Climate and Disaster Risk Screening Report for Agriculture Project in India: Hypothetical Agriculture Project[1]

[1] This is the output report from applying the World Bank Group's Climate and Disaster Risk Screening Project Level Tool (Global website: climatescreeningtools.worldbank.org; World Bank users: wbclimatescreeningtools.worldbank.org). The findings, interpretations, and conclusions expressed from applying this tool are those of the individual that applied the tool and should be in no way attributed to the World Bank, to its affiliated institutions, to the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the information included in the screening and this associated output report and accepts no liability for any consequence of its use.

1. Introduction

Building resilience to climate and geophysical hazards is a vital step in the fight against poverty and for sustainable development. Screening for risks from these hazards improves the likelihood and longevity of a project's success. The project level **Climate and Disaster Risks Screening Tool** provides early stage due diligence on climate and disaster risks at the concept stage of project development. The tool uses an **exposure - sensitivity - adaptive capacity framework** to consider and characterize risks from climate and geophysical hazards, based on key components of a project and its broader development context (Annex 1).

This report summarizes the results of the screening process for the Hypothetical Agriculture Project/India, which was applied to the following selected sub-sectors/components:

- [x] Irrigation and Drainage
- [x] Crops and Land Management
- [ ] Livestock
- [ ] Rural Transport
- [x] Storage and Processing

The potential risks flagged in this report were identified through the four screening stages by connecting information on climate and geophysical hazards exposure with the user's subject matter understanding of the project components and sensitivity to rate the impacts. The tool does not provide detailed risk assessments, rather it flags risks to inform consultations, enhance dialogue with local experts, and define further analytical work at the project location.

This early stage due diligence can be used to strengthen the consideration of climate and disaster considerations in key components of the project design, including the physical (i.e. farm irrigation, water storage) and non-physical aspects (i.e. capacity building of farmers, institutional strengthening at community level, early warning systems, etc.). The broader sectoral (i.e. appropriate policies on crop prices, water tariffs, risk insurance schemes for agriculture production) and development sectors conditions (i.e. access to technology for enhanced productivity, climate-related early warning systems) could help modulate the risks, or enhance the risks to the delivery of the outcome/service level.

The results of the screening are presented below, with supporting narrative to guide their interpretation.

2. Climate and Disaster Risk Screening Results Summary

2.1 Project Information Summary

Table 1 below provides key project information including the location and key project development objectives. This information is provided by the task team. The activities within the components are important as their sensitivity to the climate and geophysical hazards will determine the level of potential impact from these hazards.

Table 1: Project Information

Project Information	
Title	Hypothetical Agriculture Project
Number	Hypothetical
Region	South Asia
Country	India
Type of Assessment	Agriculture Projects
Purpose of Screening	Screen a Project at the Concept Stage
Current Project Phase	Concept (Identification)
Funding Source	IDA
Keywords	Market access,Value chains
Location	The location of the proposed project is the mountanous state of Himachal Pradesh (HP) in India, situated in the western Himalayas and divided into three physiographical zones - Sivaliks (tropical climate), lesser-middle Himalayas (temperate climate) and Greater Himalayas (cold desert climate). The state has three climate zones and is spread over 21,495 sq mi (55,670 km2), divided into 12 districts and has elevation of 450-7000 meters above MSL. A water rich state, HP has permanent snow fields that feed its perennial rivers. The drainage system includes the rivers: Chenab, Ravi, Beas, Sutlej and Yamuna. Legally defined forest areas constitute 66.52% of the area although area under tree cover is only 25.78% in the state. High hydroelectric potential of 23,000.43 MW exists in five rivers basins. Agriculture constitutes 45% of state's GDP and is largely practised by small holders. Home to 1200 bird and 359 animal species, the state has two major national parks/sanctuaries.
GPS Coordinates	Not particularly helpful for this specific project.
Sub Sectors	Irrigation and Drainage, Crops and Land Management, Storage and Processing
Irrigation and Drainage	The project will be promoting climate resilient on-farm and community investments through technical support and matching grants to enable producers to invest in productivity enhancing technologies. The investment will support (a) harvest, capture, collection, delivery and distribution of water; (b) on-farm water use efficiency; (c) soil moisture and fertility improvements; and (d) climate mitigation related investments (hail nets, hail guns, etc.) including support for upgrading cultivars and root stocks.
Crops and Land Management	The project would support, among others, (a) funding import and multiplication of true to type diseasefree genetic materials (both root stock and cultivars); (b) strengthening the post quarantine facilities for acclimatization of imported genetic material; and (b) disease and pest surveillance, with a specific focus on horticulture crops. The project will finance the demonstration and adaptation of locationspecific technologies (including technologies that meet the changing climatic conditions like low chill cultivars of apple); demonstration and use of improved crop varieties, integrated pest and nutrition management, as well as appropriate agronomic practices.
Storage and Processing	The project will support Supply chain infrastructure support to establish a modern supply chain,comprising of local collection centers, pack-houses, cold storage/controlled storage, processing facilities and commodity ‘integrators’.

