brun, 2019)
Qinghai–Tibet Plateau	Cryosphere	active-layer thickness (ALT) and permafrost temperatures	**Increase.** The average increase of ALT was ~ 4.26 cm/a and the average increase in permafrost temperatures at 6 m and 10 m depths were, respectively, ~ 0.13 °C and ~ 0.14 °C.	2002-2012	Observations	(Wu et al., 2015)
32 gauges (17 main stream and 15 tributary stations) of Yellow river basin	Floods	annual maximum flood	**Decrease. -** 23 out of 32 stations exhibits significant Decrease trends at the 5% significant level between sub-period (depending on stations) by Mann-Kendall test	1950-2010	Observation stations	(Bai et al., 2016)

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1907 stations around the world	Floods	annual maximum streamflow	**Decrease.**	1955-2014	Observation stations	(Do et al., 2017)
Over 30,000 sites around the world.	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000 and 1971-2010).	Observation stations	(Gudmundsson et al., 2019b)
5317 stations around the world	Floods	99 percentile of peak streamflow	**Both increase and decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
East River, part of Pearl River basin, China	Floods	annual maximum streamflow	**Decrease.** Clear Decrease tendency is mostly explained by reservoir model and natural climate variability	1954-2009	Observation stations	(Zhang Q. et al., 2015)
Middle east and southwest Asia	Drought	Rainfall	**Decrease.**	1950-2014	Observation stations	(Barlow and Hoell, 2015)
Middle east, Lavant region	Drought	Rainfall	**Decrease.**	1980-2014	Observation stations and Model	(Bergaoui et al., 2015)
Thailand	Drought	Rainfall, ENSO	**N/A** - low during ENSO (2015-2016)	1900-2016	Observation stations	(Christidis et al., 2018)
China (Beijing)	Drought	Consecutive dry days	**Increase** 3.2 days per decade	1960-2018	Observation stations	(Du et al., 2020a)
South China	Drought	Precipitation and P-ET	**Increase. -** Drought risk increase	1951-2018	Observation stations and Model	Zhang et al 2020
Southwest China	Drought	Fire weather index	**Increase.**	1960-2019	Observation stations	(Du et al., 2021)
Southwest China	Drought	Precipitation and Consecutive dry days	**Increase** Strong drying trend due to anthropogenic climate change	1960-2019	Observation stations	(Lu et al., 2021)
Southwest China (Yunan)	Drought	Precipitation and temperature	**Increase** risk of hot and dry extremes	1961-2019	Observation stations	(Wang et al., 2021)
Central China	Drought	Drought intensity /frequency: self-calibrating Palmer Drought Severity Index (scPDSI)	**Increase.**	1961-2009	Observation stations	(Wang et al., 2017a)

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Iraq, Jordan, Oman, Qatar, Saudi Arabia, UAE, Yemen	Groundwater	Groundwater depletion	**Increase**. 15.5 km3/yr	2003-13	GRACE-derived total terrestrial water storage changes	(Richey et al., 2015)
China (North China Plains)	Groundwater	Groundwater depletion	**Increase.** Depletion rates range between 4 km3/yr to 7 km3/yr	1960-2008	Calibrated MODFLOW model	(Cao et al., 2013)
China (North China Plains and East China Plains)	Groundwater	Groundwater depletion	**Increase.** -17.8 mm/year in NCP and 1.5 mm/year in ECP	1971-2015	Various, insitu observation, GRACE data, literature	(Gong et al., 2018)
Indus River Basin	Groundwater	Groundwater depletion	**Increase.** 31 km3/year	2007	Remote sensing combined with hydrological models	(Cheema et al., 2014)
Northern India	Groundwater	Groundwater depletion	**Increase.** 17.7 km3/yr (±4.5)	2002-2008	GRACE-derived total terrestrial water storage changes	(Rodell et al., 2009)
Northern India	Groundwater	Groundwater depletion	**Increase.** 35 km3/year	2003-2010	GRACE-derived total terrestrial water storage changes	Jacob et al. 2012
Bangladesh	Groundwater	Groundwater depletion	**Increase.** 0.52 (±0.30) to 0.85 (±0.17) km3/yr	2003-2007	GRACE-derived total terrestrial water storage changes	(Shamsudduha et al., 2012)
Middle East	Groundwater	Groundwater storage and recharge	**Decrease.** Mainly Decrease trends (20 mm/year Arabian aquifer	Present (1981-2010) and future (2041-2070)	Simulated	(Herbert and Döll, 2019)
Indo-Gangetic Basin, India	Groundwater	Groundwater storage and recharge	**Decrease.** Mainly Decrease trends (20 mm/yearin Indo-Gangetic Basin (India)	Present (1981-2010) and future (2041-2070)	Simulated	(Herbert and Döll, 2019)
China, North China Plains	Groundwater	Groundwater storage and recharge	**Decrease.** Mainly Decrease trends (20 mm/year in North China Plain (China))	Present (1981-2010) and future (2041-2070)	Simulated	(Herbert and Döll, 2019)

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India	Groundwater	GW levels and recharge	**No trend reported.** Recharge over alluvial aquifers happens through slow rainfall events, and in hard rock aquifers through intense rainfall events	1996-2016	Observational data	(Asoka et al., 2018)
Pakistan, India, Nepal and Bangladesh	Groundwater	Groundwater levels	**Decrease.** Declining trends of 8.0 km3/year (range 4.7-11.0 km3/year); Northern India trends: 5.2±1.9 km3/year)	2000-2012	Observational data	(MacDonald et al., 2016)
Bangladesh	Groundwater	GW levels, abstraction and quality data	**No trend reported**	2004-2013	Observational data	(Shamsudduha and Taylor, 2020)
India	Water quality	Polychlorinated biphenyls (PCBs) and high-molecular-weight polycyclic aromatic hydrocarbons (PAHs)	**Increase.** 200%		Observation stations	(Sharma et al., 2015)
	Water quality	Carbon Stocks and Fluxes	**Increase.** 1.6 times	Holocene Epoch	Field Observations	(Anthony et al., 2014)
High Mountain Asia	Water quality	dissolved inorganic and organic carbon	**Increase.** The dissolved inorganic and organic carbon fluxes increased with thawed depth.	2014-2016	Observations	(Song et al., 2019)
China	Water quality	Seasonal variations of organic and inorganic carbon	**Both increase and decrease.**	2014-2016	Observations	(Song et al., 2020)
Russia	Water quality	Organic Carbon	**Increase.** No quantitative Trend	2013	Observations	(Spencer et al., 2015)
China	Water quality	Mercury from glacial runoff	**Increase.** exports by Zhadang (ZD) glacier, the upper river basin and the entire QB were 8.76, 7.3 and 157.85 g	2011	Field Observations	(Sun et al., 2017)
High Mountain Asia	Water quality		**Increase.** No quantitative Trend	N/A	Review	(Zhang et al., 2019a)
Russia	Water quality	Organic and inorganic carbon (DOC and DIC, respectively), pH, Na, K, Ca, Mg, Cl, SO4 and Si	**Both increase and decrease**	2013-2014	Field Observations	(Pokrovsky et al., 2015)

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	Bangladesh	Water quality	Salt affected areas induced by sea level rise	**Increase.** Salt affected areas induced by sea level rise in coastal areas of Bangladesh was reported increased by almost 27%	1973-2009	Field Observations	(Rahman Talukder et al., 2015)
	China	SESL	Soil Erosion	**No trend**	1956-2014	Observations	(Tian et al., 2019)
	Russia	SESL	Sediment flux	**Decrease.** 49-82%	1970-2010	Observation stations	(Potemkina and Potemkin, 2015)
	China	SESL	sediment flux	**Decrease.** The sediment fluxes in the Jialing River basin decreased by 57-77% from the baseline period (1950-1984) to the post-change period (1985-2017)	1950-2017	Observation stations	(Zhou et al., 2020)
	Tibetan Plateau	SESL	sediment flux	**Increase.** The sediment flux has substantially increased at rate of 5.9± 1.9 %/yr (0.034±0.01 Mt/yr) over the period of 1985-2017	1985-2017	Observation stations	(Li et al., 2021)
	Tibetan Plateau	SESL	sediment flux	**Increase.** No Quantitative Trend	1985-2016	Observation stations	(Li et al., 2020a)
Australasia	Northern, western and central Australia	Soil moisture	P-ET	**Decrease** of up to 6 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	Australia	Soil moisture	Soil moisture	**Mostly no trend.** Some regions of **decrease** in western, northern, south-central and eastern Autralia. **Increase** near southern coast of mainland Australia and in Tasmania	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
	Eastern Australia	Floods	more than 1/30 flood	**Increase.** 2.4 %	1980-2009	Observation stations	(Berghuijs et al., 2017a)
	213 stations in Australia	Floods	peak streamflow	**Both increase and decrease.** -87% of the sites display Decrease trends, and the magnitude of the decreases is much larger than those displayed in the peak rainfall. 5-year flood show Decrease 4%/decade. Flood magnitude larger than 10-year begins to increase. Only for the most extreme flows (40-year flood) show similar in magnitude to the peak rainfall trend (2-3 %/decade).	1950-2014	Observation stations	(Wasko and Nathan, 2019)
	1907 stations around the world	Floods	annual maximum streamflow	**Decrease.**	1955-2014	Observation stations	(Do et al., 2017)
	Over 30,000 sites around the world	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000	Observation stations	(Gudmundsson et al., 2019b)

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					and 1971-2010).		
	491 small to medium sized catchments with record lengths from 30 to 97 years	Floods	annual maximum streamflow	**Decrease.**	1955-2004 (1955-2004, 1965-2004 and 1975-2004).	Observation stations	(Ishizaki et al., 2013)
	5317 stations around the world	Floods	99 percentile of peak streamflow	**Both increase and decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
	Australia	Groundwater	Groundwater depletion	**Increaing** . 3.6 km3/yr	2003-13	GRACE-derived total terrestrial water storage changes	(Richey et al., 2015)
	Australia	Water quality	Electrical conductivity (EC), pH, turbidity, dissolved and total nutrient, colour and chlorophyll	**Both increase and decrease**	1978-2015	Observations	(Biswas and Mosley, 2019)
	Australia	Water quality	Contaminants and nutrients flow	**Increase.** Three-fold increases in contaminants and five-fold increases in nutrients have been observed in water sources post-wildfires	N/A	Field Observations	(Khan et al., 2015)
	Australia	SESL	sedimentation yield	**Increase.** Sediment yields from post-fire debris flows (113–294 t ha−1) are 2–3 orders of magnitude higher than annual background erosion rates from undisturbed forests	2003-2009	Observations	(Nyman et al., 2015)
Central and South America	North-west South America	Soil moisture	P-ET	**Mostly increase** of over 6 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	Southern South America	Soil moisture	P-ET	**Mostly increase** of up to 6 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	Eastern South America	Soil moisture	Soil moisture	**Decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)

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	Southern South America	Soil moisture	Soil moisture	**Decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
	Ecuador	Runoff and sreamflow	Water use	**Increase.** Increased trend in western area, Decrease trends in Andes from may to september	1879-2015	Observation stations	(Quishpe-Vásquez et al., 2019)
	Southern Brazil	Streamflow	Streamflow	**Both increase and decrease**	1975-2010	Observation stations	(Chagas and Chaffe, 2018)
	Eastern Brazil	Floods	more than 1/30 flood	**Increase.** 1.4 %	1980-2009	Observation stations	(Berghuijs et al., 2017b)
	1907 stations around the world	Floods	annual maximum streamflow	**Both increase and decrease.**	1955-2014	Observation stations	(Do et al., 2017)
	over 30,000 sites around the world.	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000 and 1971-2010).	Observation stations	(Gudmundsson et al., 2019b)
	5317 stations around the world	Floods	99 percentile of peak streamflow	**Both increase and decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
	Southeast Brazil	Drought	Precipitation and P-ET	**Increase -** Decrease precipitation/P-E in 25-50%	1941-2010	Observation stations	(Funk et al., 2015)
	Northeast Brazil	Drought	Precipitation and P-ET	**Decrease.** - decrease in drought risk	1900-2016	Observation stations	(Martins et al., 2019)
	Argentina, Brazil, Paraguay, Uruguay (Guarani Aquifer)	Groundwater	Groundwater depletion	**Increase.** 1 km3/year	2003-13	GRACE-derived total terrestrial water storage changes	(Richey et al., 2015)
	Ecuador	Water quality	Macroinvertebrates	**Decrease**	2008-2010	Observations	(Jacobsen et al., 2014)
	Colombia	SESL	Sediment load	**Increase.** 34%	1980-2010	Observation stations	(Restrepo and Escobar, 2018)
Europe	Western Europe	Soil moisture	Soil moisture	**Decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)

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Eastern Europe	Soil moisture	Soil moisture	**Decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
UK	Streamflow	Annual runoff	**Increase.** Scotland: 22.2%, Wales: 14.7%, England: 1.7%, English lowlands: 0.9%	1961-2010	observation station	(Hannaford, 2015)
	Streamflow	Runoff	**Decrease.** Drying trends in the Mediterranean region and weak wetting trends in northern Europe(0-0.4s.d./y), drying trends in the south and weakwetting trends in the north(0-0.4 s.d./y).	1956-2005	observation station	(Gudmundsson et al., 2017)
	Streamflow	Annual streamflow volumes across	**Both increase and decrease**	1950-2015	observation station	(Masseroni et al., 2020)
Norway	Cryosphere	Glacial melt	**Decrease.** But no quantitative trend.	1960-2010	Observations	(Fleming and Dahlke, 2014)
Switzerland	Cryosphere	Snow cover, Snow Depth, Snow season duration	**Decrease.** Cover 8.9 days/decade, depth 3.9-10.6%, season starts 12 days later and ends 26 days earlier	1970-2015	Observations	(Klein et al., 2016)
Swiss Alps	Cryosphere	snow cover duration	**Decrease.** Snow cover duration has significantly shortened at all sites, on average by 8.9 days per decade	1970-2015	Observations	(Klein et al., 2016)
Russia	Cryosphere	glacier/snow melt runoff	**Increase.** 5-30 % in the foothills and by 30-70% in the plain area	1945-2010	Observations	(Rets et al., 2018)
European Alps	Cryosphere	glacier/snow melt runoff	**Increase.** A clear increase appears for basins with glacial regimes, with a trend magnitude of 36%.	1961–2005	Observations	(Bard et al., 2015)
North Caucasus	Cryosphere	glacier/snow melt runoff	**Decrease.** Mean annual peak discharge has dropped by 1–5% per decade in the central North Caucasus, and it occurs 1–2 weeks earlier	2007–2020 compared with 1968–1978	Observations	(Rets et al., 2020)
Europe	Floods	The highest discharge (daily mean or instantaneous)	**Both increase and decrease.** - Ranging from an increase of about 11% per decade to a decrease of 23 % per decade	1960-2010	Observation stations	(Blöschl et al., 2019b)
Spain	Floods	Annual maximum streamflow, peaks-over-threshold flow	**Both increase and decrease**. -27 gauges (44%) show decrease, 1 gauge (2%) show increase.	1942-2009	Observation stations	(Mediero et al., 2014)
Europe	Floods	more than 1/30 flood	9.9% Increase	1980-2009	Observation stations	(Berghuijs et al., 2017a)
3,738 basins in Europe	Floods	Annual maximum streamflow	**Both increase and decrease.**	1960-2010	Observation stations	(Blöschl et al., 2017)

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1907 stations around the world	Floods	Annual maximum streamflow	**Both increase and decrease.**	1955-2014	Observation stations	(Do et al., 2017)
Volga river	Floods	Spring peak flow	**Decrease.** (5-20%), 5-10 days earlier	1946-2010	Observation stations	(Frolova et al., 2017a)
37 stations in Selenga River	Floods	Annual maximum streamflow	**Decrease.**	1946-2010	Observation stations	(Frolova et al., 2017b)
Over 30,000 sites around the world.	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000 and 1971-2010).	Observation stations	(Gudmundsson et al., 2019b)
55 stations in European part of Russia	Floods	Annual maximum streamflow	**Decrease.** 1-2 months earlier in spring floods (July to May and June)	1936-2015	Observation stations	(Kireeva et al., 2020)
Western Austria	Floods	30-day moving average of daily streamflow	**N/A** - earlier annual peak snowmelt discharge	1980-2010	Observation stations	(Kormann et al., 2015)
5317 stations around the world	Floods	99 percentile of peak streamflow	**Decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
Norway	Floods	Floods	**Increase.** - Western Norway; Decrease Trends Northern Norway	1962-2012	Observation stations	(Vormoor et al., 2016)
Sweden	Floods	Floods (flood magnitude, flood occurrence)	**Both increase and decrease.** - flood magnitude changes from -10% to 12%; flood occurrence changes from -11 days to 14 days	1990-2013	Observation stations	(Matti et al., 2016)
Spain	Floods	Flood (snowmelt flood peak timing)	**Decrease**. Changes in streamflow timing (the day when the maximum flow in spring is recorded): -0.49 ±0.43 days per decade (Table 1)	1976-2008	Observation stations	(Morán-Tejeda et al., 2014)
Southern Europe	Drought	Meteorological drought intensity / frequency: SPI and SPIE	**Increase.**	1958-2001 and 1979-2014	Observations and re-analysis	(Stagge et al., 2017)
Scandinavia, Belarus, Ukraine and Russia	Drought	Drought intensity / frequency using SPI, SPEI, and RDI	**Decrease.**	1950-2012	Observation-based gridded data	(Spinoni et al., 2015)
Northern Europe	Drought	Meteorological drought intensity /	**Decrease.**	1958-2001 and 1979-2014	Observations and re-analysis	(Stagge et al., 2017)

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		frequency: SPI and SPIE				
Northern Europe	Groundwater	Groundwater storgae	**Decrease.** But no quantitative trend.	1980-1989 and 2001-2010	Observational and climate data	(Nygren et al., 2020)
England	Water quality	Metal elements in river and river banks	**Increase.** No quantitative Trend	N/A	Literature review	(Lynch et al., 2014)
Wales	Water quality	Flood Sediment contamination	**Increase.** a fator of 82, up to 1900kg of Pb	2012	Observation stations	(Foulds et al., 2014)
	Water quality	Iron Concentrations	**Increase.** No quantitative Trend	2000-2012	Field Observations	(Hawkings et al., 2014)
Switzerland	Water quality	Oxygen and phosphorus concentration	**Decrease**	1972-2010	Observations	North et al 2015
Italy	WAter quality	Groundwater resources	**Increase.** Effects (piezometric drop)	1930-2009	Modelled reconstruction	(Romanazzi et al., 2015)
Czech Republic	Water quality	Concentrations of ammonia, phosphorus and chlorophyll-a	**Increase.** Up to 10-fold increases in the concentrations of ammonia, phosphorus and chlorophyll-a at minimum flow levels	1990-2008	Observations	(Hrdinka et al., 2015)
Svalbard	SESL	Sediment load	**Increase.** from 240 to 450 Mg/Km*yr	1950-2010	Multivariate modeling	(Schiefer et al., 2018)
Russia	SESL	Sedimentation rates	**Decrease.** No Quantitative trend	1963-1985; 1986-2015	Recostruction of Radioactive Elements	(Golosov et al., 2018)
	SESL	Sediment flux	**Increase.** No Quantitative Trend	1967-2012	Photogrametry	(Micheletti et al., 2015)
Germany	SESL	Soil Erosion	**Increase.** No Quantitative Trend	2000-2016	Observations	(Steinhoff-Knopp and Burkhard, 2018)
Italy	SESL	Sediment load	**Both increase and decrease**	1810-2010	Modelled	(Diodato et al., 2018)
Italy	SESL	Sediment flux	**Both increase and decrease**	1986-2014	Observation stations	(Rainato et al., 2017)
Russian Arctic	Cryosphere	mean annual ground temperature for permafrost	**Increase.** Permafrost is warming after 2000 with a rate of 0.1−0.8 °C decade-1 in Russian Arctic	2000-2019	Observations	(Romanovsky et al., 2019)

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Mediterranean	Catalonia and the Balearic Islands in Spain, Languedoc-Roussillon, Midi-Pyr´en´ees and Provence-Alpes C^ote d'Azur in France, and Alabria in Italy	Floods	Number of floods	**Increase.** Total annual number of floods for all the regions Increase 0.25 floods/yr, as for the extraordinary ones 0.13 floods/yr, with both trends significant at 95%	1981-2010	Observation stations	(Llasat et al., 2013)
	171 basins located in southern France	Floods	Frequency of Q5 and Q10 flood	**Decrease.** Annual number of events above the Q5 flood Decrease (-0.5 to -1 event/decade)	more than 20-year record before 2010	Observation stations	(Tramblay et al., 2019)
	5317 stations around the world	Floods	99 percentile of peak streamflow	**Decrease.**	more than 10-year record before 2015	Observation stations	(Wasko and Sharma, 2017)
	Countries around the Mediterranean	Drought	Drought intensity / frequency using SPI, SPEI, and RDI	**Increase.**	1950-2012	Observation-based gridded data	(Spinoni et al., 2015)
North America	North-western North America	Soil moisture	P-ET	**Decrease** of up to 5 mm / month	1902-2014	Data-driven model reconstruction	(Padrón et al., 2020)
	USA	Soil moisture	Soil moisture	**Decrease**	1979-2016	Observed (satellite remote sensing)	(Pan et al., 2019)
		Streamflow	Streamflow	**Both increase and decrease.** Western US showed decrease trend where eastnorthern part showed increase trend.	1981-2018	observation station	(Ficklin et al., 2018)
	Canada	Streamflow	Streamflow	**Both increase and decrease**	1948-2012	CMIP5 GCMs	(Bonsal et al., 2020)
	US	Streamflow	Winter-spring center volume date (WSCVD),	**Both increase and decrease**	1940-2014	observation station	(Dudley et al., 2017)
	Canadian	Streamflow	Streamflow	**Both increase and decrease**	1986–2005	observation station	(Bonsal et al., 2020)

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Canada	Cryosphere	Glacial melt	**Decrease.** But no quantitative trend.	1960-2010	Observations	(Fleming and Dahlke, 2014)
Alyaska	Cryosphere	glacier mass and glacier/snow melt runoff	**Both increase and decrease**. Since 1966, approximately 17 % of the basin was de-glacierized. Streamflow has increased	1966-2011	Observations	(O'Neel et al., 2014)
Whole United States	Floods	Peak streamflow	**Both increase and decrease.**	1940-2013	Observation stations	(Archfield et al., 2016)
Whole United States	Floods	More than 1/30 flood	**Increase.** 8.4 %	1980-2009	Observation stations	(Berghuijs et al., 2017a)
27 natural watersheds across Canada (18) and the northern United States (9)	Floods	Number of threshold exceeding flood	**Both increase and decrease.** 33.3 % sites with significant Increase trend, 0 % with significant Decrease trend (10% significant level).	1916-2015	Observation stations	(Burn and Whitfield, 2018)
Whole United States	Floods	Annual peak streamflow	**Both increase and decrease.** Increase (5–14%) and Decrease (5–10%) trends. Regulated basins show significant Decrease trend (44-56 %).	1916-2015	Observations	(Hodgkins et al., 2019)
Central United States	Floods	Flood frequency	**Both increase and decrease.** 264 (34%) of the stations reflect an Increase frequency in the number of flood events, and 66 (9%) show Decrease trends.	1962-2011	Observations	(Mallakpour and Villarini, 2015)
Mississippi river	Floods	1/100 flood	**Increase.** by 20 per cent over those five centuries	1500-2015	Observation, sedimentary archive, tree-ring records	(Munoz et al., 2018)
Whole United States	Floods	Flood frequency	**Both increase and decrease.**	1985-2015	Observations	(Slater and Villarini, 2016)
Colorado River	Floods	High flow during peak runoff season	**Decrease.** Up to 41% decline, 2.5 days earlier per decade	1955-2014	Observations	(Solander et al., 2017)
5317 stations around the world	Floods	99 percentile of peak streamflow	**Both increase and decrease.**	more than 10-year record before 2015	Observations	(Wasko and Sharma, 2017)
1907 stations around the world	Floods	Annual maximum streamflow	**Both increase and decrease.**	1955-2014	Observations	(Do et al., 2017)

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Over 30,000 sites around the world.	Floods	Q10, annual maximum daily discharge	**Both increase and decrease.**	1951-2010 (1951-1990, 1961-2000 and 1971-2010).	Observations	(Gudmundsson et al., 2019b)
Canada	Floods	Ice-jam floods timing and magnitude	**Increase.** One week ealier or later per decade, Increaseing magnitude +3.5% to -5 % per year	1903-2015	Observations	(Rokaya et al., 2018)
Canada	Floods	Runoff and Streamflow	**Decrease** 3000 m3/s	1973-2011	Observation stations	(Yang et al., 2015a)
USA (Washington srate)	Drought	Precipitation and temperature	**Increase.**	1920-2005	Observation stations and model	(Fosu et al., 2016)
USA: upper Midwest, Louisiana, southeastern US, and western US	Drought	Drought severity: Palmer Drought Severity Index	**Increase.**	1979–2013	Observation-based gridded data	(Ficklin et al., 2015)
USA (Northern Great Plain)	Drought	Temperature, precipitation, soil moisture, evapotranspiration	**Increase** - 30% increase in drought frequency	1920-2016	Model	(Hoell et al., 2020)
Western USA	Drought	Drought severity (Standardised Precipitation Evaporation Index)	**Increase.** especially in north west	1951-2016	Observation-based gridded data	(Spinoni et al., 2019)
Central North America	Drought	Drought severity: Palmer Drought Severity Index	**Decrease.**	1979–2013	Observation-based gridded data	(Ficklin et al., 2015)
USA California's Central Valley	Groundwater	Groundwater depletion	**Increase.** 2 km3/year	1962-2003	Calibrated MODFLOW model	(Scanlon et al., 2012)
USA High Plains Aquifer	Groundwater	Groundwater depletion	**Increase.** 5.7 km3/yr	1950-2007	Calibrated MODFLOW model	(Scanlon et al., 2012)
USA Colorado River Basin	Groundwater	Groundwater depletion	**Increase.** 5.6 (±0.4)	2004-13	GRACE-derived total	(Castle et al., 2014)

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					terrestrial water storage changes	
USA High Plains and California Central Valley Aquifer	Groundwater	Groundwater storage and recharge	**Decrease.** Mainly Decrease trends (20 mm/year in High Plains and California Central Valley aquifers (USA)	Present (1981-2010) and future (2041-2070)	Simulated	(Herbert and Döll, 2019)
USA	Groundwater	GW levels, recharge and meteorological data	**No trend reported**	2000-2015	Observational and satellite data	(Thomas et al., 2016)
USA	Groundwater	GW levels and abstraction data	**No trend reported**	1940-2019 (4.2 million records)	Observational data	(Jasechko and Taylor, 2015)
USA	Groundwater	Spring discharge data	**Decrease.** Of 57 springs, 26 exhibited negative trends in springflow;	1907-2018	Observational data	Work, 2020
Canada	Water quality	Methylmercury	**Increase.** No quantitative Trend	2006-2013	Observation stations	(MacMillan et al., 2015)
Alaska, US	Water quality	Elemental export from upland thermokarst	**Increase.** No quantitative Trend	2011-2012	Observation stations	(Abbott et al., 2015)
Arctic region	Water quality	Dissolved organic and inorganic carbon	**Increase.** No quantitative Trend		Ice observations	(Fritz et al., 2015)
Alaska, US	Water quality	Dissolved organic and inorganic carbon	**Increase.** No quantitative Trend	2011-2012	Observation stations	(Abbott et al., 2014)
USA	Water quality	Dissolved oxygen, turbidity	**Both increase and decrease**. Droughts either deteriorate or enhance water systems, depending on the parameter of interest.	1950-2010	Observation stations	(Ahmadi and Moradkhani, 2019)
Alaska, US	Water quality	Dissolved Organic Carbon, Nitrate, Dissolved Organic Matter	**Decrease.** No Quantitative Trend	2010	Field Observations	(Harms et al., 2016)
US	Water quality	Benthic Macroinvertebrates	**Decrease.** No Quantitative Trend	2009-2012	Field survey	(Smith et al., 2019)
Canada	Water quality	Tritium concentration	**Increase.** No quantitative Trend	2016-2017	Observations	(Bond and Carr, 2018)
Canada	Water quality	Methyl mercury concentrations	**Increase**. 5% of stored mercury in historic permafrost to be released	2015-2016	Observations	(St. Pierre et al., 2018)

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	Canada	Water quality	Particulate organic carbon, particulate nitrate	**Increase.** 78%	2008	Observations	(Lamoureux and Lafrenière, 2014)
	Canada	Water quality	Cyanophage S-EIV1	**Increase.** No quantitative Trend	1999-2001	Field Observations	(Chénard et al., 2015)
	Canada	Water quality	Microbially derived NO3	**Increase.** No quantitative Trend	2012	Field Observations	(Louiseize et al., 2014)
	Canada	Water quality	Fallout radionuclides and other contaminants	**No trend**	2008-2011	Observations	(Owens et al., 2019)
	US	Water quality	Dilution factor for waste water	**Decrease**		Modelled	(Rice and Westerhoff, 2017)
	Canada	Water quality	Physiochemical properties	**Increase.** SO4 concentrations 1.4-2.1 times per year	2003-2016	Observation Stations	(Roberts et al., 2017)
	Canada	SESL	Sediment transport	**Constant**	2003-2017	Observation stations	(Beel et al., 2018)
	Alyaska	SESL	Riverbank Erosion	**Increase.** 70,000metrictons (t) of soil solids including 880t of organic carbon, were transported to the river from the retreating bank annually	1949-2010	Remote sensing observations	(Kanevskiy et al., 2016)
	Canada	SESL	Sediment load	**Increase.** No Quantitative Trend	2005-2010	Satellite Observations	(Kokelj et al., 2017)
	USA	SESL	sedimentation yield	**Increase.** Increase in fire severity leads to substantially increase in sediment yield (+26.0 t/ha)	1979-2010	Modeling results	(Gould et al., 2016)
	USA	SESL	sedimentation rate	**Increase.** From 0.6 cm/year (1918) to 3.2 cm/year (2018)	1918-2014	Isotope analysis	(Polyakov et al., 2017)
	Northern Hemisphere	Cryosphere	annual maximum snow mass	**Decrese.** Diferent continental trends over the 39-year satellite record. For example, snow mass decreased by 46 gigatonnes per decade across North America but had a negligible trend across Eurasia	1980-2018	Satellite data (GlobSnow 3.0 dataset)	(Pulliainen et al., 2020)
	Northern Hemisphere	Cryosphere	spring snow cover extent (SCE)	**Decrease.** -0.43 ± 0.17 10^6 km^2 decade^-1	1981-2010	Modelled. CMIP5 GCMs	(Thackeray et al., 2016)
	Western North Americaoutside of Alaska	Cryosphere	glacier mass	**Decrease.** These glaciers lost 117 ± 42 gigatons (Gt) of mass. Fourfold increase in mass loss rates between 2000–2009 [2.9 ± 3.1 Gt yr 1] and 2009–2018 [12.3 ± 4.6 Gt yr 1]	2000-2018	Satellite data	(Menounos et al., 2019)
Small Islands	Antarctica	Water quality	Cultivable Fungi	**Increase.** No quantitative Trend		Observations	(Alves et al., 2019)

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Sourth America	Andes	Cryosphere	glacier mass	**Decrease.** The total mass change over this period was −22.9 ± 5.9 Gt yr−1 (−0.72 ± 0.22 m w.e. yr−1).	2000-2018	Satellite data (ASTER stereo images)	(Dussaillant et al., 2019)
	Central Pyrenees	Water quality	Natural acid rock drainage	**Increase.** River length affected by natural acid rock drainage increases from 5 km (1945) to 35 km (2018)	1945-2018	A historical series of aerial photographs	(Zarroca et al., 2021)

Table SM4.2: Projected Changes to the Hydrological Cyle across regions

Region	Contry(ies)	Hydrological Component	Which Component of the hydrological component is Impacted	Projected trend with quantitative estimates	Time Period	Dataset e.g. observation station, gridded datasets, reanalysis	References
Global	Global	Precipitation	Annual maximum 5-day precipitation (RX5day)	**Increase** - global mean increase of between 1.1 mm and 4.6 mm (ensemble mean 3.6 mm)	1981-2010 to 2030-2055	1.5°C with RCP8.5; HadGEM3 driven by SST and sea ice patterns from selected CMIP5 models	(Betts et al., 2018)
	Global	Precipitation	Annual maximum 5-day precipitation (RX5day)	**Increase** - global mean increase of between 3.5 mm and 6.9 mm (ensemble mean 5.9 mm)	1981-2010 to 2030-2055	2°C with RCP8.5; HadGEM3 driven by SST and sea ice patterns from selected CMIP5 models	(Betts et al., 2018)
	Global	Precipitation	Annual maximum number of Consecutive Dry Days (CDD)	**Decrease** in most ensemble members - global mean change of between -5.4 days and +0.7 days (ensemble mean -1.6 days)	1981-2010 to 2030-2055	1.5°C with RCP8.5; HadGEM3 driven by SST and sea ice patterns from selected CMIP5 models	(Betts et al., 2018)
	Global	Precipitation	Annual maximum number of Consecutive Dry Days (CDD)	**Decrease** in most ensemble members - global mean change of between -5.7 days and +0.9 days (ensemble mean -2.9 days)	1981-2010 to 2030-2055	2°C with RCP8.5; HadGEM3 driven by SST and sea ice patterns from selected CMIP5 models	(Betts et al., 2018)
	Global	Precipitation	Ratio of Precipitation to Potential	**Increase** in area of drylands (Precipitation / Potential Evapotranspiration < 0.65) by 5.8 × 106 km2 (10 % increase)	1961 - 1990 to 2071-2100	RCP4.5 & RCP8.5; CMIP5 models	(Feng and Fu, 2013)

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		Evapotranspiration				
Global	Precipitation	Mean precipitation	**Both increase and decrease**	2000-2100	Perturbed-parameter ensembles with HadGEM3; RCP8.5	(Lowe et al., 2018)
Global	Precipitation	Heavy precipitation (daily precipitation >95th percentile of historical)	**Increase**: exceedance frequency increases to 60 - 100%	2071-2100	1.5 degrees global warming; CESM large ensembe	(Zhang and Villarini, 2017)
Global	Precipitation	Heavy precipitation (daily precipitation >95th percentile of historical)	**Increase**: exceedance frequency increases to 100 - 150%	2071-2100	2 degrees global warming; CESM large ensembe	(Zhang and Villarini, 2017)
Global	Precipitation	Heavy precipitation (daily precipitation >95th percentile of historical)	**Increase**: exceedance frequency increases approximately 60%	2071-2100	RCP2.6; CESM large ensembe	(Zhang and Villarini, 2017)
Global	Precipitation	Heavy precipitation (daily precipitation >95th percentile of historical)	**Increase**: exceedance frequency increases approximately 120%	2071-2100	RCP4.5; CESM large ensembe	(Zhang and Villarini, 2017)
Global	Precipitation	Heavy precipitation (daily precipitation >95th percentile of historical)	**Increase**: exceedance frequency increases approximately 220%	2071-2100	RCP8.5; CESM large ensembe	(Zhang and Villarini, 2017)

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		ET		**Increase.**	until 2100	RCP8.5; CMIP5	(Berg and Sheffield, 2019)
	Global	ET		**Decrease.**	baseline: 1979-2008, amip, and amip4K	Individual models	(Chadwick et al., 2019)
	Global				literature review		(Kamae et al., 2015)
	Global	ET		**Both increase and decrease**	N/A	a single GCM, CO2 increases at 1% yr-1	(Kooperman et al., 2018)
		ET		**Both increase and decrease**	N/A	6 Earth system model forced with a single GCM, CO2 increases at 1% yr-1	(Lemordant et al., 2018)
	Global	ET	transpiration	**Both increase and decrease**	2080-2100 to 1980-2005	a single GCM, RCP8.5, AOGCM with CO2 increases at 1% yr-1	(Skinner et al., 2017)
	Global	ET		**Both increase and decrease**	N/A	7 CMIP5 ESMs, CO2 increases at 1% yr-1	(Swann et al., 2016))
		Streamflow	Precipitation	**Both increase and decrease.** Relative change in rainfall from models with large uncertainty except for increases in high northern latitudes, decreases around the mediterranean and increases in sub-saharan africa.	1990-2090	CMIP5 GCMs	(Warszawski et al., 2014)
		Streamflow	Runoff/Streamflow	**Both increase and decrease.** Compelling evidence for projected runoff changes for the Rhine (decrease), Tagus (decrease) and Lena (increase) river basins, the sign and magnitude of change for other global basins is unclear.		Cat-HM	(Gosling et al., 2017)
		Streamflow	Streamflow	**Both increase and decrease**		GCMs: GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, NorESM1-M	(Falkner, 2016)

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Streamflow	Comparison of Groundwater Depletion	**Both increase and decrease.** Estimated groundwater depletion of 113 km3/yr	1980–2009	WaterGAP	(Döll et al., 2014)
Streamflow	Low flow	**Both increase and decrease.** Low river flow is described as the percentile of daily streamflow that is exceeded 90 % of the time. It is determined separately for each GCM/HM combination and warming scenario. The results show that the low-flow change signal amplifies with Increase warming levels. Low flows decrease in the Mediterranean region, while they increase in the Alpine and Northern regions. In the Mediterranean, the level of warming amplifies the signal from −12 % under 1.5 K, compared to the baseline period 1971–2000, to −35 % under global warming of 3 K, largely due to the projected decreases in annual precipitation. In contrast, the signal is amplified from +22 (1.5 K) to +45 % (3 K) in the Alpine region due to changes in snow accumulation.	2007-2096	GCMs: GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, NorESM1-M	(Marx et al., 2018)
Streamflow	Annual runoff	**Both increase and decrease**	2106-2115	the HAPPI project	(Zhai et al., 2020)
Streamflow	Streamflow extremes	**Both increase and decrease.** In the multimodel mean under the Representative Concentration Pathway 8.5 (RCP8.5) scenario, 37 % of global land areas experience an increase in magnitude of extremely high streamflow (with an average increase of 24.5 %). On the other hand, 43 % of global land areas show a decrease in the magnitude of extremely low streamflow (average decrease of 51.5 %).	1971–2099	CMIP5	(Asadieh and Krakauer, 2017)
Streamflow	Runoff	**Both increase and decrease. T**he frequency of extreme soil moisture and surface runoff droughts during the warm season increases by 100–200% (a factor of 2 to 3 times)	2071-2100	CMIP6	(Cook et al., 2020)

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	Streamflow	Streamflow	**Both increase and decrease. P**rojected changes of streamflow regimes are statistically not significant in 8–32% (19–59%) of the world under RCP8.5 (RCP4.5). The model agreement on projected increase or decrease in mean and high flows is stronger under RCP8.5 than that under RCP4.5. The projected changes in low flow are robust in both scenarios with strong model agreement. In ~7% (4%) of the world, high flow is projected to increase and low flow is projected to decrease, whereas in ~29% (13%) all mean, high, and low flows are projected to increase under RCP8.5 (RCP4.5).	2071-2100	CMIP5	(Koirala et al., 2014)
	Streamflow	Runoff	**Both increase and decrease.** High flows in the Ganges and Lena are generally expected to increase (up to ~100 % and ~40 % respectively), while reduction is generally shown for Tagus (up to −50 %). The pattern of changes in the Niger basin is not clear. Low flows in the Lena and Niger basins are expected to increase, while a reduction is shown for Rhine and Tagus (up to −50 % in the end-century). Results for Ganges are quite uncertain.	2006–2035,2036–2065,2070–2099	n five GCMs and four emission scenarios	(Pechlivanidis et al., 2017)
	Streamflow	Mean annual streamflow	**Both increase and decrease.** 7 day high flow is projected to increase significantly on 11% and 21% of the global land area at 1.5 °C and 2 °C, respectively.	2006–2015	CMIP5	Doll et al 2018
	Streamflow	Runoff	**Both increase and decrease.** Positive trends for Q90 in the MacKenzie, Q10 and MF in the Ganges, Q10 in the Rhine and Mississippi; and negative trends for MF and Q90 in the Rhine, all—with a moderate certainty	2070–2099	WATCH forcing data	Krysanova et al 2017

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	Streamflow	Runoff	**Both increase and decrease.**	2008-2099	five CMIP5 Earth System Models: GFDL-ESM2M, HadGEM2-ES, IPSLCM5A-LR, MIROC-ESM-CHEM and NorESM1-M w	(Vetter et al., 2017)
	Streamflow	Drought magnitude	**Increase.** Future climate projections from the 5 GCMs under the RCP8.5 scenario show a moderate increase in monthly precipitation with respect to the reference period 1981-2010 for the entire Rhine river basin. A change of 3.8 % is expected for the period 2006-2035 and 1.0 % for 2070-2099. Under scenario RCP2.6, those changes are approximately 2.3 % and 6.6 %, respectively.	1971-2099	CMIP5	(Samaniego et al., 2018)
	Cryosphere	Glacier volume	**Decrease.** The ensemble mean volume loss at the end of the century is −64 ± 5 % for all glaciers excluding those on the peripheral of the Antarctic ice sheet	until 2100	RCP8.5	(Shannon et al., 2019)
	Cryosphere	Net snow accumulation	**Decrease.** Ensemble 50-year trend for net snow accumulation: Alaska= - 21.3%; W.US = -44.93%; N.Europe= -29.72%; Central Asia= -11.98%; N.E Asia=0.74%	2000-2060	SRES A1B	(Mankin and Diffenbaugh, 2015)
	Cryosphere	Permafrost	**Decrease.** Under RCP8.5, almost no permafrost is expected to remain in China, the United States, and the Tibetan Plateau.	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Guo and Wang, 2016)
	Cryosphere	snow extent	**Decrease.** With a projected 4 °C global mean temperature increase mean Northern Hemisphere snow cover decreases from 19% to 11%	2063-2092	4 °C global warming	(Henderson et al., 2018)
	Cryosphere	annual glacier mass and area	**Decrease.** Global mass loss of all glaciers by 2100 relative to 2015 averaged over all model runs varies from 18 ± 7% (RCP2.6) to 36 ± 11% (RCP8.5)	2015-2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Hock et al., 2019)

