

Part I. Guidance for Conducting Climate Risk Assessment, Considering Adaptation Measures and Beneficiaries Estimation

Part I Guidance for Conducting Climate Risk Assessment, Consideration of Adaptation Measures and Beneficiaries Estimation

1. Objectives and Target Projects

1.1. Objectives of Climate risk assessment, consideration of adaptation and Beneficiaries Estimation

The objectives of implementing climate risk assessments and considering adaptation² in development projects conducted by JICA are as follows:

- To ensure that project designs and details contribute to sustainable development by continuing to generate the expected benefits and outcomes throughout the life of development projects.
- To assess risks, to the extent possible, during project planning and preparation stages, and to consider measures to address those risks, based on an approach of simultaneously addressing both development and climate change challenges as part of the global agenda.
- To quantitatively assess the effectiveness of projects that contribute to adaptation to climate change (hereinafter referred to as "adaptation projects³"). Climate Change" of JICA's Global Agenda sets "Achieving a Beneficiary Population of 380 million by 2030" as one of the goals.

1.2. Target Projects

The climate risk assessments and adaptation measures based on this guidance document apply, in principle, to development projects conducted by JICA, including loan projects, grant aid projects, and technical cooperation (Technical Cooperation Projects, Technical Cooperation for Development Planning, Technical Assistance under the ODA Loan Account, and SATREPS).

1.3. Intended Users

The intended users of this guidance document are primarily managers of JICA project management divisions involved in JICA financial projects (loan project, grant aid project) and technical cooperation (Technical Cooperation Projects, Technical Cooperation for Development Planning, Technical Assistance under the ODA Loan Account, and SATREPS), as well as contractors (including consultants).

1.4. Criteria for Climate Risk Assessments and Consideration of Adaptation

The following two main criteria are to be used to review the climate risk assessment and adaptation measures in the projects covered by a climate risk assessment as part of a Preparatory Survey for Cooperation, whatever the JICA project scheme may be.

- i. Have climate change impacts on the project been ascertained and assessed based on existing data and information gathered through field surveys, etc.?

² Adaptation is the process of adjusting to the actual or expected climate and its effects, aiming to mitigate or avoid harm while also seizing beneficial opportunities. Adaptation measures encompass actions that can be implemented to achieve this goal.

³ Adaptation project is to "contribute or have the potential to contribute to adaptation measures". The judgment shall be made for the project which analyzing climate risks (not limited to quantitative analysis, but qualitative analysis is also acceptable) and summarizing two items (1. potential to contribute to climate risk reduction, 2. how the project will contribute to climate risk reduction).

- ii. Based on assessment results, has consideration been made to incorporate any necessary adaptation measures into the project?

Climate risk assessment, consideration of adaptation measures and beneficiaries estimation in Climate-FIT (Adaptation) is based on the notion of climate risk/adaptation presented in the Fifth Assessment Report of the IPCC. Under this concept, the "climate risks" in the target project are organized as the result of the interaction between "hazards" (external forces such as dangerous events and trends) and "vulnerabilities" and "exposures" of human and natural systems in the target project. For more information on this concept, see Section 3. Framework for climate risk assessment.

1.5. Climate Risk Assessment in JICA Project-Cycle

Climate-risk assessment, consideration of adaptation measures and beneficiaries estimation using the Climate-FIT Adaptation are assumed to be carried out at the stage of the STEP 02 "Feasibility Study" during the implementation processes of the JICA project as shown in Figure 1. This corresponds to the "Preparatory Survey for Cooperation" of Loan and Grant Aid Projects and the "Detailed Planning Survey" of Technical Cooperation Projects. For technical cooperation (Technical Cooperation Projects, Technical Cooperation for Development Planning, Technical Assistance under the ODA Loan Account, and SATREPS), climate risk assessment, consideration of adaptation measures and beneficiaries estimation may be conducted after the beginning of the technical cooperation project in consideration of the respective project contents.

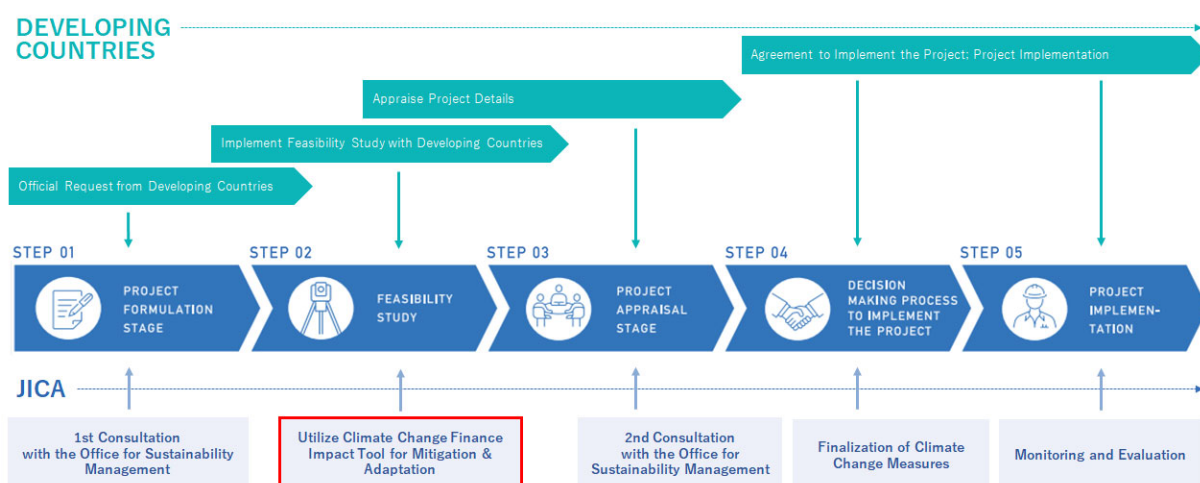


Figure 1 Implementation Processes for JICA Projects and Implementation of Climate-Risk Assessments¹

1.5.1. Flow of Climate Risk Assessments, Consideration of Adaptation Measures and Beneficiaries Estimation

The process flow is presented below, from project screening to implementation of the climate risk assessment, consideration of adaptation measures and beneficiaries estimation.