Project Information	
Outcome / Service Delivery	The Project Development Objective (PDO) is to “increase the productivity, profitability and market access of selected horticulture commodities in Himachal Pradesh”. The project will achieve the PDO by: (i) improving producer’s access to knowledge and climate resilient production technologies so that producers are able to respond to climate changes and climate variability and emerging market opportunities; (ii) promoting investments in agribusiness, fostering backward and forward linkages in the value chains for horticulture products, facilitating access to finance for agribusiness entrepreneurs, and, where appropriate, push for process, regulatory and/or policy change; and (iii) supporting the development of an improved platform for market-related information and intelligence, alternative market channels developed outside of regulated markets, piloting negotiable warehouse receipts for horticulture commodities and improved services provided by modernizing traditional wholesale

* Please note that this is based on user inputs and the coverage may not be comprehensive.

2.2 Summary of Exposure to Climate and Geophysical Hazards

Table 2 presents a summary description of exposure to climate and geophysical hazards at the project location for the Historical/Current and Future time frames[1]. Exposure to climate hazards is evaluated in two time-frames, because past records are not necessarily indicative of future conditions. The descriptions provide a summary of the key characteristics and some indication of the trends in exposure from each hazard, drawing on global, quality controlled data sets from the Climate Change Knowledge Portal (CCKP). It is useful, for example to understand the temperature range and the rate of annual or decadal increase in a region; or precipitation patterns for historical and future time frames and seasonality shifts. Understanding the trends of hazards is important as they act individually and collectively on components/sub-sectors of the project. Because geophysical hazards (such as earthquakes, tsunamis, landslides, and volcano eruptions) do not have associated future projections, exposure for those hazards is assessed only in the Historical/Current time-frame.

Table 2: Summary of Exposure to Climate and Geophysical Hazards at Project Location

Hazard	Time Frame	Description of hazards for your location
Extreme Temperature	Current	The annual average increase in temperature in the north western Himalyan Region from 1901-2002 has been 1.6oC, with winter warming at a faster pace. Warming rate was higher from 1991-2002 compared to earlier periods and it was 2.2oC from 1982 to 2002. The historical rate of increase in maximum temperatures in higher altitudes was more than it was for lower altitudes, so warming varied in the different altitudinal zones of the state. In the last century, the NW Himalayan Region warmed significantly more compared to the the global average.
	Future	Daily extremes in surface temperatures, daily maximum and daily minimum will intensify by 2030s. The spatial pattern of change in the lowest daily minimum and hightest daily maximum shows a warming in the range of 1- 4oC. The mean annual temperature is projected to increase from 0.9 to 2.6 oC in the 2030s.
Extreme Precipitation and Flooding	Current	The mean annual rainfall has varied from 1268+/-225 and 1604+/-175 with a higher rate of increase in the North Western Part of HP. Districts like Kangra, Chamba, Kullu and Una are likely to receive rainfall with increased intensity. The number of rainy days is increasing with decrease in average intensity in rainfall in the state in general. Change in rainfall variability with reduced rainfall in south eastern part of the state is leading to drought like conditions. Higher incidence of floods and flash floods due to water temperatures, increased variability and intensities are seen in the north western parts of the state. Floods is another disaster that the state experiences every year due to the south west monsooon during the months of June to August which triggers rainfall in excess of 125% of the normal. From 1951 to 1999 floods have occurred in Chamba, Bilaspur, Una, Mandi, Kangra, Hamirpur and Simaur where excess rainfall has ranged from 126-2158% higher than the normal rains.
	Future	There is insufficient understanding of the extent and severity of extreme precipitation and flooding but higher incidence of floods and flash floods due to water temperatures, increased variability and intensities may continue to be seen in the North Western parts of the state.