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Cryosphere	global glacier runoff	**Both increase and decrease.** By 2100, one-third of 56 glacier covered mountain basins might experience runoff decreases greater than 10% due to glacier mass loss	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Huss and Hock, 2018)
Cryosphere	monthly glacier runoff	**Both increase and decrease.** 1) runoff from glaciers in Western Canada and U.S. declines by 72% between 2003-2022 and 2080-2099; 2) In Arctic Canada North and Russian Arctic, the runoff steadily increases throughout most of the twenty-first century ending 36% and 85% higher than the initial period. 3) Low Latitudes exhibits the fastest runoff decline due to its rapid and near complete volume loss; runoff declines 96%	until 2100	RCP4.5, RCP8.5	(Bliss et al., 2014)
Cryosphere	spring snow cover extent	**Decrease.** Spring SCE is projected to decrease by −3.7% ± 1.1% decade−1 within the CMIP5 ensemble over the twenty-first century	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Thackeray et al., 2016)
Cryosphere	permafrost and snow water equivalent	**Decrease.** 1) When the global average surface temperature rises by 1.5 °C, the southern boundary of the permafrost will move 1–3.5° northward (relative to 1986–2005) ; 2) The permafrost area will be reduced by 3.43 × 106 km2 (21.12%), 3.91 × 106 km2 (24.1%) and 4.15 × 106 km2 (25.55%) relative to 1986–2005 in RCP2.6, RCP4.5 and RCP8.5, respectively. 3)The snow water equivalent will decrease significantly (more than 40% relative to 1986–2005) in central North America, western Europe, and northwestern Russia.	2023-2027	RCP2.6, RCP4.5, RCP8.5	(Kong and Wang, 2017)
Cryosphere	Permafrost area	**Decrease.** If the climate is stabilized at 2 °C above pre-industrial levels, we estimate that the permafrost area would eventually be reduced by over 40%. Stabilizing at 1.5 °C rather than 2 °C would save approximately 2 million km2 of permafrost	until 2300	1.5-2.0°C global warming	(Chadburn et al., 2017)
Cryosphere	glacier mass	**Decrease.** Global mass loss by 2100 relative to 2015: 79 ± 56 mm sea level equivalent for RCP2.6, 159 ± 86 mm sea level equivalent for RCP8.5	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Marzeion et al., 2020)

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	Northern Hemisphere	Cryosphere	snow extent	**Decrease.** spring snow extent will decrease by about 8 % relative to the 1995–2014 level per degree Celsius of GSAT increase		SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5	(Mudryk et al., 2020)
	Northern Hemisphere	Cryosphere	permafrost area	**Decrease.** Reduction of the permafrost area was approximately 35% (20–50% range of uncertainty from a multi-model ensemble) in the RCP8.5 scenario		RCP8.5	(Yokohata et al., 2020)
	Northern Hemisphere	Cryosphere	permafrost area and annual frozen volume	**Decrease.** The CMIP6 models project a loss of permafrost under future climate change of between 1.7 and 2:7 × 106 km2 ◦C−1. A more impact-relevant statistic is the decrease in annual mean frozen volume (3.0 to 5:3 × 103 km3 ◦C−1) or around 10 %–40 %◦C−1	until 2100	CMIP6 ensembles	(Burke et al., 2020)
		Cryosphere	Dependence of population on mountain water resources	**Increase.** ~1.5 billion people (24% of the world's lowland population) are projected to depend critically on runoff contributions from mountains by the mid-twenty-first century under a 'middle of the road' scenario, compared with ~0.2 billion (7%) in the 1960s.	2050	RCP4.5; RCP6.0	(Viviroli et al., 2020)
		Drought	Drought hazard (dH) computed from Weighted Anomaly of Standardized Precipitation (WASP) index	**Both increase and decrease.** Increase (North and south America, Europe, West and south Africa, East Asia and Australia) and Decrease (Central, South and Southeast Asia and east afirica)	2021-2050, 2071-2100 with 1971-2000 (ref.)	RCP2.6, RCP4.5, RCP8.5	(Carrão et al., 2018)
		Drought	Precipitation, soil moisture, runoff	**Both increase and decrease.** Both Increase > 100% (Western North America, Central America, Europe and the Mediterranean, the Amazon, southern Africa, China, Southeast Asia, and Australia) and Decrease (High northern latitude in India, east Africa, Argentina)	2015-2100 with 1850-2014 (ref.)	SSP1-2.6, SSP2-4.5, SSP3-3.7, SSP5-8.5	(Cook et al., 2020)

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Drought	River discharge (Qm, Q5, Q95)	**Both increase and decrease.** Long-term mean, high, low stream flow increase (northern North America, northern Eurasia, Asia, eastern and central Africa and Australia) but decrease (Europe, Middle East, Central Asia, northern and southern Africa, southwestern United States and Central America)	2071-2100 with 1971-2000 (ref.)	RCP2-4.5, RCP5-8.5	(Koirala et al., 2014)
Drought	SPEI-12	**Increase.** Avg. drought lengths increase from 9, 11, 18 months with a doubling of drought magnitude in 30%, 38%, and 51% of global land surface under 1.5, 2, and 3°C of warming (most of Africa, southern Europe, the Caribbean, Central America, West Asia, and Australia accumulated water deficits could become more than fivefold in size under 3°C of warming.).	2027, 2040, 2062 with 1976-2005 (ref.)	1.5, 2, 3 oC warming	(Naumann et al., 2018)
Drought	Terrestial water storage (TWS)	**Increase**. more than double in future drought drought from 3% during 1976–2005 to 7% and 8%	1976-2005 (ref.)	CMIP5-RCP	(Pokhrel et al., 2021)
Drought	Global Deficit Index (GDI), Regional Deficit Index (RDI)	**Increase.** Drought severity, Mean GDI increase of 3.9% under RCP2.6, 6.3% for RCP4.5, and 7.4% for RCP6.0 and reaching 13% under RCP8.5. Mean RDI increases 0 (Eastern Africa)-28% (South and Meso-America, Caribbean, central and western Europe) under RCP8.5	2070-2099 with 1976-2005 (ref.)	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Prudhomme et al., 2014)
Drought	The Standardized Precipitation Index (SPI), the Standardized Runoff Index (SRI), the Standardized Precipitation–Evapotranspiration Index (SPEI) and the Supply–Demand	**Increase.** drought risk in the spatial extent, duration and occurrence of ‘‘excep- tional’’ drought in subtropical and tropical regions. Increases in SPEI and SDDI drought in the higher latitudes of southern hemisphere (Southern South America, South Africa and Southern Australia) and in the northern hemisphere. (Northeastern Europe and Central North America)	2010-2054, 2055-2099 with 1961-2005 (ref.)	RCP8.5	(Touma et al., 2015)

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			Drought Index (SDDI).				
		Drought	Drought duration and deficit volume (Q90)	**Increase.** drought duration and deficit volume 62% (27%) of the world for stationary and nonstationary tresholds. unde RCP8.5 (Mediterrranean, the Svannah area of Africa, Middle east, Interior of Auatralia, eastern south America)	2070-2099 with 1971-2000 (ref.)	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Wanders et al., 2015)
		Drought	Drought indices, sc_PDSI, SM, Runoff	**Increase.** All drought indices increase 50-200% in frequency (most America, Europe, southern Africa, and Australia)	2006-2099 with 1850-2005 (ref.)	RCP4.5	(Zhao and Dai, 2015)
		Drought		**Increase**. 5 times more with 3C warming	1.5, 3 and 3.5 C warming		(Thiery et al., 2020)
	Global	Groundwater	GW storage	**Decrease.** GW withdrawals trend 597 km3/year by 2100	Variable; 2000 to 2013; 2050 and 2100	It is a review paper covering a range of scenarios (e.g., RCP6.0 and SSP2)	(Bierkens and Wada, 2019)
	Global	Groundwater	GW storage, depletion and abstractio	**Decrease.** Trend in GW depletion: 427 (±56) km3/year by 2099; GW depletion to SLR trends 0.82 (±0.13) mm/year by 2050	2000-2100	Various scenarios including A1B, A2 and B1	(Wada, 2016)
	Global	Groundwater	Groundwater storage	**Decrease.** Trends were not reported numerically but descriptively	Variable periods	It is a review paper covering a range of scenarios	(Amanambu et al., 2020)
	Global	Groundwater	Groundwater recharge	**Both increase and decrease.** Trends were not reported numerically but descriptively	Variable periods	It is a review paper covering a range of scenarios	(Amanambu et al., 2020)
	Global	Groundwater	GW recharge	**Both increase and decrease.** Trends were illustrated graphically using global maps and graphs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
	Global	Groundwater	GW recharge	**Both increase and decrease.**Trends were reported graphically using global-scale maps	For 2050 (2041-2070)	RCP8.5	(Herbert and Döll, 2019)

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Global	Groundwater	Environmental flow loss due to groundwater depletion	**Decrease.** Trends were reported graphically using global-scale maps	2011-2100	RCP8.5	(de Graaf et al., 2019)
Global	Groundwater	GW quality	**Both increase and decrease.** Mostly decline in quality)	For 2050	RCP8.5	(McDonough et al., 2020)
	Water quality	Climate elasticity of river water quality	**Both increase and decrease.** Temperature and precipitation elasticities of 12 water quality parameters, highlighted by N- and P-nutrients, are assessed.	N/A	N/A	(Jiang et al., 2014)
Parts of Africa, Asia, Australasia, North America and Central and South America	Precipitation	Annual total precipitation	**Both**: change of approximately -2.3 to +3.0	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
Parts of Africa, Asia, Australasia, North America and Central and South America	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Both**: change of approximately -0.1 to +0.3	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
Parts of Africa, Asia, Europe, North America and Central and South America	Precipitation	Annual total precipitation	**Increase** of approximately 0.08 to 0.17	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
Parts of Africa, Asia, Europe, North America and Central and South America	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase** of approximately 0.15 to 0.35	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)

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	Parts of Africa, Asia, Australasia, Europe, North America and Central and South America	Precipitation	Annual total precipitation	**Both**: change of approximately -1.0 mm to +1.0	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
	Parts of Africa, Asia, Australasia, Europe, North America and Central and South America	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase** of approximately 0.10 to 0.21	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
	Parts of Africa, Asia, Australasia, Europe, North America and Central and South America	Precipitation	Annual total precipitation	**Increase** of approximately 0.05 to 0.19	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
	Parts of Africa, Asia, Australasia, Europe, North America and Central and South America	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase** of approximately 0.15 to 0.25	1951-1980 to 2071-2100	RCP8.5; CMIP5	(Donat et al., 2019)
Africa	Africa	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	Africa	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)

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Mediterranean	Soil moisture	Surface soil moisture (annual mean)	**Decrease.** approximately 3%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Mediterranean	Soil moisture	Surface soil moisture (october-March)	**Decrease.** 1 standard deviation of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Mediterranean	Soil moisture	Surface soil moisture (April-September)	**Decrease.** 1 standard deviation of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Mediterranean	Soil moisture	Surface soil moisture (october-March)	**Decrease.** Up to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Mediterranean	Soil moisture	Surface soil moisture (April-September)	**Decrease.** Op to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Sahel and Horn of Africa	Soil moisture	Surface soil moisture (annual mean)	**Decrease of** approximately 5% in west, **Increase** of approximately 5% in centre and east	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Sahel and Horn of Africa	Soil moisture	Surface soil moisture (october-March)	**Increase: 1 -2** standard deviations of interannual variability over approximately half of region**, no robiust change over rest of region**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Sahel and Horn of Africa	Soil moisture	Surface soil moisture (April-September)	**Increase: 1 -2** standard deviations of interannual variability over approximately one-sixth of region, no robiust change over rest of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Sahel and Horn of Africa	Soil moisture	Surface soil moisture (october-March)	**Increase** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Sahel and Horn of Africa	Soil moisture	Surface soil moisture (April-September)	**Increase** - 1 to 5 standard deviations of interannual variability over Sahel, no robust signal over Horn of Africa	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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Angola, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe, South Africa, Lesotho, Eswatini	Soil moisture	Surface soil moisture (annual mean)	**Decrease of** approximately 5% to 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Angola, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe, South Africa, Lesotho, Eswatini	Soil moisture	Surface soil moisture (october-March)	**Decrease:** 1 - 2 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Angola, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe, South Africa, Lesotho, Eswatini	Soil moisture	Surface soil moisture (April-September)	**Decrease:** 1 - 2 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Angola, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe, South Africa, Lesotho, Eswatini	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 1 to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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Angola, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe, South Africa, Lesotho, Eswatini	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 1 to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Northern Tunisia	Streamflow	Discharge	**Both increase and decrease.** A decrease of 20 to 37% of discharge is expected for RCP 4.5 and 41 to 58% for RCP 8.5.	2040-2100	three rainfall-runoff models (RRMs): HBV, GR4 and IHACRES	(Dakhlaoui et al., 2020)
West Africa (Niger River Basin)	Floods	Q10 discharge	**Increase.** Increase (+15-44%) for RCP 4.5 and (-5 to 37% for RCP 8.5.	2021-2050	RCP4.5, RCP8.5	(Aich et al., 2016)
Niger, Upper Blue Nile, Oubangui, Limpopo	Floods	Q10 discharge	**Increase.** All climate models and both RCPs show an increase from ~10% to ~50 %.	2020-2049, 2070-2099	RCP2.6, RCP8.5	(Aich et al., 2014)
Africa	Floods	Frequency of 1/100 flood, affected population and asset	**Increase.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
Africa	Floods	Frequency of 1/100 flood	**Both increase and decrease.**	2050s	SRES A1B	(Arnell and Gosling, 2016)
Africa	Floods	7-day high flow	**Both increase and decrease.**	1.5 and 2C warming	RCP4.5, RCP8.5	(Döll et al., 2018)
Africa	Floods	Direct flood damage, death toll and walfare loss	**Both increase and decrease.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)
Volta river	Floods	Q5 discharge	**Increase.** 11% and 36% at 2050s and 2090s, respectively.	2030-2059, 2070-2099	RCP8.5	(Jin et al., 2018)
Blue Nile river in Ethiopia	Floods	100-year flood	**Increase. Increase** magnitude (19-27%), flooded area (3-5.7%) and inundation depth (10.6-17.3%).	2020-2079	RCP4.5	(Robi et al., 2019)
Tunisia	Groundwater	GW levels	Dcreasing. Mostly Decrease trends; trends were reported graphically	2036–2065	RCP4.5	(Guermazi et al., 2019)

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	East Africa, Sahara, Southern Africa, Westren Africa	Groundwater	GW recharge	**Constant and Decrease.** Slight Decrease trends at all GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
	Ethiopia	Groundwater	GW recharge	**Decrease.** Mainly Decrease trends; projected decreases of 3.4% for RCP 2.6 and 1.3% for RCP 4.5 scenarios	2020-2079	RCP2.6 and RCP4.5	(Kahsay et al., 2018)
	Morocco	SESL	Soil Erosion	**Increase**	2070-2100	NA	(Simonneaux et al., 2015)
	Burkina Faso	SESL	Suspended sediment	**Increase.** 19-37% increase of suspended sediment	2021-2050	RCP4.5, RCP8.5	(Op de Hipt et al., 2018)
	Ethiopia	SESL	Sediment yield	**Decrease.** Projected trend: Decrease (-11-52%)	2041-2070	RCP4.5, RCP8.5	(Gadissa et al., 2018)
Asia	Asia	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	Tibetan Plateau	Cryosphere	Glacier melt and total runoff	**Decrease.** No quantitative trend	2011-2070	RCP2.6, RCP4.5, RCP8.5	(Su et al., 2016)
	Tibetan Plateau	Cryosphere	Glasier mass	**Decrease.** Projections for RCP4.5,RCP6.0 and RCP8.5 reveal that much of the glacier ice is likely to disappear, with projected mass losses of 49±7 per cent, 51±6 per cent and 64±5 per cent, respectively, by the end of the century	2020-2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Kraaijenbrink et al., 2017)
		Cryosphere	Glacier melt and total runoff	**Increase.** No quantitative trend	2040-2050	RCP4.5, RCP8.5	(Lutz et al., 2014)
	High Mountain Asia	Cryosphere	Glacier mass	**Decrease.** Glaciers in High Mountain Asia will lose between 29 ± 12% (RCP 2.6) and 67 ± 10% (RCP 8.5) of their total mass relative to 2015	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Rounce et al., 2020)
	Iran	SESL	Sediment yield	**Increase**	2040-2069	SRES A2, SRES B1, SRES A1B	(Azari et al., 2016)
	Pakistan	SESL	Sediment yield	**Increase**	2011-2070	SRES A2, SRES B2	(Azim et al., 2016)
	Thailand	SESL	Soil erosion and deposition	**Increase**	2016-2045	SRES A1B, SRES B1, SRES A2, SRES B2	(Plangoen et al., 2013)

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Asia	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
Arctic Russia	Soil moisture	Surface soil moisture (annual mean)	**Both: decrease and increase of** approximately 5% to 10% in different parts of region	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Arctic Russia	Soil moisture	Surface soil moisture (october-March)	**Decrease:** up to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Arctic Russia	Soil moisture	Surface soil moisture (April-September)	**Decrease:** up to 3 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Arctic Russia	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 4 to 5 standard deviations of interannual variability in approximately two-thirds of region, **increase** of 1 standard deviation over remaining third	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Arctic Russia	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 4 to 5 standard deviations of interannual variability in approximately two-thirds of region, **increase** of 1 standard deviation over remaining third	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Central Asia	Soil moisture	Surface soil moisture (annual mean)	**Increase of** approximately 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Central Asia	Soil moisture	Surface soil moisture (october-March)	**Increase: up to 2** standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central Asia	Soil moisture	Surface soil moisture (April-September)	**No robust change over most of region**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central Asia	Soil moisture	Surface soil moisture (october-March)	**Increase** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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Central Asia	Soil moisture	Surface soil moisture (April-September)	**Both. Decrease** over half the region **- 1** standard deviation of interannual variability; **Increase** over half the region - 1 standard deviation of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Tibetan Plateau	Soil moisture	Surface soil moisture (annual mean)	**Decrease of** approximately 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Tibetan Plateau	Soil moisture	Surface soil moisture (october-March)	**Decrease:** over 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Tibetan Plateau	Soil moisture	Surface soil moisture (April-September)	**Decrease:** over 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Tibetan Plateau	Soil moisture	Surface soil moisture (october-March)	**Increase** - over 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Tibetan Plateau	Soil moisture	Surface soil moisture (April-September)	**Increase** - over 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Central and Southern China	Soil moisture	Surface soil moisture (annual mean)	**Decrease of** approximately 5%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Central and Southern China	Soil moisture	Surface soil moisture (october-March)	**Decrease:** 1 - 2 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central and Southern China	Soil moisture	Surface soil moisture (April-September)	**Decrease:** 1 - 2 standard deviations of interannual variability in western half of region. No robust change in eastern half	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central and Southern China	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Central and Southern China	Soil moisture	Surface soil moisture	**Decrease** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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		(April-September)				
Indian Subcontinent	Soil moisture	Surface soil moisture (annual mean)	**Increase of** approximately 5% in central and northern regions	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Indian Subcontinent	Soil moisture	Surface soil moisture (october-March)	**no robust signal**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Indian Subcontinent	Soil moisture	Surface soil moisture (April-September)	**no robust signal**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Indian Subcontinent	Soil moisture	Surface soil moisture (october-March)	**Increase of** approximately 1 standard deviation of interannual variability, up to 5 standard deviations regions in north-west	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Indian Subcontinent	Soil moisture	Surface soil moisture (April-September)	**Increase of** approximately 1 to 2 standard deviations of interannual variability in north-west, no robust signal over rest of region	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
	Streamflow	Glacier runoff volume	**Decrease.** the total glacier runoff volume in all the investigated basins is projected to decrease by 43 ± 14% (RCP2.6), 58 ± 13% (RCP4.5) and 74 ± 11% (RCP8.5).	2040–2060,2080-2100	CMIP5	(Huss and Hock, 2018)
Kazakhstan	Cryosphere	Glacier volume and glacier runoff discharge	**Both increase and decrease**	2006-2095	RCP2.6, RCP8.5, SRES A1B	(Shahgedanova et al., 2020)
China	Cryosphere	Glacier area	**Decrease.** Decline in glacier area of −90% to −32% until 2099 (reference to 2008)	until 2099	RCP2.6, RCP4.5, RCP8.5, SRES A1B	(Duethmann et al., 2016)
Asia	Floods	Frequency of 1/100 flood, affected population and asset	**Increase.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
High latitude Asia	Floods	Frequency of 1/100 flood	**Increase.**	2050s	SRES A1B	(Arnell and Gosling, 2016)
Asia	Floods	Direct flood damage, death	**Increase.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)

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		toll and welfare loss.				
Mekong basin (Vientiane, Mukdahan and Kratie gauge)	Floods	Q5 (95 percentile) discharge	**Increase.** 8%, 5%, and 6% at Vientiane, Mukdahan, and Kratie, respectively	2036-2065	RCP4.5, RCP8.5	(Hoang et al., 2016)
Lena, Ganges	Floods	Q10 discharge	**Increase.**	2006-2035, 2036-2065, 2070-2099	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Krysanova et al., 2017)
Jakarta, Indonesia	Floods	Inundation area	**Increase.** 6-31%	2020-2039 compared to 1985-2004	RCP4.5, RCP8.5	(Mishra et al., 2018)
Indonesia	Floods	1/100 flood, coastal flood	**Increase.** Increase in exposure76% and 120% for river and coastal floods.	2010-2049	SRES A1B, RCP8.5	(Muis et al., 2015)
Japan	Floods	3-day peak flow	**Increase.** 1.0–1.3 times.	2081-2000	RCP2.6, RCP4.5, RCP8.5	(Momiyama et al., 2020)
Lower Mekong	Floods	Q5 discharge	**Decrease.** Decrease for all rivers, and for most time horizons and GCMs. In 2030s, Decrease in 9 rivers (4-69%) Increase in 2 rivers (1-31%). In the 2090s time period, Q5 is predicted to increase only one river (Chikreng) for all GCMs.	2021-2040, 2051-2070, 2081-2100	RCP6.0	(Oeurng et al., 2019)
Pearl River delta, China	Floods	Flood vulnerability index	**Increase.** Inundation area in current condition (0.97 % of the whole PRD plain) increase 2.12% below 1 m, 2.12 % below 2m, and 7.86 % below 3 m.	2005-2100	RCP2.6, RCP4.5, RCP8.5	(Yang L. et al., 2015)
Ganges, Brahmaputra and Meghna (GBM) river systems	Floods	Q5 discharge	**Increase.** by 15%	2041-2060, 2081-2099	SRES A1B	(Whitehead et al., 2015)
Ganges, Brahmaputra and Meghna (GBM) river systems	Floods	Q5 discharge	**Increase.** 5.9-35.2% in 2050s, 13.7-97.7% in 2090s	2041-2060, 2079-2098	RCP8.5	(Whitehead et al., 2018)

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Upstream domains of Indus, Ganges, and Brahmaputra	Floods	1/50 flood	**Increase.** up to about 305% under RCP8.5	2011-2100	RCP2.6, RCP4.5, RCP8.5	(Wijngaard et al., 2017)
Iran (Zayandeh Rud river basin)	Droughts	Standard ized Precipitation Index (SPI), Standardized Runoff Index (SRI)	**Increase.** Increase significant drought in winter and spring	2006-2040, 2041-2075, 2076-2100	RCP8.5	(Ostad-Ali-Askari et al., 2020)
Central Asia, East Asia, North Asia, West Asia	Groundwater	GW recharge	**Constant**	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
South and Southeast Asia	Groundwater	GW recharge	**Decrease and Increase.** Decrease at 1.5 and 2°C and Increase at 3°C	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
Middle East	Groundwater	GW storage	**Decrease**	2006-2100	RCP8.5	(Wu et al., 2020)
India	Groundwater	GW storage	**Both increase and decrease.** Decrease till mid century and Increase from mid century to end century.	2006-2100	RCP8.5	(Wu et al., 2020)
China, North China Plains	Groundwater	GW storage	**Increase.** Slight Increase trends	2006-2100	RCP8.5	(Wu et al., 2020)
India	Groundwater	GW levels and storage	**Decrease.**	2006-2050	RCP8.5	(Zaveri et al., 2016)
India	Groundwater	GW recharge	**Increase.** Projected increase in future rainfall projected to lead to increased groundwater recharge	2040-2069	RCP8.5	(Sishodia et al., 2018)
China	Water Quality	Total nitrogen (TN) and total phosphorous (TP) pollution	**Increase.** For TN pollution, the incidence of pollution was 97.1% to 97.3%, in drought–flood abrupt alternation months. For TP pollution, the incidence of pollution was 8.1% to 13.5%, in drought–flood abrupt alternation months	2020-2050	RCP2.6, RCP4.5, RCP8.5	(Bi et al., 2019)
Bangladesh	Water Quality	River water salinity	**Increase.** Moderate to high saline river area is likely to increase from 8% at the baseline to 17% and 27% in the best and worst case scenarios	until 2050	SRES B1; SRES A1B; SRES A2	(Dasgupta et al., 2013)

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	Vietnam and Laos	SESL	Sediment yield	**Increase.** Projected trend: Increase (+5-16%)	2030, 2060, 2090	SRES B1, SRES B2, SRES A2	(Giang et al., 2014)
	Vietnam and Laos	SESL	Soil erosion	**Increase.** Projected trend: Increase (+5-23%)	2030, 2060, 2090	SRES B1, SRES B2, SRES A2	(Giang et al., 2017)
Australasia	Australia	Soil moisture	Surface soil moisture (annual mean)	**Decrease of** approximately 5% to 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
	Australia	Water quality	Chlorophyll-a concentrations	**Both increase and decrease**	to 2100	NA	(Nguyen et al., 2017)
	Australia	Water quality	Water Quality Indexes	**Constant**			(Dyer et al., 2014)
	Australia	Soil moisture	Surface soil moisture (october-March)	**Decrease**: 1 standard deviation of interannual variability over south-western and southern Australia, no robust signal over rest of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
	Australia	Soil moisture	Surface soil moisture (April-September)	**Decrease**: 1 standard deviation of interannual variability over south-western and southern Australia, no robust signal over rest of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
	Australia	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 1 to 3 standard deviations of interannual variability over south-western and southern Australia, no robust signal over rest of region	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
	Australia	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 1 to 3 standard deviations of interannual variability over south-western and southern Australia, no robust signal over rest of region	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
	Australia	Floods	Frequency of 1/100 flood, affected population and asset	**Increase.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
	Australia	Floods	Frequency of 1/100 flood	**Increase.**	2050s	SRES A1B	(Arnell et al., 2016)
	Australia	Floods	Direct flood damage, death toll and walfare loss	**Increase.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)

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	South Australia/New Zealand	Groundwater	GW recharge	**Decrease.** Slight Decrease trend at all GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
	Australia, Canning Aquifer	Groundwater	GW storage	**Constant**	2006-2100	RCP8.5	(Wu et al., 2020)
	Australia	Groundwater	GW storage	**Trends not reported**	2020-2035	RCP8.5	(Mehran et al., 2017)
	Australia	SESL	Rainfall erosivity and hillslope erosion	**Increase.** 1) The rainfall erosivity and hillslope erosion in the Alpine region are projected to increase about 2 and 8% for the near future (2020-2039), further increase to 8 and 18% for the far future (2060-2079). 2) For the entire study area, rainfall erosivity and hillslope erosion are likely to increase about 10 and 14% in the near future, about 24 and 30% in the far future on average across the study area.	2020-2039; 2060-2079	SRES A2	(Zhu et al., 2020)
	Australia	SESL	Soil erosion	**Increase.** Projected trend: Increase (+7-19%)	2020-2039, 2060-2079	SRES A2	(Yang et al., 2015c)
	Australia	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	Australia	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
Central and South America	Central and South America	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	Central and South America	Precipitation	Heavy precipitation: maximum 1-day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)

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		precipitation Rx1day				
	ET		**Both increase and decrease**	N/A	4 CMIP5 GCMs, CO2 increases at 1% yr-1	(Halladay and Good, 2017)
Central America	Soil moisture	Surface soil moisture (annual mean)	**Decrease** - approximately 5 to 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Central America	Soil moisture	Surface soil moisture (october-March)	**Decrease - 1** to 2 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central America	Soil moisture	Surface soil moisture (April-September)	**Decrease - 1** to 2 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Central America	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 2 to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Central America	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 2 to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Bolivia	Soil moisture	Surface soil moisture (annual mean)	**Decrease** - approximately 5 to 15%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Bolivia	Soil moisture	Surface soil moisture (october-March)	**Decrease - 1** to 4 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)

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Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Bolivia	Soil moisture	Surface soil moisture (April-September)	**Decrease - 1** to 3 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Bolivia	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 3 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Bolivia	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 3 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Northern and Central Argentina	Soil moisture	Surface soil moisture (annual mean)	**Increase** - approximately 5%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Northern and Central Argentina	Soil moisture	Surface soil moisture (october-March)	**No robust signal**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Northern and Central Argentina	Soil moisture	Surface soil moisture (April-September)	**No robust signal**	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Northern and Central Argentina	Soil moisture	Surface soil moisture (october-March)	**No robust signal**	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Northern and Central Argentina	Soil moisture	Surface soil moisture (April-September)	**No robust signal**	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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Chile, southern Argentina	Soil moisture	Surface soil moisture (annual mean)	**Decrease** - approximately 5 to 10%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Chile, southern Argentina	Soil moisture	Surface soil moisture (october-March)	**Decrease -** 1 to 3 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Chile, southern Argentina	Soil moisture	Surface soil moisture (April-September)	**Decrease -** 1 to 3 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Chile, southern Argentina	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 4 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Chile, southern Argentina	Soil moisture	Surface soil moisture (April-September)	**Decrease** - 4 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Central and South America	Floods	Frequency of 1/100 flood, affected population and asset	**Both increase and decrease.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
Central and South America	Floods	Frequency of 1/100 flood	**Both increase and decrease.**	2050s	SRES A1B	(Arnell et al., 2016)
Brazil	Floods	Flood vulnerability index	**Decrease.** In central Brazil, decrease in vulnerability ranging from 0.15 to 0.25 (15–25%) and and almost the entire portion of Brazil an average decrease of 20%	2071-2100	RCP4.5, RCP8.5	(Debortoli et al., 2017)
Central and South America	Floods	7-day high flow	**Both increase and decrease.**	1.5 and 2C warming	RCP4.5, RCP8.5	(Döll et al., 2018)
Central and South America	Floods	Direct flood damage, death toll and welfare loss	**Increase.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)
Brazil (Amazon)	Droughts	Precipitation, temperature,	**Increase.** drought risk in the eastern and	2005-2100	SSP1-2.6, SSP3-3.7	(Parsons, 2020)

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	Amazon, Central America/Mexico; Northeast Brazil, Southeastern South America, West Coast South America	Groundwater	GW recharge	**Decrease.**	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
	Guarani Aquifer	Groundwater	GW storage	**Increase.**	2006-2100	RCP8.5	(Wu et al., 2020)
Europe	Europe	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	UK	Precipitation	Mean precipitation	**Increase** in winter**, decrease** in summer	2000-2100	Perturbed-parameter ensembles with HadGEM3; RCP8.5	(Lowe et al., 2018)
	Europe	Precipitation	Heavy precipitation: maximum 1-day precipitation Rx1day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	UK	Precipitation	Heavy precipitation	**Increase** in all seasons	2000-2100	Perturbed-parameter ensembles with HadGEM3; RCP8.5	(Lowe et al., 2018)
	Tropical forests	ET	transpiration	**Decrease.**	baseline: 1979-2008	amip; amip4K	(Chadwick et al., 2017)
	Spain	ET		**Decrease.** annual and summer Decrease	2021-2050, 2071-2100	RCP4.5, RCP8.5, regional climate model driven by 2 GCMs	(Ojeda et al., 2021)
	Europe	Soil moisture	Surface soil moisture (annual mean)	**Decrease** - approximately 5% in most of region, up to 18% in Iberian Peninsula	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
	The Netherlands	Water quality	Pharmaceuticals, a herbicide and its	**Increase**	until 2015	NA	(Sjerps et al., 2017)

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		metabolite and an artificial sweetener				
UK	SESL	Sediment yield	**Both increase and decrease**	until 2050	SRES A1B, SRES B1	(Bussi et al., 2016a)
France	SESL	Erosion and sustainability of soil	**Increase**	until 2100	SRES A1B	(Paroissien et al., 2015)
European Alps	Cryosphere	Runoff from glacierized surfaces	**Decrease.** For an average emission scenario (RCP 4.5), annual runoff contributions from presently glacierized surfaces are expected to decrease by 16% by 2070–2099	2070-2099	RCP2.6, RCP4.5, RCP8.5	(Farinotti et al., 2016)
Italy, Austria, France, Switzerland	Cryosphere	Temperatures, precipitation, radiation, air humidity, floods, droughts, snow cover	**Both increase and decrease**	until 2100	SRES A1B, SRES A2, SRES B2	(Gobiet et al., 2014)
Switzerland	Cryosphere	Glacier/snow melt runoff	**Increase.** 50% for high flow and low flow	2071-2100	RCP2.6, RCP4.5, RCP8.5	(Brunner et al., 2019)
Austrian Alps	Cryosphere	mean annual snow water equivalent, glacier volume, runoff volume	**Decrease.** Snow water equivalent (up to 20%), glacier volume (4-20%), runoff volume (up to 39%)	until 2100	RCP2.6, RCP4.5, RCP8.5	(Hanzer et al., 2018)
Europe	Soil moisture	Surface soil moisture (october-March)	**Decrease: 1** standard deviation of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Europe	Soil moisture	Surface soil moisture (April-September)	**Decrease: 1** standard deviation of interannual variability around Mediterranean, 2 to 3 standard deviations in Scandinavia, no robust trend in rest of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Europe	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 3 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Europe	Soil moisture	Surface soil moisture	**Decrease** - 3 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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		(April-September)				
	Streamflow	Mean annual runoff	**Both increase and decrease.** Disagreement between model in magnitude and direction except for increased runoff in Scandinavia an most of Northern Europe	2071–2100	CMIP5 GCMs	(Koutroulis et al., 2018)
Spain and Portugal	Streamflow	Runoff	**Decrease.**	2071–2100	Euro-CORDEX model	(Yeste et al., 2021)
British Columbia	Streamflow	Runoff	**Increase.** Thompson–Nicola exhibits the largest relative change (+140 %) from the 1990s to 2080s, although it is historically the driest of the sub-basins, while the runoff at Hope increases by 71 % between the same epochs. With respect to annual runoff, only the Coast Mountains and the Chilko sub-basin display substantial increases (but much smaller in relative terms than cold season increases), with little change elsewhere .In addition, by the 2080s, the runoff mean and standard deviation more than double, at over 83 % and 71 % of the FRB, respectively	,2070–2099	CMIP5	(Islam et al., 2019b)
Spain, Duro Basin	Streamflow	Streamflow	**Decrease.** Annual Decrease aroun 40%	2040–2060,2080-2100	Euro-CORDEX	(Yeste et al., 2021)
European Alps	Cryosphere	Glacier volume	**Decrease.** Total glacier volume in the coming decades is relatively similar under the various representative concentrations pathways With RCP2.6, 4.5 and 8.5, volume losses are about 47 %–52 % in 2050 with respect to 2017. Under RCP8.5, glaciers are projected to largely disappear by 2100 (94.4±4.4 % volume loss vs. 2017).	2050, 2100	RCP2.6, RCP4.5, RCP8.5	(Zekollari et al., 2019)
Swiss Alps	Cryosphere	Glacier area	**Decrease.** 73% of all glaciers that were smaller than 0.1 km2 in the inventory of 2010 are expected to have disappeared by 2030 according to the A1B median scenario, and 97% are gone by 2060	until 2060	SRES A1B; SRES A2	(Huss and Fischer, 2016)
Crewe drainage catchment,	Floods	Risk of urban flooding	**Increase.** 1.04-1.09 depending on return period in 2080s in A1F1 scenario	2070-2099	A1F1, B2	(Abdellatif et al., 2015)

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northwestern England						
Europe	Floods	Annual expected flood damage	**Increase.** (currently of 5.3 Bs, rise at 20–40 Bs in 2050 and 30–100 Bs in 2080)	2006-2100	RCP8.5	(Alfieri et al., 2015)
Europe	Floods	Frequency of 1/100 flood, affected population and asset	**Increase.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
Central Europe and the European parts of Russia	Floods	Frequency of 1/100 flood	**Decrease**	2050s	SRES A1B	(Arnell and Gosling, 2016)
Eastern coast of Spain (Catalonia and the Valencian Community)	Floods	Probability of damaging flood events (threshold of heavy precipitation).	**Increase.** 11-41% under 1.5C, 28-50 % under 2C and 47-94% undear 3C warming	2006-2100	RCP8.5	(Cortés Simo et al., 2019)
Tisza and Prut rivers, Danube	Floods	1/30 flood	**Increase.** in the Tisza (4.5-62%) and in the Prut (11-22%).	2071-2100	RCP4.5, RCP8.5	(Didovets et al., 2019)
Europe	Floods	7-day high flow	**Decrease**	1.5 and 2C warming	RCP4.5, RCP8.5	(Döll et al., 2018)
Europe	Floods	Direct flood damage, death toll and welfare loss.	**Both increase and decrease.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)
West Yorkshire, northern England	Floods	Peak flow in swerer system	**Increase.**	1-5C warming	Scaling factor derived from past precipitation and temperature	(Fadhel et al., 2018)
Odense, Vienna, Strasbourg and Nice	Floods	Total area flooded by more than 10 cm of surface water.	**Increase.** more than 20% in Niece, exceed 5-10% in Odense, Strasbourg and Vienna, depending on the return period and scenario	2081-2100	RCP4.5, RCP8.5	(Kaspersen et al., 2017)

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Rhine, Missisippi, Tagus	Floods	Q10 discharge	**Both increase and decrease.**	2006-2035, 2036-2065, 2070-2099	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Krysanova et al., 2017)
Paceco urban area, southern Italy	Floods	Frequency of drainage system surcharge episodes	**Increase**	2025, 2050 compared to 1950-2008	Extreme precipitation scenario based on satatistics of the past	(Notaro et al., 2015)
Europe	Floods	Q10, Qmax	**Decrease.** Significant decrease in high flows from -11% at 1.5 K up to -330%	3C warming	RCP2.6, RCP6.0, RCP8.5	(Thober et al., 2018)
Central Europe	Groundwater	GW recharge	**Constant and Increase.** Slight Increase trends at all GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
North Europe	Groundwater	GW recharge	**Increase.** Strong Increase trend in recharge at all levels of GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
Southern Europe/Mediterranean	Groundwater	GW recharge	**Decrease.** Strong Decrease trends at all GWLs.	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
Spain	Groundwater	GW recharge	**Both increase and decrease.** Trends were reported using maps and graphs	1996-2005 and 2011-2045	RCP8.5	(Pulido-Velazquez et al., 2018)
Northern Italy	Water Quality	Amount nutrients (i.e. NO3−, NH4+, PO43−)	**Increase.** Greater increase for both river flow and nutrients loadings are predicted under the medium and long term RCP8.5 scenarios.	2041-2100	RCP4.5, RCP8.5	(Sperotto et al., 2019)
UK	Water Quality	Nitrate concentration	**Both increase and decrease.** Climate change alone should reduce the average nitrate concentration, although just by a small amount, by the 2050s in the Lower Thames, due to reduced runoff and increased instream denitrification, and should increase the average phosphorus concentration by 12%	until 2050	SRES A1B, SRES B1, Land use scenarios	(Bussi et al., 2017)
UK	Water Quality	River phytoplankton concentration, cyanobacteria	**Increase.** An increase in average phytoplankton concentration due to climate change is highly likely to occur along the River Thames. Cyanobacteria show significant increases under future climate change and land use change	2030s	UK Climate Projections 09 (UKCP09) for the 2030s	(Bussi et al., 2016b)