1) Financial Assistance Projects (Loan Assistance and Grant Assistance)

1. Screening for climate risk assessment, consideration of adaptation and beneficiaries estimation, done by Office for Sustainability Management.
2. Conducting the Preparatory Investigation is to implement the climate risk assessment, consideration of adaptation measures and beneficiaries estimation utilizing the Climate-FIT

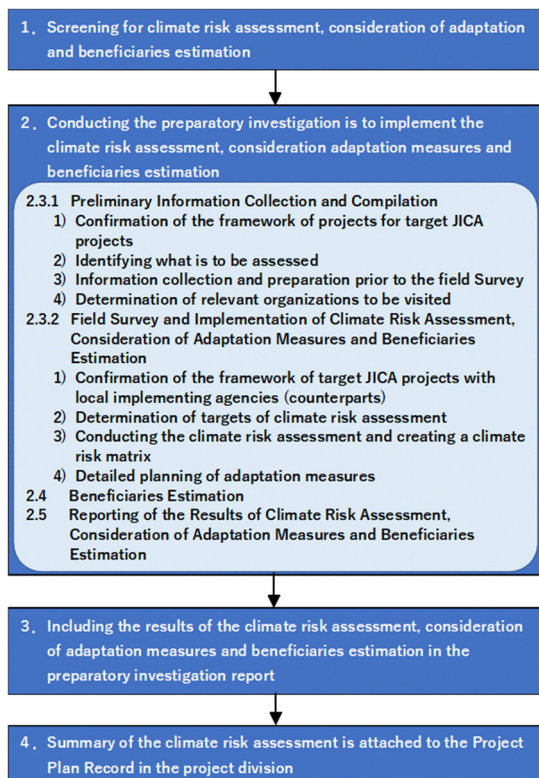


Figure 2 Implementation flow for conducting climate risk assessments, considering adaptation measures and beneficiaries estimation

risk assessment, consideration of adaptation measures and beneficiaries estimation.

If a consultant is contracted to conduct a preparatory investigation, the project division for the project is to include "Climate risk assessment, consideration of adaptation measures and beneficiaries estimation" as part of the terms of reference for the preparatory investigation. In that case, the following points should be considered.

- Explain clearly how the project includes a climate risk assessment, consideration of adaptation measures and beneficiaries estimation based on Climate-FIT (Adaptation).
- See Section 3.4 "Reporting Climate Risk Assessments" for information to be included in preparatory investigation reports.
- Based on the project details, consider the required personnel resources (person month) to conduct the climate risk assessment, consideration of adaptation measures and beneficiaries estimation.

2) Technical Cooperation (Technical Cooperation Projects, Technical Cooperation for Development Planning, Technical Assistance under the ODA Loan Account, and SATREPS)

The Office for Sustainability Management will select candidate projects to be recommended for climate risk assessment, consideration of adaptation measures and beneficiaries estimation. For technical cooperation projects, an assessment is to be made as to whether the technical cooperation activities being implemented are to lead to enhance adaptive capacity for current or future climate change. If a consultant is to be contracted for the project, the specifications of the project contracts are to state that climate risk assessment, consideration of adaptation measures and beneficiaries estimation will be implemented after the project commences.

(Adaptation).

- In principle, the timing of the climate risk assessment in the preparatory investigation is assumed to be at the initial stage of the investigation, before the outline design.

- The assessment is to be conducted in a participatory manner, with existing data, policies and information obtained locally compiled, and the assessment done in collaboration with multi-disciplinary experts and local government personnel, etc.

- An effort should be made to reach a common understanding of the climate risks associated with the project.

3. Including the results of the climate risk assessment, consideration of adaptation measures and beneficiaries estimation in the preparatory investigation report.

4. Summary of the Climate Risk Assessment is attached to the Project Plan Record in the Project Division.

5. The Office for Sustainability Management is to review the project division's attached summary of the project plan/record describing the results of the climate risk assessment, consideration of adaptation measures and beneficiaries estimation.

Even if the climate risk assessment, consideration of adaptation measures and beneficiaries estimation is going to be conducted after the start of project, it is recommended that information on climate hazard and vulnerability in the target country and region be gathered during the “Preparatory Survey for Cooperation”, and consideration be given to the need to consider and incorporate climate risk assessment, consideration of adaptation measures and beneficiaries estimation at the project implementation stage.

1.6. Period Covered by the Assessment

Given that climate change has the potential to affect projects over long periods of time (in terms of both risks and opportunities), and the climate will gradually change over time, when assessing climate risk, the time frame should be determined in advance (e.g., from 2030 to 2050). Climate-FIT (Adaptation) primarily uses the period during which the objective(s) of the JICA project are anticipated to be achieved (the period after project completion, when project benefits are observable and ongoing) as the basis. However, the “future” should be defined as a time frame that is appropriate to assess climate risk relative to the status of the individual project. When collecting and reviewing climate projection information, the collection and review should cover the “future” period defined herein.

1.7. Key Points about Climate Risk Assessments, Consideration of Adaptation and Beneficiaries Estimation Using the Climate-FIT (Adaptation)

The main assumption for climate risk assessment, consideration of adaptation measures and beneficiaries estimation using the Climate-FIT (Adaptation) is that climate risk assessment will be done for the JICA project by considering climate hazards, vulnerabilities and exposures, etc., making use of existing materials, information, and data (weather and disaster-related information and data, the results of future climate projections, and information from climate change-related documentation prepared by other countries, etc.).

It is recommended that scientific data and information (see Appendix 3) such as downscaled data be utilized to the extent possible, but it is crucial to coordinate these efforts with the JICA’s division.

With regard to beneficiary estimation, it is crucial to note that the number of beneficiaries does not determine the superiority or inferiority of a project as an adaptation measure. Additionally, beneficiary estimation for each project should be conducted on a case-by-case basis, emphasizing the importance of documenting the method and basis used for the estimation for future reference.