[1]The Future time frame is based on changes projected to occur between the 1980-1999 average and a future average. This future average is most likely the 2040-2059 average (i.e., the default in the Climate Change Knowledge Portal - CCKP).Users can choose to select another time frame, or choose to use national/local data sets, but if so, this should be reflected in the notes section of the tool (and summarized in Annex 2). The CCKP draws on global, quality-controlled datasets and is continually updated as new data become available. In some cases, the CCKP is supplemented with other sources of information. For more detail on the data used in this step, please refer to the Data Annex. Climate Change Knowledge Portal (http://climateknowledgeportal.worldbank.org).

Hazard	Time Frame	Description of hazards for your location
Drought	Current	Drought is a regular feature in Himachal Pradesh despite it being a source of several perennial rivers and being water sufficiant. There are variations in drought occurrence in the different climatic zones of the state. The occurrence of drought is more common in the cold desert and hot humid zones and happens mainly in the pre monsoon and winter seasons. All of this is reflective of spatial and seasonal variations in drought incidence. From 1900-1970 at an overall years there are 8 drought years (1902, 1905, 1907, 1911, 1918, 1928, 1065, 1968) of which 1907 and 1918 were severe drought years. At the disrict level there were many more drought years when rainfall in certain districts was below normal rainfall. From 1971-2009, drought incidence was episodic. few drought years in the 70s; intensification of drought in the 80s; lesser dorught incidence in 90s and persistent rainfall deficit and droughts in the 21st century.
	Future	There is insufficient understanding of the extent and severity of droughts but increased temperatures, increased variability and intensities may continue to lead to droughts in the South Western parts of the state.
Earthquake	Current	Seismic sensitivity of the state is very high due to the stae's location in the great alpine belt of the Himalayan Region. Large earthquakaes have occurred on all parts of the state including the 1905 earthquake in Kangra district. the districts in HP lie in Zone IV and V which are the high damage risk (Lahual- Spiti, Kinnaur, Simla, Solan, Simour) and very high damage risk (Chamba, Kullu, Kangra, Una, Hamirpur, Bilaspur, Mandi) zones. There have been close to 553 earthquakes in various parts of HP from 1800-2008.
Landslide	Current	Lanslides are a common feature in Himachal Pradesh and one or two landslides happen very year. The first landslide occurred in 1971 and then there have been major landslides in 1988, 1993 and 1995. Most of the districts of HP have high to very high-severe vulnerability status where landslides are concerned. Districts such as Simla, Solan, Chamba, Bilaspur and Mandi fall in the very high to severe category for landslides.
Other Hazard (GlacialLakeOutburstFlood)	Current	This is a very common and devastating hazard in the Himalayan region.

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

Please note that the colors shown in Table 2 are only for exposure at the project's location. Overall risk to project's outcome/service delivery, taking into account sensitivity of physical investments and adaptive capacity(non-physical components and development context), is depicted in Tables 3A and 3B.

2.3 Summary of Overall Project Risk

Tables 3A and 3B present the same results, with Table 3A highlighting the risk ratings for project component/subsectors, and the overall risk of the outcome/service level for both Historical/Current and Future time frames. Table 3A highlights the results by component; while 3B draws attention to how the climate impacts shift from the Current to the Future time frame.