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	UK	Water Quality	Nutrient concentration	**Increase.** Under future scenarios (+4.0°C increase by the end of the century), the average nutrient will be triple of current in a shallow lake	N/A	RCP8.5 (mesocosms-based experiment)	(Richardson et al., 2019)
	Spain	SESL	Soil erosion rate	**Increase.** 34-55% depending on the scenario	2031-2050, 2081-2100	RCP4.5, RCP8.5	(Eekhout and de Vente, 2019a)
	Czech Republic	SESL	Rainfall erosivity	**Increase.** Increase of rainfall erosovity of 18-51% depending on scenario.	2020-2049, 2070-2099	SRES A1B, RCP4.5, RCP8.5	(Svoboda et al., 2016)
	Belgium	SESL	Soil erosion	**Increase.** 10-22% increase of soil erosion	2016-2035, 2036-2055	1.5-2.0°C global warming	(Mullan et al., 2019)
	Greece	SESL	Rainfall erosivity	**Decrease.** 3-9% decrease of rainfall erosivity depending on scenario	2040, 2070, 2100	RCP4.5, RCP8.5	(Vantas et al., 2020)
	Spain	SESL	Suspended sediment	**Decrease**. 8-11% decrease of suspended sediment	2031-2060, 2069-2098	SRES A1B	(Rodríguez-Blanco et al., 2016)
	Germany	SESL	Rainfall erosivity	**Increase.** Projected trend: Increase (+36-78%)	2011-2055, 2051-2095	RCP4.5, RCP8.5	(Gericke et al., 2019)
	Spain	SESL	Soil erosion	**Both increase and decrease.** Projected trend: Increase (+36-74%) and Decrease (-7%)	2031-2050, 2081-2100	RCP8.5	(Eekhout and De Vente, 2019b)
	Spain	SESL	Soil erosion	**Increase.** Projected trend: Increase (+24-46%)	2031-2050, 2081-2100	RCP4.5, RCP8.5	(Eekhout et al., 2018)
Mediterranean	Mediterranean	Floods	frequency of 1/100 flood	**Decrease.**	2050s	SRES A1B	(Arnell and Gosling, 2016)
	Mediterranean	Floods	7-day high flow	**Decrease.**	1.5 and 2C warming	RCP4.5, RCP8.5	(Döll et al., 2018)
	Mediterranean	Floods	direct flood damage, death toll and welfare loss	**Decrease.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)
	Giofyros basin	Floods	Spring flood volume	**Decrease.** 5-12 for 2021-2050, 17-55% for 2071-2100	2021-2050, 2071-2100	RCP2.6, RCP4.5, RCP8.5	(Vozinaki et al., 2018)
North America	North America	Precipitation	Total precipitation	**Both increase and decrease**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)
	North America	Precipitation	Heavy precipitation: maximum 1-day	**Increase**	Various	Ensembles from CMIP5, CMIP6, HAPPI, HELIX, UKCP18. 2C global warming	(Uhe et al., 2021)

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		precipitation Rx1day				
Canada	Soil moisture	Surface soil moisture (annual mean)	**Both. Increase** up to 5% in central north, d**ecrease** up to 10% in east	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
Canada	Soil moisture	Surface soil moisture (october-March)	**Decrease -** up to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Canada	Soil moisture	Surface soil moisture (April-September)	**Decrease** - up to 2 standard deviations of interannual variability in most of region, up to 5 standard deviations in eastern Canada	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
Canada	Soil moisture	Surface soil moisture (october-March)	**Decrease** - up to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
Canada	Soil moisture	Surface soil moisture (April-September)	**Decrease** - up to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
USA	Soil moisture	Surface soil moisture (annual mean)	**Decrease** - approximately 5 to 12%	1976–2005 to 2070–2099	CMIP5: RCP8.5	(Berg et al., 2017)
USA	Soil moisture	Surface soil moisture (october-March)	**Decrease - 1** to 2 standard deviations of interannual variability in approximately half of region. No robust change in about one-third of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
USA	Soil moisture	Surface soil moisture (April-September)	**Decrease - 1** to 2 standard deviations of interannual variability in approximately half of region. No robust change in about one-third of region	1851–1880 to 2071–2100	CMIP6: SSP1-26	(Cook et al., 2020)
USA	Soil moisture	Surface soil moisture (october-March)	**Decrease** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)
USA	Soil moisture	Surface soil moisture	**Decrease** - 1 to 5 standard deviations of interannual variability	1851–1880 to 2071–2100	CMIP6: SSP3-70	(Cook et al., 2020)

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		(April-September)				
Western Canadian	Streamflow	Streamflow	**Both increase and decrease**	2031-2050,2081-2100	32 CMIP5 GCM	(Bonsal et al., 2020)
Canada	Streamflow	Mean flow	**Both increase and decrease**	2071–2100	CMIP5	(Shrestha et al., 2019b)
Canada	Streamflow	Streamflow	**Both increase and decrease**	2043–2053,2083–2093	CORDEX	(Zhang et al., 2018a)
USA	Cryosphere	Snowmelt runoff	**Decrease.** By 2100, the contribution of snowmelt to runoff will decrease by one third for the western U.S. in the RCP8.5 scenario	until 2100	RCP8.5	(Li et al., 2017a)
Northern-western North America	Cryosphere	snow drought	**Increase.** Maximum increase in frequency of snow drought is 19-83% with respect to baseline period 1961–2000 under +4.0 °C GMT change		1.0-4.0°C global warming	(Shrestha et al., 2021)
USA	Cryosphere	ability of snow to predict seasonal drought	**Decrease.** By mid-century (2036–2065), 69% of historically snowmelt-dominated areas of the western United States see a decline in the ability of snow to predict seasonal drought, Increase to 83% by late century (2070–2099)	2036-2065; 2070-2099	RCP8.5	(Livneh and Badger, 2020)
USA	Cryosphere	frequency of consecutive snow drought years	**Increase.** From 6.6% of years(1970-1999) to 42.2% (2050-2079)	2050-2079	RCP8.5	(Marshall et al., 2019)
USA	Floods	Rain-on-snow floods	**Increase.** 20–200%	until 2100	RCP8.5	(Musselman et al., 2018)
North America	Floods	Frequency of 1/100 flood, affected population and asset	**Increase.**	2006-2130	RCP8.5	(Alfieri et al., 2017)
North America	Floods	Frequency of 1/100 flood	**Both increase and decrease.**	2050s	SRES A1B	(Arnell et al., 2016)
North America	Floods	7-day high flow	**Both increase and decrease.**	1.5 and 2C warming	RCP4.5, RCP8.5	(Döll et al., 2018)

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North America	Floods	Direct flood damage, death toll and welfare loss	**Increase.**	1.5, 2, 3C warming	RCP8.5	(Dottori et al., 2018)
Boston, Massachusetts, Houston, Texas, Miami, Florida, Oklahoma	Floods	Flash flood index	**Increase.** Loss of road network 3-11%	2006-2100	RCP4.5, RCP8.5	(Kermanshah et al., 2017)
Mississippi river	Floods	Q10 discharge	**Increase.**	2006-2035, 2036-2065, 2070-2099	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Krysanova et al., 2017)
100 most populous cities in Canada	Floods	1/100, 1/250 flood	**Increase.** 40–60% of the analysed cities.	2061-2100	RCP4.5, RCP6.0, RCP8.5	(Gaur et al., 2019)
Delaware River Basin, USA	Floods	Peak flood discharge	**Increase.** -6% to 58%	2020-2099 compared to 1990-2009	RCP4.5, RCP8.5	(Woltemade et al., 2020)
Bronx River watershed in New York City	Floods	Q10 discharge	**Increase.** 54-110%	2030-2059	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Zahmatkesh et al., 2015)
USA	Groundwater	Groundwater recharge due to higher ET	**Decrease.** Trends were not reported numerically but descriptively	Not applicable	1.5, 2, and 4 °C	(Condon et al., 2020)
Central North America	Groundwater	GW recharge	**Decrease.** Slight Decrease trend at all GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
East North Africa	Groundwater	GW recharge	**Increase.** Slight Increase trends at all GWLs	2006-2099	1, 1.5, 2, and 3°C and RCP2.6, RCP6.0 and RCP8.5	(Reinecke et al., 2021)
USA Central Valley	Groundwater	GW storage	**Constant**	2006-2100	RCP8.5	(Wu et al., 2020)
USA Southern Plains	Groundwater	GW storage	**Decrease**	2006-2100	RCP8.5	(Wu et al., 2020)
USA	Groundwater	GW recharge	**Decrease.** Average declines of 10–20% in total recharge across the southern aquifers, consistent declines in all montane aquifers, and no change in northern aquifers	2050-2100	Various scenarios including A1, A1B, B1, B2, doubled CO2; RCP2.6 and RCP8.5	(Meixner et al., 2016)

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USA	Groundwater	GW recharge	**Decrease.** Trends were reported graphically using multiple graphs under various climate scenarios	1950-2099	RCP8.5	(Tillman et al., 2017)
Canada	Water Quality	Sediments, total phosphorus and nitrate-nitrogen	**Both increase and decrease**	until 2050	SRES A2	(Mehdi et al., 2015)
USA	Water quality	Total Suspended Solids, Total Phosphorous, Total Kjeldahl Nitrogen, Nitrate + Nitrite	**Both increase and decrease**	to 2050	NA	(Liu et al., 2016)
Southwest U.S.	SESL	Sediment yield	**Decrease.** On average, the mean sediment yield is expected to decrease in the future with a very high probability	2020-2050	SRES A1B	(Francipane et al., 2015)
Canada	SESL	Sediment yield	**Increase**	until 2100	RCP4.5, RCP8.5	(Shrestha and Wang, 2018)
USA	SESL	Sediment load	**Both increase and decrease**	until 2100	RCP2.6, RCP4.5, RCP6.0, RCP8.5	(Cousino et al., 2015)
Canada	Cryosphere	Snow cover and sea ice	**Decrease.** The multi-model consensus over the 2020–2050 period shows reductions in fall and spring snow cover fraction and sea ice concentration of 5–10 % per decade	2020-2050	RCP8.5	(Mudryk et al., 2018)
USA	Cryosphere	snow drought	**Increase.** The average frequency of consecutive snow drought years is projected to increase from 6.6% to 42.2% of years	2050-2079	RCP8.5	(Lute et al., 2015)
USA	Groundwater	GW recharge	**Increase.** GW recharge rates are projected to increase from 6 mm/year to 22 mm/year under the most extreme scenario	Indicative projected change	RCP2.6, RCP6.0 and RCP8.5	(McKenna and Sala, 2018)
USA	Water Quality	Nitrogen and phosphorus load	**Increase.** Annual-average pollutant loads increased by 9% to 12% with ensemble projected climate change.	2040-2071	RCP8.5	(Yasarer et al., 2017)
Canada	Water Quality	Groundwater nitrate concentration	**Increase.** 25 to 32 % increase in N-NO3 concentration under combined effects of climate and agricultural adaptation	2040-2069	SRES A2; SRES B2	(Paradis et al., 2016)

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USA	SESL	Sediment load	**Increase.** Sediment loads increased with projected climate change an average of 12%	2040-2071	RCP8.5	(Yasarer et al., 2017)
Canada	SESL	Sediment yield	**Decrease.** For 2015-2034, annual sediment yields decreased by 37% for the RCP 2.6 scenario and 62% for the RCP 8.5. For 2043-2062, sediment yields only decreased 13% for the RCP 2.6 scenario and 42% for the RCP 8.5 scenario.	2015-2034, 2043-2062	RCP2.6, RCP8.5	(Louiseize et al., 2014)
USA	SESL	Sediment yield	**Increase.** Mean annual watershed level sediment export increases 6.7% during the future period with considerable variability among models	2045-2068	SRES A2	(Wagena et al., 2018)
USA	SESL	Soil erosion	**Increase.** Projected trend: Increase (+116%)	2041-2070	RCP8.5	(Garbrecht and Zhang, 2015)

Table SM4.3: Observed Sectoral Impacts across regions

Region	Country	Observed climate hazard	Component of the water use sector is impacted	Water use sector impacted	Sectoral impact	Time period	Reference
Global		Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. Floods and extreme weather events and cyclones have affected acquaculture production through animal escapees and infrastructure damage.		(Beveridge et al., 2018)
		Soil moisture deficit and excess soil moisture (green water anomalies)	Yield loss	Agriculture	**Negative**. Maize and wheat production decreased by 12%–18% and 7%–12% respectively.	1982-2010	(Borgomeo et al., 2020)
		Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. Global mean yields of maize, wheat and soybeans reduced by 4.1, 1.8 and 4.5%, respectively. the estimates of average annual production losses throughout the world for the most recent years of the study (2005–2009) account for 22.3 billion USD (B$) for maize, 6.5 B$ for soybeans, 0.8 B$ for rice and 13.6 B$ for wheat.	1981-2010	(Iizumi et al., 2018)

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Inland and riverine floods (too much water)	Yield loss	Agriculture	**Negative**. Production losses due to droughts were associated with a reduction in both harvested area and yields, whereas extreme heat mainly decreased cereal yields.	1964-2007	(Lesk et al., 2016)
Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Water quality	Agriculture	**Negative**. Intensive precipitation may increase surface and subsurface runoff, which might be an intermediate contamination pathway of pathogens from manure at livestock farms and from grazing pastures. When crops are irrigated with this water, contamination might be Increase. Flooding as a result of extreme precipitation events can bring pathogens from surface water to fresh produce and might contaminate whole fields.		(Liu et al., 2013)
Changes in groundwater availability (too little water)	Water quantity	Agriculture	**Negative.** Livestock particularly in arid and semiarid region are mostly reared under extensive or traditional pastoral farming systems. The animals have different water requirements in different ambient temperatures. The requirement of water varies breed to breed according to their adaptability in a particular region and ambient temperature. Livestock of arid and semiarid region face the problem of water scarcity in most of the time of the year.		(Naqvi et al., 2015; Anderson et al., 2019)
Drought	Yield variability	Agriculture	**Negative**. We quantify how modes of climate variability contribute to crop production variance. We find that the El Ni√±o Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD), tropical Atlantic variability (TAV), and the North Atlantic Oscillation (NAO) together account for 18, 7, and 6% of globally aggregated maize, soybean, and wheat production variability, respectively	1980-2010	(Anderson et al., 2019)
Drought	Yield loss	Agriculture	**Negative**. Droughts are associated with worse child nutrition.	1990-2019	(Cooper et al., 2019)
Drought	Yield variability	Agriculture	**Negative**. cereals tended to be more drought resistant than legumes androot/tubers. The variability of yield reduction for cereals was	1980-2015	(Daryanto et al., 2017)

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					also lower in comparison to legume or root/tuber crops, probably due to the extensive and deep rooting system.	
		Drought	Yield variability	Agriculture	**Both Negative and Positive**. The results of a 100-member ensemble climate and crop simulation suggest that climate change has decreased the global mean yields of maize, wheat and soybeans by 4.1, 1.8 and 4.5%, respectively. rice, no significant impacts (−1.8%) are detected. The uncertainties in estimated yield impacts represented by the 90% probability interval that are derived from the ensemble members are −8.5 to +0.5% for maize, −8.4 to −0.5% for soybeans, −9.6 to +12.4% for rice and − 7.5 to +4.3% for wheat.	1981-2010	(Iizumi et al., 2018)
		Drought	Yield loss	Agriculture	**Negative**. approximately three-fourths of the global harvested areas—454 million hectares—experienced drought-induced yield losses over this period, and the cumulative production losses correspond to 166 billion U.S. dollars..	1983-2009	(Kim et al., 2019)
	USA, India, Russia, Canada	Drought	Yield loss	Agriculture	**Negative**. Between 1961 and 2006 it has been estimated that 25% yield loss occurred, with yield loss probability increased by 22% for maize, 9% for rice, and 22% for soybean in drought conditions.	1961-2016	(Leng and Hall, 2019)
		Drought	Yield loss	Agriculture	**Negative**. About 7% greater yield losses were due to more recent droughts (1985-2007) than from earlier droughts (1964-1984), with a 8-11% greater losses in high-income countries than in low-income ones	1964-2007	(Lesk et al., 2016)
		Drought	Yield variability	Agriculture	**Both Negative and Positive**. Impact of global climate change on yields of different crops from climate trends ranged from -13.4% (oil palm) to 3.5% (soybean).Climate variability accounts for 31-39% of observed yield variability.	1974-2000	(Ray et al., 2019)
		Water scarcity, Drought including soil moisture deficits (too little water)	Yield loss	Agriculture	**Positive.** our study maps and quantifies the productivity potential of sustainable irrigation expansion into rain-fed croplands	1996-2005	(Rosa et al., 2020)

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			that are economically water scarce. Sustainable irrigation expansion has the potential to increase food production without degrading terrestrial and aquatic habitats by claiming uncultivated land or environmental flows.		
Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Food insecurity	Agriculture	**Both Negative and Positive**. People widely report changes in the seasonality and predictability of weather (46% of localities, 96 countries).In addition to obvious detrimental consequences for agriculture (including altered cropping calendars and weed and pest cycles), such changes can affect fishing and hunting because these activities are often planned in conjunction with specific seasonal conditions or weather patterns.	1955-2005	(Savo et al., 2016)
Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. Floods are shown to lead to harvest failure, crop and fungal contamination.		(Uyttendaele et al., 2015)
Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield variability	Agriculture	**Negative**. growing season climate factors—including mean climate as well as climate extremes—explain 20%–49% of the variance of yield anomalies (the range describes the differences between crop types), with 18%–43% of the explained variance attributable to climate extremes, depending on crop type - maize and rice.	1961- 2008	(Vogel et al., 2019)
Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** Among coal fired power plants (CFFPs), 32% (625 GW) exhibit water scarcity for five or more months per year and 43% (830GW) of the world's CFPPs face regional water scarcity for at least one month per year.	2011-2015	(Rosa et al., 2020)
Drought	Energy	Hydroelectricity generation	**Negative.** The utilization rate of hydropower a was reduced by 5.2% during drought years, as compared to long-term average values.	1981-2010	(van Vliet et al., 2016a)

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	Drought	Energy	Thermoelectricity generation	**Negative.** The utilization rate of thermoelectric power was reduced by 3.8% during drought years, as compared to long-term average values.	1981-2010	(van Vliet et al., 2016a)
	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry period and a decrease of 1/1000 with heavy rainfall after wet periods.	2004-2012	(Carlton et al., 2014)
	Water quality	WaSH	Drinking water	**Negative**. Child diarrhoea was associated with 1-log10 higher faecal indicator bacteria concentrations in drinking water and on children's hands .	2005-2021	(Goddard et al., 2020)
	Natural disasters	WaSH	Women health	**Negative**. Women helalth is more vulnerable to disaster.		(Goodman, 2016)
Global	Heavy precipitation	Urban and Peri-Urban	Precipitation patterns	**Negative**. 17% of sites showed a statistically significant increase p-value <0.05.	1973-2012	(Mishra, 2015)
	Increased air temperature, acidification and hypoxia	Freshwater Ecosystems	Algal blooms, Ecosystem functioning	**Negative**. Thermal extremes, low dissolved oxygen, and low pH, biodiversity loss.		(Griffith and Gobler, 2020)
	Intense rainstorms, Warmer-than-average summer temperatures and low winds	Freshwater Ecosystems	Harmful algal blooms	**Negative**. Increased algal bloom events.		(Michalak, 2016)
	Increased air and water, soil erosion	Freshwater Ecosystems	Carbon storage and sequestration	**Negative**. Increase in methane emissions, reduced carbion storage and sequestrations.		(Moomaw et al., 2018)
	Increased air and water temperature, changes in stream flow	Freshwater Ecosystems	Species population dynamics	**Negative**. Mistmatch in estimated decline of fish populations, Salmonid abundance decreased in 89.5% of documented effects, with most evidence from North America and Europe and gaps in evidence elsewhere.	1985-2015	(Myers et al., 2017)
	Increased air temperature	Freshwater Ecosystems	Biodiversity loss, Methane emissions, Ecosystem functioning	**Negative**. 20 % increase in algal blooms, 5 % increase in toxic blooms, 4 % increase in Methane emissions; Increase trends in lake surface temperature by 0.72 degC/decade and 0.53 degC/decade for seasonally ice-covered and ice-free lakes respectively.	1985-2009	(O'Reilly et al., 2015)
	Increased air and water temperature.	Freshwater Ecosystems	Species range shifts	**Negative**. Upstream shift in freshwater fish. Decline in Atlantic salmon due to expansion		(Pecl et al., 2017)

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			of its predator, the northern pike in Finland, Unexpected emergence of Vibrio infections, a bacterial waterborne disease, in northern Europe due to changes in sea surface temperature, Poleward range shift in the coastal fish species, Argyrosomus coronus, from Angola into Namibia.		
Increased air and water, soil erosion, precipitation changes	Freshwater Ecosystems	Biodiversity loss, Methane emissions, Ecosystem functioning, ecosystem services, water quality	**Negative**. 81% of inland wetland species populations and 36% of coastal and marine species have declined.		(Ramsar Convention, 2018)
Increased air and water temperature, Reduction in the duration of ice cover, and the alteration of the seasonal duration of thermal stability or stratification of the water column	Freshwater Ecosystems	Species range shifts	**Negative**. Hybridization between freshwater species like invasive rainbow trout (Oncorhynchus mykiss) and native cutthroat trout (O. clarkia) and the coastal species like West Coast dusky cob (Argyrosomus coronus); temperature-dependent sex determination (TSD) of species in marine and terrestrial systems like Snake pipefish (Entelurus aequoreus) in the northeastern Atlantic, advances in the timing of annual phytoplankton blooms; Shifts in spawning times have been documented for 43 fish species in the northeast Pacific Ocean.		(Scheffers et al., 2016)
Increased air temperature, lowering wtaer tables, peat fires	Freshwater Ecosystems	Peat fires, carbon storage	**Negative**. deep-burning peat fies in Indonesia in 1997 and 1998 released approximately 0.95 Gt of carbon24,37, equivalent to ~15% of global fossil fuel emissions at that time.	1991-2010, 2081-2100	(Turetsky et al., 2015)
General climate impacts	Conflict	Deviations from normal precipitation and mild temperature	**Negative**. Increase risk of conflict.	From 10,000 BCE to 2013	(Hsiang and Burke, 2014)
General climate impacts	Conflict	Precipitations	**Positive**. Deviations from moderate temperatures and precipitation patterns systematically increase conflict risk.		(Burke et al., 2015)
Water security	Conflict	Transboundary conflict	**Positive**. country dyads governed by treaties with water allocation mechanisms exhibiting	1948-2001	(Dinar et al., 2015)

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			both flexibility and secificity evince more cooperative behaviour		
Drought	Mobility and Migration	Drought, conflict and refugee migration	**Both Negative and Positive**. A one (within-country) standard deviation decrease in the SPEI leads on average to an increase of approximately 0.03 in the probability of asylum seeking flows from the country experiencing this change in climatic conditions.	2006-2015	(Abel et al., 2019)
Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Negative**. Both climate variables show a positive and significant effect. More specifically, a 1° Celsius higher average temperature in the countries of origin is associated with a 1.9 percentage increase in migration flows between a country pair over one year. Further, a change in average precipitation in the countries of origin by 1 millimetre corresponds to a 0.5 percentage change in emigration flows.	1995-2006	(Backhaus et al., 2015)
Temperature anomalies	Mobility and Migration	Effects on migration	**Both Negative and Positive**. "a one percent increase in temperature increases international migration rates by 4% in middle-income countries, whereas it decreases emigration rates in poor countries by 16%, ceteris paribus. This implies a middleincome country with an average yearly temperature of 22 ◦ C(the average of our sample) would experience a 20% increase in the rate of emigration if its average yearly temperature increased by 1◦ (roughly a 5% increase)."	1960-2000	(Cattaneo and Peri, 2016)
General climate impacts	Mobility and Migration	Effects on migration	**Both Negative and Positive.**		(Cattaneo et al., 2019)
Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Positive**. We thus find that an increase in temperature over the trend, during a 10-year period, induces people especially from poor income countries to emigrate, an effect estimated with great precision.	1960-2010	(Falco et al., 2019)

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		other (specify)	Mobility and Migration	Internal Displacement due to disasters	**Positive.**	2008-2020	(IDMC., 2020)
		General climate impacts	Mobility and Migration	Weather changes and migration	**None**.	2003-2018	(Kaczan and Orgill-Meyer, 2020)
		Floods, droughts and other disasters	Mobility and Migration	Temperature and precipitation fluctuations and asylum applications to Europe	**Negative**. The change in the volume of applications is highly nonlinear: A 1°C warming results in a relative modest 6% increase in applications, but a 5°C warming leads to a 175% increase. Rainfall had no significant effect on asylum applications.	2000-2014	(Missirian and Schlenker, 2017)
		General climate impacts	Mobility and Migration	International environmental migration	**Both negative and positive**		(Obokata et al., 2014)
		Precipitation and temperature anomalies	Mobility and Migration	Climate variability effects on asylum applications to EU	**None**.	1999-2018	(Schutte et al., 2021)
	Ghana, Tanzania, Guatemala, Peru, Bangladesh, India, Thailand and Vietnam	Change in precipitation variability and extreme precipitation	Mobility and Migration	Effects on migration	**Both Negative and Positive.**		(Afifi et al., 2016)
Africa	Ethiopia	ENSO	Yield loss	Agriculture	**Both Negative and Positive**. ENSO is responsible for the 30 to 41% of wheat production variability.	1980-2010	(Anderson et al., 2019)
	Kenya, Tanzania	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Decreased and increased maize yield variability across contries.	1981-2010	(Iizumi and Ramankutty, 2016)
		Drought	Yield loss	Agriculture	**Negative**. Anthropogenic emissions increased the chances of October-December droughts over the region by 1.4 to 4.3 times and resulted in below average harvests in Zambia and South Africa.	2018	(Nangombe et al., 2020)
	Kenya	General climate impacts	Yield variability	Agriculture	**Negative**. Irrigation water availability has become more available and more sporadic negatively affecting agricultural production.	1980-2010	(Caretta and Börjeson, 2015)

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Rwanda, Kenya, Tazmania, Zimbabwe, Swaziland	Drought	Food insecurity, malnutrition, yield loss	Agriculture	**Negative**. Between 2006 to 2016 drought contributed to food insecurity and malnutrition in northern, eastern and southern Africa, Asia and the Pacific. In 36% of these nations ,Äì mostly in Africa ,Äì where severe droughts hit, undernourishment rose.	2006-2016	(Phalkey et al., 2015)
Madagascar, Togo, South Africa, Zimbabwe, Ghana, Tanzania	Drought	Yield variability	Agriculture	**Negative**. Maize and sugarcane yields decreased by 5.8% and 3.9%, respectively. In contrast, recent climate change caused yields to increase in the more heat- and drought-tolerant sorghum (0.7%) and cassava (1.7%). Maize yield losses are highest in South Africa (-22%), with the highest losses occurring in the provinces of The Free State and North West.	1974-2000	(Ray et al., 2019)
West Africa	Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. regional average yield reductions 10-20% for miller 5-15% for sourghum between 2000-2009. Loss of 2.33-4.02 BUSD for miller and 0-73-2.17 sorghum.	2000-2009	(Sultan et al., 2019)
Ghana	Rainfall variability	Energy	Hydroelectricity generation	**Negative.** Rainfall variability accounted for 21% of inter-annual variations in hydropower generation.	1970-1990	(Boadi and Owusu, 2019)
South Africa	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative**. In South Africa, 34GW of thermoelectric capacity face water scarcity for at least five months per year.	2011-15	(Rosa et al., 2020)
	Temperature and precipitation	WaSH	WaSH impacts on childhood diarrhoea	**Negative**. Monthly average temperature and monthly average rainfall were positively associated with the rate of childhood diarrhea, whereas the relative humidity was negatively associated with the rate of childhood diarrhea.	2013-2015	(Azage et al., 2017)
Zambia, Ghana, Tanzania	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry period and a decrease of 1/1000 with heavy rainfall after wet periods.	2004-2006	(Carlton et al., 2014)

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	Changes in precipitation; temperature	WaSH	Vector borne diseases	**Negative**. Increase vector borne diseases.		(Chinwendu et al., 2017)
	Floods	WaSH	Disaster vulnerability	**Negative**. 84% of households feeling that there is more rainfall now than before. 65% reported that their household has been affected by flooding disaster.		(Cissé et al., 2016)
Central African Republic Chad Congo DR, Ghana Kenya Ghana Togo Nigeria Sierra Leone Somalia South Sudan Sudan Swaziland Mauritania Tunisia Zimbabwe		WaSH	WaSH access impacts on child mortality	**Negative**. Living in a household where members did not usually use a flush toilet was associated with 9–12% greater relative risk of child death than living in a household where members usually used flush toilets; Those children born into communities with > 90% improved sanitation usage were 12% less likely to die than those born into communities with ≤20% usage. An increase in the odds of a child under five years of age being reported to have had diarrhoea in the previous two weeks (10–13%) was associated with children collecting water. Using unimproved drinking water supply compared to improved drinking water supply was associated with an increase in the odds of diarrhoea by 5%. Improved sanitation usage was associated with the odds of childhood diarrhoea reducing by 8% to 21% .	2009-2016	(Geere and Hunter, 2020)
DR Congo, Tanzania, Mozambique, Rwanda, Zambia, Kenya	Water quality	WaSH	Drinking water	**Negative**. Child diarrhoea was associated with 1-log10 higher faecal indicator bacteria concentrations in drinking water and on children's hands .	2005-2019	(Goddard et al., 2020)
Mozambique	Precipitation	WaSH	Malaria incidence	**Negative**. ENSO is the dominant driver of precipitation driving malaria incidence, but the SIOD [Subtropical Indian Ocean Dipole] is also an important driver of climate variability over the region. Two dominant spatio-temporal modes related to precipitation account for more than 80% of malaria variability.	2010-2017	(Harp et al., 2021)

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	Mozambique	Precipitation	WaSH	Diarrhoeal disease	**Negative**. One additional wet day per week was associated with a 1.86%, 1.37%, 2.09%, and 0.63% increase in diarrheal disease in Mozambique, northern, central, southern, and coastal regions, respectively	1997-2014	(Horn et al., 2018)
	Tanzania, Mozambique, Nigeria, South Africa, Malawi	Precipitation	WaSH	Drinking water	**Negative**. Fecal contamination in improved drinking water sources follows a statistically significant seasonal trend of greater contamination during the wet season that is consistent across fecal indicator bacteria, five source types, twelve Köppen–Geiger climate zones, and across both rural and urban areas.		(Kostyla et al., 2015)
	Ghana, Nigeria, Ethiopia, Uganda, Kenya, Tanzania, Malawi	Water insecurity (general)	WaSH	Water insecurity	**Negative**. 90% of women indicated that water insecurity impacted infant feeding; Water insecurity is associated with increased mental, emotional, and physical stress, particularly for women and caregivers	2017-2018	(Schuster et al., 2020)
		Precipitation and temperature	WaSH	Diarrhoeal disease	**Negative**. There is positive association between diarrhoeal incidence and high average temperature of 36 C and above and high cumulative monthly rainfall at 57 mm and above.	2011-2014	(Thiam et al., 2017)
	Malawi	Floods	WaSH	Water-induced disasters	**Negative**. Floods exacerbate poor WaSH conditions; coverage decreased from 65% to 51% as a result of damage from earthquakes and floods; increase WaSH-related diseases in hospitals.		(Wanda et al., 2017)
	Ghana, Nigeria, Ethiopia, Uganda, Kenya, Tanzania, Malawi	Water insecurity (general)	WaSH	Water fetching and health	**Negative**. 13% of respondents reported at least one water- fetching injury. Of 879 injuries, fractures and dislocations were the most commonly specified type (29.2%), and falls were the most commonly specified mechanism (76.4%). Where specified, 61.1% of injuries occurred to the lower limbs, and dangerous terrain (69.4%) was the most frequently reported context. Significant correlates included being female; rural or periurban	2017-2018	(Venkataramanan et al., 2020)

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				residence; higher household water insecurity scores and reliance on surface water or off-premise water sources that required queueing.		
	Lesotho	Rainfall, drought, water quality	WaSH	Water scarcity and psychological health	**Negative**. Insufficient supply and contamination. Half the respondents reported having fallen ill from drinking dirty water. All three water insecurity indicators correlated significantly with reported levels of depression, with access and cleanliness also exhibiting significant relationships with anxiety and overall reported levels of distress.	2011	(Workman and Ureksoy, 2017)
	South Africa	Drought	Urban and Peri-Urban	Water insecurity	**Negative**. by a factor of three, 95% confidence interval 1.5-6.	1930-2017	(Otto et al., 2018)
	Burkina Faso	Flood	Urban and Peri-Urban	Precipitation patterns	**Negative**. Increase recurrence of flooding in the Ougadougo region since the early 2000s due to urbanisation.	1961-2015	(Tazen et al., 2019)
	South Africa	Increased air temperature, Seasonal shifts in warming	Freshwater Ecosystems	Freshwater birds	**Negative**. Phenological shifts in migratory patterns of waterbirds.	1987–1991, 2007-2012	(Bussière et al., 2015)
	DR Congo	Drought	Conflict	Drought	**Negative**. Increase support for the use of political violence.		(von Uexkull et al., 2016)
		Perceived climate change, precipitation and temperature anomalies	Mobility and Migration	Perceptions of climate change and variability together with rainfall and temperature	**None**.	1988–2007	(de Longueville et al., 2020)
	Kenya, Uganda, Nigeria, Burkina Faso and Senegal	Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Both Negative and Positive**. With one unit increase in temperature the number of migrants sent per household increases 123 % in Uganda ($p = 0.008$), decreases 42 % in Kenya ($p = 0.003$), decreases 71 % in Burkina Faso ($p < 0.001$), and does not significantly change in Nigeria ($p = 0.35$) or Senegal ($p = 0.75$).	2004-2009	(Gray and Wise, 2016)
	South Africa	Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Negative**. A 10% relative increase in positive maximum temperature anomalies and in negative precipitation anomalies, or one percentage point increase in soil moisture, result in a percentage change in	1997-2001; 2007-2011	(Mastrorillo et al., 2016)

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				migration flow of about 1.9, 2.2 and 5 respectively. A 10% increase in positive precipitation anomalies increases migration flows by approximately 1% (albeit its effect is only marginally significant).		
Uganda, Malawi, Ethiopia, Tanzania	Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Positive**. One Standard deviation temperature increase --> 10% decline in out migration. One Standard deviation rainfall decrease --> 12% decline in out migration.	2009-2014	(Mueller et al., 2020)
Burkina Faso and Senegal	Precipitation and temperature anomalies	Mobility and Migration	Climate variability, agriculture and migration	**Both Negative and Positive**. For Burkina Faso, an increase of 10% in heatwave months (about 7 months across the 6-year observation period) led to a decline n the odds of an international move by 20% [...] for Senegal, an increase of 10% in months with excessive precipitation led to an approximately four times higher probability of international migration	1960-2010	(Nawrotzki and Bakhtsiyarava, 2017)
Tanzania	Natural disasters	Mobility and Migration	Droughts, floods, crop diseases and severe water shortages impacts on internal migration	**Negative**. Respondents who experienced drought or floods were 49 % less likely to migrate.	2008-2009	(Ocello et al., 2015)
Multiple	Drought and temperature anomalies	Mobility and Migration	Climate variability, conflict and displacement	**Both Negative and Positive**.	1963-2014	(Owain and Maslin, 2018)
Kenya	Water insecurity (general)	WaSH	Water insecurity	**Negative**. Water insecurity had a predictive effect on food security with greater depressive symptomatology t 21 months postpartum. One point increase in water insecurity associated with a 0.06 point increase in depression scores.	2014-2015	(Boateng et al., 2020)
Tanzania, Burundi, Sudan, South Afri-ca, Uganda, Zambia, Malawi, Nigeria,	Natural disasters	WaSH	Cholera risk and WaSH	**Both Positive and Negative**. WaSH is preventive of cholera - stat sig relationships with boiling, municipal/piped with no outbreak, rainwater, handwashing. Statistically significant relationships with untreated water , surface water open defecation , shared facilities.		(Jones et al., 2020)

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	Zimbabwe, Kenya, Cameroon, Ghana, Madagas-car Sierra Leo-ne Guinea-Bissau Guinea Zambia Kenya Democratic Republic of the Congo Ghana Senegal Ethiopia Ivory Coast Uganda South Africa Benin Rwanda Mozambique Cameroon The Gambia Zimbabwe Egypt	Water quality	WaSH	Wash impacts on childhood diarrhoea	**Positive**. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% ; piped water to premises of higher quality and continuous availability by 75% and 36%, respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting handwashing with soap by 30% vs. no intervention.	1970-2020	(Wolf et al., 2018)
Asia	China, India	ENSO	Yield variability	Agriculture	**Both Negative and Positive**. ENSO accounts for 26 and 25% of maize production variability but has a much smaller influence on wheat production because of extensive irrigation of wheat.	1980-2010	(Anderson et al., 2019)
	China, Bangladesh, Myanmar, Indonesia	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Across the whole continent a mixed of Both increase and decrease yield variability of maize, soybean, rice and wheat across the continent, even within the same countries between 1981-2010.	1981-2010	(Iizumi and Ramankutty, 2016)
	Bangladesh	Drought	Water scarcity	Agriculture	**Negative**. In 2009–2010, extreme weather caused late maturity of fish for breeding in Bangladesh. Fish farmers are struggling with	2009-2010	(Islam and Wong, 2017)

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				higher production costs due to water scarcity.		
China	Drought	Yield loss	Agriculture	**Negative**. In China the gap between rainfed and irrigated maize yield widened from 5% in the 1980s to 10% in the 2000s.	1980-2009	(Meng et al., 2016)
India, Bangladesh	Drought	Food insecurity, malnutrition, yield loss	Agriculture	**Negative**. Between 2006 to 2016 drought contributed to food insecurity and malnutrition in northern, eastern and southern Africa, Asia and the Pacific. In 36% of these nations ,Äì mostly in Africa ,Äì where severe droughts hit, undernourishment rose	2006-2016	(Phalkey et al., 2015)
China, Vietnam, Philippines, Turkey, Iran, Nepal, India, Bangladesh	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Climate change's impacts on crop yield and consumable calories in Asia are varied. In China, mean climate changes overall benefitted crop yields and increased consumable food calories in these ten crops by ~2% (or ~1% across all consumable food calories), though there are exceptions such as decreases in rice yields in Guangxi and Fujian or wheat yields in Sichuan and Guizhou.	1974-2000	(Ray et al., 2019)
China	Drought	Yield loss	Agriculture	**Negative**. Agricultural production has been affected by Increase droughts. Additionally, despite the Increasely active role of women in managing water during the drought, they are excluded from community-level decision-making about water.		(Su et al., 2017)
Cambodia, Laos, Myanmar, Thailand, Vietnam	Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. Important climate-related risks included rapid changes in temperature, intense rainfall events, and floods. Farmers who had experienced significant losses from any climate-related source were more concerned with risks. Women and higher educated farmers perceived higher risks.	1998-2018	(Lebel et al., 2020)
India	Water scarcity	Water scarcity	Agriculture	**Negative**. The livestock sector contributes 1.4 % of the world's gross domestic product (GDP) with 2.2 % growth rate over ten years (1995–2005). Globally livestock contribute 40 % of the agricultural GDP, but water		(Naqvi et al., 2015)

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				reserve in this globe is depleting day by day and prediction hints severe water scarcity in the near future.		
Nepal	Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. Farmers have modified traditional cropping patterns and calendar, changed crop varieties and increased fertilizer and pesticide applications in order to maintain crop yields. They have also sought off-farm employment. However, agricultural productivity in the area is declining and only one third of all households in the area were food secure.	1980-2009	(Shrestha and Nepal, 2016)
Nepal	Soil erosion and sediment load	Yield loss	Agriculture	**Negative**. Farmers reported increases in crop pests, hailstorms, landslides, floods, thunderstorms, and erratic precipitation as climate-related hazards affecting agriculture.	1979-2009	(Sujakhu et al., 2016)
India	Changes in precipitation including precipitation variability and extreme precipitation (too much water)	Yield loss	Agriculture	**Negative**. 81% of farmers experienced Decrease and unpredictable rain fall which led to crop failures, declining crops and livestock yields	1994-2011	(Varadan and Kumar, 2014)
China	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** China more than 30% of the installed capacity of coal fired power plants (CFFPs) faces water scarcity from March to October.	2011-15	(Rosa et al., 2020)
India	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** More than 40% of India's coal fired power plants (CFPP) capacity faces water scarcity in the dry season (December–June).	2011-15	(Rosa et al., 2020)
Central Asia	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1995,2001 and 2002 which were drought years.	1981-2010	(van Vliet et al., 2016a)
East Asia	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1998, 1999 which were drought years.	1981-2010	(van Vliet et al., 2016a)

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South Asia	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1983, 1992 which were drought years.	1981-2010	(van Vliet et al., 2016a)
Mediterranean	Drought	Energy	Thermoelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the year 2003 which was a drought year.	1981-2010	(van Vliet et al., 2016a)
East Asia	Drought	Energy	Thermoelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the year 1997which was a drought year.	1981-2010	(van Vliet et al., 2016a)
Bangladesh	Natural disasters	WaSH	Water-induced disasters	**Positive**. having experienced a typhoon women are better able to adapt eg collecting water from further away Thsi has negative impacts on family food security, women's occupation, women's health and sexual harassment of women and adolescent girls 89% of women cited lack of separate toilet and washroom facility in shelters as problem; 78% lack of freshwater supply.		(Alam and Rahman, 2014)
Nepal	Temperature and precipitation	WaSH	Diarrhoeal disease	**Negative**. Increases over monthly averages in temperature and rainfall increased monthly diarrhoea cases in Nepal 8.1%. Similarly, rainfall was found to have significant effect on the monthly diarrhoea count, with a 0.9% increase in cases for every 10mm increase in rainfall above the monthly cumulative value recorded within that month.		(Bhandari et al., 2020)
Afghanistan Bhutan Indonesia Iraq Vietnam Mongolia Nepal Pakistan Kazakhstan Lao PDR Lebanon	Water quality	WaSH	WaSH access impacts on child mortality	**Negative**. Living in a household where members did not usually use a flush toilet was associated with 9–12% greater relative risk of child death than living in a household where members usually used flush toilets; Those children born into communities with > 90% improved sanitation usage were 12% less likely to die than those born into communities with ≤20% usage. An increase in the odds of a child under five years of age being reported to have had	2009-2014	(Geere and Hunter, 2020)