2. Framework for climate risk assessment

2.1. Overview of the Climate Risk Assessment Framework

According to the Fifth IPCC Report (AR5), climate risks are evaluated based in the interactions of climate-related "hazards" (including external forces: dangerous events and trends) with "vulnerability" and "exposure" of human and natural systems (Figure 3). This concept is basically carried over in the Sixth Assessment Report (AR6). This guidance is a climate risk assessment based on this concept.

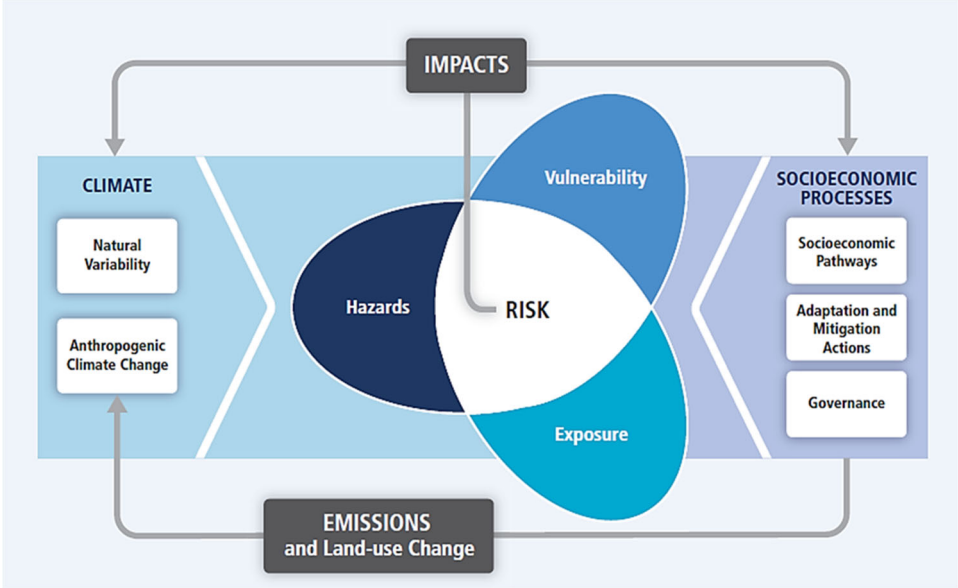


Figure 3 Conceptual Diagram of Factors and Elements Related to Climate Risk

(Source: IPCC AR5, WGII AR5; Figure SPM.1)

2.2. Components, Definitions and Concepts of Climate Risk Assessment

The definition of climate change is defined uniquely by the UNFCCC and IPCC. Since the IPCC definition is used in JICA, climate change risks will be assessed based on the definition of IPCC. The definitions and concepts of terms and components related to climate risk assessment are shown in Table 1, the elements (exposure, hazard, vulnerability, and impact) of Figure 4 will be summarized for the JICA project, and the risks will be investigated.

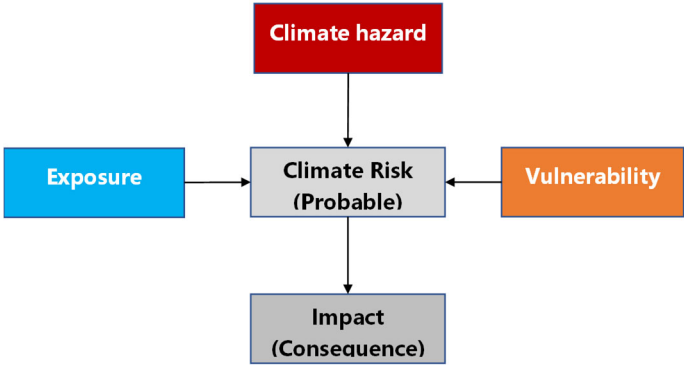


Figure 4 Framework Conceptual Diagram of Climate Risk Assessment

Concept of "Risk" in the implementation of Climate Risk Assessment

The definition of risk in the Fifth Assessment Report (AR5) of the IPCC, as shown in Table 2, is "the potential for consequences where something valuable is at stake and where the outcome is uncertain."

On the other hand, the concept of risk is recognized as a risk not only in terms of the possibility of undesirable outcomes (negative impacts) from an international perspective, but also in terms of the possibility of generating profit opportunities (positive impacts). The international standard for risk management ISO14090 and the international standard for adaptation to climate change ISO31000 also cover both positive and negative deviations from the expected risk.

Regarding the disclosure of climate-related information, the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), established by the Financial Stability Board, are also based on the concept of managing climate-related risks and opportunities.

This guidance is based on the notion of IPCC adaptation and therefore considers risks as potentially undesirable consequences. Its foundation is based on considering the risks that climate change poses to JICA projects themselves (the potential for climate change to interfere with project objectives and prevent project objectives from being accomplished) and aiming to create project plans that are resilient to climate change.

However, there is also the possibility that the JICA project may provide opportunities to contribute to the resolution of climate-related issues faced by the target area of the project and the target systems (e.g., wide-range water supply systems, power systems, and administrative systems). Therefore, where appropriate, both risks and opportunities for the JICA project are regarded as risks in a broad sense, and the consideration of both of these risks will not be prevented. It should also be noted that IPCC definition of adaptation includes those that not only moderate or avoid harm but also attempt to exploit beneficial opportunities.