The ratings are derived on the basis of the hazard information, subject matter expertise, contextual understanding of the project, and modulated on the basis of adaptive capacity and the larger development context of the agriculture sector and country. The results indicate what components are most at risk. The actual ratings themselves, while instructive, should inform further consultations, dialogue, and future planning processes. Keep in mind that the greatest value of the tool is that it provides a structured and systematic process for understanding climate and disaster risks.

2.3.1 Results Summary - by Component / Subsector

Table 3A provides a characterization of risks caused by climate and geophysical hazard on project subsector/components.

The results indicate where risks may exist within one or multiple components and where further work may be required to reduce or manage these climate and geophysical risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

The potential impact due to exposure from hazards is modulated by the project's non-physical components (enabling and capacity building activities). The right kind of capacity building measures could increase preparedness and longer-term resilience and reduced the risks. The larger sector and development context can help to modulate climate risks. For example, in the agriculture sector, access to technology or sound land ownership issues may help reduce risks; while a conflict situation may aggravate the risks.

Table 3A: Results Summary - by Component / Subsector

<table>
<tr><th rowspan="2">Subsector</th><th colspan="2" rowspan="2">Potential Impact</th><th colspan="2" rowspan="2">Non-Physical Components</th><th colspan="4">Development Context</th><th colspan="2" rowspan="2">Outcome / Service Delivery</th></tr>
<tr><th colspan="2">Agriculture Sector</th><th colspan="2">Broader Context</th></tr>
<tr><th>Time Frame</th><th>Current</th><th>Future</th><th>Current</th><th>Future</th><th>Current</th><th>Future</th><th>Current</th><th>Future</th><th>Current</th><th>Future</th></tr>
<tr><td>Irrigation and Drainage</td><td></td><td></td><td colspan="2" rowspan="3">Agricultural extension and research
Significantly Reduces Impact
Capacity building and training
Significantly Reduces Impact
Data gathering, monitoring, and information management systems
Slightly Reduces Impact
Overall
Significantly Reduces Impact</td><td colspan="2" rowspan="3">Slightly Reduces Impact</td><td colspan="2" rowspan="3">Access to technology
Slightly Reduces Impact
Gender inequity
Slightly Increases Impact
Education
Slightly Increases Impact
Overall
Slightly Increases Impact</td><td></td><td></td></tr>
<tr><td>Crops and Land Management</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Storage and Processing</td><td></td><td></td><td></td><td></td></tr>
</table>

2.3.2 Results Summary by Time-Frame

The results in Table 3B displays the results by time frame. Potential impacts to the components are evaluated separately for the Historical/Current and Future time frames to capture changes in the exposure from climate hazards over time. For example, if recent trends indicate that temperatures are rising and could exceed the tolerable range for certain crops, this may significantly escalate the potential impact on future yields and local food production.

For investments with long operational lifetimes, such as physical infrastructure, considering future climate variability and change is critical to avoid "locking in" designs and features that are only suited to current climate. Inadequate design standards include, for example, an irrigation infrastructure designed for historical water quantities, which may be less effective in the future due to significant reductions in water availability. Another example of inadequate design is crop storage and processing facilities that are not designed to withstand more frequent or severe flooding.

Table 3B: Results Summary - by Time Frame

<table>
<tr><th></th><th colspan="5">Current</th><th colspan="5">Future</th></tr>
<tr><th rowspan="2">Subsector</th><th rowspan="2">Potential Impact</th><th rowspan="2">Non-Physical Components</th><th colspan="2">Development Context</th><th rowspan="2">Outcome / Service Delivery</th><th rowspan="2">Potential Impact</th><th rowspan="2">Non-Physical Components</th><th colspan="2">Development Context</th><th rowspan="2">Outcome / Service Delivery</th></tr>
<tr><th>Agriculture Sector</th><th>Broader Context</th><th>Agriculture Sector</th><th>Broader Context</th></tr>
<tr><td>Irrigation and Drainage</td><td></td><td rowspan="3">Agricultural extension and research
Significantly Reduces Impact