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				diarrhoea in the previous two weeks (10–13%) was associated with children collecting water. Using unimproved drinking water supply compared to improved drinking water supply was associated with an increase in the odds of diarrhoea by 5%. Improved sanitation usage was associated with the odds of childhood diarrhoea reducing by 8% to 21% .		
India, Bangladesh, Cambodia	Water quality	WaSH	Drinking water	**Negative**. Child diarrhoea was associated with 1-log10 higher faecal indicator bacteria concentrations in drinking water and on children's hands .	2005-2020	(Goddard et al., 2020)
	Natural disasters	WaSH	Diarrhoeal disease	**Negative**. Floods were significantly associated with infectious diarrhea.	2004-2011	(Liu et al., 2018)
Bangladesh	Temperature and precipitation	WaSH	Diarrhoeal disease	**Negative**. Study found an 8% increase in the incidence of diarrheagenic E. coli for each 10C increase in mean monthly temperature.	1975	(Philipsborn et al., 2016)
Lebanon, Tajikistan, Pakistan, Nepal	Water insecurity (general)	WaSH	Water insecurity	**Negative**. 90% of women indicated that water insecurity impacted infant feeding; Water insecurity is associated with increased mental, emotional, and physical stress, particularly for women and caregivers.	2017-2018	(Schuster et al., 2020)
	Precipitation, drought	WaSH	Water insecurity	**Negative**. Springs have been drying up over the past decade due to decreased rainfall and increase dry seasons.		(Shrestha et al., 2019c)
Lebanon, Tajikistan, Pakistan, Nepal	Water insecurity (general)	WaSH	Water fetching and health	**Negative**. 13% of respondents reported at least one water- fetching injury. Of 879 injuries, fractures and dislocations were the most commonly specified type (29.2%), and falls were the most commonly specified mechanism (76.4%). Where specified, 61.1% of injuries occurred to the lower limbs, and dangerous terrain (69.4%) was the most frequently reported context. Significant correlates included being female; rural or periurban residence; higher household water insecurity scores and reliance on surface water or off-premise water sources that required queueing.	2017-2018	(Venkataramanan et al., 2020)

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	China	Heavy precipitation	Urban and Peri-Urban	Precipitation patterns	**Negative**. Long-term annual variations of maximum hourly precipitation in Shanghai increased significantly during the study period. The mean value of maximum precipitation intensity (2005-2014; 85.5mm h-1) was about 1.5 times higher compared to that in (1965-74; 57 mm h-1). Between 1981-2014, frequencies of local heavy rainfall events increased at a rate of 1.5 (10yr)-1, and frequencies of abrupt heavy rainfall events increased at a rate of 1.8 (10yr)-1.	1916-2014	(Liang and Gong, 2017)
	India	Heavy precipitation	Urban and Peri-Urban	Precipitation patterns	**Negative**. relatively small impact of climate change due to the impact of greenhouse gas increases being largely counteracted by those of aerosols.	1969-2013	(van Oldenborgh et al., 2017)
	China	Precipitation change, increased air temperature	Freshwater Ecosystems	Glacial melt, Lake extent changes	**Negative**. Rapid expansion in 79% of lakes on the central-northern plateau (with continuous permafrost), even without glacial contributions, while lakes fed by retreating glaciers in southern regions (with isolated permafrost) are relatively stable or shrinking.	1970-2010	(Li et al., 2014)
	China	Increased air and soil temperature	Freshwater Ecosystems	Permafrost thawing. Methane emissions	**Negative**. soil temperature as the most direct and positive control over wetland CH4 emission, increased methane emissions.	2016	(Sun et al., 2018)
		Drought	Conflict	Mobility and migration	**Positive**. The impact of climate change on conflict and asylum seeking flows is limited to specific time periods and contexts.	2006-2015	(Abel et al., 2019)
	Bangladesh	Floods	Mobility and Migration	Effects on migration	**Both Negative and Positive**. Quantification NA	2014	(Bernzen et al., 2019)
	Bangladesh	Floods, temperature and precipitation anomalies	Mobility and Migration	Effects on migration	**Both Negative and Positive**. Individuals have 17% lower odds of migrating in a month of flooding than in a month without flooding.	1986-2003	(Call et al., 2017)
	Bangladesh	Floods, temperature and precipitation anomalies	Mobility and Migration	Warm spells, dry spells, wet spells, intense precipitation and contextual factors like agricultural	**Both Negative and Positive**. Dry spells are most strongly and reliably associated with migration; a one standard deviation increase in the duration of dry spells is associated with a 20% increased risk in the odds of making a first domestic trip. […] A one	1973-2012	(Carrico and Donato, 2019)

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			livelihoods, social ties, migration	standard deviation increase in the duration of dry spells is associated with a 27% increase in the probability of making a first international move.		
	Bangladesh	Floods, poor water quality (salinity)	Mobility and Migration	Effects on migration	**Both Negative and Positive**. Going from quintile 1 to quintile 2 (or 5) for soil salinity increases the likelihood of internal migration by 1.6 (or 1.36) percentage points […] going from quintile 1 to quintile 4 (or 5) for salinity decreases international migration by 0.41 (or 0.53) percentage points.	2003-2011	(Chen and Mueller, 2018)
	India	Drought and flood	Mobility and Migration	Effects on migration	**Negative**. One additional month of drought increases the bilateral migration rate by 1.7% at the 5% level of significance.	1991-2001	(Dallmann and Millock, 2017)
	Bangladesh	General climate impacts	Mobility and Migration	Slow onset natural hazards and migration	**Both Negative and Positive**. Quantification NA		(Kabir et al., 2018)
	Vietnam	Perceived climate change	Mobility and Migration	Perceptions of climate change and variability together with rainfall and temperature	**Both Negative and Positive**. Quantification NA	2013	(Koubi et al., 2016)
	Nepal	Increased temperature, precipitation	Cultural, Indigenous and Traditional Uses	Decrease snow, increased snowmelt	**Negative**. Indigenous Gurung herders reported water scarcity in traditional water sources such as streams and wells along traditional livestock migration routes. As a result of these changes, they have changed their routes and camp locations.	2011-2013	(Gentle and Thwaites, 2016)
	India	Increased temperatures	Culturan, Indigenous and Traditional Uses	Decrease snowfall	**Negative**. Dokpa herders reported that pasture conditions have deteriorated due to shallower snowpack, shorter winters and erratic rainfall, which has impacted sheep populations. As a result of these changes, Dokpa herders are replacing traditionally important sheep with yaks, which are more tolerant to poor-quality pasturage.	2011-2013	(Ingty, 2017)
	Nepal	Increased temperatures; increased precipitation	Culturan, Indigenous and	Glacier retreat; decreased permanent snow cover	**Negative**. Manangi villagers reported a deep sense of spiritual loss associated with the decline of mountain snows and the receding	2011	(Konchar et al., 2015)

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			Traditional Uses		glacier, which some attributed to a lack of spiritual devotion.		
	Nepal	Increased temperatures; increased precipitation	Culturan, Indigenous and Traditional Uses	Glacier retreat; decreased permanent snow cover	**Negative**. Manangi villagers reported a deep sense of spiritual loss associated with the decline of mountain snows and the receding glacier, which some attributed to a lack of spiritual devotion.		(Mukherji et al., 2019)
	Tibet Autonomous Region, People's Republic of China	Increased temperatures	Culturan, Indigenous and Traditional Uses	Glacier melt	**Negative**. Due to the expansion of the majority of large lakes on the Tibetan Plateau, herders in Jagshung Village have lost large areas of pastures to inundation. As a result, the quality of nearby feed has also deteriorated, which has led to reduced livestock populations and productivity.	2015-2016	(Nyima and Hopping, 2019)
	India Bangladesh Philippines Thailand Vietnam Pakistan Iran	Natural disasters	WaSH	Cholera risk and WaSH	**Both Positive and Negative**. WaSH is preventive of cholera - stat sig relationships with boiling, municipal/piped with no outbreak, rainwater, handwashing. Statistically significant relationships with untreated water , surface water open defecation , shared facilities.		(Jones et al., 2020)
	China Bangladesh India Afghanistan Cambodia Vietnam Philippines Pakistan Saudi Arabia Yemen Thailand Uzbekistan	Water quality	WaSH	Wash impacts on childhood diarrhoea	**Positive**. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% ; piped water to premises of higher quality and continuous availability by 75% and 36%, respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting handwashing with soap by 30% vs. no intervention.	1970-2019	(Wolf et al., 2018)
Australasia	Australia	ENSO	Yield variability	Agriculture	**Both Negative and Positive**. ENSO is responsible for the 30 to 41% of wheat production variability.	1980-2010	(Anderson et al., 2019)
	Australia	Changes in precipitation including precipitation variability and extreme	Yield loss	Agriculture	**Both Negative and Positive**. Water-limited yield potential declined by 27% over a 26 year period from 1990 to 2015. We attribute this decline to reduced rainfall and to rising temperatures while the positive effect of	1990-2015	(Hochman et al., 2017)

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	precipitation (too much water)			elevated atmospheric CO2 concentrations prevented a further 4% loss relative to 1990 yields.		
Australia	Drought	Yield loss	Agriculture	**Negative**. Forage and herd characteristics were significantly affected by drought intensities and durations. Series of consecutive dry years are not unusual in northern Queensland as exemplified by the periods 1992–1996, 2001–2004 and 2013–2015, which showed annual precipitations below 500 mm.	1992-2015	(Godde et al., 2019)
Australia	Drought	Yield variability	Agriculture	**Negative**. Significant increase in wheat yield variability between 1981-2010.	1981-2010	(Iizumi and Ramankutty, 2016)
Papa New Guinea	Drought	Yield loss	Agriculture	**Negative**. Between 2006 to 2016 drought contributed to food insecurity and malnutrition in northern, eastern and southern Africa, Asia and the Pacific. In 36% of these nations ,mostly in Africa where severe droughts hit, undernourishment rose.	2006-2016	(Phalkey et al., 2015)
Australia	Drought	Yield variability	Agriculture	**Negative**. ~ 9% reduction in current Australian wheat yields. Reductions in barley, maize, sorghum and soybean yields, but overall increases in rapeseed, rice, and sugarcane yields. Climate change reduced Australian consumable crop calorie production in the ten crops by ~6% (or ~-3% in overall calories) annually.	1974-2000	(Ray et al., 2019)
Australia	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative**. In Australia, 12 GW of thermoelectric capacity face water scarcity for at least five months per year	2011-15	(Rosa et al., 2020)
Australia	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 2003 which was a drought year	1981-2010	(Rosa et al., 2020)
Pooled including Australia,	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry	2004-2008	(Carlton et al., 2014)

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	New Zealand, Fiji,				period and a decrease of 1/1000 with heavy rainfall after wet periods.		
	Micronesia, Papua New Guinea, Marshall Islands	Natural disasters	WaSH	Cholera risk and WaSH	**Both Positive and Negative**. WaSH is preventive of cholera - stat sig relationships with boiling, municipal/piped with no outbreak, rainwater, handwashing. Statistically significant relationships with untreated water , surface water open defecation , shared facilities.		(Jones et al., 2020)
	Australia	Increased air temperature, Increased nutrients	Freshwater Ecosystems	Species richness	**Negative**. Decline in macroinvertebrates and fish species.	2002-2010	(Mantyka-Pringle et al., 2014)
Central and South America	Dominican Republic Haiti	Water quality	WaSH	Wash impacts on childhood diarrhoea	**Positive**. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% ; piped water to premises of higher quality and continuous availability by 75% and 36%, respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting handwashing with soap by 30% vs. no intervention.	1970-2018	(Wolf et al., 2018)
	Colombia, Haiti, Peru Ecuador El Salvador	Natural disasters	WaSH	Cholera risk and WaSH	**Both Positive and Negative**. WaSH is preventive of cholera - stat sig relationships with boiling, municipal/piped with no outbreak, rainwater, handwashing. Statistically significant relationships with untreated water , surface water open defecation , shared facilities.		(Jones et al., 2020)
	Brazil Guatemala Panama Bolivia Puerto Rico Argentina Peru Honduras	Water quality	WaSH	Wash impacts on childhood diarrhoea	**Positive**. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% ; piped water to premises of higher quality and continuous availability by 75% and 36%, respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting handwashing with soap by 30% vs. no intervention.	1970-2017	(Wolf et al., 2018)

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Brazil,	ENSO	Yield variability	Agriculture	**Both Negative and Positive**. above median precipitation leads to above normal yields for maize and soybeans but lower yields for weath.	1980-2010	(Anderson et al., 2019)
Argentina	Drought	Yield variability	Agriculture	**Negative**. Increased maize, rice and wheat yield variabilty between1981-2010.	1981-2010	(Iizumi and Ramankutty, 2016)
Guatemala, Panama, Honduras, Belize, Uruguay, Venezuela, Brazil, Argentina, Paraguay, Cuba, Dominican Republic, Ecuador, Bolivia	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Major losses in consumable food calories have occurred in the Dominican Republic, Ecuador, Bolivia, Uruguay and Venezuela whereas in Brazil, Argentina Paraguay and Cuba consumable food calories overall increased.	1974-2000	(Ray et al., 2019)
Brazil	Changes in precipitation, changes in streamflow	Energy	Hydroelectricity generation	**Negative.** In Brazil, during drought events in 2016 and 2017, hydropower plants operated with an average capacity factor of only 23% and 17% respectively).	1961-1990	(de Jong et al., 2018)
Southern Central Amercia	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 2006,which was drought year	1981-2010	(van Vliet et al., 2016a)
Pooled including Peru, Ecuador and global tropics	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry period and a decrease of 1/1000 with heavy rainfall after wet periods.	2004-2009	(Carlton et al., 2014)
Argentina, Belize, Santa Lucia, Jamaica, Barbados, Costa Rica	Water quality	WaSH	WaSH access impacts on child mortality	**Negative**. Living in a household where members did not usually use a flush toilet was associated with 9–12% greater relative risk of child death than living in a household where members usually used flush toilets; Those children born into communities with > 90% improved sanitation usage were 12%	2009-2015	(Geere and Hunter, 2020)

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	Cuba Suriname				less likely to die than those born into communities with ≤20% usage. An increase in the odds of a child under five years of age being reported to have had diarrhoea in the previous two weeks (10–13%) was associated with children collecting water. Using unimproved drinking water supply compared to improved drinking water supply was associated with an increase in the odds of diarrhoea by 5%. Improved sanitation usage was associated with the odds of childhood diarrhoea reducing by 8% to 21% .		
	Colombia	Water quality	WaSH	Drinking water	**Negative**. Child diarrhoea was associated with 1-log10 higher faecal indicator bacteria concentrations in drinking water and on children's hands .	2005-2021	(Goddard et al., 2020)
	Guatemala, Haiti, Colombia, Bolivia, Mexico,	Water insecurity (general)	WaSH	Water insecurity	**Negative**. 90% of women indicated that water insecurity impacted infant feeding; Water insecurity is associated with increased mental, emotional, and physical stress, particularly for women and caregivers	2017-2018	(Schuster et al., 2020)
	Guatemala, Haiti, Colombia, Bolivia	Water insecurity (general)	WaSH	Water fetching and health	**Negative**. 13% of respondents reported at least one water- fetching injury. Of 879 injuries, fractures and dislocations were the most commonly specified type (29.2%), and falls were the most commonly specified mechanism (76.4%). Where specified, 61.1% of injuries occurred to the lower limbs, and dangerous terrain (69.4%) was the most frequently reported context. Significant correlates included being female; rural or periurban residence; higher household water insecurity scores and reliance on surface water or off-premise water sources that required queueing.	2017-2018	(Venkataramanan et al., 2020)
	Brazil	Drought	Urban and Peri-Urban	Water insecurity	**Negative**. more likely driven by water use changes and accelerated population growth.	1941-2015	(Otto et al., 2015)

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	Mexico and USA	Change in precipitation variability and extreme precipitation	Mobility and Migration	Effects on migration	**Positive**. A 20% point higher-than-normal level of rainfall leads to a predicted 10.3% decrease in migration.	1998-2005	(Barrios Puente et al., 2016)
	Bolivia	Changes in cryosphere	Mobility and Migration	Effects on migration	**Both Negative and Positive**.		(Raoul, 2015)
	Costa Rica	Natural disasters	Mobility and Migration	Effects on migration	**Both Negative and Positive**. An additional emergency in the canton of origin would increase emigration rates to another canton by 0.0010 percentage points of the total population in the canton of origin.	1995-2000	(Robalino et al., 2015)
	Multiple	Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Both Negative and Positive**. Each month of exposure to negative temperature shocks is associated with a 9.9% increase in the odds of inter-province moves to urban destinations, with a corresponding positive effect of an approximately 3.6% for each month of exposure to positive temperature shocks. Effects vary between countries and demographic characteristics.	1970-2011	(Thiede et al., 2016)
	Peru	Increased temperatures; reduced rainfall; Increase rainfall variability	Culturan, Indigenous and Traditional Uses	Decreased snow and ice	**Negative**. Pastoralists reported water scarcity in traditional water sources along migration routes. As a result, women pastoralists had to herd livestock farther to find water. Pastoralists also reported the deterioration of pasture due to Decrease water availability.	2007-2020	(Postigo, 2020)
	Bolivia	Increased temperatures	Culturan, Indigenous and Traditional Uses	Glacier loss	**Negative**. Decrease rain and snow have led to degraded and dry peatland pastures (bofedales). This reduction of pasture contributes to out-migration, over-grazing, and the loss of ancestral practices and community commitment to pasture management.	1986-2017	(Yager et al., 2019)
Europe	Scandinavia, Balkans	ENSO	Yield variability	Agriculture	**Both Negative and Positive**. Climate variability accounts for ~14% of winter wheat production variance in Europe.	1980-2010	(Anderson et al., 2019)
	United Kingdom, Spain, France, Italy, Sweden, Finland,	Changes in precipitation including precipitation variability and extreme	Yield variability	Agriculture	**Both Negative and Positive**. Crop failures in Northern and Eastern Europe, higher than usual yields in Southern Europe.	1901-2018	(Beillouin et al., 2020)

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	Germany, Denmark, Belgium, Netherlands, Luxemborg	precipitation (too much water)				
		Changes in precipitation	Yield variability	Agriculture	**Both Negative and Positive**. A longer growing season, arising from warmer temperatures, allows a greater number of vegetables to be cultivated, contributing to greater annual yields. However, some vegetables need a period of cold accumulation to produce a harvest.	1990-2017	(Bisbis et al., 2018)
		Drought	Yield loss	Agriculture	**Negative**. Cereal yields decreased by 9-7.3%, non cereal yields decreased by 3.8-3-1%. These losses intensified by 3% per year.	1961-2018	(Brás et al., 2021)
	France, Ukraine	Drought	Yield variability	Agriculture	**Negative**. Increased maize, rice and wheat yield variabilty between 1981-2010.	1981-2010	(Iizumi and Ramankutty, 2016)
		Drought	Yield loss	Agriculture	**Negative**. Sensitivity analysis shows that temperature plays an important role in determining drought impacts, through reducing or amplifying drought-driven yield loss risk. Compared to present conditions, an ensemble of 11 crop models simulated an increase in yield loss risk by 9%,12%, 5.6%,6.3%, 18.1%, 19.4% and 15.1%,16.1 for wheat, maize, rice and soybeans by the end of 21st century, respectively, without considering the bene!ts of CO2 fertilization and adaptations.	1961-2016	(Leng and Hall, 2019; Ray et al., 2019)
	Spain, Ukraine, Russia, Germany, UK	Drought	Yield loss	Agriculture	**Negative**. Yields for all the dominant (non-tropical) crops in western and southern Europe decreased 6.3–21.2% because of climate change.	1974-2000	(Ray et al., 2019)
		Changes in precipitation; increased frequency and intensity of extreme heat	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** On extreme days (p99), almost 50% (7GWe) of freshwater thermal capacity is unavailable.	1975-2004	(Byers et al., 2020)

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	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** in Europe, where at least 20% of coal fired power plants (CFFPs) capacity faces water scarcity from June to September.	2011-15	(Rosa et al., 2020)
Russia	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** In Russia, 8 GW of thermoelectric capacity face water scarcity for at least five months per year.	2011-15	(Rosa et al., 2020)
Poland	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** In Poland, 8 GW of thermoelectric capacity face water scarcity for at least five months per year.	2011-15	(Rosa et al., 2020)
Germany	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** In Germany, 7 GW of thermoelectric capacity face water scarcity for at least five months per year	2011-15	(Rosa et al., 2020)
Switzerland	Changes in cryosphere	Energy	Hydroelectricity generation	**Positive.** Since 1980, 3.0%–4.0% (1.0–1.4 TWh yr−1) of Switzerland's hydropower production was directly provided by the net glacier mass loss.	1980-2010	(Schaefli et al., 2019)
	Drought	Energy	Hydroelectricity generation	**Negative.** Reduction in useable hydropower capacities by −6.6% during drought year of 2003 in Europe.	2003	(van Vliet et al., 2016a)
Northern Europe	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1983,1989 and 2003 which were drought years.	1981-2010	(van Vliet et al., 2016a)
Mediterranean	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1985,1986 and 2005 which were drought years	1981-2010	(van Vliet et al., 2016a)
	Drought	Energy	Thermoelectricity generation	**Negative.** Reduction in useable thermoelectric capacities by −4.7% during drought year of 2003 in Europe.	2003	(van Vliet et al., 2016a)

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Northern Europe	Drought	Energy	Thermoelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1991 and 2003 which were a drought years	1981-2010	(van Vliet et al., 2016a)
Pooled including England, Wales, Scotland, Netherlands, 10 country study in Europe	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry period and a decrease of 1/1000 with heavy rainfall after wet periods.	2004-2010	(Carlton et al., 2014)
Bosnia and Herzegovina Belarus Moldova Montenegro Serbia Ukraine	Water quality	WaSH	WaSH access impacts on child mortality	**Negative**. In households where women carried the water the relative risk of child death was 1.05 (95% confidence intervals 1.02–1.08). Where men carried the water, the risk was similar (1.04, 95%CI 1.00–1.07); Living in a household where members did not usually use a flush toilet was associated with 9–12% greater relative risk of child death than living in a household where members usually used flush toilets; Those children born into communities with > 90% improved sanitation usage were 12% less likely to die than those born into communities with ≤20% usage. "An increase in the odds of a child under five years of age being reported to have had diarrhoea in the previous two weeks (10–13%) was associated with children collecting water, but not with adults collecting water, when compared to households in which no one collects water; Using unimproved drinking water supply compared to improved drinking water supply was associated with an increase in the odds of diarrhoea by 5%. Use of an improved or unimproved toilet and open defecation in comparison to a flush toilet was also associated with an increase in the	2009-2017	(Geere and Hunter, 2020)

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					odds of diarrhoea, with improved toilets associated with a greater comparative increase (16%) than unimproved toilets (11%) or open defecation (5%). Improved sanitation usage was associated with the odds of childhood diarrhoea reducing by 8%, 13% and 21% in the > 60–80, > 80–90 and > 90% categories of coverage respectively"		
	Netherlands	Precipitation change	Urban and Peri-Urban	Precipitation patterns	**Negative**. Identified a consistent year-round precipitation enhancement of about 7% downwind of urban areas along the Dutch west coast.	1951-2010	(Daniels et al., 2016)
	Denmark, Greenland	Increased air temperature	Freshwater Ecosystems	Permafrost thawing, Release of Methane and other GHGs in atmosphere	**Negative**. Significant northward expansion of the southern limit of permafrost, permanent temperature increase in permafrost upper layers.		(Minayeva et al., 2016)
	Russia	Extreme climate events (precipitation, heat waves and flows	Freshwater Ecosystems	Permafrost thawing, Changes in streams drainage and aquatic habitats	**Negative**. Changes in competitiveness and resilience of some species.		(Nilsson et al., 2015)
	Finland and Norway	Cryosphere changes	Culturan, Indigenous and Traditional Uses	Harder and deeper snow cover; increased ice formation; flooding	**Negative**. Changes in the quality of winter pastures (especially decreased access to forage and the amount of forage) have increased the number of working hours and altered reindeer herding practices.	2007-2008	(Forbes et al., 2019)
	Finland and Norway	Harder and deeper snow cover; increased ice formation; flooding rivers and wet ground	Culturan, Indigenous and Traditional Uses	Harder and deeper snow cover; increased ice formation; flooding	**Negative**. Changes in the quality of winter pastures (especially decreased access to forage and the amount of forage) have increased the number of working hours and altered reindeer herding practices. Rainy summers increase the difficulty of gathering and moving reindeer to round-up sites and limit hay production for supplementary winter feed	1980s-2010s	(Rasmus et al., 2020)
North America	United States, Mexico	ENSO	Yield variability	Agriculture	**Both Negative and Positive**. El Nino leads to increase precipitation and affects positively wheat, maize and soybean yields, the reverse happens with la Nina.	1980-2010	(Anderson et al., 2019)
	United States	Changes in precipitation including	Water quantity	Agriculture	**Positive**. Agricultural intensification increases the potential for	1910-2007	(Mueller et al., 2016)

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	precipitation variability and extreme precipitation (too much water)			evapotranspiration, leading to cooler temperatures and contributing to increased precipitation.		
United States	Drought	Yield loss	Agriculture	**Negative**. Since 1978,crop yield declines were reported on 11-21% of total irrigated acres, mostly due to surface water shortage.	1978-2012	(Elias et al., 2016)
United States	Drought	Yield variability	Agriculture	**Positive**. Decreased maize, rice and wheat variability between 1981-2010.	1981-2010	(Iizumi and Ramankutty, 2016)
United States, Canada	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Overall in the United States barley, rice and wheat yields reduced whereas maize, sorghum, soybean and sugarcane yields increased.	1974-2000	(Ray et al., 2019)
USA	Drought	Yield variability	Agriculture	**Both Negative and Positive**. Between 2007 and 2007 yields maize and soybeans have increased, but meteorological drought has been associated with 13% of overall yield variability, but not in areas where irrigation is prevalent.	1958-2007	(Zipper et al., 2016)
USA	Changes in precipitation; Increased frequency and intensity of extreme heat	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** In the US, social costs of water scarcity between 2001-2012 was estimated to be US$330,000 (at 2015 value) per month for every power plant that experienced water scarcity.	2001-2012	(Eyer and Wichman, 2018)
USA	Water scarcity	Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** In the United States, at least 20% of coal fired power plants (CFFPs) CFPP capacity faces water scarcity from April to November.	2011-15	(Rosa et al., 2020)
	Drought	Energy	Hydroelectricity generation	**Negative.** Reduction in useable capacities by −6.1% in hydropower a due to 2007 drought in eastern North America.	2007	(van Vliet et al., 2016a)
Western North America	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1988, 2001 and 2002 which were drought years.	1981-2010	(van Vliet et al., 2016a)
Central North America	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 1988, which was drought year.	1981-2010	(van Vliet et al., 2016a)

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Eastern North America	Drought	Energy	Hydroelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the years 2001 and 2007 which were drought years.	1981-2010	(van Vliet et al., 2016a)
	Drought	Energy	Thermoelectricity generation	**Negative.** Reduction in useable capacities by −9.0% in thermoelectric power due to 2007 drought in eastern North America.	2007	(van Vliet et al., 2016a)
Western North America	Drought	Energy	Thermoelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the year 1981 which was a drought year.	1981-2010	(van Vliet et al., 2016a)
Eastern North America	Drought	Energy	Thermoelectricity generation	**Negative.** Utilisation rates were reduced significantly ($p<0.05$) compared to the average over 1981–2010 in the year 2007 which was a drought year.	1981-2010	(van Vliet et al., 2016a)
Pooled including Canada	Precipitation	WaSH	Rainfall effects on diarrhoeal disease	**Both Negative and Positive**. The model predicts a 1.5/1000 increase in diarrhoea for each week with heavy rainfall after a dry period and a decrease of 1/1000 with heavy rainfall after wet periods.	2004-2011	(Carlton et al., 2014)
Canada	Water quality	WaSH	Gastrointestinal illness	**Negative**. Most common exposure reported to gastrointenstinal illnness are municipal water and bottled water as drinking sources (71·8% and 57·0%, respectively).	2009-2020	(David et al., 2014)
USA	Precipitation	WaSH	Gastrointestinal illness	**Negative**. Combined sewer overflows to drinking water sources increase hospital visits up to 13% for gastrointestinal illness lasting up to 15 days after heavy periods of rainfall; stronger associations for children and the elderly.	2003-2007	(Jagai et al., 2015)
Canada	Water scarcity	WaSH	Water quantity	**Positive.** Domestic rainwater harvesting in an Inuit community increased consumption of water for general purposes (i.e., personal hygiene, washing clothes and dishes, and household cleaning, not drinking water) by 17%, reduced water retrieval efforts by 40.92%, improved perceptions of psychological health, and resulted in savings of $12.70 CDN per household per week. Community design improvements (hose pipe	2016	(Mercer and Hanrahan, 2017)

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				into house, better placement of systems, tie downs against winds) improved accessibility		
	Mexico	Water insecurity (general)	WaSH	Water insecurity	**Negative**. 90% of women indicated that water insecurity impacted infant feeding; Water insecurity is associated with increased mental, emotional, and physical stress, particularly for women and caregivers	2017-2018	(Schuster et al., 2020)
	Mexico	Water insecurity (general)	WaSH	Water fetching and health	**Negative**. 13% of respondents reported at least one water- fetching injury. Of 879 injuries, fractures and dislocations were the most commonly specified type (29.2%), and falls were the most commonly specified mechanism (76.4%). Where specified, 61.1% of injuries occurred to the lower limbs, and dangerous terrain (69.4%) was the most frequently reported context. Significant correlates included being female; rural or periurban residence; higher household water insecurity scores and reliance on surface water or off-premise water sources that required queueing.	2017-2021	(Venkataramanan et al., 2020)
	Mexico	Water quality	WaSH	Wash impacts on childhood diarrhoea	**Positive**. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% ; piped water to premises of higher quality and continuous availability by 75% and 36%, respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting handwashing with soap by 30% vs. no intervention.	1970-2016	(Wolf et al., 2018)
	USA	Heavy precipitation	Urban and Peri-Urban	Precipitation patterns	**Negative**. The presence of urban land cover influences the position of the storm cell (100–200 km rainfall feature) thereby producing greater rainfall over the urban center. Thus, Urban land cover mainly influences the spatial features of the storm by favoring rainfall in the vicinity of the urban area.	2007-2008	(Ganeshan and Murtugudde, 2015)

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	USA	Heavy precipitation	Urban and Peri-Urban	Precipitation patterns	**Negative**. Statistically significant ($p<0.001$) anomalies in daily precipitation were found over (3.4), east (3.2) and northeast (3.4) of Atlanta during summer.	2002-2015	(McLeod et al., 2017)
	USA	Flood	Urban and Peri-Urban	Urban discharge	**Negative**. Climate change alone has increased peak discharge by about 20%; CC and urbanisation combined increased peak discharge by 84%.	1900-2017	(Sebastian et al., 2019)
	USA	Flood	Urban and Peri-Urban	Precipitation patterns	**Negative**. probability of an event has increased by a factor of 1.4 due to radiative forcing.	1971-2015	(Wiel et al., 2017)
	Canada, USA	Increased air and water temperatures	Freshwater Ecosystems	Lake water temperature	**Negative**. shallow (1 m depth) lakes have warmed substantially over the last 30 years (2.4°C), with MABT above freezing 5 of the last 7 years.	1969-2015	(Arp et al., 2016)
	Canada	Increased air temperature	Freshwater Ecosystems	seasonal snow cover, mountain glaciers, permafrost, freshwater ice cover, and river discharge.	**Negative**. Mountain glaciers to recede at all latitudes, permafrost to thaw at its southern limit, and active layers over permafrost to thicken.	1950-2010	(DeBeer et al., 2016)
	USA	Global warming, increase in shrubification	Freshwater Ecosystems	Species range shifts of American Beaver (Castor canadensis)	**Positive**. Shift in species range to higher latitudes in tundra habitat.	2015	(Jung et al., 2016)
	Canada	Increased air temperature	Freshwater Ecosystems	Permafrost thawing, Release of Methane and other GHGs in atmosphere	**Negative**. Significant northward expansion of the southern limit of permafrost, permanent temperature increase in permafrost upper layers.		(Minayeva et al., 2016)
	Canada	Climatic: Extreme climate events (precipitation, heat waves and flows	Freshwater Ecosystems	Permafrost thawing, Changes in streams drainage and aquatic habitats	**Negative**. Changes in competitiveness and resilience of some species.		(Nilsson et al., 2015)
	Canada	Increased air and water temperature, extreme events, general climate change impacts	Freshwater Ecosystems	Fish Community composition and diversity	**Negative**. loss of coldwater refugia, mismatches between environmental phenology and life history, and increased competition from eurythermal species.		(Poesch et al., 2016)
	Canada	Increased air temperature, droughts, wildfires	Freshwater Ecosystems	Vegetation community	**Negative**. reductions in stem density and conifer seedling dominance leading to a lowered overall conifer biomass in wetlands	1984-2016	(Whitman et al., 2019)

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	Mexico and USA	Precipitation and temperature anomalies	Mobility and Migration	Effects on migration	**Both Negative and Positive**. A one standard deviation unit increase in warm spell duration leads to an increase of the odds of international migration by 15% while a one standard deviation unit increase in wet spell duration leads to an increase in the odds of an international move by 5%.	1986-1999	(Nawrotzki et al., 2015)
	USA	Increased temperatures	Culturan, Indigenous and Traditional Uses	Increase temperature of freshwater lakes; permafrost melt; thinning ice	**Negative**. In Alaska, permafrost melting and the shorter ice season make it more difficult for hunters to access traditional hunting grounds. Increased temperatures are changing the habitats and migration patterns of culturally important freshwater species. Declining fish health and populations threaten requirements of treaty rights and tribal shares of harvestable fish populations.	2006-2018	(Albert et al., 2018)
	Canada	Increased temperature, precipitation	Culturan, Indigenous and Traditional Uses	Early snowmelt	**Negative**. Inuit in Labrador, Canada, are grieving the rapid decline of culturally significant caribou, which is partly due to rising temperatures in the circumpolar north and the associated changes to caribou habitat and migration. In addition, the decline of this species is negatively affecting their sense of cultural identity because of the importance of hunting and cultural continuity.		(Cunsolo, 2017)
	Canada	Cryosphere changes	Culturan, Indigenous and Traditional Uses	Changing ice conditions	**Negative**. Trail access models showed that overall land and water trail access in the Inuit Nunangat had been minimally affected by temperature increase between 1985 to 2016. However, these findings illustrate that although Inuit are developing new trails and alternative forms of transport, these changes could negatively impact cultural identity and well-being.	2015-2017	(Ford et al., 2019)
	Canada	Increased temperatures	Culturan, Indigenous and Traditional Uses	Flooding	**Negative**. The timing and extent of spring flooding have changed, which, combined with inadequate infrastructure, has increased the frequency and risk of flooding for the Kashechewan community. Earlier snowmelt has also affected the migration patterns of	2016	(Khalafzai et al., 2019)

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					migratory birds and reduced the duration of traditional hunting and harvesting camps for culturally important species.		
	USA	Increased temperatures	Culturan, Indigenous and Traditional Uses	Increase temperature of freshwater lakes; permafrost melt; thinning ice	**Negative**. In Alaska, permafrost melting and the shorter ice season make it more difficult for hunters to access traditional hunting grounds. Increased temperatures are changing the habitats and migration patterns of culturally important freshwater species. Declining fish health and populations threaten requirements of treaty rights and tribal shares of harvestable fish populations		(Norton-Smith et al., 2016)
Small Islands	Fiji	Sea level rise	Culturan, Indigenous and Traditional Uses	Flooding, indundation and salt-water intrusion	**Negative**. As a consequence of climate change-induced relocation, villagers of Vunidogoloa have experienced profound spiritual predicament and detachment from their customary lands.	2016	(Charan et al., 2017)
	Fiji	Sea level rise	Culturan, Indigenous and Traditional Uses	Coastal erosion; inundation	**Negative**. Villagers of Viti Levu identified concerns related to how climate change, particularly sea level rise, was affecting their cosmology and cultural traditions.		(du Bray et al., 2017)
	Tuvalu	Sea level rise	Culturan, Indigenous and Traditional Uses	Coastal erosion; inundation	**Negative.** Tuvaluan residents experience distress in the form of anxiety, tiredness and sadness in response to climate change-related impacts on livelihoods as well as the threat of displacement and cultural loss.	2015	(Gibson et al., 2019)
	Fiji	Sea level rise	Culturan, Indigenous and Traditional Uses	Coastal erosion; inundation	**Negative**. Villagers of Viti Levu have experienced significant sadness at the prospect of losing traditions in the face of climate change.	2020	(McNamara et al., 2021)
	Tuvalu	Sea level rise	Culturan, Indigenous and Traditional Uses	Coastal erosion; inundation	**Negative.** Fears of cultural loss were resulting in anxiety and sadness.	2020	(McNamara et al., 2021)
	Fiji	Sea level rise	Culturan, Indigenous and	Flooding, indundation and salt-water intrusion	**Negative**. Although villagers of Vunidogoloa felt their sense of community had strengthened during and since their (climate change-induced) relocation, the	2017	(Piggott-McKellar et al., 2019)

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			Traditional Uses		move away from the ocean has impacted spiritual ties as the ocean is an important part of village culture.	
	Fiji	Sea level rise	Culturan, Indigenous and Traditional Uses	Coastal erosion; inundation	**Negative**. Villagers were concerned their ties to land were disrupted by relocation. The relocation of the village to a steep hillside had an adverse psychological impact on less-mobile elders, hindering them from fully participating in social and relgious activities.	(Yates et al., 2021)

Table SM4.4: Projected Sectoral Risks across regions

Region	Country(ies)	Water use sector	Component of the water use sector	Projected risks	Projected period	Scenario/ Degree of warming	Models/ Methods	Reference
Global		Agriculture	Irrigation water demand	**Both Negative and Positive**. If environmental protection is implemented, limitation to irrigation water occur; demand generally projected to increase.	1995-2045	socio-economic scenarios	MAgPIE	(Bonsch et al., 2015)
		Agriculture	Rainfed agriculture	**Positive**. 41% increase in land suitable for rainfed agriculture in temperate drylands.	2070-2099	RCP8.5	CMIP5	(Bradford et al., 2017)
		Agriculture	Irrigation water demand	**Positive**. Doubling of irrigation water-demand by 2095.	2005-2095	Own scenarios within GCAM model	GCAM	(Chaturvedi et al., 2015)
		Agriculture	Yield loss	**Negative**. Water limitations will likely reduce yields across regions and crops, necessitating investments in infrastructure.	2011-2099	RCP8.5	ISI-MIP Fast-Track	(Elliott et al., 2014)
		Agriculture	Water scarcity of croplands	**Negative**. 11% +/-5% increase in water scarcity risk.	2050	SSP2	Various land cover projections; CMIP5 GCMs	(Fitton et al., 2019)
		Agriculture	Water scarcity of agricultural lands	**Negative**. 10% +/-5% increase in water scarcity risk.	2050	SSP2	Various land cover projections; CMIP5 GCMs	(Fitton et al., 2019)

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Agriculture	Irrigation water demand	**Positive**. Required irrigation water demand to meet food security above safe operating space for water security.	2050	GFWS platform	GFWS platform	(Grafton et al., 2015)
Agriculture	Livestock water demand	**Positive**. from 18 km3/year in 2005 to 24– 63 km3/year.	2095	GCAM, own scenarios	GCAM	(Hejazi et al., 2014)
Agriculture	Irrigation water demand	**Positive**. from 2481 km3/year in 2005 to 3830–9182 km3/year.	2095	GCAM, own scenarios	GCAM	(Hejazi et al., 2014)
Agriculture	Irrgation water consumption	**Positive**. 14% increase in irrigation water demand driven by climate change.	2090	RCP6.0	GCAM; WATCH; ISIMIP	(Huang et al., 2019)
Agriculture	Cotton production	**Both Negative and Positive**. Decrease in virtual water content with full Co2 fertilisation; increase without.	2011-2099	All RCPs	LPJmL model; ISIMIP fast-track	(Jans et al., 2018)
Agriculture	Expected annual output losses	**Negative**. EAOL approx. 16%.	2024 to 2027 (30yr centered)	1.5°C	Lisflood; asset damage assessment; MRIA model	(Koks et al., 2019)
Agriculture	Expected annual output losses	**Negative**. EAOL approx. 17%.	2033-2039 (30 yr centered)	2°C	Lisflood; asset damage assessment; MRIA model	(Koks et al., 2019)
Agriculture	Expected annual output losses	**Negative**. EAOL approx. 20%.	2053-2061 (30yr centered)	3°C	Lisflood; asset damage assessment; MRIA model	(Koks et al., 2019)
Agriculture	Yield loss	**Negative**. Projected increase in yield loss risk for wheat, maize, rice and soybeans by the end of 21st century, respectively. Yield loss risk tends to grow faster when experiencing a shift in drought severity.	2071-2100	RCP8.5	ISI-MIP Fast-Track	(Leng and Hall, 2019)
Agriculture	Irrigation water demand	**Positive**. Increase irrigation water demand to compensate climate change - depending on crop and Co2 fertilisation as low as 3% increase for some projections.	2081-2100	RCP4.5	CMIP5	(Levis et al., 2018)