Table 1 Definitions and Concepts of Terms and Components Related to Climate Risk Assessment

Component	Definition Source: IPCC AR5	Examples of Climate Risk Assessments using Climate-FIT
Climate change	Climate change refers to a change in climate that usually persists for decades or longer.	
Climate Hazard	The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In this guidance, the term "hazard" means <u>a physical, climate-related physical events or trends, or their physical impacts.</u>	<ul style="list-style-type: none"> • Increased frequency and scale of extreme weather events such as floods, droughts, storms, etc. • Sea-level rise
Exposure	The <u>presence</u> of people, livelihoods, species or ecosystems, environmental functions and services and resources, infrastructure or economic, social or cultural assets in <u>places and settings that may be adversely affected.</u>	<ul style="list-style-type: none"> • Structures to be built by the project (roads, bridges, power generation facilities, wastewater facilities, etc.) • Facilities, property, homes, natural ecosystems, etc. in areas included in scope of project

Component	Definition Source: IPCC AR5	Examples of Climate Risk Assessments using Climate-FIT
Vulnerability	The propensity or predisposition to adverse effects (undesirable effects). Vulnerability encompassed various concepts and factors such as <u>susceptibility and sensitivity to climate hazards and lack of capacity to cope and adapt.</u>	<ul style="list-style-type: none"> • Presence of coastal protection structures and degree of aging • Presence of water gates where water ingress may occur • Capacity/measures to maintain water intake capacity in response to reduced river flow • Existence of emergency response plans • Capacity to utilize weather-related information • Organizational structure and capabilities of implementing agencies • Availability of weather insurance
Climate Risk	The <u>potential for adverse consequences</u> where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from <u>the interaction of vulnerability, exposure, and hazard.</u>	<ul style="list-style-type: none"> • Flooding of critical infrastructure, decreased capacity due to sea level rise • Reduced water supply capacity
Impact	Effects on natural and human systems. In this report, the term “impact” is used primarily to refer to the impacts of extreme climate and climate change on natural and human systems. Impacts generally refer to impacts on life, livelihoods, health, ecosystems, economies, society, culture, services and infrastructure resulting from the interaction of climate change or dangerous climate events that occur within a particular period of time with vulnerabilities of the society or system to which they are exposed. <u>Impacts are also expressed as (undesirable) consequences and consequences.</u>	<ul style="list-style-type: none"> • Significant soil erosion • Inundation of power generation/other facilities, power supply disruptions from sea-level rise, storm surge, flooding • Decreased crop yields.
Adaptation	Adaptation is the process of <u>coordination for real or projected climate and its impacts.</u> Adaptation seeks to <u>moderate or avoid harm</u> or <u>exploit beneficial opportunities.</u>	

2.3. Steps for Climate Risk Assessments and Consideration of Adaptation

Below is an outline of the flow of climate risk assessments and consideration of adaptation measures for JICA projects. Responsible members of the survey team are to advance these activities, in communication with technical team members and personnel from local implementation agencies, etc.

2.3.1. Preliminary Information Collection and Compilation

1) Confirmation of the framework of projects for target JICA projects

The framework of the JICA project at the time of commencement of the JICA study should be confirmed in advance in order to consider the information needed for the climate risk assessment. The following 6W points are to be confirmed:

- Project objectives and goals (Why)
- Project activities and inputs to achieve project objectives and goals (What)
 - Implementing entity (Who)
 - Location and region where the project are to be carried out (Where)
 - Beneficiaries of the target project (For whom)
 - Timing of implementation of the project (When)

Assessing climate risk, the above-mentioned 6W should be confirmed and adjusted with local stakeholders, so that the risk assessment can be carried out with a shared understanding of the JICA project framework in cooperation with local stakeholders.

When assessing climate risk, stakeholders involved in the target JICA project should be considered, and how to communicate with these stakeholders involved in the implementation of the climate risk assessment should be discussed in advance.

2) Identifying what is to be assessed

In conducting the climate risk assessment, consideration of adaptation measures and beneficiaries estimation, all aspects of the project that can be covered by assessment (project components, activities, etc.) are to be ascertained and summarized.

3) Information collection and preparation prior to field survey

Keeping in mind the framework and scope of the project being assessed, information collection plans should be prepared for the preparatory survey (for grant assistance projects) and the detailed planning survey (for technical assistance projects), considering the information required for the climate risk assessment, consideration of adaptation measures and beneficiaries estimation.

Information gathered in the Nature Condition Survey and the Environmental and Social Consideration Survey, and baseline information on project plans used to examine project objectives and effectiveness indicators include a large amount of information that can be used in climate risk assessment. For this reason, information that is scheduled to be collected under these survey scopes should be confirmed and organized. When doing so, keep the framework of climate risk components described above in mind and summarize what information items pertaining to "climate hazards," "exposures," "vulnerabilities," "climate risks," and "impacts" are included in the target JICA project. When such information is available to some extent in domestic work, organize an outline of the information related to each of these elements.

Based on a desk survey of existing materials, organize the information to be collected and confirmed in the field survey. When doing so, consider what information may be necessary in addition to the information gathered in the Nature Condition Survey and the Environmental and Social Consideration Survey and establish a plan for gathering additional information in the field. When collecting information and data about past natural disasters, climate projections, vulnerability, risks and impacts of climate change etc. for the project sites and target countries, results of projects and research conducted at target country/region by national government agencies, research organizations, academic institutions, and relevant international donors should be also reviewed.

Table 2 Examples of Information Items Collected in Preparation for Climate Risk Assessment