Capacity building and training
Significantly Reduces Impact

Data gathering, monitoring, and information management systems
Slightly Reduces Impact

Overall
Significantly Reduces Impact</td><td rowspan="3">Slightly Reduces Impact</td><td rowspan="3">Access to technology
Slightly Reduces Impact

Gender inequity
Slightly Increases Impact

Education
Slightly Increases Impact

Overall
Slightly Increases Impact</td><td></td><td></td><td rowspan="3">Agricultural extension and research
Significantly Reduces Impact

Capacity building and training
Significantly Reduces Impact

Data gathering, monitoring, and information management systems
Slightly Reduces Impact

Overall
Significantly Reduces Impact</td><td rowspan="3">Slightly Reduces Impact</td><td rowspan="3">Access to technology
Slightly Reduces Impact

Gender inequity
Slightly Increases Impact

Education
Slightly Increases Impact

Overall
Slightly Increases Impact</td><td></td></tr>
<tr><td>Crops and Land Management</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Storage and Processing</td><td></td><td></td><td></td><td></td></tr>
</table>

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

2.4 Key Drivers of Risks

Based on the results above, Table 4 highlights the key drivers of risk for each project component/subsector ratings, in terms of hazards that are likely to pose the greatest challenge.

The ratings for the potential impact for each component/subsector reflect the aggregate rating across multiple hazards, drawing on all of the exposure information and their own expert judgment. For example, irrigation and drainage rating may be assessed as having low impact under current time-frame, against the multiple hazards considered (such as temperature, precipitation, drought); but may become high impact later in the century (due to increased temperatures and uncertain precipitation trends).

Specific consideration should be given to those hazards which have high ratings, or are moving from moderate to high ratings over time. For example, sea-level rise may not be a key risk driver in the Historical/Current time frame; but may emerge as a key driver across multiple sectors in the future time frame. Understanding which hazards are key drivers may be important in the context of managing climate risks within the design and delivery of the project.

Table 4: Key Drivers of Risk

	Historical/Current Drivers	**Future Drivers**
Hazards and Location	Extreme Precipitation and Flooding Drought Landslide Earthquake	Extreme Temperature Extreme Precipitation and Flooding Drought
Physical Components	Crops and Land Management Storage and Processing	Irrigation and Drainage Crops and Land Management Storage and Processing
Outcome / Service Delivery	*	*

Key: High Risk Moderate Risk

* If a cell is blank it implies there is 'No high or moderate risks' identified for this aspect of the project.

- Overall, the Non-Physical Components : **Significantly Reduces Impact**
- The Agriculture Sector Development Context : **Slightly Reduces Impact**
- Overall, the Broader Development Context : **Slightly Increases Impact**

3. Next Steps

By understanding which of your agriculture project components are most at risk from climate change and other natural hazards, the design of the project that you are applying the screening tool can begin to take measures to avoid their impacts by:

- Enhancing the consideration of climate and disaster risks early in the design stage of the project.
- Using your risk screening analysis to inform follow-up feasibility studies and technical assessments.
- Encourage local stakeholder consultations and dialogues to enhance resilience measures and overall success of the project.

Table 5A provides some general guidance based on the risk ratings for the Outcome/Service Delivery, and Table 5B lists some climate risk management measures for your consideration. Visit the "Next steps" page of the tool on the website for guidance and a list of useful resources.

Note: Please recall that that this is a high-level due diligence tool, and the characterization of risks should be complemented with more detailed work.

Table 5A: General Guidance Based on Risk Ratings for Outcome/Service Delivery

Insufficient Understanding	Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project.
No Risk	If you are confident that climate and geophysical hazards pose no risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented.
Low Risk	If you are confident that climate and geophysical hazards pose low risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented. You may also consider gathering additional information to increase your level of confidence in your rating.
Moderate Risk	For areas of Moderate Risk, you are encouraged to build on this screening through additional studies, consultation, and dialogue. This initial screening may be supplemented with a more detailed risk assessment to better understand the nature of the risk to the project.
High Risk	For areas of High Risk, you are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.