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Agriculture	Irrigation water demand	**Positive**. Increase irrigation water demand to compensate climate change - depending on crop and Co2 fertilisation as high as 23% increase for some projections.	2081-2100	RCP8.5	CMIP5	(Levis et al., 2018)
Agriculture	Yield change (CO2-fert.)	**Positive**. 3% yield gain.	2061-2080	RCP4.5	CMIP5	(Ren et al., 2018)
Agriculture	Yield change (CO2-fert.)	**Positive**. 8% yield gain.	2061-2080	RCP8.5	CMIP5	(Ren et al., 2018)
Agriculture	Yield change (NO-CO2-fert.)	**Negative**. 16% yield loss.	2061-2080	RCP4.5	CMIP5	(Ren et al., 2018)
Agriculture	Yield change (NO-CO2-fert.)	**Negative**. 23 % yield loss.	2061-2080	RCP8.5	CMIP5	(Ren et al., 2018)
Agriculture	Growing season change	**Negative**. Increase heat extremes and drought during growing season.	2091-2100	RCP2.6	CMIP5	(Ruane et al., 2018)
Agriculture	Growing season change	**Negative**. Increase heat extremes and drought during growing season; 1.5°C and 2°C.	2091-2100	RCP4.5	CMIP5	(Ruane et al., 2018)
Agriculture	Yield change (CO2-fert.)	**Both Negative and Positive**. Positive for wheat and maize; no water limitations taken into account.	2091-2100	1.5°C	CMIP5	(Schleussner et al., 2018)
Agriculture	Yield change (CO2-fert.)	**Both Negative and Positive**. Negative in tropical regions. No water limitations to crops taken into account.	2091-2100	2°C	CMIP5	(Schleussner et al., 2018)
Energy	Thermoelectric. Freshwater demand for thermo-electric cooling	**Negative.** 2 °C result in EC water withdrawals changing between −10% and 611% relative to base year (2000) conditions.	2000 to 2100	2°C	Different GCM ensembles	(Fricko et al., 2016)
Energy	Hydroelectricity generation	**Both negative and positive.** +5% to -5% increase or decrease by 2080s.	2080s (End of century)	RCP8.5	Different GCM ensembles	(Turner et al., 2017)

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Energy	Hydroelectricity generation	**Positive.** Global gross hydropower potential is expected to increase between +2.4% (GCM-GHM ensemble mean for RCP 2.6) and +6.3% (RCP 8.5) for the 2080s compared to 1971–2000.	1971-2000 (baseline) to 2080s	RCP 2.6 and 8.5	Different GCM ensembles	(van Vliet et al., 2016a; van Vliet et al., 2016b; van Vliet et al., 2016c)
Energy	Thermoelectric generation	**Negative.** Reductions in usable capacity 81–86% of the thermoelectric power plants worldwide.	Baseline: 1971–2000; Endline: 2040-2069	RCP 2.6 and 8.5	Different GCM ensembles	(van Vliet et al., 2016a; van Vliet et al., 2016b; van Vliet et al., 2016c)
Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** Global mean cooling water discharge capacity is projected to decrease by 4.5-15% (2080s).	1971-2000 (baseline) to 2080s	RCP 2.6 and 8.5	Different GCM ensembles	(van Vliet et al., 2016a; van Vliet et al., 2016b; van Vliet et al., 2016c)
Energy	Hydroelectricity generation	**Negative.** Reductions in usable capacity for 61–74% of the hydropower plants.	Baseline: 1971–2000; Endline: 2040-2069	RCP 2.6 and 8.5	Different GCM ensembles	(van Vliet et al., 2016a)
Energy	Thermoelectric. Freshwater availability for thermo-electric cooling	**Negative.** Global cooling water sufficiency is projected to decline by -7.9% to -11.4% by 2040-2069 and -11.3% to -18.6% by 2070-90.	2040-69 and 2070-90	RCP 8.5 SSP2	Different GCM ensembles	(Zhou et al., 2018)
WaSH	Water-related diseases	**Negative**. Sunlight, temperature, and microbial grazing are among the environmental factors promoting the inactivation of viral pathogens in surface waters.				(Carratalà et al., 2020)
WaSH	Disease and death	**Negative**. Compared with a future without climate change, the following additional deaths are projected for the year 2030: 38 000 due to heat exposure in elderly people, 48 000 due	2030-2050	SRES A1B		(WHO, 2014)

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				to diarrhoea, 60 000 due to malaria, and 95 000 due to childhood undernutrition.				
		Urban and Peri-Urban	Surface-water deficit	**Negative**. 27% of cities studied will experience surface-water deficits.	1971-2000 (Baseline); 2050 (Future)	RCP6.0; SSP2	5 GCMs associated with RCP6.0 and SSP2; 482 cities	(Flörke et al., 2018)
		Urban and Peri-Urban	Water demand	**Negative**. 44% of cities vulnerable due to increased agricultural and urban water demands.	2010-2040	does not account for climate change	City Water Map Initiative; global databases (71 cities)	(Padowski and Gorelick, 2014)
		Urban and Peri-Urban	Water demand	**Negative**. 50 to 250% increase in water demand depending on scenario by 2050	2010-2050	SSP1-5; RCP4.5 and RCP6.0;	SSP1-5; RCP4.5 and RCP6.0; H08; PCR-GLOBWB; WaterGAP	(Wada et al., 2016)
	Global	Freshwater Ecosystems	Climatic vulnerability of ray-finned fishes (Actinopterygii)	**Negative**. Change in fish thermal sensitivity, reduced warming tolerance for many freshwater fishes across the Northern Hemisphere, lowest warming tolerances in the oceans are projected for tropical fishes, Freshwater basins located in southern Europe, southeast North America and central Asia highlighted for conservation priority, highest projected physiological sensitivity of the marine faunas, especially in the tropical eastern Pacific, central and western Indo-Pacific.	Modern day (1951–2000) and future climate (2061–2080) scenarios	RCP8.5	In-situ observations, Multi-climate-model ensembles	(Comte and Olden, 2017)
	Global	Freshwater Ecosystems	Species population dynamics	**Negative**. 35.7% of studies reporoted projected negative effects	Not provided	Several papers used different scenarios.	Systematic review	(Myers et al., 2017)
	Global	Freshwater Ecosystems	Species range shifts	**Negative**. Skipjack tuna is projected to become less abundant in western, and more abundant in eastern,	Mid-Late century (2050, 2100)	Several papers used different scenarios.	Systematic review	(Pecl et al., 2017)

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			areas of the Western and Central Pacific Ocean (WCPO).				
	Global	Freshwater Ecosystems	Lake nutrient dynamics	**Negative**. 2 °C leads to a net increase in CH4 emissions by 101 –183% in hypereutrophic lakes and 47 –56% in oligotrophic lakes	Not applicable	Simulation of lake reponses to hypothetical values of temperature increase	In situ measurements, linear mixed effect models	(Sepulveda-Jauregui et al., 2018)
	Global	Freshwater Ecosystems	Lake stratification	**Negative**. Under the highgreenhouse-gas-emission scenario, stratification will begin 22.0 ± 7.0 days earlier and end 11.3 ± 4.7 days later by the end of this century. Accelerated lake deoxygenation with subsequent effects on nutrient mineralization and phosphorus release from lake sediments.	Historic period (1901-2005), Future period (2006-2099)	RCP2.6; RCP6.0; RCP8.5	In situ observations, Multi-model ensemble under the ISIMIP phase 2b (ISIMIP2b) lake sector	(Woolway et al., 2021)
		Conflict	Transboundary waters	**Negative**. Combination of climate and population growth dynamics is expected to impact negatively on overall hydro-political risk.	2050-2100	5 GCMs from CMIP5 and two RCP scenarios (RCP4.5 and 8.5)	Future scenarios of 2050-2100 were calculated by using the multi-model mean of the daily temperature and precipitation estimated from 5 GCM's belonging to the Coupled Model Intercomparison Project Phase 5 (CMIP5) considering two different emission and radiative forcing scanrioes RCP 4.5 and 8.5 for the 15 years period before the reference time	(Farinosi et al., 2018)

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	Conflict	WaSH	**Negative**. Urban water demand will increase by 80% by 2050, while climate change will alter the timing and distribution of water.	2041-2070	5 GCMs associated with RCP6.0 and SSP2	Integrated global water modelling framework	(Flörke et al., 2018)
	Conflict	General climate impacts	**Positive**. SSPs with high investments in broad societal development are associated with the largest reduction in conflict risk.	2014-2100	SSP1-5	Simulation of future civil conflict using new scenario data for five alternative socioeconomic pathways	(Hegre et al., 2016)
	Conflict	Transboundary waters	**Negative**. Population under water stress is expected to increase by 50% under a low population growth and emissins scenario SSP1-RCP2.6) and double under a high population growth and emission scenario (SSP3-RCP6.0) compared to year 2010.	2010-2050	RCP2.6 and RCP6.0	Ensemble of four global hydrological models forceed by five global climate models and the latest greenhouse-gas concentration (RCP) and socioeconomic pathway (SSP) scenario to assess the impact of these drivers on transboundary water stress in the past and in the future	(Munia et al., 2016)
Multiple	Mobility and Migration	Temperature and precipitation fluctuations	**Negative**. Increased asylum applications by between 0.098 million (RCP4.5) and 0.66 million (RCP8.5) per year.	2100	RCP 4.5, RCP 8.5	Data on asylum-seekers from UNHCR, weather Data from University of Delaware (Baseline) and Berkeley Earth, projected weather data: NEX-GDDP, NASA's Socioeconomic Data Applications Center: Gridded Population of the World (GPW) v4, population and GDP data from CIA world Factobook, share of the population that is	(Missirian and Schlenker, 2017)

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							working in agriculture from World Bank, Corruption data from Transparency International, Conflict data from UCDP/PRIO (v4).	
	Multiple	Mobility and Migration	Climate related disasters	**Negative**. Increase, between 31 and 143 million IDPs by 2050.	2020-2050	SSP2 and SSP4, RCP 2.6 and RCP 8.5	Model of slow-onset climate impacts in relation to projections of future population distribution	(Rigaud et al., 2018)
Africa	Kenya	Agriculture	Tea production impacts	**Both Negative and Positive**. Decrease under most models and scenrios, increases for some.	2069-2099	All RCPs	LPJmL model; ISIMIP fast-track	(Beringer et al., 2020)
		Agriculture	Irrigation	**Negative**. Irrigation potential of the water- shed is projected to be at least halved by mid-century in all scenario combinations.	2040, 2090	RCP2.6	CMIP5	(Duku et al., 2018)
		Agriculture	Yield loss	**Negative**. Projected decrease in maize yield is mainly caused by increased temperature and reduced growing season rainfall, which resulted in a shortened growing period of maize by 9-22 %.	2040-2069	RCP8.5	CSIRO-MK3-6-0, CanESM2, HadGEM2-ES	(Kassie et al., 2015)
	Malawi	Agriculture	Yield loss	**Negative**. Rainfed maize production in the Lilongwe District of Malawi is projected to decrease up to 14 % by mid-century due to climate change, rising to as much as 33 % loss by the century.	2050, 2090	SRES B1	AR4 model ensemble	(Msowoya et al., 2016)
	East &Central Africa	Energy	Hydroelectricity generation	**Positive.** Around 3-4 studies in this systematic review shows increase in NT (2030s)-MC (2050s) and 1	2010-2039 (2030s, Near Term NT) and 2040-69	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)

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			study shows increase in EC in East Africa (2080).	(Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)			
Northern Africa	Energy	Hydroelectricity generation	**Negative.** 3 studies project decreases in NT-MC, and 2 studies project decreases in NC.	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)
Southern Africa (Zambezi Basin)	Energy	Hydroelectricity generation	**Negative.** Decline by 10–20% under a drying climate.	1948-2008 (baseline)-2010-2070 (endline)	Different GCM ensembles	Different GCM ensembles	(Spalding-Fecher et al., 2017)
	WaSH	Water-related diseases	**Negative**. There will be an increase in the incidence rate of measles, diarrheal cases, guinea worm infestation, malaria, cholera, cerebro-spinal meningitis and other water related diseases due to the current climate projections and variability.	2020-2080		Review study	(Asante and Amuakwa-Mensah, 2015)
Tanzania	Urban and Peri-Urban	Water shortage (due to groundwater decline)	**Negative**. Increase of urban footprint will reduce groundwater recharge by 23%. With climate change, groundwater recharge may fall 30-44% by 2050.	2015-2050	RCP8.5	Observations; LULC; WetSpass-M; databases; RCP8.5	(Olarinoye et al., 2020)
Africa	Freshwater Ecosystems	Spcecies life history disruption, range shifts, Species	**Negative**. Approximately 80% of fish species in Africa will experience substantially different hydrologic regimes	Current (1961–1990),	Several papers used different scenarios.	Systematic review	(Knouft and Ficklin, 2017)

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			Assemblages and Novel Interactions	in 2050, high frequency of range shifts in southeastern Australia	Midcentury (2041–2070)			
		Conflict	Agriculture	**Negative**. Growing population and rising temperatures will lead to higher levels of violence if political rights do not improve. If political rights continue to improve at the same rate as observed over the last three decades, there is reason for optimisms that overall levels of violence will hold steady or even decline in Africa, in spite of projected population increases and rising temperatures.	1980-2012	SSP1-5	Climate-sensitive approach to model sub-Saharan African violence in the past (geolocated to the nearest settlements) and then forecast future violence using sociiopolitical factors such as population size and politilca rights coupled with temperature anomalies	(Witmer et al., 2017)
Asia	China, India	Agriculture	Tea production impacts	**Positive**. Increase under assumption of no water limitations.	2069-2099	All RCPs	LPJmL model; ISIMIP fast-track	(Beringer et al., 2020)
	Indonesia, Sri Lanka, Bangaldesh	Agriculture	Tea production impacts	**Both Negative and Positive**. Decrease under most models and scenrios, increases for some.	2069-2099	All RCPs	LPJmL model; ISIMIP fast-track	(Beringer et al., 2020)
	China	Agriculture	Drought	**Negative**. Increased drought will pose additional challenges to the agricultural productivity in the dry regions where water shortage is already severe and at a time when irrigation is expected to become more important to stabilize and in-crease food production for a growing population.	2020-2049	RCP8.5	ISI-MIP Fast-Track	(Leng et al., 2015)
	Iran	Agriculture	Rainfed agriculture	**Both Negative and Positive**. Regional increases in green water for humid regions; decreases in green	2041-2070	All RCPs	CMIP5	(Shahsavari et al., 2019)

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			water and increase in drought severity in dry areas.				
Nepal	Agriculture	Agricultural damage area due to flooding	**Negative**. Increase in flood damage area for paddy rice up to 50%.	2075-2099	RCP8.5	MRI-AGCM3.2S for precipitation projections; RRI model for flood projections	(Shrestha et al., 2019a)
Phillipines	Agriculture	Agricultural damage area due to flooding	**Negative**. Increase in flood damage area for paddy rice up to 16%.	2075-2099	RCP8.5	MRI-AGCM3.2S for precipitation projections; RRI model for flood projections	(Shrestha et al., 2019a)
Cambodia and Vietnam	Agriculture	Agricultural damage area due to flooding	**Negative**. Increase in flood damage area for paddy rice up to 23%.	2075-2099	RCP8.5	MRI-AGCM3.2S for precipitation projections; RRI model for flood projections	(Shrestha et al., 2019a)
Thailand	Agriculture	Agricultural damage area due to flooding	**Negative**. Increase in flood damage area for paddy rice up to 13%.	2075-2099	RCP8.5	MRI-AGCM3.2S for precipitation projections; RRI model for flood projections	(Shrestha et al., 2019a)
Indonesia	Agriculture	Agricultural damage area due to flooding	**Negative**. Increase in flood damage area for paddy rice up to 55%.	2075-2099	RCP8.5	MRI-AGCM3.2S for precipitation projections; RRI model for flood projections	(Shrestha et al., 2019a)
India	Energy	Hydroelectricity generation	**Both negative and positive.** Due to the projected increase in precipitation, hydropower production (up to +25%) is projected to rise under the future climate. However, hydropower production is projected to decline in snow dominated hydropower projects due to cryospheric melting.	2040–2069	RCP 8.5	Different GCM ensembles	(Ali et al., 2018)
Eastern, Southern and Southeastern Asia	Energy	Hydroelectricity generation	**Positive.** Around 3 studies in this systematic review shows increase in NT (2030s)-MC (2050s) and 1 study shows increase in EC (2080).	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s),	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)

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				2070-99 (2080s, End of the century EC)			
Eastern and Southeast Asia	Energy	Thermoelectric generation	**Positive.** 2 studies project increases by EC.	2070-99 (2080s, End of the century EC)	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)
China	Energy	Hydroelectricity generation	**Negative.** The total changes of hydropower output caused by climate factors by 2100 under the RCP8.5, RCP4.5 and RCP2.6 scenarios are 153.29 billion kWh, 67.49 billion kWh and 22.10 billion kWh, respectively.	2100	RCP 2.6, 4.5 and 8.5	Different GCM ensembles	(Fan et al., 2018)
Southeast Asia, Mekong Basin	Energy	Hydroelectricity generation	**Negative.** The hydropower generation decreases by 49.82%, 20.48% and 56.21% under the sce- narios of 1.5 ◦C (RCP2.6), 1.5 ◦C (RCP6.0) and 2 ◦C (RCP6.0), sepa- rately, compared to the historical period.	Time horizons correspondin g to 1.5°C is 2036 under RCP2.6 and in 2033 under RCP6.0; 2°C in 2056 under RCP6.0.	1.5°C and 2°C warming	Different GCM ensembles	(Meng et al., 2021)
	Energy	Thermoelectric generation	**Negative.** Coal power plants annual usable capacity factor in Mongolia, Southeast Asia, and parts of China and India are projected to decrease due to water constraints.	NA	2°C warming	Different GCM ensembles	(Wang et al., 2019b)
	Freshwater Ecosystems	Water quality	**Both Negative and Positive**. Deterioration of the microbial water quality (E. coli, enterococci) (+75% by the 2090s) due to socio-economic changes, such as	2031-2050, 2081-2100	SSP3	Water quality model (MIKE21FM-ECOLab).	(Islam et al., 2018a)

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			higher population growth, and changes in rainfall patterns. However, microbial water quality improves with improved sewage treatment (-98% by the 2090s).				
	Indonesia	Urban and Peri-Urban	Flooding	**Negative**. Median increase in flood risk of 183% in 2030 compared to baseline conditions.	2012-2030	RCP2.6; RCP4.5; RCP6.0; RCP8.5	GCMs, RCPs	(Budiyono et al., 2016)
	Southeast Asia	Freshwater Ecosystems	Ecosystem shifts, loss of critical freshwater habitat and species	**Negative**. Loss of cloud forests in the Andes, Snow and glacier melt in the Andes (reduced streamflow at high altitudes during the dry season), Marine and coastal regime shifts in Southeast Asia, Degradation of tropical coral reefs, Overfishing and pollution (inorganic nitrogen loads in the rivers of Southeast Asia are expected to rise nearly 20% by 2030 in pessimistic scenarios), Sea-level rise is projected to contribute about 10%–20% of the total estimated losses of mangroves on Pacific Islands by the end this century (Gilman et al. 2008) and up to 80% of the wetland losses in areas throughout Southeast Asia.	Mid-Late century (2050, 2100)	Several papers used different scenarios.	Systematic review	(Leadley et al., 2014)
	Bangladesh	Mobility and Migration	Sea level rise	**Negative**. 0.9 million people (by year 2050) to 2.1 million people (by year 2100) could be displaced by direct inundation.	2050-2100	RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5	Elevation data from SRTM, population data from Gridded Population of the World (GPWv4) dataset.	(Davis et al., 2018)

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	Philippines	Cultural, Indigenous and Traditional Uses	Increased risk of water deficit	**Negative**. Increases in future wet season rainfall pose increase risks of excess surface water runoff and potential for soil erosion, which may cause the collapse of Ifugao rice terraces. Reductions in future dry season rainfall and warmer temperatures indicate significant water deficits during the growing season of local tinawon rice.	2014-2016 compared to 2041-2050; 2091-2100	RCP4.5; RCP8.5	Hydrological model; GCMs	(Soriano and Herath, 2020)
	China	WaSH	WASH-related diseases (diarrhoea, malaria, dengue, Japanese encephalitis) (DALYs)	**Negative**. Climate change is projected to delay China's rapid progress towards reducing WaSH-attributable infectious disease burden by 8–85 months. From 2008 to 2030 climate change is projected to slow the rate of decrease in diarrhoeal disease burden by 6.5% under RCP 2.6 and 8.9% under RCP 8.5, between 2008 and 2030 climate change slows the rate of decrease in vector-borne disease burden by 21.2% under RCP 2.6 and by 27.8% under RCP 8.5. These delays amount to more than 400,000 DALYs lost that would have been prevented by climate change mitigationassuming linear increases in WASH infrastructure.	2020 (2018–2022); 2030 (2028–2032)	HadGEM2-ES model outputs for the four representative concentration pathway (RCP) scenarios were used to project semidecadal provincial temperature deviation (Td)		(Hodges et al., 2014)
Australasia	Australia	Urban and Peri-Urban	Water shortage risk	**Negative**. As future demand on the reservoir system increases from 0.7 to 0.9 of	1961-1990 (Baseline);	RCP2.6; RCP4.5;	CMIP5; Australian Water Availability Project (observations)	(Henley et al., 2019)

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			observed annual average inflow, the severe water supply shortage risk at 2C of global warming increases rapidly (without desalination). At an annual demand of 0.75 of mean inflow, median water supply shortage risk is 0.6% with 90th percentile limits of [0.1%, 4.3%] at 1.5C of warming. This increases to 2.9% [0.1%, 12.1%] at 2C of warming. At the higher demand level of 0.85, median water supply shortage risk is 9.6% [3.8%, 24.4%] at 1.5C, and 20.4% [3.9%, 39.5%] at 2C of global warming.	2040-2050 (Future)	RCP6.0; RCP8.5		
Australia	Freshwater Ecosystems	Spcecie life history disruption, range shifts, Species Assemblages and Novel Interactions	**Negative**. High frequency of range shifts in southeastern Australia by 2050	Mid-century (2030)	Several papers used different scenarios.	Systematic review	(Knouft and Ficklin, 2017)
New Zealand	Cultural, Indigenous and Traditional Uses	Ecosystem change	**Negative**. Changes in temperature and precipitation are projected to shift the range of wetland plants (Kūmarahou and Kuta) in New Zealand, which may decrease access to these culturally significant species, which are used for medicinal and weaving purposes. The changing distribution of these plants may lead to a loss of Indigenous Knowledge and	2021-2050; 2051-2080	RCP2.6; RCP8.5	Species distribution modelling	(Bond et al., 2019)

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				affect inter-tribal reciprocity and gifting practices.				
	New Zealand	Cultural, Indigenous and Traditional Uses	Flooding impact on significant fish species	**Negative**. Increase flood events may negatively impact spawning and fishing sites of the culturally important īnaka (whitebait; Galaxias maculates) in the Waikōuaiti River.			Fieldwork; interviews	(Carter, 2019)
	Australia	Cultural, Indigenous and Traditional Uses	Flooding of waterholes and wetlands	**Negative**. Culturally important coastal waterholes, wetlands and sites are at risk of saltwater inundation due to rising sea levels. If inundated, traditional owners may not be able to maintain cultural connections to these important sites.	Until 2100	RCP4.5; RCP8.5	Fieldwork; interviews; climate projections	(Lyons et al., 2019)
Central and South America	Colombia	Energy	Hydroelectricity generation	**Negative.** ~10% decrease under the RCP4.5 dry scenario.	2050	RCP4.5	Different GCM ensembles	(Arango-Aramburo et al., 2019)
	Brazil	Energy	Hydroelectricity generation	**Negative.** Dry season hydropower potential could decline by −7.4 to −5.4%.	2026-2045	RCP 4.5	Different GCM ensembles	(Arias et al., 2020)
	Ecuador	Energy	Hydroelectricity generation	**Both negative and positive.** Hydropower production is projected to increase by +7% to +21% or decline by -25% to -44% by 2050.	2071-2100	RCP4.5, and various policy scenarios	Wet and dry scenarios under RCP4.5, and various policy scenarios	(Carvajal et al., 2019)
	Brazil	Energy	Hydroelectricity generation	**Negative.** In the São Francisco basin of Brazil, hydropower production is projected to reduce by -15% to -20%.	2100	IPCC A1B scenario	IPCC A1B scenario	(de Jong et al., 2018)
	Venezuela	Cultural, Indigenous and Traditional Uses	Flooding	**Negative**. The partial or total inundation of the Orinoco Delta will result in the loss of freshwater wetlands and species, which will produce rapid shifts in	2008-2100	RCP2.6; RCP4.5; RCP6.0; RCP8.5	SLR forecasts; population growth model	(Vegas-Vilarrúbia et al., 2015)

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			the culturally significant lands and resources of the Warao. Among the affected species is the Mauritia palm, on which Warao culture and livelihoods are based.				
	Argentina	Agriculture	Changes in livestock suitability	**Both Negative and Positive**. Shift in suitable areas; potential increase in overall suitability, but Increase water requirements for fodder.	2015-2039	RCP4.5	CCSM4; CMIP5	(Rolla et al., 2019)
	Argentina	Agriculture	Changes in livestock suitability	**Both Negative and Positive**. Shift in suitable areas; potential increase in overall suitability, but Increase water requirements for fodder.	2075-2099	RCP4.5	CCSM4; CMIP6	(Rolla et al., 2019)
	central South america	Freshwater Ecosystems	Ecosystem shifts, loss of critical freshwater habitat and species	**Negative**. Loss of cloud forests in the Andes, Snow and glacier melt in the Andes (reduced streamflow at high altitudes during the dry season), Marine and coastal regime shifts in Southeast Asia, Degradation of tropical coral reefs, Overfishing and pollution (inorganic nitrogen loads in the rivers of Southeast Asia are expected to rise nearly 20% by 2030 in pessimistic scenarios), Sea-level rise is projected to contribute about 10%–20% of the total estimated losses of mangroves on Pacific Islands by the end this century (Gilman et al. 2008) and up to 80% of the	Late century (2075, 2100)	Several papers used different scenarios.	Systematic review	(Leadley et al., 2014)

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				wetland losses in areas throughout Southeast Asia				
Europe	England	Agriculture	Irrigation	**Negative**. A significant future increase in irrigated abstraction licence use due to an increase in aridity, particularly in the most productive agricultural areas located in eastern and southern England.	2071-2098	SRES A1B	Other model ensemble	(Rio et al., 2018)
		Energy	Thermoelectric generation	**Negative.** The number of basins experiencing water stress is projected to rise from 47 basins to 54 basins between 2014 and 2030, with negative impacts on colling water supplies.	2030	RCP8.5 and SSP2	RCP8.5 and SSP2	(Behrens et al., 2017)
	Italy	Energy	Hydroelectricity generation	**Positive.** Icrease in energy generation 1.5%; 2.4% and 6.4% at RCP 2.6. 4.5 and 8.5 respectively my mid-century, and increase by 3.7% and 4% respectively by end century under RCP2.6 and 4.5 respectively.	2040-49 and 2090-99	RCP 2.6, 4.5 and 8.5	RCP 2.6, 4.5 and 8.5	(Bombelli et al., 2019)
	Italy	Energy	Hydroelectricity generation	**Negative.** Decrease in energy generation by -4.4% under RCP 8.0 by end century.	2090-99	RCP 2.6, 4.5 and 8.5	RCP 2.6, 4.5 and 8.5	(Bombelli et al., 2019)
		Energy	Thermoelectric generation	**Negative.** Thermoelectric plant capacity on the hottest summer day in the EU are projected to fall by 2% under a 2°C global warming and by 3.1% under a 4°C global warming. Under 2◦C and 4◦C of warming respectively, an overall loss of 0.6%–1.5% of thermal generating capacity is		2°C and 4°C warming	Different GCM ensembles	(Coffel and Mankin, 2020)

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			projected for summer months of July-August.				
	Northern Europe	Energy	Hydroelectricity generation	**Positive.** Around 3-4 studies in this systematic review projects consistent increase in NT (2030s)-MC (2050s) and 2-3 studies projects consistent increase in EC (2080).	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)
	Southern & Eastern Europe	Energy	Hydroelectricity generation	**Negative.** 4 studies in studies project decreases in NT-MC. 3 studies in Southern Europe, and 3 studies in Eastern Europe project decreases by EC.	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)
	Southern & Eastern & Western Europe	Energy	Thermoelectric generation	**Negative.** ~14 studies project decreases in NT-MC; and ~7 stuides project decreases in NC.	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)	Several papers used different scenarios.	Systematic review	(Emodi et al., 2019)
	Switzerland	Energy	Hydroelectricity generation	**Negative.** Production reduction of about 1.0 TWh/yr is projected.	2070-90	Not mentioned explicitly.	Not mentioned explicitly.	(Schaefli et al., 2019)
	Portugal	Energy	Hydroelectricity generation	**Negative.** Results show that hydropower generation may	2050	Climate scenarios include: SRES	Climate scenarios include: SRES A2c	(Teotónio et al., 2017)

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			decrease by 41% by mid-century.		A2c scenario, SRES B2a, RCP4.5, 8.5	scenario, SRES B2a, RCP4.5, 8.5	
	Northern, eastern and southern Europe	Energy	Hydroelectricity generation	**Both negative and positive.** Mean gross hydropower potential increases in northern, eastern and western Europe and decreases in southern Europe.The magnitudes of change of the ensemble mean do not exceed 10% for 1.5◦C, 15% for 2◦C or 20% for 3◦C.	Time horizons correspondin g to various RCMs models range from: 2004-2043 for 1.5°C; 2016-2059 for 2°C and 2037-2083 for 3°C	1.5°C, 2°C and 3°C warming	Different GCM ensembles	(Tobin et al., 2018)
		Energy	Thermoelectric generation	**Negative.** The magnitude of the decreases are about 5% for 1.5 ◦C, 10% for 2 ◦C and ∼15% for 3 ◦ C for most countries.	Time horizons correspondin g to various RCMs models range from: 2004-2043 for 1.5°C; 2016-2059 for 2°C and 2037-2083 for 3°C	1.5°C , 2°C and 3°C warming	Different GCM ensembles	(Tobin et al., 2018)
	Austria & Germany	Energy	Hydroelectricity generation	**Negative.** Slight decreases are projected.	2051-2080	Three regional climate models (RCM), namely the ARPEGE, the RegCM3, and the Remo model	Three regional climate models (RCM), namely the ARPEGE, the RegCM3, and the Remo model	(Totschnig et al., 2017)
		WaSH	Water-related diseases	**Negative**. If future emissions are not sufficiently reduced or treatment efficiencies are not improved, glyphosate,		KNMI'06 scenarios		(Sjerps et al., 2017)

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		aminomethylphosphonic acid (AMPA), carbamazepine, metoprolol, diatrizoic acid, acesulfame will Increasely be found in drinking water.				
Urban and Peri-Urban	Drought	**Negative**. Drought conditions are expected to intensify in southern European cities under all impact scenarios. High impact scenario: only 2% of cities are not projected to exceed the HMD; 21 cities in Southern Europe have more than 70% probability that the HMD will be exceeded in any given month; 30% of cities projected to have at least a 30% probability of exceeding the historical maximum in any given month. (HMD is historical maximum Drought Severity Index, DSI).	1951-2000 (Baseline); 2051-2100 (Future)	RCP8.5	CMIP5 for RCP8.5 (571 cities from Urban Audit database)	(Guerreiro et al., 2018)
Urban and Peri-Urban	Flooding	**Negative**. Low impact scenario: 68% of cities show no change or a reduction in Q10; 85% of UK cities see a projected increase in Q10. Medium impact scenario: 72% cities projected to experience an increase in Q10; some cities in the UK, Ireland and Norway could experience an increase in Q10 of more than 50%; most cities in south of Europe have no change or a decrease. High impact	1951-2000 (Baseline); 2051-2100 (Future)	RCP8.5	CMIP5 for RCP8.5 (571 cities from Urban Audit database)	(Guerreiro et al., 2018)

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			scenario: only 9 cities are not expected to see increases in Q10 (in Spain, Cyprus, France, Italy); half of UK cities see increases in Q10 of more than 50%; some cities in Spain, Ireland, Norway, Portugal and UK see increases above 80%. Norwegian cities show increases in all scenarios and a large icnrease in the high impact scenario.(Q10 is the 1in 10 year return period of annual maximum daily river discharge).				
	United Kingdom	Urban and Peri-Urban	Flooding	**Negative**. The frequency of rainfall events exceeding the present day 1/30-year, 1/100-year, and 1/200-year return levels increased by 165%, 64% and 600% under the 2030H scenario, and by 70%, 57%, and 200% under the 2050 scenario. The average area of 1/30-year events decreased in the 2030H scenario, and increased from the baseline in all other cases.	1961-1990 (Baseline); 2030-2050 (Future)	SRES B1 and A1F1; RCP4.5; RCP8.5	UKCP09 Weather Generator	(Jenkins et al., 2018)
	Europe	Freshwater Ecosystems	Lake stratification	**Negative**. Under the highgreenhouse-gas-emission scenario, stratification will begin 22.0 ± 7.0 days earlier and end 11.3 ± 4.7 days later by the end of this century. Accelerated lake deoxygenation with subsequent effects on nutrient mineralization and	Historic period (1901-2005), Future period (2006-2099)	RCP2.6; RCP6.0; RCP8.5	In situ observations, Multi-model ensemble under the ISIMIP phase 2b (ISIMIP2b) lake sector	(Woolway et al., 2021)

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				phosphorus release from lake sediments.				
	North America	Freshwater Ecosystems	Lake stratification	**Negative**. Under the highgreenhouse-gas-emission scenario, stratification will begin 22.0 ± 7.0 days earlier and end 11.3 ± 4.7 days later by the end of this century. Accelerated lake deoxygenation with subsequent effects on nutrient mineralization and phosphorus release from lake sediments.	Historic period (1901-2005), Future period (2006-2099)	RCP2.6; RCP6.0; RCP8.5	In situ observations, Multi-model ensemble under the ISIMIP phase 2b (ISIMIP2b) lake sector	(Woolway et al., 2021)
	Finland	Cultural, Indigenous and Traditional Uses	Winter thaw	**Negative**. Climate change poses risks to reindeer health and health of reindeer herders in terms of increased risks for accidents and future health prospects. Most prominent health effects are mental heath effects, such as increased stress, concern over the future of Saami way of life, and pressures to abandon traditional lifeways and livelihoods.			Literature review	(Jaakkola et al., 2018)
	Finland	Cultural, Indigenous and Traditional Uses	Winter thaw	**Negative**. Changes in ecosystems may erode cultural meanings, stories, memories and traditional knowledge attached to them, and affect nature-based traditional livelihoods.	2100	Increase in global mean temperature of 1.5°C by 2100	Literature review; survey	(Markkula et al., 2019)
North America		Agriculture	Yield loss	**Negative**. Reduction of irrigation availability causes a decrease in total corn production 20-30% and total wheat production about 10%	2015-2099	RCP8.5	CMIP5	(Cotterman et al., 2018)

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			for each of the climate scenarios.				
	Agriculture	Evaporative loss ratio	**None**. The climate change induced higher Evaporative Loss Ratio is associated with a reduction in return flows, thus negatively impacting downstream water availability.	2030-2060	RCP4.5	CMIP5	(Malek et al., 2018)
USA	Energy	Hydroelectricity generation	**Negative.** Average summertime generating capacity projected to reduce by 1.1% to 3.0%, with overall reductions of up to 7.2-8.8%.	2040-2060	RCP4.5	RCP4.5	(Bartos and Chester, 2015)
USA	Energy	Thermoelectric generation	**Negative.** Thermoelectric plant capacity on the hottest summer day in the EU are projected to fall by 2% under a 2°C global warming and by 3.1% under a 4°C global warming. Under 2◦C and 4◦C of warming respectively, an overall loss of 0.6%–1.5% of thermal generating capacity is projected for summer months of July-August.		2°C and 4°C warming	Different GCM ensembles	(Coffel and Mankin, 2020)
	Energy	Hydroelectricity generation	**Positive.** More than 4 studies project consistent increase in NT (2030s)-MC (2050s). Around 2-3 studies projects consistent increase in EC.	2010-2039 (2030s, Near Term NT) and 2040-69 (Middle of the century MC 2050s), 2070-99 (2080s, End of the century EC)	Systematic review based on several papers and several scenarios	Systematic review based on several papers and several scenarios	(Emodi et al., 2019)

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	USA	Energy	Hydroelectricity generation	**Negative.** Using projections of future drought index and power demand, the study suggest a reductions in hydropower generation by 1.6% by mid-century.	2051-2062	Climate scenario is not specified	Climate scenario is not specified	(Eyer and Wichman, 2018)
	USA	Energy	Thermoelectric generation	**Negative.** Consistent increase in water stress will affect about 27% of the power production by 2030s.	2021–2035	RCP-2.6, 4.5, 6, and 8.5	Different GCM ensembles	(Ganguli et al., 2017)
	USA	Energy	Hydroelectricity generation	**Both negative and positive.** Increase (+ 19%) in the winter/ spring, and Decrease (- 29%) in the summer by the 2080s.	2080s (2070–2099)	Echam5 A1B scenario as a representative climate change scenario	Echam5 A1B scenario as a representative climate change scenario	(Lee et al., 2016)
	USA	Energy	Thermoelectric generation	**Negative.** Climate change alone may reduce average generating capacity by 2–3% by the 2060s.	2060s	The RCP4.5 and RCP8.5 scenarios project moderate (2.4 ◦C) and high (4.9 ◦C) respectively	Different GCM ensembles	(Liu et al., 2017)
	USA	Energy	Hydroelectricity generation	**Negative.** Climate change is expected to decrease the average annual hydropower generation by 3.1% under RCP 4.5, but decline is neglible under RCP 8.5.	2050	RCP 4.5 , 8.5	RCP 4.5 , 8.5	(Tarroja et al., 2016)
	Canada	WaSH	Waterborne disease	**Negative**. The risk model estimated that, with limited treatment and handling interventions (i.e., 30% water treatment compliance rate and no boiling of water prior to consumption, referred to hereafter as the baseline scenario), the sum of DALYs attributed to the two protozoa could increase by factors of 11 and 25 by	2041– 2070; 2071–2100	2 and 4oC	QMRA	(Smith et al., 2015)

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			the 2050s and 2080s, respectively . **Positive**. The risk model demonstrated that when treatment and boiled water compliance were increased to 95% and 80%, respectively, risks from Giardia were effectively maintained at baseline levels in the period represented by the 2050s, compensating for the estimated impact of climate change on source water contamination with Giardia.				
	WaSH	Urban permeability	**Negative**. Increased urban permeability - likely offsets climate change impacts.	2055-2066	RCP2.6	CMIP5	(Tariq et al., 2017)
USA	Freshwater Ecosystems	Ecological flows, species reproductive cycles	**Negative**. annual zero-flow day frequency to increase by 27% by midcentury, 17% increase in the frequency of stream drying events, Flowing portions of the river network will diminish between 8% and 20% in spring and early summer; midcentury and late century climate will reduce network-wide hydrologic connectivity for native fishes by 6–9% over the course of a year and up to 12–18% during spring spawning months.	Current (1988–2006), Midcentury (2046–2064), and Late century (2080–2098) time periods	RCP8.6	In-situ observations, Modified SWAT hydrologic models, 16 GCM ensembles	(Jaeger et al., 2014)
USA	Freshwater Ecosystems	Spcecie life history disruption, range shifts, Species Assemblages	**Negative**. Increase in thermal stress and range contractions for salmon throughout the Columbia River Basin by 2050,	Historic (1971–2000) and future (2071–2100), Near	Several papers used different scenarios.	Systematic review	(Knouft and Ficklin, 2017)

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		and Novel Interactions	increase in water temperature by 3.7-7 degC	end century (2080s)			
USA	Culturan, Indigenous and Traditional Uses	Flooding	**Negative**. Climate-related degradation and flooding of wetlands and streams in the Lumbee River watershed will negatively affect cultural practices of fishing and harvesting that rely on access to and resources obtained from the area.	Until 2050	RCP8.5	Climate projections	(Emanuel, 2018)

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Table SM4.5: Supplementary Table on Observed Adaptation. Also see SM4.2 for methodology of assessment and full database is available at https://doi.org/10.5337/2021.220