Examples of Information Items to Collect ⁴	Factors involved in the corresponding climate risk assessment ⁵
<ul style="list-style-type: none"> • Project Plan Contents (Requested contents. etc.) • Information on related infrastructure and ancillary facilities required for the project (access roads, water supply pipes, etc.) • Topography of the target land (low land, coastal areas, mountainous areas, etc.) • Location of the target project (traffic access, land use in the vicinity, etc.) • Socio-economic conditions (beneficiary population, economic activities, etc.) in the areas covered by the project 	Aspects to be assessed Exposure
<p><Previous climate, disaster records, data></p> <ul style="list-style-type: none"> • Information on the past and current weather and sea conditions of the target site • Disaster information such as records of natural disasters, hazard maps, etc. of the target area • Content of IPCC Fifth Assessment Report and Sixth Assessment Report • Relevant statements of the country's Nationally Determined Contribution (NDC), Long-term Low Emission Development Strategies (LT-LEDS, LTS), National Communication (NC) or National Adaptation Plan (NAP) • Content of climate change impact assessment and vulnerability assessment reports for the country or region concerned <p><Future Climate Forecasts></p> <ul style="list-style-type: none"> • Information on future climate and disasters at the target site (also considering forecasts in IPCC RCPs scenarios and SSP scenarios (Refer Page 28)) • Downscaled climate forecasting information (regional climate forecasting data) 	Climate Hazard
<ul style="list-style-type: none"> • Organizational structure, human resources, and financial conditions of implementing agencies • Natural environment (forests are deteriorating or declining) • Socio-economic conditions (industrial structure, employment status, income level, etc.) of the target area • Legal systems, policies and guidelines for adaptation to the impacts of climate change in the target areas (adaptation plans, etc.) • Relevant statements in the assessment of the impacts of climate change and the assessment of vulnerabilities of the country or region concerned • Previous Climate and Disaster Response Records (Damage Records and Recovery Work Records, etc.) held by implementing agencies 	Vulnerability
<ul style="list-style-type: none"> • Relevant statements of the country's NDC, LT-LEDS, NC or NAP • Relevant statements in the assessment of the impacts of climate change and the assessment of vulnerabilities of the country or region concerned 	Climate risk
<ul style="list-style-type: none"> • Content of IPCC Fifth Assessment Report and Sixth Assessment Report pertaining to the region concerned (Refer Part III, Reference) • Relevant descriptions of the country's NDC, LT-LEDS, NC or NAP • Climate and disaster response records (damage records, etc.) held by implementing agencies 	Impact

4) Determination of relevant organizations to be visited

Existing information gathered and organized through the above-mentioned desk survey shall be examined, and information required to be gathered and investigated by relevant organizations shall be examined through on-site surveys. The organizations to be visited shall be organized, and an on-site survey plan shall be prepared. If there are offices of international or national organizations engaged in the related activities in the project area, these should also be visited and interviewed. The survey

⁴ The following items are examples. Based on the content and characteristics of the JICA project, the information required for assessing climate-risk of the project should be scrutinized and collected.

⁵ The corresponding elements may vary depending on the content of the information.

information of other team members should also be confirmed, and duplications should be avoided by utilizing the survey results of other team members, and the scope between team members shall be confirmed.

2.3.2. Field Survey and Implementation of Climate Risk Assessment, Consideration of Adaptation Measures and Beneficiaries Estimation

In addition to gathering information planned in advance through visits to relevant organizations, visits will be made to the site where the project is to be implemented. Hearings will be held with residents in the neighborhood of the target area and local governments, etc. in order to understand the general conditions of the target area and, if necessary, hold supplementary hearings. (Supplementary confirmation of hazards, exposures, vulnerabilities, etc. identified in the Desk Survey). Based on the information gathered and surveyed for climate risk assessment, described above, the team members responsible for climate risk assessment will conduct climate risk assessments while communicating with other engineering team members, local implementation agency officials, and others. Hereinafter, the process of implementation will be described.

1) Confirmation of the framework of target JICA projects with local implementing agencies (counterparts)

Review the 6W to be assumed for climate-risk assessment for the target JICA project and the assessment framework based on the 6W with the relevant parties, such as local implementing agencies. Establish common understanding of climate risk assessment. This will ensure that the direction of climate risk assessment will not deviate from its original purpose.

- "6W" related to the project planning content shall be clarified while interviewing the parties concerned with the project (Whom, Where, When, What, Who, Why)
 - Identify what type of project will be carried out in what type of location, the goals of the project, project implementers and beneficiaries, etc. The characteristics of the climate at the site of the project are summarized based on the information gathered above.

For example, clarifying whether the project goals are an increase in rice productivity or an improved livelihood of the local populations will change the direction of discussions on whether the adaptation measures to be discussed later are related to rice production technology or whether measures including different means of livelihoods can be considered. For this reason, the Government of Japan will proceed while paying attention to the framework of projects so as not to shift the direction of the study.

2) Determination of targets of climate risk assessment

Identifying the targets for the climate risk assessment from all aspects that were organized in the preliminary study considering both the results of discussions with the counter parts and site visits and the below concept of climate risk assessment, consideration of adaptation measures and beneficiaries estimation in JICA projects.

Climate risk can prevent the project from achieving its expected value and performing its expected functions that were decided at the planning stage due to the extreme events caused by the climate hazards (e.g., high temperature, low rain, heavy rain, storms, droughts, floods, and sea level rises).

- The target facility or asset becomes structurally unable to perform its function (physical dysfunction)
 - Excessive demand caused by climate change or use under conditions exceeding assumptions may cause deterioration of the target functions and assets, resulting in a state in which intended services and functions cannot be provided in advance (lowering of service level)
 - Large costs are incurred in maintenance and management (deterioration of economy in use)
- Adaptation measures are measures that enable the JICA project to generate the project's value, anticipated functions and benefits, based on the climate risk assessment.

3) Conducting the climate risk assessment and creating a climate risk matrix

Using the steps outlined below, a climate risk assessment is to be conducted, and a climate risk matrix created.

The following methodologies may be considered for conducting climate risk assessments, but they are to be considered based on the actual project details and coordination with local counterparts.

- The members of the group responsible for climate risk assessment shall hold individual interviews and discussions with local organizations, such as members of other organizations and implementing agencies, and compile the results.
- Using the prepared information, technical experts and local officials will gather and study in a workshop format. It is expected that the provision of time for discussions with relevant technical personnel, local implementation agencies, climate-related agencies, local governments, etc. will lead to a shared understanding of climate risks for the target JICA project.