Table 5B: Types of Climate Risk Management Measures for typical Agriculture Projects

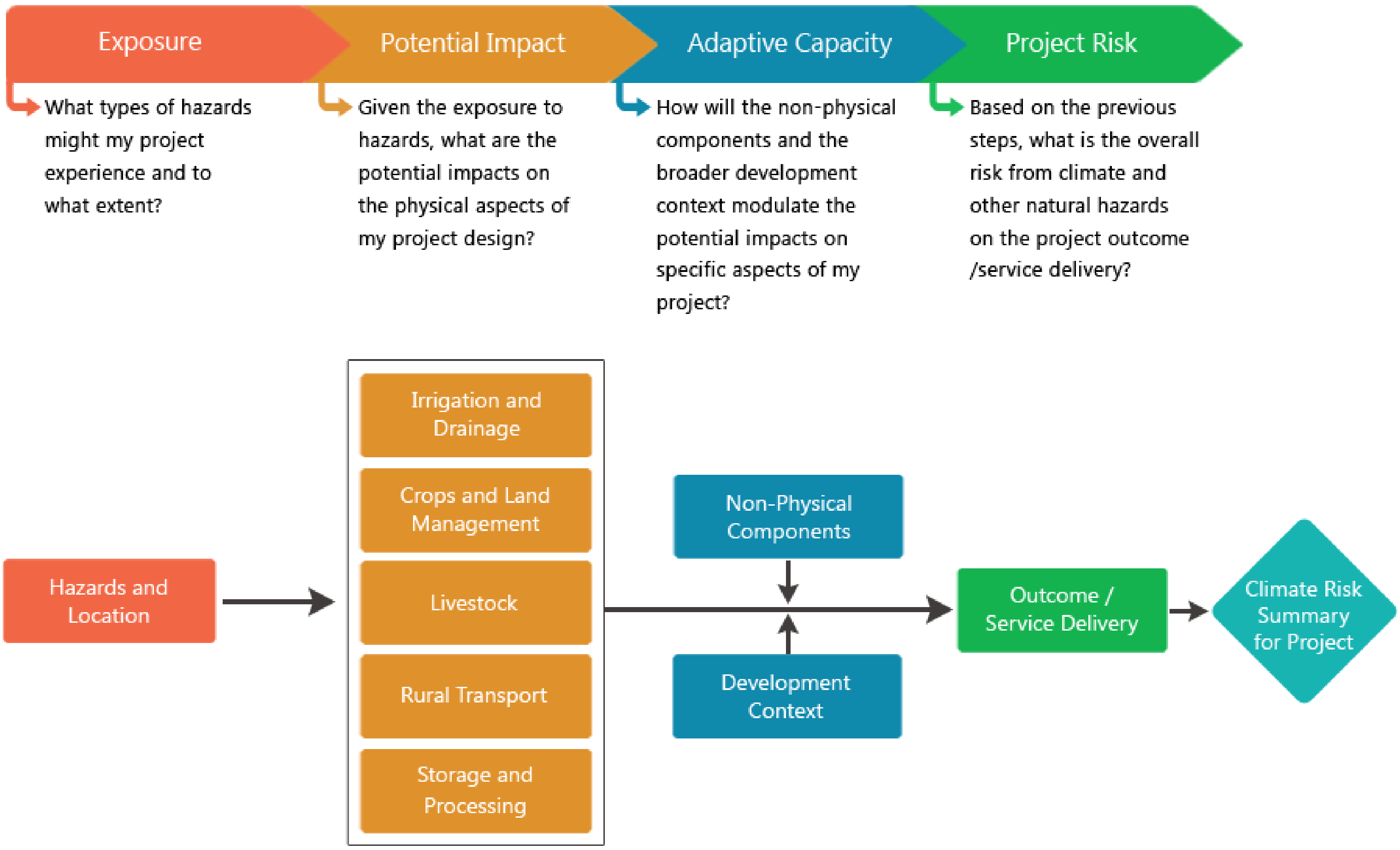
CATEGORY	PROS	CONS	EXAMPLES
Accommodate and Manage	• Flexible • Typically low-cost • Useful when risk is low, but projected to rise in the future	• Temporary solution • Can be insufficient in preventing losses	• Increasing repair and maintenance budgets for physical infrastructure • Modifying land management practices
Protect and Harden	• Can be used for existing and new assets • Responds to immediate risks	• High cost • Inflexible • Effectiveness may decrease over time	• Expanding drainage capacity to cope with heavy rainfall and flooding • Implementing wind protection measures • Elevating key facilities such as storage warehouses and processing centers
Retreat and Relocate	• Long-term solution • Responds to immediate risk	• High cost • Inflexible	• Relocating crops to different plots of land • Moving infrastructure further inland