Country	Adaptation response category	Hazard	Water use sector where adaptation is happening	Who initiated adaptation response?	Were there any positive outcomes of adaptation? Yes/No	On which outcome indicator did the adaptation have positive benefits?	Mal-adaptation Yes/No	Mitigation co-benefits Yes/No	Limits to adaptation	Confidence in link between adaptation response and outcomes	References
Africa											
Ethiopia	AR1	H5, H6	S6	I6	Y	B1, B2, B3	N	N	L4, L6, L7	3	(Fentie and Beyene, 2019)
Malawi	AR1	H5	S6	I1, I2, I4	Y	B1, B2, B3, B4	Y	N	L2, L3, L8	3	(Thierfelder et al., 2015)
Malawi	AR1	H5, H6	S6	I4, I6	Y	B1, B2	N	N	L1, L3, L4, L6	3	(Holden and Fisher, 2015)
Nigeria	AR1	H5	S6	I1, I7, I11	Y	B1	N	N	L7	3	(Wossen et al., 2017)
Zimbabwe	AR1	H3, H5, H6	S6	I1, I4, I6	Y	B2, B3	Y	N	L4, L7	3	(Mupakati and Tanyanyiwa, 2017)
Zimbabwe	AR1	H5, H7	S6	I6, I7	Y	B1, B2	N	N	NA	3	(Makate et al., 2017)
Senegal	AR1, AR12	H3	S6	I6	Y	B1	Y	N	NA	3	(Lalou et al., 2019)
Kenya	AR1, AR2	H4, H5	S6	I4, I6	Y	B1, B5	N	N	L1, L4, L6, L7	3	(Handschuch and Wollni, 2016)
Madagascar	AR1, AR2	H3, H4, H10, H16	S6	I6, I7	N	NA	Y	N	L1, L3, L5, L7, L10	3	(Penot et al., 2018)
Malawi	AR1, AR2	H3, H5, H6	S6	I4, I6	Y	B1, B2	N	N	L3, L4, L8	3	(Kankwamba et al., 2018)
Malawi, Zimbabwe	AR1, AR2	H3, H5, H7	S6	I6	Y	B1, B2, B4	N	Y	L4, L6, L7	3	(Makate et al., 2019)
Uganda	AR1, AR2	H3, H5, H6, H7	S6	I6	Y	B1, B4, B5	Y	N	L4, L5, L7	3	(Rahn et al., 2018a)

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Uganda	AR1, AR2	H5	S6	I6	Y	B1	N	N	L2, L4, L5, L6, L7	3	(Fisher and Carr, 2015)
Zimbabwe	AR1, AR2, AR11	H5, H6, H7	S6	I6	Y	B1	N	N	L4, L7, L8	3	(Chitongo, 2019)
Malawi	AR1, AR2, AR16	H5, H7	S6	I4, I6	N	NA	N	N	L3, L4, L5	3	(Sesmero et al., 2018)
Nigeria	AR1, AR2, AR16	H3, H5	S6	I6	Y	B1, B3, B4	Y	N	L2, L4, L5	3	(Yila and Resurreccion, 2014)
Ethiopia	AR1, AR2, AR3	H3, H5, H6	S6	I6	Y	B2	N	Y	L3, L4, L5, L7	3	(Teklewold et al., 2019)
Ethiopia	AR1, AR2, AR3	H3, H5, H10, H19	S6	I6	Y	B1	N	N	NA	3	(Lemessa et al., 2019)
Kenya	AR1, AR2, AR3	H3, H5	S6	I6	Y	B1	N	N	L4, L6, L7	3	(Stefanovic et al., 2019)
Kenya	AR1, AR2, AR3	H3, H4, H8	S6	I6	Y	B1, B2, B3, B4	Y	Y	L4	3	(Salat and Swallow, 2018)
Zambia	AR1, AR2, AR3	H3, H5, H6, H7	S6	I4, I6, I7	Y	B2	N	Y	L5	3	(Arslan et al., 2015)
Kenya	AR1, AR2, AR3, AR12	H5	S6	I2, I4	Y	B1, B2	N	N	L1, L2, L4, L7, L8	3	(Githunguri et al., 2015)
South Africa	AR1, AR2, AR3, AR4	H6	S6	I6	Y	B2	Y	N	L2, L4	3	(Samuel and Sylvia, 2019)
Ghana	AR1, AR2, AR3, AR4, AR5, AR6, AR7, AR9, AR11	H5, H6, H7	S6	I6	Y	B1	N	N	L4, L5	3	(Assan et al., 2018)
Ethiopia	AR1, AR2, AR3, AR4, AR5, AR6, AR8, AR9	H4, H5	S6	I2, I4	Y	B3	N	N	L4, L5	3	(Abi et al., 2019)
Kenya, Uganda	AR1, AR2, AR3, AR4, AR5, AR6, AR9	H3, H6, H7	S6	I2, I6	Y	B1, B2, B5	N	N	L4, L5, L10	3	(Ombogoh et al., 2018)

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Ethiopia	AR1, AR2, AR3, AR4, AR6, AR11	H3, H5, H7	S6	I6	Y	B1, B2, B3, B4	N	N	L3, L4, L6, L7, L8	3	(Alemayehu and Bewket, 2017)
Zimbabwe	AR1, AR2, AR3, AR4, AR6, AR11, AR12	H3, H5, H6, H7, H18	S3, S5, S6	I2, I3, I6	Y	B1, B2, B5	Y	N	L3, L5, L7, L8, L9	3	(Mashizha, 2019)
Malawi	AR1, AR2, AR3, AR4, AR7	H4, H6	S6	I1, I4, I6, I8, I9	Y	B1, B2, B3	N	N	L2, L3, L5, L6, L7, L9	3	(Thierfelder et al., 2015)
Nigeria	AR1, AR2, AR3, AR4, AR9	H3, H4, H5, H6, H7, H8	S6	I6	Y	B1, B3	N	N	L4, L7	3	(Okunlola et al., 2019)
Ghana, Botswana	AR1, AR2, AR3, AR5, AR6, AR8	H2, H3, H5, H7	S3, S6	I4, I6	Y	B1	N	N	L3, L4, L5	3	(Pauw, 2013)
Ghana	AR1, AR2, AR3, AR6	H3, H5, H6, H7, H8	S3, S6	I6	Y	B1, B4	Y	N	L2, L3, L4, L6, L7, L8	3	(Guodaar et al., 2017)
Kenya	AR1, AR2, AR3, AR9, AR11	H3, H6, H8, H19	S6	I2	Y	B5	N	N	L4	3	(Wekesa et al., 2018)
Ethiopia	AR1, AR2, AR4	H3, H6, H12	S6	I1, I3, I4, I6, I8, I11	Y	B1, B2, B3, B4	N	N	L4	3	(Bedeke et al., 2019)
Ethiopia	AR1, AR2, AR4	H3, H5, H6, H7	S6	I6	Y	B1, B3	N	N	NA	3	(Asmare et al., 2019)
Zambia	AR1, AR2, AR4, AR5	H5, H6	S6	I2, I4, I6, I7, I9	Y	B1, B2	Y	Y	L2, L3, L4, L5, L6, L7	3	(Somanje et al., 2017)
Zimbabwe	AR1, AR2, AR4, AR5, AR12	H5, H6, H7	S6	I2, I6	Y	B5	N	Y	NA	3	(Mugambiwa, 2018)
Niger	AR1, AR2, AR4, AR5, AR8, AR9	H5, H6	S6, S10	I1	Y	B1, B4, B5	N	N	NA	3	(Vardakoulias and

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Nigeria	AR1, AR2, AR4, AR6	H3, H5, H6, H8	S6	I6	Y	B1, B2	N	N	L3, L4	3	(Ojo and Baiyegunhi, 2020)
Kenya	AR1, AR2, AR4, AR6, AR7, AR16	H3, H5, H6	S6	I6	Y	B1	N	N	L7	3	(Waldman et al., 2019)
Tanzania	AR1, AR2, AR4, AR6, AR9, AR11	H3, H5, H6	S6	I6	Y	B1, B3	Y	N	L2, L7	3	(Brüssow et al., 2017)
Burkina Faso, Senegal, Ghana	AR1, AR2, AR4, AR9, AR11	H6	S6	I6	Y	B1, B5	N	N	L3, L7	3	(Douxchamps et al., 2016)
Ghana	AR1, AR2, AR5, AR6, AR8	H3, H6, H7	S6	I2, I6, I7	Y	B1, B2, B3, B5	Y	N	L4, L5	3	(Dapilah et al., 2020)
Burkina Faso	AR1, AR2, AR5, AR8	H3, H5	S6	I1, I2, I6, I11	Y	B1, B4, B5	N	Y	L5, L7	3	(Vom Brocke et al., 2014)
Benin	AR1, AR2, AR5, AR9	H3, H5, H6, H10, H18	S2, S6, S10	I1, I2, I4, I6	Y	B1, B2, B3, B4, B5	Y	Y	L1, L2, L3, L6, L7, L9, L10	3	(Kloos and Renaud, 2014)
Niger	AR1, AR2, AR6	H2, H5, H6	S6	I6	Y	B1, B2	N	N	L5	3	(Asfaw et al., 2018)
Zambia	AR1, AR2, AR6, AR11	H3, H5, H6	S6, S10	I4, I6	Y	B1	N	N	L3, L4	3	(Asfaw et al., 2018)
Benin	AR1, AR2, AR6, AR7	H5, H6	S3, S6	I6	Y	B1, B5	N	N	L3, L6	3	(Yegbemey et al., 2017)
Ghana	AR1, AR2, AR6, AR8, AR12	H3, H5, H6, H10, H11	S6	I6	Y	B1, B4	Y	Y	L1, L4, L5	3	(Aniah et al., 2019)
Tanzania	AR1, AR2, AR6, AR9	H3, H5, H6	S6	I6	Y	B1	Y	N	L4, L5, L6, L8	3	(Balama et al., 2017)
Zimbabwe	AR1, AR2, AR8	H5	S6	I4, I5, I6	Y	B1, B2	N	N	L5, L7	3	(Makate and Makate, 2019)

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Ghana	AR1, AR2, AR9	H4, H5, H6	S6	I1, I4, I6	Y	B1, B3, B5	N	Y	NA	3	(Weston et al., 2015)
Uganda	AR1, AR2, AR9	H3, H5, H6, H7	S6	I1, I2	Y	B3, B4	N	N	NA	3	(Sarmiento-Soler et al., 2019)
Kenya	AR1, AR3	H3, H5, H6	S6	I6	Y	B1, B2	N	N	L4, L5, L7, L8	3	(Asayehegn et al., 2017)
Algeria	AR1, AR3, AR4	H2, H5, H6	S6	I4, I6, I11	Y	B1, B3	Y	N	L5, L6, L7, L8	3	(Rouabhi et al., 2016)
Ethiopia	AR1, AR3, AR4	H5, H6, H8, H10, H18	S6	I6	Y	B1, B2, B5	N	N	L4, L5, L6, L7	3	(Teklewold et al., 2017)
Mali	AR1, AR4	H3, H4	S6	I1, I6, I11	Y	B1, B2, B3	N	N	L6	3	(Traore et al., 2017)
Vietnam, Kenya	AR1, AR4, AR6	H3, H5, H8	S6	I4, I6	Y	B1, B2	Y	Y	L4, L5	3	(Hoang et al., 2014)
Niger	AR1, AR4, AR7, AR8, AR11	H6	S5, S6, S10	I1, I4, I6, I7	Y	B1, B4, B5	N	N	L7	3	(Tabbo and Amadou, 2017)
Ghana	AR1, AR5, AR6, AR7, AR8	H2, H6	S6, S9	I1, I2, I6	Y	B1, B2, B3, B5	Y	N	L4, L5	3	(Soeters, 2016)
Nigeria	AR1, AR5, AR6, AR7, AR8, AR9, AR10	H3, H5, H6, H7, H8	S3, S5, S6, S10	I2, I4, I6	Y	B1, B3, B5	N	N	L5	3	(Choko et al., 2019)
Several African countries	AR1, AR5, AR8	H3, H5, H9	S6	I2, I3, I6	Y	B5	Y	N	NA	3	(Mapfumo et al., 2017)
Ghana	AR1, AR6, AR12	H3, H5, H7	S3, S6	I6	Y	B1, B3, B4	Y	N	L4	3	(Antwi-Agyei et al., 2018)
Kenya	AR1, AR6, AR7, AR11	H3, H5	S3, S6	I6	Y	B1	N	N	L2, L3	3	(Ng'ang'a et al., 2016)
Tanzania	AR1, AR6, AR9	H3, H4, H7, H10, H12, H14	S2, S3, S6, S7, S11	I6	N	NA	Y	N	L5, L7, L9	3	(Suckall et al., 2014)

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Mozambique	AR10	H8, H10, H12	S5, S10	I1, I7	Y	B1, B2, B3, B4	N	N	NA	3	(Spekker and Heskamp, 2017)
Nigeria	AR10	H3, H6, H8	S5, S10	I4, I5	N	NA	N	N	L4, L5, L6, L7, L8	3	(Ajibade and McBean, 2014)
Nigeria	AR10, AR13	H3, H8	S5, S10	I3, I4, I5	Y	B3	N	N	L2, L4, L5, L8	3	(Egbinola et al., 2017)
Ethiopia	AR11	H5, H6	S6	I6	Y	B1, B2, B3	Y	N	L2, L3, L4, L6, L7	3	(Megersa et al., 2014)
Ethiopia	AR11	H5, H10	S6	I6	Y	B1, B2, B3	N	N	NA	3	(Wako et al., 2017)
Ghana	AR11	H4, H6, H10, H12	S5, S6, S7, S10, S11	I1, I2, I4, I5, I6	Y	B5	Y	N	L1, L2, L4, L5, L7	3	(Freduah et al., 2019)
Kenya	AR11	H5	S6, S11	I6	Y	B1, B2, B5	Y	N	L2, L4, L6, L7	3	(Volpato and King, 2019)
Ghana, India, Kenya	AR13	H3, H8	S5	I1, I3	Y	B5	Y	N	L4, L5, L7	3	(Tauhid and Zawani, 2018)
Zimbabwe	AR15	H3, H5, H7	S8	I6	N	NA	N	N	L9	3	(Kanda et al., 2017)
Malawi	AR2	H5	S6	I4	Y	B1	Y	N	L5, L9	3	(Fisher and Snapp, 2014)
Several African countries	AR2	H3, H5, H6	S6	I6	Y	B5	N	N	L1, L3, L4, L5, L8	3	(Waha et al., 2017)
Zimbabwe	AR2	H5	S6	I6	N	NA	Y	N	L1, L2, L3, L5, L6, L7, L8, L9	3	(Phiri et al., 2019)
Zimbabwe	AR2	H3, H5, H6, H7	S6	I6	Y	B1	N	N	L4, L7, L8	3	(Makate et al., 2016)
Ghana	AR2, AR3	H3, H5, H7	S6	I6	Y	B1, B2	Y	Y	L4, L5, L7	3	(Yamba et al., 2019)
Burkina Faso	AR2, AR3, AR4, AR5, AR6	H3, H5	S3, S6	I6	Y	B1, B3, B4, B5	N	N	L3, L4	3	(West Colin et al., 2016)

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Ethiopia	AR2, AR3, AR4, AR6, AR11	H3, H5, H6, H7, H10	S3, S6	I6	Y	B1, B2, B3	N	N	NA	3	(Di Falco and Veronesi, 2014)
Uganda	AR2, AR3, AR4, AR9	H3, H4, H8, H17	S2, S6	I6, I11	Y	B1, B2, B5	N	Y	L2, L3, L4, L5, L6, L7	3	(Sullivan-Wiley and Short Gianotti, 2018)
Lesotho, Swaziland	AR2, AR3, AR5, AR6, AR8, AR11, AR12	H5	S6	I1, I4, I6	Y	B1, B5	Y	N	L3, L5, L7	3	(Kamara et al., 2019)
Ethiopia	AR2, AR3, AR6, AR11	H5	S6	I6	Y	B1, B3	Y	N	L4, L7	3	(Berhe et al., 2017)
Ghana	AR2, AR3, AR6, AR7, AR10, AR16	H5	S3, S6, S10	I6	Y	B1, B2	N	N	NA	3	(Musah-Surugu et al., 2018)
Tunisia	AR2, AR3, AR9	H3, H5, H6, H7	S6	I4, I6	Y	B1	Y	Y	L8	3	(Daly-Hassen et al., 2019)
Malawi, Zimbabwe, Zambia, Mozambique	AR2, AR4	H3, H4, H6	S6	I1, I6	Y	B1, B3, B4	N	N	L3, L6, L7	3	(Thierfelder et al., 2015)
Ghana	AR2, AR4, AR5, AR6, AR9	H3, H4, H5, H6, H7	S3, S6	I2, I4, I6	Y	B1, B3, B4, B5	N	Y	L4, L5	3	(Abass et al., 2018)
Ghana	AR2, AR6	H3, H5	S3, S6	I1, I2, I6	Y	B1, B2, B3	N	N	L4, L5, L7, L8	3	(Azumah et al., 2017)
Kenya	AR2, AR6, AR11	H5, H7	S5, S6	I3, I4, I6	Y	B1, B5	Y	N	L3, L4, L5, L7, L9, L10	3	(Opiyo et al., 2015)
Uganda	AR2, AR6, AR11	H3, H5, H8	S6, S10	I6	Y	B1	Y	N	L3, L4, L5, L7, L8	3	(Musinguzi et al., 2016)
Kenya	AR2, AR9, AR11	H5	S6, S10	I5, I6	Y	B1, B2, B5	Y	Y	L8, L10	3	(Muricho et al., 2019)

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Malawi	AR3	H3, H4, H5, H6, H7	S6	I6, I7	Y	B1, B2	Y	N	L2, L5, L8	3	(Joshua et al., 2016)
Tunisia	AR3, AR16	H2	S6	I6	Y	B1, B3	Y	N	L3, L4, L7, L9	3	(Ferchichi et al., 2017)
Ethiopia	AR3, AR4	H4, H5	S6	I5, I6	Y	B1, B3, B4	Y	N	NA	3	(Kosmowski, 2018)
Ethiopia	AR3, AR4	H2, H3, H4, H5	S2, S6	I4	Y	B1, B3, B4, B5	N	Y	L3	3	(Simane et al., 2017)
Kenya	AR3, AR4	H3, H5, H7	S6	I2, I3	Y	B1, B2, B3	N	N	L4, L5, L6, L7, L9	3	(Stöber et al., 2017)
Sudan	AR3, AR4, AR5	H5, H6, H8	S6, S10	I2, I6	Y	B3	N	N	L4, L5, L7, L9	3	(Fadul et al., 2019)
Ethiopia	AR3, AR4, AR8	H4, H6	S6	I1, I6	Y	B1, B2	N	N	L4, L5	3	(Chesterman et al., 2019)
Malawi	AR3, AR5, AR7, AR9, AR11, AR14	H3, H5, H8	S6, S7	I7	Y	B1, B3, B4, B5	Y	Y	L3, L4, L7, L8	3	(Wood et al., 2017)
Kenya	AR4	H5	S2, S6, S10	I1, I2, I6, I11	Y	B3, B4	N	N	NA	3	(Ryan and Elsner, 2016)
Kenya	AR4	H5	S6, S8	I3, I4, I6	Y	B1, B2, B3, B4, B5	N	Y	L3, L4, L6, L7, L8, L9	3	(Kalungu et al., 2021)
Ethiopia	AR4, AR6, AR9	H5, H7	S5, S6	I4, I7	Y	B1, B2, B3, B4, B5	N	N	NA	3	(Siraw et al., 2018)
Ethiopia, Nigeria	AR4, AR9	H4, H6	S6	I6, I11	Y	B1, B3, B4	N	Y	L7	3	(Okunlola et al., 2019)
Malawi	AR4, AR9	H4, H5, H6	S6	I1, I7	Y	B1, B2, B5	N	N	NA	3	(Amadu et al., 2020)
Eritrea	AR5	H3, H5, H6, H7	S6	I4	N	NA	Y	N	L2, L3, L4	3	(Tesfamariam and Hurlbert, 2017)
South Africa	AR5, AR12	H3, H5, H6	S2, S5, S6, S10	I2, I6	Y	B1, B2, B3, B4, B5	N	Y	NA	3	(Apraku et al., 2018)
Malawi, Tanzania, Zambia	AR5, AR16	H3, H5, H6, H8	S5, S10	I4, I7	N	NA	N	N	L4, L5, L7	3	(England et al., 2018)
Ghana, Tanzania	AR5, AR6, AR11	H3, H5,	S2, S6	I6	Y	B1, B2, B5	Y	N	L1, L4, L5, L7, L8	3	(Yang et al., 2019)

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		H6, H7, H9, H10, H12, H13, H16									
Ethiopia	AR5, AR6, AR7, AR8	H3, H5	S3, S6	I4, I6	Y	B1, B2	Y	N	L4, L5	3	(Gao and Mills, 2018)
Uganda	AR5, AR6, AR8	H3, H5, H6, H8	S5	I1, I2, I6	Y	B1, B2, B3, B5	N	Y	NA	3	(Dobson et al., 2015)
Malawi	AR5, AR7	H3, H5, H6	S6	I4, I6	Y	B1, B2	N	N	L4, L5	3	(Kawaye and Hutchinson, 2018)
South Africa	AR5, AR7	H3, H6, H8	S7, S10	I2, I6	Y	B1, B2, B5	Y	N	L2, L4	3	(Shale, 2014)
Uganda, Spain	AR5, AR7, AR13	H5, H6	S5, S8	I3	Y	B1, B2, B3	N	N	NA	3	(Kayaga and Smout, 2014)
Zimbabwe, Mozambique, Malawi	AR5, AR8	H3, H5	S6	I1, I7	Y	B1, B2, B5	N	N	L2, L3, L4, L5	3	(Nyikahadzoi et al., 2017)
Uganda	AR5, AR8, AR16	H3, H5, H7	S6	I2, I4, I9	Y	B1, B2, B5	Y	N	L4, L5	3	(Cooper and Wheeler, 2015)
Cameroon	AR5, AR9	H3, H5, H6	S2, S5, S6, S10	I1, I3, I6, I7	Y	B2, B4	N	N	L5	3	(Brown and Sonwa, 2015)
Kenya	AR5, AR9	H3	S6	I1, I3, I6	Y	B1, B2	N	N	L5, L6, L7	3	(Fuchs et al., 2019)
Botswana	AR6	H6, H8	S3, S5, S10	I4, I6	N	NA	Y	N	L5, L8	3	(Shinn et al., 2014)
Kenya	AR6	H3, H5, H7	S2, S5, S6, S9, S11	I2, I4, I6, I8, I9	Y	B1, B3, B4	Y	N	L1, L3, L5	3	(Bedelian and Ogutu, 2017)
Senegal	AR6	H4, H5	S3, S8	I6	Y	B1, B2, B3, B5	Y	N	L1, L2, L4, L5, L8	3	(Romankiewicz et al., 2016)
Ethiopia	AR6, AR11, AR12	H5, H7	S6	I6	Y	B1, B2	N	N	L2, L4, L8	3	13_Berhau and Beyene_2015
Ethiopia	AR6, AR7	H5	S3, S6, S10	I4, I6, I7	Y	B1, B4	Y	N	NA	3	(Mersha and van

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											Laerhoven, 2018)
Senegal	AR6, AR7, AR11	H5, H7	S3, S6	I6	Y	B1, B2	N	N	L3, L8	3	322_Brottem and Brooks et al 2017
Guatemala, Peru, Ghana, Tanzania, Bangladesh, India, Thailand, Vietnam	AR6, AR8	H3, H5	S3	I6	Y	B1	Y	N	L4, L7	3	(Warner and Afifi, 2014)
South Africa	AR7	H3, H5, H6, H7, H8	S6	I6, I9	Y	B1	Y	N	L3, L4, L6	3	(Elum et al., 2018)
Kenya, Senegal	AR8	H3, H5, H6, H7	S6	I6, I7	N	NA	N	N	L2	3	(McKune et al., 2018)
Burkina Faso	AR9	H5, H6, H7	S2, S6, S10	I2, I4, I6, I7	Y	B1, B4	Y	Y	L1, L2, L3, L4, L5, L7, L8	3	(Etongo et al., 2015)
Ethiopia	AR9	H4, H6	S6	I6	Y	B3, B4	N	Y	NA	3	(Balehegn et al., 2015)
Ghana	AR9	H5, H7	S6	I6, I7	Y	B1, B4	N	Y	L7, L8	3	(Abdulai et al., 2018)
Kenya	AR9	H5, H6	S6	I6	Y	B1, B4	N	Y	L2, L7, L8	3	(Quandt et al., 2019)
Kenya	AR9	H5, H8	S5, S6, S10	I6	Y	B1, B3, B4	N	Y	L4	3	(Quandt et al., 2017)
Asia											
Bangladesh	AR1	H3, H4, H5, H6, H7	S6	I4, I6, I7	Y	B1	N	N	L2, L3, L6, L8	3	(Hasan et al., 2018)
China	AR1	H5, H6	S6	I3, I6	Y	B1	N	N	L4, L7, L9	3	(Bai et al., 2015)
Thailand	AR1	H5	S6	I4, I6	Y	B1	N	N	L9	3	(Sansen et al., 2019)
China	AR1, AR2	H5	S6	I3, I6	Y	B1, B5	N	N	L3, L4, L5, L7, L8	3	(Yin et al., 2016)

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China	AR1, AR2	H3, H5	S6	I6	Y	B1, B2	Y	N	L3, L4, L5, L7, L9	3	(Lei et al., 2016b)
China	AR1, AR2	H3, H5, H8	S6	I6	Y	B1	N	N	NA	3	(Huang et al., 2015)
Pakistan	AR1, AR2	H3, H6, H7	S6	I6	Y	B1	N	N	L4, L6, L7, L10	3	(Ali and Erenstein, 2017)
Pakistan	AR1, AR2	H3, H5	S6	I6	Y	B1	N	N	L4, L7	3	(Abid et al., 2016)
India	AR1, AR2, AR3	H2, H3	S6	I6	Y	B1, B2, B3	N	N	L6, L8	3	(Jain et al., 2015)
Nepal	AR1, AR2, AR3	H3, H5, H19	S6	I6	Y	B1	N	N	L3, L4, L5, L6, L7	3	(Khanal et al., 2018)
Nepal	AR1, AR2, AR3	H3, H5, H8	S6	I6	Y	B1	Y	N	L6, L7	3	(Khanal et al., 2018)
Pakistan	AR1, AR2, AR3	H2, H3, H5, H6, H9, H10, H15	S6	I7	Y	B1, B3, B4, B5	N	N	L4, L6, L7, L8, L9	3	(Imran et al., 2018)
Bangladesh	AR1, AR2, AR3, AR11	H3, H4, H6, H9, H10, H15	S6	I6	Y	B1, B2, B3, B4	Y	N	L3, L5, L9	3	(Kabir et al., 2016)
Bangladesh	AR1, AR2, AR3, AR11	H3, H5, H6, H8, H10, H15	S6	I6	Y	B1, B3, B5	Y	N	L1, L4, L5, L6, L10	3	(Arfanuzzaman et al., 2016)
Nepal	AR1, AR2, AR3, AR11	H3, H5, H6, H7	S6	I6	Y	B1	Y	N	L4	3	(Dhakal et al., 2016)
Pakistan	AR1, AR2, AR3, AR4	H3, H5, H6, H7	S6	I3, I6	Y	B1, B3	Y	N	L4, L5	3	(Gorst et al., 2018)

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Vietnam	AR1, AR2, AR3, AR4, AR6	H5, H10, H15	S6	I4, I5, I6, I9	Y	B1	N	N	L7	3	(Ho and Shimada, 2019)
India	AR1, AR2, AR3, AR4, AR6, AR7	H3, H7	S3, S6	I6	Y	B1, B2, B5	N	N	NA	3	(Jha et al., 2018)
India	AR1, AR2, AR3, AR4, AR6, AR7, AR11	H2, H3, H5, H6	S3, S6	I1, I5, I6	Y	B1, B2, B5	Y	N	L3, L4, L7	3	(Singh et al., 2019)
Pakistan	AR1, AR2, AR3, AR4, AR6, AR7, AR11	H3, H5, H6	S6, S8	I6	Y	B1	N	N	L2, L4, L5, L6, L7, L9	3	(Ahmad et al., 2016)
India	AR1, AR2, AR3, AR4, AR6, AR8, AR11	H5	S6	I4, I6, I7	Y	B1, B2	N	N	L3, L4	3	(Kumar et al., 2016)
Bangladesh	AR1, AR2, AR3, AR4, AR6, AR8, AR11, AR12	H2, H3, H5, H6, H7	S6	I2, I6	Y	B1, B3, B4	N	N	L4, L7, L8	3	(Hossain et al., 2016)
Nepal	AR1, AR2, AR3, AR4, AR7, AR9, AR16	H3, H5, H6	S2, S6	I2, I3, I6	Y	B3, B4	N	Y	L3, L5, L8	3	(Bhatta et al., 2015)
Nepal	AR1, AR2, AR3, AR4, AR9	H2, H3, H5, H6, H7	S6	I6	Y	B1, B2	N	N	NA	3	(Khanal et al., 2018)
China	AR1, AR2, AR3, AR5	H2, H5, H10, H15	S6	I2, I6	Y	B4, B5	Y	N	L1, L4, L5, L8	3	(Zhou et al., 2014)
India	AR1, AR2, AR3, AR5, AR7	H3, H5	S6	I6	Y	B3, B5	N	N	L3, L5, L7	3	(Nambi et al., 2015)
Indonesia	AR1, AR2, AR3, AR5, AR7, AR8,	H5, H6	S6	I1, I6	Y	B1, B3, B5	N	N	L5, L6, L7	3	(Rahmawati and Lestari, 2019)

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	AR11, AR12										
Bangladesh	AR1, AR2, AR3, AR6	H2, H5, H7	S6	I3, I4, I6, I11	Y	B1, B4	Y	N	L4	3	(Islam et al., 2019a)
India	AR1, AR2, AR3, AR6, AR11	H2, H5	S6	I6	Y	B1, B2, B4	Y	N	L8	3	(Kattumuri et al., 2017)
India	AR1, AR2, AR3, AR8	H3, H5, H6	S6	I1, I2, I4	Y	B1, B3, B4	Y	Y	L5, L7	3	(Kakumanu et al., 2018)
India	AR1, AR2, AR4	H3, H5	S6	I1, I3, I6, I7	Y	B1, B2	N	N	L4, L7	3	(Patnaik and Das, 2017)
Myanmar	AR1, AR2, AR4	H3, H5, H7	S3, S6	I6	Y	B1, B3	N	N	NA	3	(Zin et al., 2019)
Myanmar	AR1, AR2, AR4, AR11	H3, H5	S6	I6	Y	B1	N	N	L1, L4, L8	3	(Tun Oo et al., 2017)
Bangladesh, India, Nepal	AR1, AR2, AR4, AR5	H2, H3, H5, H7, H8, H15	S6	I3, I6, I9	Y	B1, B2, B3, B5	Y	N	L5	3	(Ojha et al., 2014)
Nepal	AR1, AR2, AR4, AR6, AR9, AR11	H3, H5, H6, H7, H16, H17, H18	S3, S6	I3, I6	Y	B1, B4	Y	Y	L8	3	(Sujakhu et al., 2016)
Philippines	AR1, AR2, AR5, AR6, AR7, AR8, AR11, AR12	H3, H4, H5, H6, H7, H16, H17, H18	S6	I2, I3, I6	Y	B1, B2	N	Y	L2, L5, L7	3	(Nelson et al., 2019)
Nepal	AR1, AR2, AR5, AR6, AR8, AR9, AR11,	H3, H4, H5, H6	S6, S8	I2, I4, I6, I7	Y	B1, B3, B4	N	Y	L4, L5, L7, L8	3	(Adhikari et al., 2018)

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	AR12, AR16										
Sri Lanka	AR1, AR2, AR6	H5	S6	I2, I4	Y	B1, B2	N	N	L5, L8	3	(Williams and Carrico, 2017)
Bangladesh	AR1, AR2, AR6, AR10	H4, H8	S3, S6, S10	I2, I6	N	NA	Y	N	L3, L4, L5, L8	3	(Ferdous et al., 2019)
Bangladesh	AR1, AR2, AR6, AR11	H3, H5, H6, H7, H8, H9, H12, H13, H15, H16, H18	S3, S5, S6	I6	Y	B1, B2, B3	N	N	L4	3	(Kabir et al., 2019)
Vietnam	AR1, AR2, AR6, AR12	H3, H6, H8	S3, S6, S10	I6	Y	B1, B4, B5	Y	Y	L5	3	(Thi Hoa Sen and Bond, 2017)
Pakistan	AR1, AR2, AR6, AR9, AR11	H3, H6	S6	I6	Y	B1, B2	N	N	NA	3	(Rahut and Ali, 2017)
India	AR1, AR2, AR7	H2, H3, H6, H7, H10, H18	S6	I4, I6	N	NA	Y	N	L1, L3, L4, L5, L7, L9	3	(Chengappa et al., 2017)
India	AR1, AR2, AR8, AR12	H5	S6, S10	I2, I6, I11	Y	B1, B2, B3, B4	N	N	NA	3	(Singh et al., 2019)
China	AR1, AR3	H6	S6	I6	N	NA	Y	N	L1, L7	3	(Quan et al., 2019)
China	AR1, AR3	H2, H3, H5, H9	S6	I4, I5, I6	Y	B1, B2, B5	Y	N	L2, L5, L9	3	(Burnham and Ma, 2017)
India	AR1, AR3	H5	S6	I1, I7, I11	Y	B1, B3, B5	N	N	NA	3	(Cornish et al., 2015)
Pakistan	AR1, AR3	H2, H5,	S6, S7	I6	Y	B1, B3, B4	N	Y	L3, L4, L6, L7, L9	3	(Imran et al., 2019)

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		H6, H9, H10, H15									
China	AR1, AR3, AR4, AR5, AR6, AR8	H2, H5	S3, S6	I3, I4	Y	B1, B2, B3, B5	Y	N	NA	3	(Tan and Liu, 2017)
Nepal	AR1, AR3, AR4, AR5, AR8	H3, H6	S6	I10	Y	B1, B2, B3, B4, B5	N	N	L4, L9	3	(Rai et al., 2018)
Bangladesh	AR1, AR3, AR4, AR7, AR11	H3, H5, H7, H8	S6	I1, I4, I6	N	NA	Y	N	L5	3	(Hossain and Paul, 2019)
India	AR1, AR3, AR8	H5, H6	S6	I4, I6, I7	Y	B1, B2, B3	Y	N	L4, L8	3	(Kakumanu et al., 2019)
Nepal	AR1, AR4	H3, H5, H6, H18	S6	I1, I2, I6	Y	B1, B2, B3, B4	N	N	L4	3	(Subedi et al., 2019)
India	AR1, AR4, AR5, AR11	H3, H4, H5, H6, H7, H10, H16	S5, S6	I3, I4, I5, I6	Y	B1, B3, B4, B5	N	Y	L4, L6, L7	3	(Srinivasa Rao et al., 2016)
Iran	AR1, AR4, AR6	H5, H7	S6	I6	Y	B4	Y	N	L3, L4, L6, L7, L9	3	(Keshavarz et al., 2014)
Sri Lanka	AR1, AR5	H2, H3, H5	S6	I6	Y	B1, B5	Y	N	L2, L4	3	(Burchfield and Gilligan, 2016a)
Bangladesh, India, Nepal	AR1, AR5, AR8, AR12	H3	S6	I1, I7	Y	B1, B2, B5	N	N	L5	3	(Roschinsky et al., 2016)
Bangladesh	AR10	H3, H10, H12, H16	S10	I1, I2, I4	N	NA	Y	N	L4	3	(Islam et al., 2018b)
India	AR10	H3, H8	S5, S10	I4	N	NA	Y	N	L2, L3, L5, L7	3	(Pritchard and Thielemans, 2014)

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Indonesia	AR10, AR13	H6, H10, H12, H13, H15	S5, S10	I1, I3, I4, I6	Y	B1, B5	Y	N	L4, L5, L7	3	(Wijaya, 2015)
Pakistan	AR10, AR16	H8	S6, S10	I2, I4, I6	Y	B1	Y	N	L3, L4	3	(Abbas et al., 2018)
Philippines	AR11	H3, H5, H7, H8, H16	S6	I2, I6	Y	B1, B2	Y	N	L3, L5, L7	3	(Escarcha et al., 2018)
India	AR11, AR12	H3, H4, H5, H7, H8	S2, S6	I6	Y	B1, B3, B4	N	Y	NA	3	(Sarkar et al., 2018)
Bangladesh	AR13	H6, H8	S5	I6	Y	B2, B3, B5	N	N	L5, L8	3	(Birtchnell et al., 2019)
Nepal	AR14	NA	S7, S9	I4, I8	Y	B1, B3	N	Y	L4, L5, L7	3	(Shrestha et al., 2015)
Nepal	AR14	NA	S7	I4	N	NA	N	N	L10	3	(Balasubramanya et al., 2014)
Taiwan	AR14	H3, H8	S5, S6, S7, S10	I2, I3, I5, I6, I9	Y	B1, B3, B4	N	N	NA	3	(Lin and Chen, 2016)
Bangladesh	AR15	H9	S8	I2, I4, I7	Y	B2	N	N	L2	3	(Dey et al., 2019)
Indonesia	AR16	H3, H5	S6	I6	N	NA	Y	N	NA	3	(Pramudya et al., 2016)
Bangladesh	AR2	H3, H8	S6	I6	N	NA	N	N	L4, L5, L6	3	(Younus and Harvey, 2014)
China	AR2	H5, H7	S6	I6	Y	B1	N	N	L8	3	(Yu et al., 2014)
Bangladesh	AR2, AR12	H3, H5, H6, H7	S6	I6	Y	B1, B2, B4	N	N	L6, L7	3	(Ahmed and Atiqul Haq, 2019)
China	AR2, AR3	H5, H6	S6	I4, I6	Y	B1	Y	N	L3, L5	3	(Wang et al., 2014)
India	AR2, AR3	H3, H5	S6	I6	N	NA	N	N	L4, L9	3	(Taraz, 2017)

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India	AR2, AR3	H2, H3, H5, H6, H8	S6	I6	Y	B1, B2, B3, B4, B5	N	Y	L5, L7, L9	3	(Singh et al., 2014)
India	AR2, AR3, AR4	H3, H5, H7	S6	I7, I11	Y	B1, B2, B3	Y	N	L1, L2, L3, L4, L5, L6, L7, L8, L9	3	(Aryal et al., 2020)
Vietnam	AR2, AR3, AR4, AR10, AR11	H3, H5, H6, H8, H9, H10, H15	S6, S10	I6	Y	B1, B3, B4, B5	N	Y	L3, L4, L7, L8, L9	3	(Tran and Rodela, 2019)
Sri Lanka	AR2, AR3, AR4, AR5, AR12	H5, H6	S6	I2, I4, I6	Y	B1	N	N	L5	3	(Oka et al., 2015)
Afghanistan	AR2, AR3, AR4, AR5, AR6, AR16	H2, H3, H5	S3, S6, S9	I2, I5, I6	Y	B2, B3, B5	Y	N	L3, L5, L9	3	(Iqbal et al., 2018)
Bangladesh	AR2, AR3, AR4, AR5, AR6, AR9, AR10, AR11, AR12, AR14, AR16	H2, H3, H4, H6, H7, H8, H10, H16, H17, H18, H19	S2, S6, S7, S8, S10	I3, I6	Y	B1, B3, B4	N	N	NA	3	(Rahman and Alam, 2016)
China	AR2, AR3, AR4, AR5, AR7	H5, H6	S6	I2, I3, I8	Y	B1, B3, B5	N	N	L4, L5	3	(Zhang et al., 2018b)
India	AR2, AR3, AR4, AR5, AR8	H3, H5	S6	I6, I11	Y	B1, B3	Y	N	L5, L7, L8, L9	3	(Hochman et al., 2017)
China	AR2, AR3, AR4, AR6	H5, H6, H7	S6, S10	I5, I6	Y	B1, B3, B4	Y	N	L4, L5, L6, L7, L9, L10	3	(Yang et al., 2015b)

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Bangladesh	AR2, AR3, AR4, AR6, AR7	H2, H3, H4, H5, H8, H10, H16	S3, S6, S10	I6	Y	B1, B2, B3	Y	N	L5	3	(Ayeb-Karlsson et al., 2016)
India	AR2, AR3, AR4, AR6, AR7	H2, H4, H5, H6, H7	S3, S6	I1, I2, I3, I4, I5, I6, I7, I11	Y	B1, B3, B4	Y	Y	L5, L6, L7, L8	3	(Singh et al., 2019)
India	AR2, AR3, AR4, AR6, AR7, AR11	H3, H5, H6	S6	I3, I5, I7	Y	B1, B3	Y	N	NA	3	(Patnaik and Das, 2017)
China	AR2, AR3, AR4, AR6, AR7, AR8	H3, H5, H10, H18	S6	I6	Y	B1, B2	Y	N	L4, L6, L7	3	(Shi et al., 2019)
India, Nepal	AR2, AR3, AR4, AR9	H1, H3, H6, H7	S6	I6	Y	B1, B3, B4	Y	N	L2, L3, L4, L8	3	(Macchi et al., 2015)
Thailand	AR2, AR3, AR5, AR6	H5	S6	I3, I6, I8	Y	B1	N	N	L4, L8	3	(Pak-Uthai and Faysse, 2018)
Indonesia	AR2, AR3, AR5, AR7, AR8, AR12	H3, H5, H6, H7, H10, H18	S6	I2, I6	Y	B1, B2, B3, B4, B5	N	Y	L2, L5, L8, L9	3	(Hapsari et al., 2019)
India	AR2, AR3, AR7	H3, H5, H6, H7	S6	I6	Y	B1, B3, B4	N	Y	L4, L5	3	(Raghavendra and Suresh, 2018)
Pakistan	AR2, AR3, AR9	H4, H5, H8, H10, H16, H18	S6	I6	N	NA	Y	N	L4	3	(Ullah et al., 2019)
China	AR2, AR4, AR9	H2, H3, H5	S6, S10	I4	Y	B1, B3, B4, B5	Y	Y	NA	3	(Lei et al., 2014)