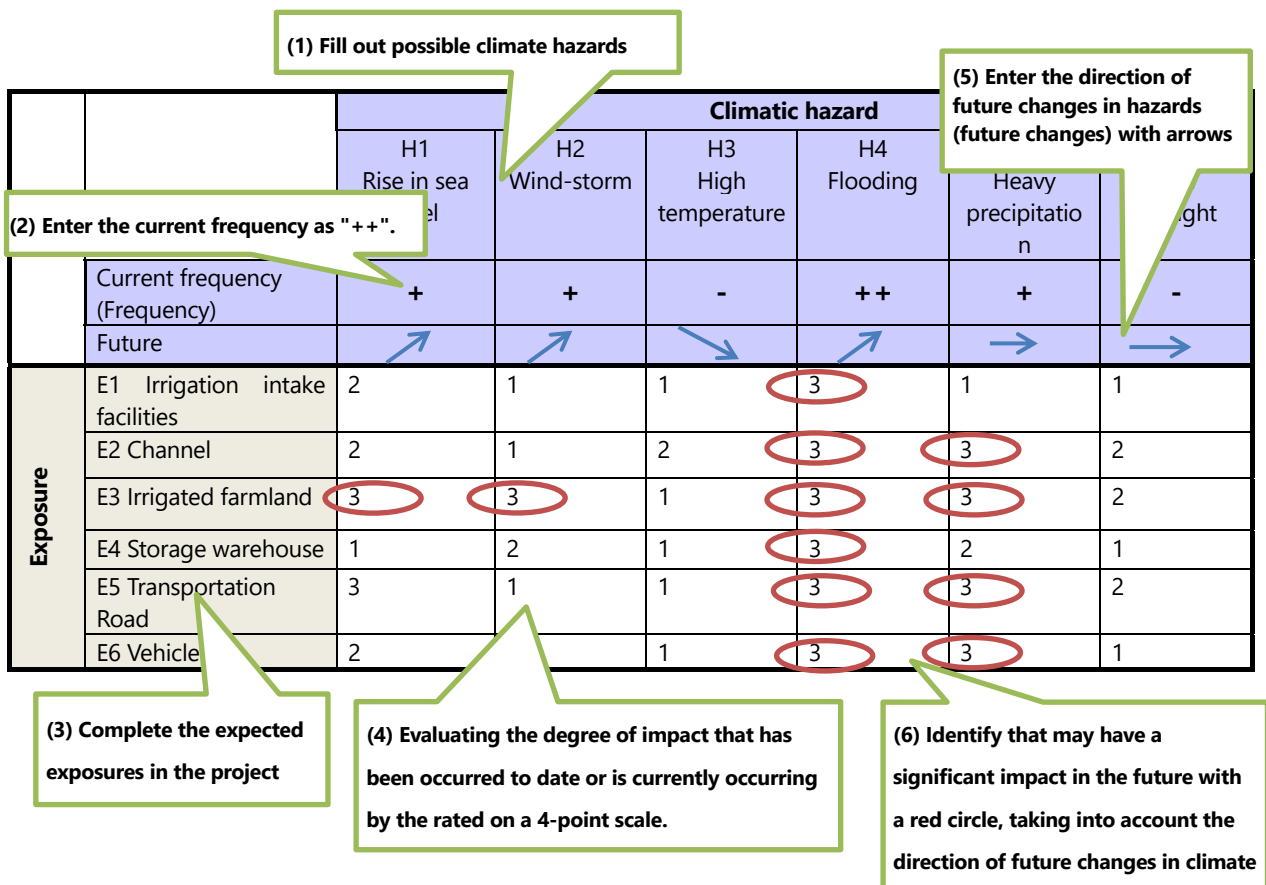


Figure 5 Image of Climate Risk Matrix

The procedure for conducting climate risk assessment, consideration of adaptation measures and beneficiaries estimation using the Climate Risk Matrix is described below.

(1) Consider and export "hazards" related to the target JICA project

Consider "hazards" that may be relevant to the project based on weather conditions at the target site. Review past, current, and future climate forecasts and consider possible climate scenarios due to climate change during the project period in the project area.

- Reference the technical engineer for the target JICA project and confirm the validity of the gathered information on the natural conditions of the project area (climate, hydrology, natural disasters, etc.). Discuss the relevant information on climate, hydrology, and natural disasters. Brainstorm a list of other information that could be relevant.
- Utilize the prepared weather and climate-related information (Collected and analyzed data/information such as weather data, climate forecasts etc.)
- From the list, choose the hazards that are likely to be relevant to the project and are likely to occur during the project planning period in the target area.

Temperature	Rise in average temperature, the generation of heat waves and high temperatures, and the generation of cold waves
Rainfall	Changes in annual rainfall, shifts in rainfall seasons, and intensive torrential rainfall Flooding caused by increased rainfall
Solar radiation	Changes in solar radiation
Wind	Changes in wind speed, changes in wind direction characteristics, and storms

<Example>

		Climatic hazard					
		H1 Rise in sea level	H2 Wind-storm	H3 High temperature	H4 Flooding	H5 Heavy precipitation	H6 Low sunlight
	Current frequency (Frequency)						
	Future						
Exposure	E1 Irrigation intake facilities						
	E2 Channel						
	E3 Irrigated farmland						
	E4 Storage warehouse						
	E5 Transportation Road						
	E6 Vehicle						

(2) Consider and fill out the frequency of hazards

The hazards listed above will be described on the scale shown in

Table 3 below, after confirming and examining the frequency of occurrence thus far and at present, respectively.

Table 3 Scale of hazard frequency assessment

Frequencies	Description and Definitions
++	Frequently occurring thus far or at present
+	Sometimes occurring thus far or at present
-	Has hardly occurred thus far or at present

In the case the assessment of a hazard according to the scale in the above table differs from person to person, and it is difficult for the concerned parties to reach an agreement, a concrete definition of the assessment scale may be decided within the survey team as an option. In such a case, the report shall also contain this revised assessment scale.1

Table 4 Examples of defining criteria for JICA project covered by the scale of hazard frequency assessment

Frequencies	Description and Definitions	Examples of establishment of concrete standards for target JICA projects
++	Frequently occurring thus far or at present	More than 10 occurrences in the past 20 years
+	Sometimes occurring thus far or at present	More than 5 occurrences in the past 20 years
-	Has hardly occurred thus far or at present	Fewer than one occurrence in the past two 20 years