Annex 1: Tool Approach

Tool Approach

The framework below describes the approach taken to screen the project. Climate and natural hazards information used to screen the project is most likely obtained from the World Bank's Climate Change Knowledge Portal, which houses numerous global data sets with historical records and future projections as well as country-specific adaptation profiles.

Figure A1: Project Level Climate and Disaster Risk Screening Tool: Approach for Agriculture projects



Annex 2: Notes

Table A2-1 summarizes the sub-national locations of high risk noted during the assessment, if the user entered these sub-national locations. Table A2-2 summarizes all the notes entered by user for each section while completing the assessment, if the user elected to enter notes. These notes can help shed light on specific ratings as well as considerations and limitations of the user's expertise.

Table A2-2 Summary of Comments by Section

Section		Notes
Hazards and Location	Extreme Temperature	Future temperature increases are a concern to the location of this project.
	Extreme Precipitation and Flooding	Extreme precipitation has been and will continue to be a concern at the project location.
	Drought	Droughts are a current and historical problem, and will likely be so in the future.
Non-Physical Components	Agricultural extension and research	Access to technology and knowledge through improved extension services on seeds, soil, land treatment, nutrient and pest management and market-information will significantly reduce the impact of climate on the project outcomes
	Capacity building and training	The project includes capacity building for participatory planning and plan implementation of collective actions. Capacity building on technological aspects of adoption of high yeidling cultivars of apple and diversification into vegetable farming and the associated package of practices for phasing in high density and high productivity apple orchards, combined with market awareness/intelligence; value chain efficiency and financial linkages will significantly reduce the impact of climate on the project outcomes.
	Data gathering, monitoring, and information management systems	The project will invest in setting up of a monitoring and evaluation (M&E) system for the project, including a project management information system and contracting an external M&E agency to monitor project activities and impact. Improved data gathering and M&E that positively impacts decisions in the project will contribute to reducing the impact of climate and sustain outcomes.
	Non-Physical component overall	Combined, these components of the project will significantly reduce impact, taking the risk down a level.
Outcome / Service Delivery	Irrigation and Drainage	In the current scenario inadequate irrigation systems combined with increasing temperatures and rainfall variability contributes to lowering productivity and incomes of small holders in the horticulture sector. The project will invest in small and micro irrigation infrastructure and watershed management practices that will help to overcome the climate risks to some extent and its related constrains on production.
	Crops and Land Management	Literature shows that variation in annual diurnal temperatures, intensity and timing of rainfall and snowfall play in important role in apple production. Untimely frost during spring time, long dry spells during summer months and insufficiently low temperatures during winter months can affect apple production. Apple production is becoming more suited to higher altitudes as the number of chilling hours are suitable for breaking dormancy and subsequent fruit development. The project interventions and enabling environment include: selection of appropriate cultivars based on atltitude; diversification into vegetables; improved soil/ irrigation technology and capacity building systems will sigficantly reduce the impact of climate on project outcomes.
	Storage and Processing	The lack of post harvest infrastructure such as storage and processing results in significant wastage of horticulture produce and loss to farmers. Project investments in storage and processing combined with market intelligence will help the farmers to manage risks related to climate and market prices and thereby secure / improve incomes