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Nepal	AR2, AR5, AR6	H3, H5, H7	S3, S6	I6	N	NA	Y	N	L2, L3, L4	3	(Sapkota et al., 2016)
Indonesia, Timor-Leste	AR2, AR6	H6	S6	I6	Y	B1	N	N	L5	3	(Paulus et al., 2019)
Bangladesh	AR2, AR6, AR10, AR11	H8	S2, S3, S6, S10	I2, I6	Y	B1, B3	Y	Y	L4, L5, L7, L8	3	(Fenton et al., 2017)
China	AR3	H5	S6	I6	N	NA	N	N	L7	3	(Wang and Chen, 2018)
China	AR3	H3, H5	S6	I6	Y	B1	Y	N	L3, L4, L5, L7, L9	3	(Song et al., 2018)
China	AR3	H3, H5, H6	S6	I3, I4	Y	B1, B3, B4	N	N	L6, L8	3	(Lei et al., 2016a)
China	AR3	H5	S6	I6	Y	B1, B3	N	N	NA	3	(Wang et al., 2018b)
India	AR3, AR12	H1, H5	S6	I1, I2, I6	Y	B1, B2, B3, B4, B5	Y	Y	L2, L3, L6, L7	3	(Sudan and McKay, 2015)
China	AR3, AR4	H2, H5	S6	I6	Y	B1	N	N	NA	3	(Wang et al., 2019a)
India	AR3, AR4, AR5	H3, H5, H6, H18	S6, S8	I2, I3, I6, I11	Y	B3, B4, B5	Y	N	L3, L4, L5, L10	3	(Banerjee, 2015)
Sri Lanka	AR3, AR4, AR5, AR12	H5	S6	I2, I3, I5, I6	Y	B2, B5	N	N	L5, L8, L9	3	(Burchfield and Gilligan, 2016b)
China	AR3, AR4, AR6, AR15	H5, H6	S6, S8	I2, I3, I4, I6, I9	Y	B1, B2, B3	N	N	L2, L5, L6, L8	3	(Su et al., 2017)
India	AR3, AR4, AR9, AR12	H2, H3, H5, H15, H18	S1, S6, S8	I1, I6	Y	B1, B2, B3, B4	N	N	L2, L5	3	(Sarkar et al., 2015)
India	AR3, AR5, AR8	H3, H5	S6	I6	Y	B1, B3	N	Y	NA	3	(Kakumanu et al., 2018)
China	AR3, AR7	H2, H3, H5, H7	S6	I6	Y	B1, B3	Y	N	L1, L4, L5	3	(Zhang et al., 2016b)
Indonesia	AR4	H5	S6	I4	Y	B1, B2, B3, B4, B5	N	Y	L1, L3, L4, L5, L7, L8	3	(Muttaqin et al., 2019)

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Nepal	AR4	H3, H5, H6	S6	I4	Y	B1, B2, B5	N	N	L4, L5, L8	3	(Adhikari et al., 2018)
Malaysia	AR4, AR10, AR13	H3, H8	S5, S10	I3, I4	Y	B3, B4	N	Y	NA	3	(Chan et al., 2019)
Nepal	AR4, AR5, AR13, AR15, AR16	H2, H5, H6, H9	S5, S8	I2, I6	Y	B1, B3	N	N	L4	3	(Rai et al., 2019)
Jordan	AR4, AR8, AR14, AR16	H3, H5, H7	S2, S7	I2, I6	Y	B3, B4, B5	N	N	NA	3	(Jamaliah and Powell, 2019)
Bangladesh	AR5	H2, H3, H4, H7, H8	S5, S6	I2, I6	Y	B2, B3, B5	Y	N	L2, L3, L4, L5, L7	3	(Karim and Thiel, 2017)
Bangladesh	AR5	H3, H6, H7, H8, H13, H15	S5	I3, I4, I5	N	NA	N	N	L4, L5, L6	3	(Araos et al., 2017)
Bangladesh	AR5	H3, H5, H6, H8, H10, H15	S10	I1, I2, I3	Y	B1, B5	N	N	L4, L5	3	(Roy, 2018)
India	AR5	H3, H10, H16	S10	I1, I3, I5, I7	Y	B5	N	N	L5	3	(Walch, 2019)
Nepal, Bangladesh	AR5	H1, H3, H4, H5, H6, H8	S9	I2, I3, I6, I11	Y	B1, B2, B3, B5	N	N	L5	3	(Sultana et al., 2019)
Indonesia	AR5, AR10	H3, H4, H8, H10,	S5, S8, S10	I2, I6	Y	B2, B5	Y	N	L1, L2, L3, L4, L5, L7	3	(Bott and Braun, 2019)

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		H12, H16									
Taiwan	AR5, AR10	H3, H8, H10, H12, H13, H17	S5, S8, S10	I1, I2, I3, I4	Y	B1, B5	Y	N	L5	3	(Lu, 2016)
Japan	AR5, AR12	H5, H7	S2, S5, S6, S7, S8	I2, I3, I4, I8, I11	Y	B3, B4, B5	N	N	L5	3	(Tembata and Takeuchi, 2018)
Mongolia	AR5, AR6, AR7, AR8, AR11, AR12	H1, H6, H19	S3, S6	I4, I6, I7	Y	B1, B2, B4, B5	Y	N	L1, L3, L4, L5, L6, L8	3	(Fernández-Giménez et al., 2015)
Bangladesh	AR5, AR6, AR8, AR9, AR10, AR11, AR12	H3, H4, H6, H8, H12, H13, H15, H16	S2, S6, S8, S10	I1, I4, I7	Y	B1, B2, B3, B4, B5	N	Y	L1, L3, L5, L8	3	(Rahman et al., 2019)
Bangladesh	AR5, AR7, AR8	H3, H8	S10	I2, I6, I9, I11	Y	B1, B2, B3, B5	Y	N	L4, L8	3	(Fenton et al., 2017)
India	AR5, AR7, AR8, AR13	H3, H5, H9	S5, S8	I1, I2, I3, I5	Y	B3, B5	N	N	L3, L4, L5, L7	3	(Chu, 2017)
India	AR5, AR8	H6, H8, H10, H16	S10	I1, I2, I3, I5	Y	B1, B5	N	N	NA	3	(Bahinipati and Patnaik, 2015)
Vietnam	AR5, AR8, AR10, AR12	H8, H12, H15, H16	S5, S6, S10	I6	N	NA	Y	N	L4, L5, L8	3	(Ling et al., 2015)
Indonesia	AR5, AR8, AR10, AR15	H6, H8	S5, S8, S10	I1, I3, I11	Y	B1, B5	N	N	L7, L9	3	(Sari and Prayoga, 2018)
Bangladesh	AR6	H10, H12,	S3, S5	I2	Y	B1, B2, B3	Y	N	L4, L6	3	(Islam et al., 2014)

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		H13, H16									
Cambodia	AR6	H5, H10, H12, H15	S3	I6, I11	Y	B1, B5	Y	N	L2, L4, L6	3	(Asif, 2019)
China	AR6	H3, H5, H7, H8	S3	I5	Y	B1, B2, B5	Y	N	NA	3	(Lei et al., 2017)
Pakistan	AR6	H1, H4, H8, H10, H17	S3	I6	Y	B1, B5	Y	N	L2, L4	3	(Gioli et al., 2014)
Philippines	AR6, AR10	H6, H10, H12, H13	S3, S5, S10	I3, I6	N	NA	Y	N	L1, L2, L3, L4, L5, L8	3	(Jamero et al., 2017)
India	AR6, AR11	H3	S6	I6	N	NA	Y	N	L2, L7, L9	3	(Venugopal et al., 2019)
Pakistan	AR6, AR11	H5, H6, H7	S6	I6	Y	B1	Y	N	L3, L4, L5	3	(Rahut and Ali, 2018)
Pakistan	AR6, AR7	H6, H8	S6	I6	N	NA	N	N	NA	3	(Ullah and Shah, 2019)
Bangladesh	AR6, AR7, AR9, AR10	H3, H4, H8, H10, H12, H16	S3, S5, S10	I4, I5, I6	Y	B4	N	N	L4, L5, L7	3	(Barua et al., 2017)
China	AR6, AR8	H3, H4, H5, H6, H7, H9, H18, H19	S6	I6	Y	B5	N	N	L1, L3, L5, L7, L8, L9	3	(Burnham and Ma, 2018)
Indonesia	AR7	H5, H6,	S6	I4	N	NA	N	N	L4, L7	3	(Dewi et al., 2018)

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		H8, H18									
Thailand, Cambodia, Laos, Vietnam,	AR7, AR14	NA	S2, S7	I4, I9	N	NA	Y	N	L5	3	(Suhardiman et al., 2014)
Philippines	AR8	H3, H5, H6, H8	S6, S10	I2, I3	Y	B1, B2, B3, B5	N	Y	L4, L5, L7	3	(Bacud, 2018)
Vietnam	AR8	H3, H5, H6, H7	S6, S11	I6	Y	B1, B2, B5	N	N	NA	3	(Phuong et al., 2018)
Vietnam	AR8, AR10	H3, H8	S10	I1, I2, I3, I6	Y	B1, B5	N	N	NA	3	(Tran and Rodela, 2019)
Bangladesh	AR8, AR10, AR12	H3, H8	S6, S10	I1, I2	Y	B3	N	N	L5, L7	3	(Bremer et al., 2019)
Nepal	AR8, AR10, AR12	H3, H8	S10	I2, I6	Y	B2	N	N	L5	3	(Devkota et al., 2014)
China	AR8, AR16	H5	S6	I3, I4, I5, I6	Y	B2	N	N	L4, L5, L6, L7, L9	3	(Li et al., 2017b)
India	AR9	H3, H6	S6	I6	Y	B1, B2, B3, B4	Y	Y	L5, L7	3	(Pandey et al., 2017)
Bangladesh	AR9, AR10	H3, H8, H10, H12, H15, H16	S2, S5, S10	I4, I6, I7	Y	B1, B2, B3, B4	N	Y	L1, L2, L3, L5, L8, L9	3	(Saroar, 2018)
India	AR9, AR12	H5, H6, H7, H16	S6	I2, I6	Y	B1, B2, B4, B5	N	Y	NA	3	(Kodirekkala, 2018)
Australasia											
Australia	AR1, AR3, AR11	H5	S6	I6	Y	B3	Y	N	NA	3	(Kirby et al., 2014)
Australia	AR16	H6	S2	I3	Y	B1, B3, B4	Y	Y	L4, L5, L7, L8	3	(Lukasiewicz et al., 2016)
New Zealand	AR5	H6, H7,	S5	I2	Y	B1, B2, B5	N	Y	NA	3	(Simon et al., 2020)

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		H12, H13									
Australia	AR5, AR13	H3, H5, H7, H10, H12, H16	S5, S8	I3	Y	B5	N	Y	L4, L5, L6	3	(Fallon and Sullivan, 2014)
Solomon Islands	AR5, AR7, AR12	H8, H16	S10	I6	Y	B2, B5	N	N	L5	3	(Ha'apio et al., 2019)
Solomon Islands, USA	AR6, AR12	H1, H6, H7, H12, H13	S3, S5, S6, S10	I2, I3, I5	Y	B5	N	N	L2, L4	3	(Albert et al., 2018)
Central and Southern America											
Argentina	AR1, AR2, AR11	H5, H11	S6	I6	N	NA	N	N	L2, L3, L5	3	(Wehbe et al., 2018)
Bolivia	AR1, AR2, AR3	H3, H5, H6, H7, H8, H10, H19	S6	I6	Y	B1, B3	Y	N	L1, L8	3	(Taboada et al., 2017)
Chile	AR1, AR2, AR3, AR4, AR9	H3, H5, H6	S6	I6	Y	B1, B3	N	N	L4, L6, L7	3	(Roco et al., 2017)
Guatemala	AR1, AR3, AR4, AR9	H5, H7	S6	I4	Y	B1, B4	N	Y	L4	3	(Sain et al., 2017)
Bolivia	AR1, AR4, AR5	H5, H7	S6	I2, I6	Y	B1, B2, B4, B5	N	Y	L4, L5, L7	3	(Jacobi et al., 2015)
Guatemala	AR1, AR4, AR5, AR12	H6	S6, S9	I1, I7	Y	B1, B2, B3, B4, B5	N	Y	NA	3	(Hellin et al., 2018)
Costa Rica	AR1, AR4, AR9	H3, H5, H7	S6	I6	Y	B1, B2, B4	N	Y	NA	3	(Viguera et al., 2019)
Peru	AR1, AR5, AR8, AR12	H1	S1, S2, S5, S6	I2, I6	Y	B1, B2, B4, B5	N	N	L1, L5, L6, L8	3	(Sayre et al., 2017)
Brazil	AR11, AR12	H3, H5, H6,	S2, S6	I2, I4, I5, I6	Y	B1, B2, B3, B4, B5	N	N	L2, L5	3	(Oviedo et al., 2016)

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		H7, H8, H9									
Argentina, Canada, Colombia	AR2, AR3, AR5, AR6, AR7, AR9, AR12	H1, H5, H8, H17, H18, H19	S6	I4, I6	Y	B1, B3	Y	N	L4, L5, L6, L7, L9	3	(Mussetta et al., 2016)
Colombia	AR2, AR4, AR9	H1, H2, H3	S5, S6	I1	Y	B1, B2, B3, B4, B5	N	Y	NA	3	(Acevedo-Osorio et al., 2017)
Costa Rica	AR2, AR6	H5	S6	I6	Y	B2, B3	Y	N	L2, L3, L5, L8	3	(Warner et al., 2015)
Peru, US, Italy	AR3	H1	S6, S8	I2, I3, I6	Y	B2, B3	Y	N	L3, L5, L8, L9	3	(Orlove et al., 2019)
Brazil	AR3, AR11	H5, H7	S6	I2	Y	B1, B3, B5	Y	N	L1, L8	3	(Burney et al., 2014)
Costa Rica	AR3, AR4, AR5, AR13	H5	S5, S6, S8	I3	Y	B3	N	N	L4, L8, L9	3	(Madrigal-Ballestero and Naranjo, 2015)
Brazil	AR3, AR4, AR8	H5	S6, S8	I3, I4, I5, I6	Y	B1, B2, B3, B4, B5	N	N	L4, L6, L7, L8	3	(Lindoso et al., 2018)
Chile	AR3, AR4, AR9	H5	S6, S10	I2, I4, I9, I11	Y	B1	N	N	L5	3	(Lillo-Ortega et al., 2019)
Peru	AR4, AR5, AR7, AR8	H3, H6	S2, S5, S8	I1, I2, I4, I5, I7	Y	B1, B3, B4, B5	N	Y	L5, L6	3	(Lindsay, 2018)
Costa Rica	AR5	H5	S5, S6, S8, S9	I2, I3, I9	Y	B3, B5	N	N	L5, L6	3	(Kuzdas et al., 2016)
Nicaragua	AR6	H3, H5, H6, H7	S3, S6	I6	Y	B1	Y	N	L3, L4, L5, L6	3	(Radel et al., 2018)
Guatemala, Mexico	AR6, AR9, AR11	H5, H6, H16, H18	S3, S6	I6	Y	B4, B5	Y	Y	L3, L4, L5	3	(Rodriguez-Solorzano, 2014)
Brazil	AR7	H5, H7	S6	I4	Y	B1, B5	N	N	L1, L3, L5, L8	3	(Mesquita and Bursztyn, 2017)
Brazil	AR9	H4, H6	S2, S6	I2, I3, I4, I6, I8	Y	B1, B3, B4	N	Y	L3, L4, L5, L7	3	(Schembergue et al., 2017)

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Colombia	AR9	H5, H6	S6	I6	N	NA	Y	N	L5, L7	3	(Barrucand et al., 2017)
Ecuador	AR9	H1, H5, H6, H7	S6	I6	Y	B1, B3, B4	N	Y	L1, L8	3	(Córdova et al., 2019)
Several Central and Southern America countries, and Mexico	AR9	H4, H5, H6	S2, S6	I6	Y	B1, B4	Y	Y	L7, L8	3	(Krishnamurthy et al., 2019)
Europe											
Sweden, Finland	AR1	H3, H5, H6, H7	S6	I6	N	NA	Y	N	NA	3	(Neset et al., 2019)
France	AR1, AR2	H4, H5, H6	S6	I6	Y	B1	N	N	L1, L3, L4	3	194_Havet et al_2014
UK	AR1, AR2, AR3, AR4, AR5, AR7	H5	S6	I6, I11	Y	B1, B5	N	N	L4, L5, L9	3	(Rey et al., 2017)
Czech Republic	AR10	H3, H8	S5, S10	I6	N	NA	N	N	L3, L4	3	(Duží et al., 2017)
Sweden	AR10, AR13	H8, H10, H12	S2, S5, S10, S11	I3, I4, I7	Y	B1, B4, B5	N	Y	L4, L5, L6	3	(Wamsler et al., 2016)
Finland	AR12, AR16	H1, H3, H6	S3, S7	I2, I6	N	NA	N	N	L4, L5, L6, L8	3	(Kaján, 2014)
France	AR13	H7	S5	I3	Y	B4	N	N	NA	3	(Hendel and Royon, 2015)
Spain	AR13	H3, H6, H7, H8, H9	S5, S7	I3, I9	Y	B1, B3, B4	N	Y	L8, L9	3	(Rodríguez-Sinobas et al., 2018)
Spain	AR13	H5, H6	S5, S6, S8	I3, I4, I5	Y	B3, B4	N	Y	L4, L5, L9	3	(Morote et al., 2019)
Spain, Israel	AR13	H2, H5	S5, S6	I4	Y	B3	Y	N	L1, L3, L9	3	(Martínez-Alvarez et al., 2018)
Netherlands	AR3	H10, H15	S2, S6	I6	Y	B1, B3, B4	N	N	NA	3	(van Duinen et al., 2015)

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Portugal	AR3, AR4	H3, H5, H6	S2, S6, S8	I6	Y	B3, B4	Y	Y	NA	3	(Santos et al., 2018)
France, USA	AR3, AR4, AR5, AR10, AR13	H1, H3, H4, H5, H7, H8, H10, H13	S2, S5, S6, S7, S8, S10	I2, I3, I4, I5	Y	B1, B3, B4	N	N	L1, L4, L5, L8	3	(Andrew and Sauquet, 2017)
Germany	AR4, AR5, AR10, AR13	H3, H7, H8, H13	S5, S8, S10	I2, I3, I11	Y	B3, B5	N	Y	L5	3	(Tosun and Leopold, 2019)
The Netherlands	AR5, AR10	H3, H8, H13	S2, S5, S10	I4	Y	B3, B4, B5	N	N	L5, L7, L9	3	(Zevenbergen et al., 2015)
UK	AR5, AR10	H4, H10, H12, H13	S5, S10, S11	I6	N	NA	Y	N	L2, L8	3	(Petzold, 2018)
Norway	AR5, AR13	H6, H8	S5, S10	I3, I4	Y	B5	N	N	L5, L6, L7	3	(Flyen et al., 2018)
Spain, USA	AR5, AR13	H3, H7, H8, H13, H16	S5	I3, I5	Y	B3, B4	N	Y	L5, L9	3	(Sánchez and Izzo, 2017)
Sweden	AR5, AR13	H6, H8	S5	I3	Y	B3, B4, B5	N	Y	L10	3	(Fitzgerald and Lenhart, 2016)
Sweden	AR5, AR7, AR10, AR12	H6, H8, H10, H12	S10	I4, I5, I7	Y	B5	Y	N	L5, L7	3	(Hedelin, 2016)
Germany, Spain, Estonia, Denmark,	AR7, AR8, AR13	H2, H5, H9	S5, S8	I3, I8	Y	B1, B3	N	N	L8, L9	3	(Stavenhagen et al., 2018)
UK	AR8, AR10	H2, H3,	S7, S10	I4, I8	Y	B1, B3, B4, B5	N	Y	L5	3	(Energy UK, 2015)

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		H5, H6, H7, H8, H10, H12, H16, H17									
North America											
Mexico	AR1, AR2, AR3, AR5, AR6, AR7	H5	S6	I2, I6	Y	B1, B3, B5	N	N	L3, L4, L5	3	(Villamayor-Tomas and García-López, 2017)
Mexico	AR1, AR2, AR6	H3, H6, H8, H10, H17	S3, S6	I4, I6	N	NA	Y	N	L4, L5	3	(Ruiz Meza, 2015)
Canada	AR1, AR4, AR10	H5	S6, S10	I2, I4	Y	B1, B3	Y	N	L4, L5, L6, L8	3	(McMartin and Hernani Merino, 2014)
Mexico	AR11	H10, H14	S6	I1, I2, I4	Y	B1, B4, B5	N	N	L5	3	(Finkbeiner, 2015)
USA	AR11	H1, H5, H6, H7, H8	S2, S6	I5, I6	Y	B1	Y	N	L1, L2, L8	3	(Lamborn and Smith, 2019)
USA	AR11	H5, H6	S6	I6	Y	B1, B4, B5	Y	N	L2, L4, L5, L8	3	(Yung et al., 2015)
Canada	AR12	H6, H9	S1, S2, S5, S11	I6	Y	B1, B2, B5	N	N	L2, L5	3	(Abu and Reed, 2018)
USA	AR2, AR11	H1, H3, H4, H6	S1, S3, S5, S6, S11	I6	N	NA	N	N	L4	3	(Wilson, 2014)
Mexico	AR2, AR4, AR5, AR6	H3, H5	S3, S6	I6	Y	B1, B2, B3	Y	N	L4	3	(Mardero et al., 2015)
Canada	AR3, AR4, AR7, AR11	H5	S6	I5, I6	Y	B1, B3, B4, B5	N	N	L4, L6	3	(Hurlbert and Pittman, 2014)

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USA	AR4, AR11	H5, H6, H7	S2, S6	I1, I2, I3	Y	B4	N	N	NA	3	(Jacobi et al., 2015)
USA	AR4, AR7, AR10	H3, H6, H7	S6, S10	I8, I9	Y	B1, B3, B4	N	N	NA	3	(Schattman et al., 2018)
USA	AR5, AR10	H1, H6, H8	S10	I5	Y	B1, B2, B5	N	N	NA	3	(Kontar et al., 2015)
USA	AR5, AR10	H6, H10, H13	S5, S9, S10	I2, I3, I4, I5	Y	B4, B5	N	N	L2, L5, L8	3	(Pinto et al., 2018)
Canada	AR5, AR10, AR16	H3, H6, H8	S2, S4, S5, S10	I2, I3, I5	Y	B1, B3, B5	N	N	L4, L5, L6	3	(Picketts, 2015)
Mexico	AR5, AR8, AR12	H4, H17, H19	S1, S2, S6, S8	I6	Y	B4, B5	N	Y	L5	3	(Kernecker et al., 2017)
Mexico	AR7	H3, H5, H6, H7, H8, H11, H18	S2, S6, S8, S10	I4	Y	B1, B2, B4, B5	Y	Y	L2, L4, L7, L10	3	(Newsham et al., 2018)
Canada	AR7, AR11, AR16	H5, H6	S6	I4, I5	Y	B1, B3, B4, B5	N	Y	L5	3	(Hurlbert, 2014)
USA	AR8, AR9	H3, H5, H6, H10, H11, H18	S2, S6, S10	I6	Y	B1, B3, B4, B5	N	N	NA	3	(Fischer, 2019)
Small Island and States											
Jamaica	AR1, AR2, AR4, AR7	H6, H10, H16	S6	I1, I4	Y	B1, B3, B5	N	N	L4	3	(Moulton, 2017)
Puerto Rico	AR1, AR3, AR4	H3, H5	S6	I4, I7	N	NA	N	N	L5, L6	3	(Álvarez-Berríos et al., 2018)
Belize	AR10	H10, H12	S5, S10, S11	I2, I4, I6	Y	B2, B4, B5	Y	N	L5, L9	3	(Karlsson and Hovelsrud, 2015)

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Guyana	AR5, AR10, AR13	H3, H8, H13	S3, S5, S10	I3, I4, I5, I6	N	NA	Y	N	L1, L3, L4, L5, L6, L7, L8, L9	3	(Mycoo, 2014)
Dominican Republic	AR8, AR14	H3, H6, H16	S7	I2, I4, I7	Y	B1, B2, B3, B4, B5	Y	Y	L5, L7	3	(Sánchez and Izzo, 2017)

Table Notes:

List of coded variables

Adaptation responses (16 categories)

AR1 - Improved cultivars & agronomic practices, AR2 - Changes in cropping pattern and crop systems, AR3 - On farm irrigation and water management, AR4 - Water and soil moisture conservation, AR5 - Collective action, policies, institutions, AR6 - Migration & off-farm diversification, AR7 - Economic/financial incentives, AR8 - Training and capacity building, AR9 - Agro-forestry and forestry interventions, AR10 - Flood risk reduction measures, AR11 - Livestock and Fishery related, AR12 - IK and LK based adaptations, AR13 - Urban water management, AR14 - Energy related adaptations, AR15 - WaSH related adaptations, AR16 - Any other (includes coping),

Sector in which adaptation is taking place (11 categories)

S1 - Cultural uses of water, S2 - Fresh water ecosystems, S3 - Human mobility and migration, S4 - Inland navigation and transportation, S5 - Urban and peri-urban, S6 - Water for agriculture, S7 - Water for energy and industry, S8 - Water for health and sanitation, S9 - Water related conflicts, S10 - Water-induced disasters (floods, droughts, cyclones, storms etc.), S11 - Other water use sector,

Initiation of adaptation (11 categories)

I1 - Civil society (international/multinational/national), I2 - Civil society (sub-national/local), I3 - Initiated by Government (local), I4 - Initiated by Government (national), I5 - Initiated by Government (sub-national), I6 - Initiated by Individual and households, I7 - Initiated by International or multinational governance institutions, I8 - Initiated by Private sector (corporations), I9 - Initiated by Private sector (SME), I10 - Initiated by Not assessed/Not available/Not known, I11 - Initiated by Others,

Hazards against which adaptation responses are forged (19 categories)

H1 - Cryosphere change (too much or too little water), H2 - Groundwater availability change (too little water), H3 - Precipitation change & extreme precipitation (too much water), H4 - Soil erosion and sediment load change, H5 - Drought (too little water), H6 - General climate impacts, H7 - Extreme heat increased frequency and intensity, H8 - Inland and riverine floods (too much water), H9 - Poor water quality (too dirty water), H10 - Other Hazards (state), H11 - Bushfire, H12 - Coastal related (erosion, floods, tidal and storm surges), H13 - Other Sea level rise, H14 - Other Higher SST, H15 - Saline intrusion/Soil salinization, H16 - Storms: Cyclones, hurricanes, typhoons, Tsunamis, H17 - Landslides/Mudslides, H18 - Pests, H19 - Frost, intense cold, fog,

Benefits of adaptation (5 categories)

B1 - Are the economic/financial outcomes positive?, B2 - Was impact on vulnerable people reduced?, B3 - Was the water related outcome positive?, B4 - Was the ecological/environmental outcome positive?, B5 - Was the institutional/sociocultural outcome positive?

Limits to adaptation (10 categories)

L1 - Limit type: Biological, L2 - Cultural Limits, L3 - Economic Limits, L4 - Financial Limits, L5 - Governance/Institutions and Policies Limits, L6 - Human capacity Limits, L7 - Information and awareness Limits, L8 - Physical Limits, L9 - Technological Limits, L10 - Others Limits.

Confidence in link between adaptation response and adaptation outcomes (3 categories)

1=Link is causal, 2=There is correlation between adaptation response and outcomes, but it is not causal 3=No clear link is established

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Table SM4.6: Adaptation projections. See SM4.2 for full description of the methodology.

Region	Country	Baseline	Scenario period	Climate models	Impact models	Scenario	Projection without adaptation	Projection with adaptation	Baseline with adaptation	Baseline without adaptation	Indicator of effectiveness	Unit	Global warming level (increase relative to 1850-1900 baseline)	Effectiveness class	Residual class	Reference
Option 1: Improved cultivars and agronomic practices																
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP8.5	0.49	0.48		1.0	WUE	Changes in %	4.0	Insufficient	Maladaptation	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP8.5	0.52	0.58		1.0	WUE	Changes in %	4.0	Insufficient	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP8.5	0.49	0.47		1.0	WUE	Changes in %	4.0	Insufficient	Maladaptation	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP8.5	0.52	0.56		1.0	WUE	Changes in %	4.0	Insufficient	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP4.5	0.74	0.75		1.0	WUE	Changes in %	3.0	Insufficient	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP4.5	0.49	0.66		1.0	WUE	Changes in %	3.0	Small	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP4.5	0.74	0.74		1.0	WUE	Changes in %	3.0	Insufficient	Large	(Amouzou et al., 2019)

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Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP4.5	0.49	0.69		1.0	WUE	Changes in %	3.0	Small	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP2.6	0.77	0.83		1.0	WUE	Changes in %	2.0	Insufficient	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP2.6	0.58	0.73		1.0	WUE	Changes in %	2.0	Small	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP2.6	0.77	0.82		1.0	WUE	Changes in %	2.0	Insufficient	Large	(Amouzou et al., 2019)
Africa	Benin	1986-2005	2080-2099	BNU-ESM,_CanESM2,_MPI-ESM-MR	CSM_CERES-MAIZE,_CSM_CERES-SORGHUM_M	RCP2.6	0.58	0.77		1.0	WUE	Changes in %	2.0	Small	Large	(Amouzou et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	100.92	101.1	100.0	sediment_load_change	Changes in %	4.0	Large	Negligible	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	100.97	101.5	100.0	sediment_load_change	Changes in %	4.0	Large	Negligible	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-	SWAT	RCP8.5	104.73	101.02	101.1	100.0	sediment_load_change	Changes in %	3.0	Moderate	Small	(Qiu et al., 2019)

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				CHEM,_NorESM1-M												
Asia	China	1980-2004	2045-2069	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	104.73	101.07	101.5	100.0	sediment_load_change	Changes in %	3.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1961-1990	2080-2100	HadCM3	APSIM-OzCot	A2	3.44	3.69	1.9	4.0	CWP (=yield/water used)	kg/m3	4.0	Small	Large	(Yang et al., 2014)
Asia	China	1961-1990	2080-2100	HadCM3	APSIM-OzCot	A2	3.44	3.75	1.3	4.0	CWP (=yield/water used)	kg/m3	4.0	Moderate	Moderate	(Yang et al., 2014)
North America	United States	1991-2005	2040-2059	CCSM4,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5	SWAT,_CLM_(Community_Land_Model)	RCP4.5	18.31	16.83	16.2	16.3	IWR (=ETC-P)	1E9m3/y	2.0	Moderate	Small	(Yang et al., 2014)
North America	United States	1991-2005	2080-2099	CCSM4,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5	SWAT,_CLM_(Community_Land_Model)	RCP4.5	18.70	16.85	16.2	16.3	IWR (=ETC-P)	1E9m3/y	2.0	Moderate	Small	(Yang et al., 2014)
North America	United States	1991-2005	2040-2059	CCSM4,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5	SWAT,_CLM_(Community_Land_Model)	RCP8.5	18.88	17.14	16.2	16.3	IWR (=ETC-P)	1E9m3/y	2.0	Moderate	Moderate	(Yang et al., 2014)
North America	United States	1991-2005	2080-2099	CCSM4,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5	SWAT,_CLM_(Community_Land_Model)	RCP8.5	21.13	17.67	16.2	16.3	IWR (=ETC-P)	1E9m3/y	4.0	Moderate	Small	(Yang et al., 2014)

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North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	4.15	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	3.10	1.8	2.6	soil_N-leaching	kg N/ha	2.0	Large	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	2.70	1.7	2.6	soil_N-leaching	kg N/ha	2.0	Large	Negligible	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	4.20	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	3.60	1.9	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	5.20	2.4	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	4.50	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	5.70	2.6	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A1B	5.60	4.90	2.3	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	5.15	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	4.00	1.8	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	3.50	1.7	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	5.50	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	4.80	1.9	2.6	soil_N-leaching	kg N/ha	2.0	Small	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	6.80	2.4	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	6.10	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	8.30	2.6	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	A2	7.00	7.30	2.3	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	3.55	2.1	2.6	soil_N-leaching	kg N/ha	1.5	Small	Large	(Qin et al., 2018)

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North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	2.90	1.8	2.6	soil_N-leaching	kg N/ha	1.5	Large	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	2.70	1.7	2.6	soil_N-leaching	kg N/ha	1.5	Large	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	3.30	2.1	2.6	soil_N-leaching	kg N/ha	1.5	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	3.00	1.9	2.6	soil_N-leaching	kg N/ha	1.5	Moderate	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	4.00	2.4	2.6	soil_N-leaching	kg N/ha	1.5	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	3.50	2.1	2.6	soil_N-leaching	kg N/ha	1.5	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	4.40	2.6	2.6	soil_N-leaching	kg N/ha	1.5	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CCMA_CGCM3	DAYCENT	B1	4.30	3.80	2.3	2.6	soil_N-leaching	kg N/ha	1.5	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	8.30	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	6.80	1.8	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	6.10	1.7	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	7.90	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	6.80	1.9	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	8.70	2.4	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	7.20	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	9.80	2.6	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP4.5	10.75	7.40	2.3	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	14.25	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	11.50	1.8	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)

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North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	10.20	1.7	2.6	soil_N-leaching	kg N/ha	3.0	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	14.60	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	12.70	1.9	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	17.50	2.4	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	14.60	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	19.60	2.6	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	CanESM2	DAYCENT	RCP8.5	19.65	15.70	2.3	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	4.60	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	4.00	1.8	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Moderate	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	3.70	1.7	2.6	soil_N-leaching	kg N/ha	2.0	Moderate	Small	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	5.00	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	4.50	1.9	2.6	soil_N-leaching	kg N/ha	2.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	6.50	2.4	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	5.60	2.1	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	7.40	2.6	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP4.5	6.35	6.20	2.3	2.6	soil_N-leaching	kg N/ha	2.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	9.45	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	8.30	1.8	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	7.80	1.7	2.6	soil_N-leaching	kg N/ha	3.0	Moderate	Moderate	(Qin et al., 2018)

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North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	11.10	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	10.00	1.9	2.6	soil_N-leaching	kg N/ha	3.0	Small	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	14.60	2.4	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	12.50	2.1	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Large	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	20.50	2.6	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Maladaptation	(Qin et al., 2018)
North America	Canada	1961-2010	2017-2076	HadGEM2-ES	DAYCENT	RCP8.5	13.85	15.10	2.3	2.6	soil_N-leaching	kg N/ha	3.0	Insufficient	Maladaptation	(Qin et al., 2018)
Option 2: Changes in cropping pattern and crop systems																
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.21	0.16		0.4	CWP	kg/m3	1.5	Insufficient	Maladaptation	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.32	0.19		0.4	CWP	kg/m3	1.5	Insufficient	Maladaptation	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.21	0.20		0.4	CWP	kg/m3	1.5	Insufficient	Maladaptation	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.56	0.59		0.7	CWP	kg/m3	1.5	Insufficient	Large	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.32	0.33		0.4	CWP	kg/m3	1.5	Insufficient	Large	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.56	0.64		0.7	CWP	kg/m3	1.5	Moderate	Moderate	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.54	0.50		0.7	CWP	kg/m3	1.5	Insufficient	Maladaptation	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.54	0.62		0.7	CWP	kg/m3	1.5	Moderate	Moderate	(Brouziyne et al., 2018)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP8.5	0.18	0.19	0.2	0.2	water_productivity	$/m^3	2.0	Insufficient	Large	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP4.5	0.19	0.19	0.2	0.2	water_productivity	$/m^3	1.5	Insufficient	Large	(Dai et al., 2020)

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Asia	Iran	1961-1990	2080	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	0.23	0.25		0.4	CWP (=yield/water used)	kg/m3	2.0	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2080	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.20	0.22		0.4	CWP (=yield/water used)	kg/m3	4.0	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2020	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	0.29	0.31		0.4	CWP (=yield/water used)	kg/m3	1.5	Small	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2020	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	1.04	1.07		1.1	CWP (=yield/water used)	kg/m3	1.5	Small	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2020	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.27	0.29		0.4	CWP (=yield/water used)	kg/m3	1.5	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2020	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.99	1.04		1.1	CWP (=yield/water used)	kg/m3	1.5	Small	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2050	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	0.26	0.29		0.4	CWP (=yield/water used)	kg/m3	2.0	Small	Large	(Paymard et al., 2018)

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Asia	Iran	1961-1990	2050	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	0.96	1.02		1.1	CWP (=yield/water used)	kg/m3	2.0	Small	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2080	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP4.5	0.87	0.92		1.1	CWP (=yield/water used)	kg/m3	2.0	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2050	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.24	0.27		0.4	CWP (=yield/water used)	kg/m3	3.0	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2050	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.89	0.99		1.1	CWP (=yield/water used)	kg/m3	3.0	Small	Large	(Paymard et al., 2018)
Asia	Iran	1961-1990	2080	FIO-ESM,_GFDL-ESM2_M,_IPSL-CM5A-LR,_MIROC-ESM-CHEM	(CSM)-CERES-Wheat_(DSSAT)_version_4.6	RCP8.5	0.81	0.89		1.1	CWP (=yield/water used)	kg/m3	4.0	Insufficient	Large	(Paymard et al., 2018)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP2.6	0.27	0.21		0.2	water_resource_vulnerability_index	%	1.5	Large	Small	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP4.5	0.36	0.31		0.2	water_resource_vulnerability_index	%	1.5	Small	Large	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP8.5	0.44	0.38		0.2	water_resource_vulnerability_index	%	2.0	Insufficient	Large	(Mehrazar et al., 2020)

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Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP2.6	0.27	0.23		0.2	water_resource_vulnerability_index	%	1.5	Moderate	Moderate	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP4.5	0.36	0.33		0.2	water_resource_vulnerability_index	%	1.5	Insufficient	Large	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP8.5	0.44	0.40		0.2	water_resource_vulnerability_index	%	2.0	Insufficient	Large	(Mehrazar et al., 2020)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	91.44		100.0	WUE	Changes in %	1.5	Insufficient	Maladaptation	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	99.22		100.0	WUE	Changes in %	1.5	Moderate	Small	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	103.00		100.0	WUE	Changes in %	1.5	Co-benefits	Negligible	(Luo et al., 2016)
Option 3: On farm irrigation and water management																
Africa	South Africa	1990-2010	2040-2060	CSIRO	IMPACT,_GTAP-W	B1	100532.03	119243.77		116222.0	production	Million_tons	1.5	Co-benefits	Negligible	(Calzadilla et al., 2014)
Africa	Ethiopia	1980-2009	2040-2069	CanESM2,_CSIRO-MK3-6-0,_HadGEM2-ES	DSSAT,_WOFOST	RCP4.5	5.47	6.10	7.2	6.7	yield	Mg/ha	2.0	Moderate	Moderate	(Kassie et al., 2015)
Africa	Ethiopia	1980-2009	2040-2069	CanESM2,_CSIRO-MK3-6-0,_HadGEM2-ES	DSSAT,_WOFOST	RCP8.5	5.23	5.97	7.2	6.7	yield	Mg/ha	3.0	Small	Large	(Kassie et al., 2015)

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Africa	West Africa	1985-2006	non available	CCCma-CanESM2,_CSIRO-Mk3.6.0,_ICHEC-EC-EARTH,_MOHC-HadGEM2-ES,_IPSL-CM5A-MR,_MPI-M-MPI-ESM-LR	GLAM	RCP8.5	1031.00	1050.00		1086.0	yield	kg/ha	2.0	Small	Large	(Parkes et al., 2018)
Africa	West Africa	1985-2006	non available	CCCma-CanESM2,_CSIRO-Mk3.6.0,_ICHEC-EC-EARTH,_MOHC-HadGEM2-ES,_IPSL-CM5A-MR,_MPI-M-MPI-ESM-LR	GLAM	RCP8.5	647.00	650.00		1086.0	yield	kg/ha	4.0	Insufficient	Large	(Parkes et al., 2018)
Africa	Uganda	1961-1990	2010-2039	HadCM3	CERES-maize	A2	99.50	106.50		100.0	yield_change	Changes in %	1.5	Co-benefits	Negligible	(Babel and Turyatunga, 2015)
Africa	Uganda	1961-1990	2010-2049	HadCM3	CERES-maize	B2	99.00	105.50		100.0	yield_change	Changes in %	1.5	Co-benefits	Negligible	(Babel and Turyatunga, 2015)
Africa	Uganda	1961-1990	2040-2069	HadCM3	CERES-maize	A2	97.00	110.00		100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Babel and Turyatunga, 2015)
Africa	Uganda	1961-1990	2040-2070	HadCM3	CERES-maize	B2	99.00	109.50		100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Babel and Turyatunga, 2015)
Africa	Uganda	1961-1990	2070-2099	HadCM3	CERES-maize	A2	83.50	97.00		100.0	yield_change	Changes in %	4.0	Large	Small	(Babel and Turyatunga, 2015)
Africa	Uganda	1961-1990	2070-2099	HadCM3	CERES-maize	B2	91.00	102.00		100.0	yield_change	Changes in %	3.0	Co-benefits	Negligible	(Babel and