<Example>

(2) Enter the frequency of occurrences thus far or at present

		Climatic hazard					
		H1 Rise in sea level	H2 Wind-storm	H3 High temperature	H4 Flooding	H5 Heavy precipitation	H6 Low sunlight
Current frequency (Frequency)	+	+	-	++	+	-	
	Future						
Exposure	E1 Irrigation intake facilities						
	E2 Channel						
	E3 Irrigated farmland						
	E4 Storage warehouse						
	E5 Transportation Road						
	E6 Vehicle						

(3) Select and enter potential "exposures" in the target JICA project

Selecting and entering the targets elements which are likely to be exposure by climate hazards in the target area during the project planning period from the evaluation targets in the target project that have been identified and clarified in advance into the climate matrix. New facilities to be built in the project shall also be considered as an exposure. Discuss the individual facilities in the project plan (including target area and system facilities and equipment effected by climate change), technical engineers in charge of the project, and experts in charge of the project's activities to determine if they are likely to have a relationship and choose the relevant components. If during any subsequent stage

of climate risk assessment, a component appears to be of little relevance or insignificance, it may be revised later.

<Example>

		Climatic hazard					
		H1	H2	H3	H4	H5	H6
Exposure	(Frequency) Future						
	E1 Irrigation intake facilities						
	E2 Channel						
	E3 Irrigated farmland						
	E4 Storage warehouse						
	E5 Transportation Road						
	E6 Vehicle						

(4) Evaluate the current "impact"

Confirm and examine whether or not the combination of exposure and hazard has caused/occurred and assess the degree of impact of what is or has happened. The scale of the evaluation is as shown in Table 5.

If it is difficult to evaluate the impact that has already occurred at the time of the survey for a new JICA project, check the following information, for example, and consider the impact level indirectly as the impact level that would have occurred had the target JICA project currently existed.

- Impacts that have occurred on similar facilities operated by the implementing agency of the target JICA project
- Impacts that have occurred on similar facilities in the region where the project was implemented
- Impacts that have occurred on similar facilities located in similar locations in the target country

Table 5 Evaluation Scale for current impact levels

Scale of the impact level	Description and Definitions
3	Events and impacts that have occurred thus far have been so difficult that they cannot be addressed and handled.
2	Events and impacts that have occurred to date have been moderately difficult to manage and deal with.
1	It has not been so difficult to manage the events and impacts that have occurred thus far. The resulting impact was minor and managed to some extent.
0	The impacts of events that have occurred to date have been negligible.

There may be cases where the degree of difficulty in dealing with the impacts differs from person to person, and it is difficult for the concerned parties to reach an agreement using the evaluation scale "currently occurring impacts" in the table above. In these cases, a more specific definition of the evaluation scale may be decided within the survey team, as in the case of the frequency of hazards. In such cases, the report shall also contain the revised assessment scale. If the impacts that had already

been occurred are considered to be critical climate risk to the project, it is recommended to confirm the details of the impacts through interviews with relevant local organizations and residents living in the area. In addition, it is also necessary to confirm whether there are any similar research/studies being conducted in neighboring areas or countries. It is better to determine whether the same kinds of impacts are likely to occur in the future or not through these studies. Based on that, it is recommended to conduct climate risk assessments and consider adaptation measures.

Table 6 Examples of Definitions of Standards for JICA projects

Scale of the impact level	Description and Definitions	Examples of establishment of concrete standards for target JICA projects
3	Events and impacts that have occurred so far have been so difficult that they cannot be addressed and handled.	The entire area of the premises was flooded, and water could not be supplied for more than several months before recovery.
2	Events and impacts that have occurred to date have been moderately difficult to manage and deal with.	The site was partially flooded, and the facility could not be operated, but it was restored in about one week and the water supply could be resumed.
1	It has not been so difficult to manage the events and impacts that have occurred thus far. The resulting impact was minor and was managed to some extent.	The site was partially flooded and there was a temporary shutdown of the facility. The facility was immediately recovered, and the water supply was resumed.
0	The impacts of events that have occurred to date have been negligible.	The site was temporarily partially flooded, but the operation of the facility was not affected, and the water supply could be continued.

<Example>

		Climatic hazard (Climate Hazard)				
		H2 Wind-storm	H3 High temperature	H4 Flooding	H5 Heavy precipitation	H6 Low sunlight
	Current frequency (Frequency)	+	-	++	+	-
	Future					
Exposure (Exposure)	E1 Irrigation intake facilities	2	1	1	3	1
	E2 Channel	2	1	2	3	2
	E3 Irrigated farmland	3	3	1	3	2
	E4 Storage warehouse	1	2	1	3	2
	E5 Transportation Road	1	2	1	3	2
	E6 Vehicle	2	1	1	3	1

(4) The degree of impact that is currently occurring is evaluated in four stages.

Events that have occurred so far and now are the result of a combination of "climate hazard" and "exposure," and how much of the effect was confirmed and examined.

(5) Check and examine the direction of future changes in "climate hazards" (future trends) and describe them with arrows.

- Utilize basic information gathered in preparation for climate risk assessment.
- There may be no information on projection forecasts. In this case, enter the arrow after considering discussing with experts and counterparts.
- Use climate forecast data from the target country's climate agency or climate change agency if it's available.
- Some future forecasts by region, such as temperature and rainfall, can be confirmed somewhat conveniently on the Internet, and will be utilized as needed.

For future projections of climate hazards and other relevant information, refer also to "3. Understanding the Future Climate and Impacts of the Target Area and Reference Information Resources" after p. 31 of this guidance.

<Example>

		Climatic hazard					
		H1 Sea level rise	H2 Wind-storm	H3 High temperature	H4 Flooding	H5 Heavy precipitation	H6 Low sunlight
	Current frequency (Frequency)	+	+	-	++	+	-
	Future	↗	↗	↘	↗	→	→
Exposure	E1 Irrigation intake facilities	2	1	1	3	1	1
	E2 Channel	2	1	2	3	3	2
	E3 Irrigated farmland	3	3	1	3	3	2
	E4 Storage warehouse	1	2	1	3	3	2
	E5 Transportation Road	1	2	1	3	2	1
	E6 Vehicle	2	1	1	3	3	1

(6) Select a combination of "climate hazard" and "exposure" to be considered

Based on the degree of impact assessed in the table from 0 to 3, consider the direction of future changes in hazards, and select the impact (= risk) that may be significant in the future for the project from the following viewpoints.