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																Turyatunga, 2015)
Asia	India	1971-2000	2036-2065	HadCM3,_ECHAM5	LPJmL	A1B	67.35	74.33		70.4	Renewable_water_usage_relative_to_groundwater_in_crop_production	Changes in %	2.0	Co-benefits	Negligible	(Biemans et al., 2013)
Asia	India	1971-2000	2036-2065	HadCM3,_ECHAM6	LPJmL	A1B	67.35	71.95		70.4	crop_production_relative_to_water_resources	Changes in %	2.0	Co-benefits	Negligible	(Biemans et al., 2013)
Asia	India	1971-2000	2036-2065	HadCM3,_ECHAM7	LPJmL	A1B	67.35	78.76		70.4	crop_production_relative_to_water_resources	Changes in %	2.0	Co-benefits	Negligible	(Biemans et al., 2013)
Asia	Thailand	1980-2004	2020-2044	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.94	2.23		2.0	yield	t/ha	1.5	Co-benefits	Negligible	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.82	2.13		2.0	yield	t/ha	2.0	Co-benefits	Negligible	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.75	2.11		2.0	yield	t/ha	2.0	Co-benefits	Negligible	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2020-2044	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.95	2.23		2.0	yield	t/ha	1.5	Co-benefits	Negligible	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.76	2.08		2.0	yield	t/ha	3.0	Co-benefits	Negligible	(Boonwichai et al., 2019)

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Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.68	2.01		2.0	yield	t/ha	4.0	Co-benefits	Negligible	(Boonwichai et al., 2019)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP8.5	0.18	0.20	0.2	0.2	water_productivity	$/m^3	2.0	Large	Small	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP8.5	0.18	0.19	0.2	0.2	water_productivity	$/m^3	2.0	Moderate	Moderate	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP4.5	0.19	0.19	0.2	0.2	water_productivity	$/m^3	1.5	Small	Large	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP4.5	0.19	0.19	0.2	0.2	water_productivity	$/m^3	1.5	Insufficient	Large	(Dai et al., 2020)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	128.54	133.0	100.0	sediment_load_change	Changes in %	4.0	Small	Large	(Qin et al., 2018)

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Asia	Vietnam	2001-2010	2040-2060	HadCM3	Aquacrop_Model	B2	4.83	6.30		5.2	yield	t/ha	2.0	Co-benefits	Negligible	(Shrestha et al., 2016)
Asia	Vietnam	2001-2010	2040-2060	HadCM3	Aquacrop_Model	A2	4.72	6.02		5.2	yield	t/ha	2.0	Co-benefits	Negligible	(Shrestha et al., 2016)
Asia	Vietnam	2001-2010	2070-2090	HadCM3	Aquacrop_Model	B2	4.64	6.16		5.2	yield	t/ha	3.0	Co-benefits	Negligible	(Shrestha et al., 2016)
Asia	Vietnam	2001-2010	2070-2090	HadCM3	Aquacrop_Model	A2	4.01	5.70		5.2	yield	t/ha	3.0	Co-benefits	Negligible	(Shrestha et al., 2016)
Asia	Iran	2000-2008	2010-2038	HadCM3	SWAT	A2	3.52	3.26		4.8	product calories	10^11 kcal	1.5	Insufficient	Maladaptation	(Rezaei Zaman et al., 2016)
Asia	Iran	2000-2008	2010-2038	HadCM3	SWAT	A2	3.52	3.54		4.8	product calories	10^11 kcal	1.5	Insufficient	Large	(Rezaei Zaman et al., 2016)
Asia	Iran	2000-2008	2010-2038	HadCM3	SWAT	B2	4.15	3.89		4.8	product calories	10^11 kcal	1.5	Insufficient	Maladaptation	(Rezaei Zaman et al., 2016)
Asia	Iran	2000-2008	2010-2038	HadCM3	SWAT	B2	4.15	4.13		4.8	product calories	10^11 kcal	1.5	Insufficient	Maladaptation	(Rezaei Zaman et al., 2016)
Asia	Thailand	1980-2004	2020-2044	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.94	1.97		2.0	yield	t/ha	1.5	Large	Negligible	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.82	1.90		2.0	yield	t/ha	2.0	Moderate	Moderate	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.75	1.89		2.0	yield	t/ha	2.0	Moderate	Moderate	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2020-2044	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.95	1.91		2.0	yield	t/ha	1.5	Insufficient	Maladaptation	(Boonwichai et al., 2019)

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Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.76	1.77		2.0	yield	t/ha	3.0	Insufficient	Large	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.68	1.67		2.0	yield	t/ha	4.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.94	1.82		2.0	yield	t/ha	2.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.93	1.75		2.0	yield	t/ha	2.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.77	1.76		2.0	yield	t/ha	3.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.71	1.68		2.0	yield	t/ha	4.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.94	1.94		2.0	yield	t/ha	2.0	Insufficient	Large	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.93	1.95		2.0	yield	t/ha	2.0	Small	Moderate	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.77	1.79		2.0	yield	t/ha	3.0	Insufficient	Large	(Boonwichai et al., 2019)

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Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.71	1.74		2.0	yield	t/ha	4.0	Insufficient	Large	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.94	1.86		2.0	yield	t/ha	2.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP4.5	1.93	1.84		2.0	yield	t/ha	2.0	Insufficient	Maladaptation	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2045-2069	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.77	1.77		2.0	yield	t/ha	3.0	Insufficient	Large	(Boonwichai et al., 2019)
Asia	Thailand	1980-2004	2070-2094	ACCESS1.0,_CNRM-CM5,_MPI-ESM-LR,_EC-EARTH	DSSAT_v_4.6,_CERES_rice_crop	RCP8.5	1.71	1.72		2.0	yield	t/ha	4.0	Insufficient	Large	(Boonwichai et al., 2019)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP2.6	0.27	0.17		0.2	water_resource_vulnerability_index	%	1.5	Co-benefits	Negligible	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP4.5	0.36	0.22		0.2	water_resource_vulnerability_index	%	1.5	Large	Small	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP8.5	0.44	0.25		0.2	water_resource_vulnerability_index	%	2.0	Moderate	Small	(Mehrazar et al., 2020)
Asia	India	1980-2010	2040-2069	MPI-ESM-MR,_MIROC5,_CCSM4_HadGEM2-ES	DSSAT-CROPGRO-Peanut	RCP8.5	98.80	114.40		100.0	yield_change	Changes in %	3.0	Co-benefits	Negligible	(Kadiyala et al., 2015)

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Asia	Vietnam	1971-2000	2011-2040	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	A2	91.00	95.83		100.0	yield_change	Changes in %	1.5	Moderate	Moderate	(Deb et al., 2016)
Asia	Vietnam	1971-2000	2041-2070	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	A2	87.50	95.33		100.0	yield_change	Changes in %	2.0	Moderate	Moderate	(Deb et al., 2016)
Asia	Vietnam	1971-2000	2071-2099	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	A2	83.33	90.67		100.0	yield_change	Changes in %	3.0	Small	Large	(Deb et al., 2016)
Asia	Vietnam	1971-2000	2011-2040	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	B2	93.00	100.00		100.0	yield_change	Changes in %	1.5	Large	Negligible	(Deb et al., 2016)
Asia	Vietnam	1971-2000	2041-2070	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	B2	90.67	96.33		100.0	yield_change	Changes in %	2.0	Moderate	Moderate	(Deb et al., 2016)
Asia	Vietnam	1971-2000	2071-2099	ECHAM4,_CCSR,_UKMO-HadCM3,_CSIRO-Mk2.0,_CGCM2.0,_GFDL-R30	AquaCrop4.0	B2	88.00	92.50		100.0	yield_change	Changes in %	3.0	Small	Large	(Deb et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.64	98.30		100.0	yield	Changes in %	1.5	Small	Large	(Luo et al., 2016)

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Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	97.71		100.0	WUE	Changes in %	1.5	Insufficient	Large	(Luo et al., 2016)
Central and South America	Ecuador	1961-1990	2070-2099	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	181.75	185.30		109.8	agricultural_gross_water_demand	hm^3	4.0	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2070-2099	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	181.75	164.75		109.8	agricultural_gross_water_demand	hm^3	4.0	Insufficient	Large	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2040-2069	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	150.95	154.00		109.8	agricultural_gross_water_demand	hm^3	3.0	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2040-2069	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	150.95	136.90		109.8	agricultural_gross_water_demand	hm^3	3.0	Small	Large	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2070-2099	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	137.80	140.55		109.8	agricultural_gross_water_demand	hm^3	2.0	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2070-2099	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	137.80	124.90		109.8	agricultural_gross_water_demand	hm^3	2.0	Small	Large	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2040-2069	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	136.20	138.85		109.8	agricultural_gross_water_demand	hm^3	2.0	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2040-2069	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	136.20	123.40		109.8	agricultural_gross_water_demand	hm^3	2.0	Small	Large	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2010-2039	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	122.45	124.90		109.8	agricultural_gross_water_demand	hm^3	1.5	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)

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Central and South America	Ecuador	1961-1990	2010-2039	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP8.5	122.45	110.95		109.8	agricultural_gross_water_demand	hm^3	1.5	Large	Small	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2010-2039	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	124.65	127.10		109.8	agricultural_gross_water_demand	hm^3	1.5	Insufficient	Maladaptation	(Rivadeneira Vera et al., 2020)
Central and South America	Ecuador	1961-1990	2010-2039	CCSM4,_ECHAM6	Lumped-Témez_Hydrological_Model	RCP4.5	124.65	113.00		109.8	agricultural_gross_water_demand	hm^3	1.5	Moderate	Small	(Rivadeneira Vera et al., 2020)
Europe	Spain	1980-2010	2070-2099	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP8.5	18.00	28.74		100.0	yield_change	Changes in %	4.0	Insufficient	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2070-2099	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP8.5	18.00	35.56		100.0	yield_change	Changes in %	4.0	Insufficient	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2040-2069	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP8.5	55.98	68.78		100.0	yield_change	Changes in %	3.0	Insufficient	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2040-2069	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP8.5	55.98	77.54		100.0	yield_change	Changes in %	3.0	Small	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2070-2099	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP4.5	62.26	70.22		100.0	yield_change	Changes in %	3.0	Insufficient	Large	(Cabezas et al., 2020)

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Europe	Spain	1980-2010	2070-2099	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP4.5	62.26	77.52		100.0	yield_change	Changes in %	3.0	Small	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2040-2069	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP4.5	96.04	97.48		100.0	yield_change	Changes in %	2.0	Small	Large	(Cabezas et al., 2020)
Europe	Spain	1980-2010	2040-2069	GFDL-CM3,_GISS-E2-R,_HadGEM2-ES,_MIROC5,_MPI-ESM-MR	AdaptaOlive	RCP4.5	96.04	101.10		100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Cabezas et al., 2020)
Europe	UK	2008-2017	2041-2050	HadCM3	Aquacrop	B1	6.00	11.10	9.0	7.8	yield	t/ha	1.5	Co-benefits	Negligible	(El Chami and Daccache, 2015)
Europe	UK	2008-2017	2041-2050	HadCM3	Aquacrop	A1	6.25	11.25	9.0	7.8	yield	t/ha	2.0	Co-benefits	Negligible	(El Chami and Daccache, 2015)
Europe	Portugal	1981-2005	2041-2070	MPI-M-MPI-ESM-LR,_CNRM-CM5	STICS	RCP8.5	79.42	90.83		100.0	yield_change	Changes in %	3.0	Moderate	Moderate	(Fraga et al., 2018)
Europe	Italy	1981-2020	2021-2060	CNRM-CM5	SPI-Q,_GMAT	RCP4.5	521.70	535.80		664.3	annual_cumulated_ground_water_discharge	1E6m3	1.5	Insufficient	Large	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2021-2060	CNRM-CM5	SPI-Q,_GMAT	RCP4.5	521.70	560.90		664.3	annual_cumulated_ground_water_discharge	1E6m4	1.5	Insufficient	Large	(Guyennon et al., 2017)

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Europe	Italy	1981-2020	2021-2060	CNRM-CM5	SPI-Q,_GMAT	RCP8.5	417.60	428.90		720.4	annual_cumulated_ground_water_discharge	1E6m5	2.0	Insufficient	Large	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2021-2060	CNRM-CM5	SPI-Q,_GMAT	RCP8.5	417.60	456.80		720.4	annual_cumulated_ground_water_discharge	1E6m6	2.0	Insufficient	Large	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2061-2100	CNRM-CM5	SPI-Q,_GMAT	RCP4.5	492.60	507.80		664.3	annual_cumulated_ground_water_discharge	1E6m3	2.0	Insufficient	Large	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2061-2100	CNRM-CM5	SPI-Q,_GMAT	RCP4.5	492.60	610.10		664.3	annual_cumulated_ground_water_discharge	1E6m4	2.0	Moderate	Moderate	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2061-2100	CNRM-CM5	SPI-Q,_GMAT	RCP8.5	312.20	324.60		720.4	annual_cumulated_ground_water_discharge	1E6m5	4.0	Insufficient	Large	(Guyennon et al., 2017)
Europe	Italy	1981-2020	2061-2100	CNRM-CM5	SPI-Q,_GMAT	RCP8.5	312.20	387.70		720.4	annual_cumulated_ground_water_discharge	1E6m6	4.0	Insufficient	Large	(Guyennon et al., 2017)
Europe	Portugal	1981-2005	2021-2041	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP4.5	88.00	99.00		100.0	yield_change	Changes in %	1.5	Large	Small	(Fraga et al., 2020)
Europe	Portugal	1981-2005	2021-2041	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP8.5	77.00	97.00		100.0	yield_change	Changes in %	1.5	Large	Small	(Fraga et al., 2020)

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Europe	Portugal	1981-2005	2041-2061	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP4.5	84.00	98.50		100.0	yield_change	Changes in %	2.0	Large	Small	(Fraga et al., 2020)
Europe	Portugal	1981-2005	2041-2061	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP8.5	79.00	98.50		100.0	yield_change	Changes in %	3.0	Large	Small	(Fraga et al., 2020)
Europe	Portugal	1981-2005	2061-2081	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP4.5	84.00	101.00		100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Fraga et al., 2020)
Europe	Portugal	1981-2005	2061-2081	MPI-M-MPI-ESM-LR,_CNRM-CM5,_EC-EARTH,_IPSL-CM5A-MR	dynamic_olive_crop_model_by_Viola_et_al_2012	RCP8.5	80.00	100.50		100.0	yield_change	Changes in %	4.0	Co-benefits	Negligible	(Fraga et al., 2020)
Global	Global	1986-2005	2081-2100	CESM	post-4.5_version_of_the_Community_Land_Model_(CLM)	RCP4.5	6.70	11.00	10.7	6.9	yield	t/ha	2.0	Co-benefits	Negligible	(Levis et al., 2018)
Global	Global	1986-2005	2081-2100	CESM	post-4.5_version_of_the_Community_Land_Model_(CLM)	RCP4.5	6.20	11.00	10.7	6.9	yield	t/ha	2.0	Co-benefits	Negligible	(Levis et al., 2018)
Global	Global	1986-2005	2081-2100	CESM	post-4.5_version_of_the_Community_Land_Model_(CLM)	RCP8.5	6.20	10.70	10.7	6.9	yield	t/ha	4.0	Co-benefits	Negligible	(Levis et al., 2018)
Option 4: Water and soil moisture conservation																
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.56	0.68		0.7	CWP	kg/m3	1.5	Large	Small	(Brouziyne et al., 2018)

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Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.21	0.33		0.4	CWP	kg/m3	1.5	Moderate	Small	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP8.5	0.54	0.63		0.7	CWP	kg/m3	1.5	Moderate	Moderate	(Brouziyne et al., 2018)
Africa	Morocco	2004-2009	2031-2050	CNMR_CM5	SWAT	RCP4.5	0.32	0.50		0.4	CWP	kg/m3	1.5	Co-benefits	Negligible	(Brouziyne et al., 2018)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP8.5	1251.00	1092.00	847.0	1006.0	unmet_water_demand	million_cubic_meter	4.0	Moderate	Moderate	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP8.5	1251.00	940.00	765.0	1006.0	unmet_water_demand	million_cubic_meter	4.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP8.5	1251.00	887.00	723.0	1006.0	unmet_water_demand	million_cubic_meter	4.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP8.5	1251.00	551.00	398.0	1006.0	unmet_water_demand	million_cubic_meter	4.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP4.5	1205.00	1046.00	847.0	1006.0	unmet_water_demand	million_cubic_meter	3.0	Moderate	Small	(Olabanji et al., 2020)

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Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP4.5	1205.00	927.00	765.0	1006.0	unmet_water_demand	million_cubic_meter	3.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP4.5	1205.00	872.00	723.0	1006.0	unmet_water_demand	million_cubic_meter	3.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	South Africa	1976-2005	2070-2099	CanESM2,_CNRM-CMS,_CSIRO Mk3.6.0,_IPSL-CM5A,_MIROC5,_MPI-ESM-LR	WEAP	RCP4.5	1205.00	497.00	398.0	1006.0	unmet_water_demand	million_cubic_meter	3.0	Co-benefits	Negligible	(Olabanji et al., 2020)
Africa	Malawi	2007-2012	2010-2030	Reg4CM,_global_climate_model_unspecified	DSSAT,_CERES-Maize	A1B	3937.20	4335.80	5002.0	4271.0	yield	kg/ha	1.5	Co-benefits	Negligible	(Ngwira et al., 2014)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	109.74	106.8	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	109.82	113.1	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)

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Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	108.99	107.8	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	113.49	117.6	100.0	sediment_load_change	Changes in %	4.0	Moderate	Moderate	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	118.97	129.2	100.0	sediment_load_change	Changes in %	4.0	Moderate	Moderate	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	131.30	136.0	100.0	sediment_load_change	Changes in %	4.0	Insufficient	Large	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	119.08	121.6	100.0	sediment_load_change	Changes in %	4.0	Moderate	Moderate	(Qiu et al., 2019)

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Asia	China	1980-2004	2070-2099	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	144.52	136.82	140.7	100.0	sediment_load_change	Changes in %	4.0	Insufficient	Large	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	110.76	106.8	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	111.54	113.1	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	110.43	107.8	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	115.64	117.6	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)

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Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	121.66	129.2	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	135.69	136.0	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	132.55	133.0	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	123.64	121.6	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M, _HadGEM2-ES, _IPSLCM5A-LR, _MIROC-ESM-CHEM, _NorESM1-M	SWAT	RCP8.5	104.73	141.99	140.7	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)

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Asia	Thailand	1975-2009	2010-2039	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	80.00	86.70		100.0	annual streamflow	Changes in %	1.5	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2010-2039	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	78.20	83.30		100.0	annual streamflow	Changes in %	1.5	Insufficient	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2040-2069	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	86.00	90.10		100.0	annual streamflow	Changes in %	2.0	Insufficient	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2040-2069	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	81.30	87.90		100.0	annual streamflow	Changes in %	3.0	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2070-2099	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	76.00	84.20		100.0	annual streamflow	Changes in %	2.0	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2070-2099	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	69.40	76.80		100.0	annual streamflow	Changes in %	4.0	Insufficient	Large	(Shrestha et al., 2018)
Europe	Portugal	1981-2005	2021-2040	MPI-M-MPI-ESM-LR	STICS	RCP8.5	89.25	99.63		100.0	yield_change	Changes in %	1.5	Large	Negligible	(Fraga and Santos, 2018)
Europe	Portugal	1981-2005	2041-2070	MPI-M-MPI-ESM-LR	STICS	RCP8.5	70.75	82.13		100.0	yield_change	Changes in %	3.0	Small	Large	(Fraga and Santos, 2018)
Europe	Portugal	1981-2005	2061-2080	MPI-M-MPI-ESM-LR	STICS	RCP8.5	60.13	74.75		100.0	yield_change	Changes in %	3.0	Small	Large	(Fraga and Santos, 2018)
Europe	Portugal	1981-2005	2021-2040	MPI-M-MPI-ESM-LR	STICS	RCP8.5	89.50	100.38		100.0	yield_change	Changes in %	1.5	Co-benefits	Negligible	(Fraga and Santos, 2018)
Europe	Portugal	1981-2005	2041-2070	MPI-M-MPI-ESM-LR	STICS	RCP8.5	71.13	81.75		100.0	yield_change	Changes in %	3.0	Small	Large	(Fraga and Santos, 2018)

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Europe	Portugal	1981-2005	2061-2080	MPI-M-MPI-ESM-LR	STICS	RCP8.5	59.13	74.88		100.0	yield_change	Changes in %	3.0	Small	Large	(Fraga and Santos, 2018)
North America	United States	1960-2006	2020-2050	CMIP5	HSPF_v2.3	RCP4.5	6.71	6.38	6.1	6.4	runoff	m3/second	1.5	Co-benefits	Negligible	(Dudula and Randhir, 2016)
North America	United States	1960-2006	2050-2080	CMIP5	HSPF_v2.3	RCP4.5	8.52	8.11	6.1	6.4	runoff	m3/second	2.0	Insufficient	Large	(Dudula and Randhir, 2016)
North America	United States	1991-2015	2021-2045	CCSM4,_CSIRO-MK3-6-0,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5,_MPI-ESM-LR	SWAT	RCP8.5	1340.00	750.00		1280.0	total_phosphore	kg/year	1.5	Co-benefits	Negligible	(Giri et al., 2020)
North America	United States	1991-2015	2021-2045	CCSM4,_CSIRO-MK3-6-0,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5,_MPI-ESM-LR	SWAT	RCP8.5	1340.00	1160.00		1280.0	total_phosphore	kg/year	1.5	Co-benefits	Negligible	(Giri et al., 2020)
North America	United States	1991-2015	2021-2045	CCSM4,_CSIRO-MK3-6-0,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5,_MPI-ESM-LR	SWAT	RCP8.5	1340.00	1330.00		1280.0	total_phosphore	kg/year	1.5	Insufficient	Large	(Giri et al., 2020)
North America	United States	1991-2015	2021-2045	CCSM4,_CSIRO-MK3-6-0,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5,_and_MPI-ESM-LR	SWAT	RCP4.5	162.00	158.44		154.0	runoff	mm/year	1.5	Small	Large	(Giri et al., 2020)

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North America	United States	1991-2015	2021-2045	CCSM4,_CSIRO-MK3-6-0,_GFDL-ESM2G,_IPSL-CM5A-LR,_MIROC5,_and_MPI-ESM-LR	SWAT	RCP8.5	167.00	162.16		151.0	runoff	mm/year	1.5	Small	Large	(Giri et al., 2020)
Option 5: Multiple agricultural adaptation options																
Africa	West Africa	1985-2006	non available	CCCma-CanESM2,_CSIRO-Mk3.6.0,_ICHEC-EC-EARTH,_MOHC-HadGEM2-ES,_IPSL-CM5A-MR,_MPI-M-MPI-ESM-LR	GLAM	RCP8.5	1031.00	1150.00		1086.0	yield	kg/ha	2.0	Co-benefits	Negligible	(Parkes et al., 2018)
Africa	West Africa	1985-2006	non available	CCCma-CanESM2,_CSIRO-Mk3.6.0,_ICHEC-EC-EARTH,_MOHC-HadGEM2-ES,_IPSL-CM5A-MR,_MPI-M-MPI-ESM-LR	GLAM	RCP8.5	647.00	757.00		1086.0	yield	kg/ha	4.0	Insufficient	Large	(Parkes et al., 2018)
Africa	Malawi	2007-2012	2010-2030	Reg4CM,_global_climate_model_unspecified	DSSAT,_CERES-Maize	A1B	3937.20	4388.30	5190.0	4271.0	yield	kg/ha	1.5	Co-benefits	Negligible	(Ngwira et al., 2014)
Asia	Pakistan	1980-2010	2040-2070	CSIRO-Mk3-6-0,_GFDL-ESM2G,_GFDL-ESM2M,_HadGEM2-ES,_CMCC-CM	(CSM)-CERES-Maize	RCP8.5	0.80	1.14		1.0	yield_change	percentage	2.0	Co-benefits	Negligible	(Ahmad et al., 2020)

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Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP8.5	0.18	0.19	0.2	0.2	water_productivity	$/m^3	2.0	Moderate	Moderate	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP8.5	0.18	0.19	0.2	0.2	water_productivity	$/m^3	2.0	Small	Large	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP4.5	0.19	0.19	0.2	0.2	water_productivity	$/m^3	1.5	Insufficient	Large	(Dai et al., 2020)
Asia	China	1975-2004	2021-2050	CMIP5	nan	RCP4.5	0.19	0.19	0.2	0.2	water_productivity	$/m^3	1.5	Insufficient	Maladaptation	(Dai et al., 2020)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	109.80	114.1	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	104.73	111.53	114.1	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	Pakistan	1980-2010	2039-2069	CESM1-BGC,_CMCC-CMS,_inmcm4,_IPSL-CM5A-MR,_NorESM1-M	APSIM-ORYZA	RCP8.5	92.70	108.70		100.0	yield_change	Changes in %	3.0	Co-benefits	Negligible	(Shabbir et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP2.6	0.27	0.20		0.2	water_resource_vulnerability_index	%	1.5	Large	Negligible	(Mehrazar et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP4.5	0.36	0.22		0.2	water_resource_vulnerability_index	%	1.5	Large	Small	(Mehrazar et al., 2020)

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Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP8.5	0.44	0.22		0.2	water_resource_vulnerability_index	%	2.0	Large	Small	(Mehraza r et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP2.6	0.27	0.16		0.2	water_resource_vulnerability_index	%	1.5	Co-benefits	Negligible	(Mehraza r et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP4.5	0.36	0.20		0.2	water_resource_vulnerability_index	%	1.5	Large	Negligible	(Mehraza r et al., 2020)
Asia	Iran	1976-2005	2020-2049	CMIP5	nan	RCP8.5	0.44	0.23		0.2	water_resource_vulnerability_index	%	2.0	Large	Small	(Mehraza r et al., 2020)
Asia	India	1980-2010	2040-2069	MPI-ESM-MR,_MIROC5,_CCSM4_HadGEM2-ES	DSSAT-CROPGRO-Peanut	RCP8.5	98.80	120.00		100.0	yield_change	Changes in %	3.0	Co-benefits	Negligible	(Kadiyala et al., 2015)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.64	94.78		100.0	yield	Changes in %	1.5	Insufficient	Maladaptation	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.64	96.11		100.0	yield	Changes in %	1.5	Insufficient	Maladaptation	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.64	97.22		100.0	yield	Changes in %	1.5	Insufficient	Large	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	92.56		100.0	WUE	Changes in %	1.5	Insufficient	Maladaptation	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	99.89		100.0	WUE	Changes in %	1.5	Large	Negligible	(Luo et al., 2016)
Australasia	Australia	1980-1999	2020-2039	GFDL,_CSIRO-Mark3.5_MPI,_MIROC	CSIRO-OZCOT	A2	96.89	101.89		100.0	WUE	Changes in %	1.5	Co-benefits	Negligible	(Luo et al., 2016)

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Europe	Italy/France	1991-2010	2021-2040	NOResm,_MIROC_ESM,_HadGEM2-ES,_GISS_ES	STICS,_WARM	RCP2.6	6.71	9.23		7.2	yield	t/ha	1.5	Co-benefits	Negligible	(Bregaglio et al., 2017)
Europe	Italy/France	1991-2010	2021-2040	NOResm,_MIROC_ESM,_HadGEM2-ES,_GISS_ES	STICS,_WARM	RCP8.5	6.58	9.23		7.2	yield	t/ha	1.5	Co-benefits	Negligible	(Bregaglio et al., 2017)
Europe	Italy/France	1991-2010	2061-2080	NOResm,_MIROC_ESM,_HadGEM2-ES,_GISS_ES	STICS,_WARM	RCP2.6	6.69	9.52		7.2	yield	t/ha	1.5	Co-benefits	Negligible	(Bregaglio et al., 2017)
Europe	Italy/France	1991-2010	2061-2080	NOResm,_MIROC_ESM,_HadGEM2-ES,_GISS_ES	STICS,_WARM	RCP8.5	5.90	8.48		7.2	yield	t/ha	3.0	Co-benefits	Negligible	(Bregaglio et al., 2017)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP2.6	97.00	112.60		100.0	kcal_production	Changes in %	1.5	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP2.6	97.00	138.40		100.0	kcal_production	Changes in %	1.5	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP4.5	92.40	108.10		100.0	kcal_production	Changes in %	2.0	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP4.5	92.40	133.10		100.0	kcal_production	Changes in %	2.0	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP6.0	90.60	105.80		100.0	kcal_production	Changes in %	3.0	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP6.0	90.60	130.80		100.0	kcal_production	Changes in %	3.0	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP8.5	81.80	96.20		100.0	kcal_production	Changes in %	4.0	Moderate	Small	(Jägermeyr et al., 2016)
Global	Global	1980-2009	2070-2099	CMIP5	LPJmL	RCP8.5	81.80	118.90		100.0	kcal_production	Changes in %	4.0	Co-benefits	Negligible	(Jägermeyr et al., 2016)
Option 6: Agro-forestry and forestry																

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Africa	Uganda	1950-2000	2040-2069	HadGEM2-ES	SpCAF,_CAF2014	RCP6.0	91.50	98.00	97.5	100.0	yield_change	Changes in %	2.0	Moderate	Small	(Rahn et al., 2018b)
Africa	Tanzania	1950-2000	2040-2069	HadGEM2-ES	SpCAF,_CAF2014	RCP6.0	95.50	115.00	109.0	100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Rahn et al., 2018b)
Africa	Tanzania	1950-2000	2040-2069	HadGEM2-ES	SpCAF,_CAF2014	RCP6.0	79.50	101.00	109.0	100.0	yield_change	Changes in %	2.0	Co-benefits	Negligible	(Rahn et al., 2018b)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	112.76	114.7	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1980-2004	2070-2099	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	144.52	110.02	111.2	100.0	sediment_load_change	Changes in %	4.0	Moderate	Small	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	104.73	115.01	114.7	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)
Asia	China	1980-2004	2045-2069	GFDL-ESM2M,_HadGEM2-ES,_IPSLCM5A-LR,_MIROC-ESM-CHEM,_NorESM1-M	SWAT	RCP8.5	104.73	111.77	111.2	100.0	sediment_load_change	Changes in %	3.0	Insufficient	Maladaptation	(Qiu et al., 2019)

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Asia	Thailand	1975-2009	2010-2039	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	80.00	106.50		100.0	annual streamflow	Changes in %	1.5	Co-benefits	Negligible	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2010-2039	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	78.20	86.40		100.0	annual streamflow	Changes in %	1.5	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2040-2069	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	86.00	90.20		100.0	annual streamflow	Changes in %	2.0	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2040-2069	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	81.30	89.40		100.0	annual streamflow	Changes in %	3.0	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2070-2099	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP4.5	76.00	83.80		100.0	annual streamflow	Changes in %	2.0	Small	Large	(Shrestha et al., 2018)
Asia	Thailand	1975-2009	2070-2099	ACCESS1,_CNRM-CM5,_MPI-ESM-LR	SWAT,_Dyna-CLUE	RCP8.5	69.40	76.80		100.0	annual streamflow	Changes in %	4.0	Insufficient	Large	(Shrestha et al., 2018)
North America	USA	2000-2003	2060-2063	MRI-CGCM3	SWAT,_SNTEMP	RCP2.6	44.30	8.00	6.0	36.8	average_number_of_days_per_year_that_water_temperature_exceeded_27_degrees	days	1.5	Co-benefits	Negligible	(Knouft et al., 2021)
North America	USA	2000-2003	2030-2033	CCSM4	SWAT,_SNTEMP	RCP4.5	61.70	12.80	8.2	45.2	average_number_of_days_per_year_that_water_temperature_exceeded_27_degrees	days	1.5	Co-benefits	Negligible	(Knouft et al., 2021)

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North America	USA	2000-2003	2060-2063	CCSM4	SWAT,_SNTEMP	RCP4.5	69.80	25.30	8.2	45.2	average_number_of_days_per_year_that_water_temperature_exceeded_27_degrees	days	2.0	Co-benefits	Negligible	(Knouft et al., 2021)
North America	USA	2000-2003	2030-2033	MIROC-ESM	SWAT,_SNTEMP	RCP8.5	69.00	13.70	1.7	36.8	average_number_of_days_per_year_that_water_temperature_exceeded_27_degrees	days	2.0	Co-benefits	Negligible	(Knouft et al., 2021)
North America	USA	2000-2003	2060-2063	MIROC-ESM	SWAT,_SNTEMP	RCP8.5	86.50	59.30	1.7	36.8	average_number_of_days_per_year_that_water_temperature_exceeded_27_degrees	days	3.0	Moderate	Moderate	(Knouft et al., 2021)
Option 7: Flood risk reduction measures (excluding coastal flooding)																
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	1.56E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Insufficient	Maladaptation	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	6.73E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	2.88E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Co-benefits	Negligible	(Scussolini et al., 2017)

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Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	9.49E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	1.79E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.49E+09	9.88E+08		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	1.5	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	1.77E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Insufficient	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	8.67E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	4.79E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	1.11E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	2.18E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP4.5,_SSP2	1.92E+09	1.29E+09		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Large	Small	(Scussolini et al., 2017)

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Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	1.56E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Insufficient	Maladaptation	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	6.73E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	2.88E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	9.49E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	1.79E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	1.49E+09	9.88E+08		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	2.02E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Insufficient	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	1.01E+09	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	6.53E+08	########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Co-benefits	Negligible	(Scussolini et al., 2017)

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Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	1.24E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Large	Small	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	2.54E+08	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5,_SSP5	2.15E+09	1.43E+09		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Moderate	Small	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	1.77E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Insufficient	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	8.67E+08	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	4.79E+08	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	1.11E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	2.18E+08	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Co-benefits	Negligible	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2040-2060	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	1.92E+09	1.29E+09		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	2.0	Large	Small	(Scussolini et al., 2017)

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Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	4.28E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Insufficient	Maladaptation	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	3.14E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Small	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	3.26E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Insufficient	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	3.51E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Insufficient	Large	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	1.47E+09	##########	1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Large	Small	(Scussolini et al., 2017)
Asia	Vietnam	2010-2020	2090-2110	CMIP5	TELEMAC-2D,_Damage-Scanner-Model	RCP8.5 H.E.,_SSP5	4.10E+09	2.90E+09		1144970470.9	estimates_of_expected_anual_damage_(EAD)	$/year	4.0	Small	Large	(Scussolini et al., 2017)
Asia	China	2005-2020	2090-2100	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP8.5	9.00E+01	3.50E+01	0.0	0.1	annual_damage	billion_US$	4.0	Moderate	Moderate	(Du et al., 2020b)
Asia	China	2005-2020	2090-2100	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP8.5	9.00E+01	4.00E-01	0.1	0.1	annual_damage	billion_US$	4.0	Large	Negligible	(Du et al., 2020b)

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Asia	China	2005-2020	2090-2100	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP4.5	5.00E+01	9.00E+00	0.0	0.1	annual_damage	billion_US$	3.0	Large	Small	(Du et al., 2020b)
Asia	China	2005-2020	2090-2100	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP4.5	5.00E+01	8.50E-02	0.1	0.1	annual_damage	billion_US$	3.0	Co-benefits	Negligible	(Du et al., 2020b)
Asia	China	2005-2020	2040-2060	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP8.5	5.00E+00	8.50E-01	0.0	0.1	annual_damage	billion_US$	2.0	Large	Small	(Du et al., 2020b)
Asia	China	2005-2020	2040-2060	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP8.5	5.00E+00	6.00E-03	0.1	0.1	annual_damage	billion_US$	2.0	Co-benefits	Negligible	(Du et al., 2020b)
Asia	China	2005-2020	2040-2060	HadGEM2-ES,IPSL-CM5A-LR,_MIROC-ESM-CHEM,NORESM1-M	TOMAWAC,_TELEMAC,_and_MIKE_1_D/2_D	RCP4.5	4.00E+00	6.00E-03	0.1	0.1	annual_damage	billion_US$	2.0	Co-benefits	Negligible	(Du et al., 2020b)
Europe	Austria	1971-2000	2016-2045	ECHAM5	Hqsim,_Hydro_AS-2D,_Dyna-CLUE	A2	2.50E+04	1.80E+04	9000.0	13000.0	estimates_of_expected_anual_damage_(EAD)	Euros	1.5	Moderate	Moderate	(Thieken et al., 2016)
Europe	Austria	1971-2000	2016-2045	HadGem2	Hqsim,_Hydro_AS-2D,_Dyna-CLUE	A1B	7.00E+04	4.90E+04	9000.0	13000.0	estimates_of_expected_anual_damage_(EAD)	Euros	1.5	Small	Large	(Thieken et al., 2016)

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North America	USA	1986-2005	2015-2099	MRI-CGCM3,_IPSL-CM5A-LR,_GISS-E2-R,_GFDL-CM3,_CCSM4	IPSS	RCP8.5	3.10E+03	2.90E+03		1.0	estimates_of_expected_anual_damage_(EAD)	millions_US$	3.0	Insufficient	Large	(Melvin et al., 2017)
North America	USA	1986-2005	2015-2099	MRI-CGCM3,_IPSL-CM5A-LR,_GISS-E2-R,_GFDL-CM3,_CCSM4	IPSS	RCP4.5	2.40E+03	2.30E+03		1.0	estimates_of_expected_anual_damage_(EAD)	millions_US$	2.0	Insufficient	Large	(Melvin et al., 2017)
Option 8: Urban water																
Europe	Germany	1951-2010	2040-2069	CanESM2	PCSWMM	RCP8.5	40.90	3.20	3.0	38.1	runoff	percentage	3.0	Co-benefits	Negligible	(Rosenberger et al., 2021)
Option 9: Energy related adaptations																
North America	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	99.90	102.40		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	97.80	100.20		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	97.20	99.50		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Large	Small	(van Vliet et al., 2016c)

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Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	96.30	98.60		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Moderate	Moderate	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	96.90	99.30		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Moderate	Small	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	94.50	96.80		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Small	Large	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	98.50	102.80		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	99.90	104.20		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	99.30	103.60		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	95.80	99.90		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Large	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	99.10	101.20		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	99.10	101.20		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	97.80	101.80		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	99.10	103.10		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	96.90	100.90		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	97.00	101.00		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	89.60	95.50		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Moderate	Moderate	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	93.60	99.60		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Large	Small	(van Vliet et al., 2016c)

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Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	91.70	97.70		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Moderate	Small	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	83.60	89.10		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Small	Large	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	98.30	101.60		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	98.80	102.20		100.00	mean annual usable capacity of hydropower	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	98.10	101.50		100.00	mean annual usable capacity of hydropower	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	96.40	99.70		100.00	mean annual usable capacity of hydropower	Changes in %	3.0	Large	Small	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	93.90	98.10		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Moderate	Moderate	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	92.80	97.00		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Moderate	Moderate	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	94.60	98.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Moderate	Small	(van Vliet et al., 2016c)
North America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	87.00	91.50		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Small	Large	(van Vliet et al., 2016c)

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Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	98.70	104.50		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	97.40	103.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	98.10	103.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	93.50	100.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	91.40	99.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Large	Small	(van Vliet et al., 2016c)

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Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	90.00	98.10		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Large	Small	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	91.80	99.60		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Large	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	84.80	93.80		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Moderate	Moderate	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	96.90	100.50		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	94.80	98.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Moderate	Moderate	(van Vliet et al., 2016c)

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Africa	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	95.20	98.80		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Moderate	Small	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	82.20	85.80		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Insufficient	Large	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	96.40	102.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	95.30	101.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	96.80	103.00		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	91.60	98.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Large	Small	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	93.70	103.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	95.20	105.00		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	94.50	104.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	88.70	100.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	94.20	101.00		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	93.00	99.90		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Large	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	94.70	101.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	87.90	95.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Moderate	Moderate	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP2.6	93.90	110.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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North America	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	92.80	109.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	94.60	110.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
North America	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	87.00	104.60		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	98.70	99.60		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Moderate	Moderate	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	97.40	98.50		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Small	Large	(van Vliet et al., 2016c)

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Central and South America	South America	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	98.10	99.00		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Small	Large	(van Vliet et al., 2016c)
Central and South America	South America	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	93.50	95.10		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Insufficient	Large	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	91.40	108.90		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	90.00	107.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Europe	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	91.80	109.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Europe	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	84.80	103.60		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	96.90	119.10		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	94.80	118.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	95.20	118.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Africa	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	82.20	115.80		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	96.40	101.90		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	95.30	101.30		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	96.80	102.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Asia	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	91.60	98.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Large	Small	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	93.70	119.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	95.20	120.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	94.50	119.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Australasia	Australia	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP8.5	88.70	117.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	94.20	108.20		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_frame-work	RCP2.6	93.00	107.40		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	2.0	Co-benefits	Negligible	(van Vliet et al., 2016c)

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Global	Regional	1971-2000	2010-2039	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	94.70	108.60		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	1.5	Co-benefits	Negligible	(van Vliet et al., 2016c)
Global	Regional	1971-2000	2040-2069	MIROC-ESM-CHEM,_IPSL-CM5A-LR,_HadGEM2-ES,_NorESM1-M,_GFDL-ESM2M	a_global_hydrological–electricity_modelling_framework	RCP8.5	87.90	103.70		100.00	mean annual usable capacity of thermoelectric power plant	Changes in %	3.0	Co-benefits	Negligible	(van Vliet et al., 2016c)

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