- Among the impacts that have been assessed to be "3" in the current situation, some of these impacts are likely to be more severe in the future.
- Among the impacts that have been assessed to be "3" in the current situation, some of these impacts are likely to continue to be of similar severity in the future.
- Although the degree of impact is "2" in the current situation, considering the direction of future changes in climate hazards, it is likely that some of these impacts will be as significant as "3" in the future.

For example, the following viewpoints can be used as a reference when considering which risk to include in the matrix as the impact (risk) that can be significant in the future in the target JICA project.

<Example>

		Climatic hazard (Climate Hazard)					
		H1 Rise in sea level	H2 Wind-storm	H3 High temperature	H4 Flooding	H5 Heavy precipitation	H6 Low sunlight
Current frequency (Frequency)		+	+	-	++	+	-
Future		↗	↗	↘	↗	→	→
Exposure	E1 Irrigation intake facilities	2	1	1	3	1	1
	E2 Channel	2	1	2	3	3	2
	E3 Irrigated farmland	3	3	1	3	3	2
	E4 Storage warehouse	1	2	1	3	3	2
	E5 Transportation Road	1	2	1	3	2	1
	E6 Vehicle	2		1	3	3	1

(6) Taking into account the direction of future changes in hazards, consider and select the impact (= risk) that may be significant in the future in the project (circled with red).

Points to be considered for selection

- Potential and frequency of occurrence: How often does the impact occur during the period in which the objective of the target JICA project is expected to be fulfilled (whether the impact is moderate, but may occur frequently from the previous occurrence conditions, etc.)
- Magnitude of impact on project objectives in the event of an occurrence: How likely is the impact to affect the target JICA project (even if the frequency is small, it may have a serious impact, etc.)
- Condition of response to impacts: To what extent is it possible to respond to the impacts based on the level of impacts that have already occurred (is it difficult to respond to the impacts, and is it not possible to adequately respond to the impacts?)
- Speed at which the impact becomes apparent: For example, the possibility of flooding and interrupting target projects and facilities is considered to be a relatively early manifestation of the impact of flooding. The risk of inflow of soil and sand into reservoirs due to heavy rainfall does not immediately materialize, but if the risk of inflow of soil and sand into reservoirs due to heavy rainfall has a significant impact on the purpose of reservoirs due to gradual inflow, the speed of materialization of the impact is considered to be relatively slow.

(7) Consider "Vulnerability" of "Exposure" Factors

Regarding combinations of "climate hazards" and "exposure" to be carefully considered for the selected project, "vulnerabilities" should be considered that may contribute (or have already contributed) to "climate risks" that may be significant in the future.

Table 7 Identification of vulnerabilities that contribute to climate risk generation

	(A) Combination of "climate hazards" and "exposures" to be considered	(B) Vulnerabilities assessment contributing to climate risks (Susceptibility to and capacity to cope with impacts)	(C) Possible major future climate risks
1	Example of Risk Entry H1 (sea level rise) +E3 (paddy fields)	(Example) There is a weir/barrage to keep salt water out of irrigated	

	Possible saltwater ingress on irrigated farmland due to sea level rise.. <Key points to document> • Describe exposure/hazard combinations, and possible impacts.	farmland, but frequent failures allowed saltwater to ingress at failure points <Key points to document> • Consider sensitivity to impacts • Consider ability to respond to impacts For example, what actions have been taken in the past when an impact has occurred due to a given climate hazard?	
--	--	---	--

In column A, indicate the combination of "climate hazards" and "exposures" that require attention, and resulting impacts. In column B, indicate the sensitivity if the situation occurs and ability to respond to impacts (vulnerability assessment). Vulnerability assessment should be considered based on the following two perspectives:

- The impacts listed in column (A) are described in terms of their susceptibility and sensitivity to hazards.
- Enter an assessment of the ability to respond to impacts. For example, confirm and describe what measures have been taken to deal with the impacts that have had in the past and the present. This part will be confirmed mainly through local surveys, interviews with counterparts and target areas, and records of implementation measures.

(8) Determination of possible major future climate risks

- For the "combination of "climate hazards" and "exposures" that require attention, and resulting impacts" from column A, based on "sensitivity if the situation occurs and ability to respond to impacts (vulnerability assessment)" from column B, if it is deemed to be a significant climate risk for the project, select that item as the future climate risk for the target project. In cases where multiple future climate risks are assumed, it is advisable to consider adaptation measures for each of them rather than narrowing the focus to a single one.
- In column C, summarize the selected climate risk.

Table 8 Identification of possible major future climate risks of the project

	(A)	(B)	(C)
	Combination of "climate hazards" and "exposures" to be considered	Vulnerabilities assessment contributing to climate risks (Susceptibility to and capacity to cope with impacts)	Possible major future climate risks
1	Example of Risk Entry) <u>H1 (sea level rise) + E3 (paddy fields)</u> Possible saltwater ingress on irrigated farmland due to sea level rise. <Key points to document> - Describe exposure/hazard combinations, and possible impacts.	(Example) There is a weir/barrage to keep salt water out of irrigated farmland, but frequent failures allowed saltwater to ingress at failure points <u><Key points to document></u> - Consider sensitivity to impacts - Consider ability to respond to	(Example) H1 (sea-level rise) + E3 (paddy field) Damage from saltwater ingress on irrigated farmland could increase due to ongoing sea level rise. <Key points to document> - Only combinations with vulnerabilities that have been considered and be selected as potential major future climate risks

		impacts For example, what actions have been taken in the past when an impact has occurred due to a given climate hazard?	for the project should be noted. - Leave blank for items that were not selected.
--	--	---	---

(9) Creating Climate Risk Trees

Based on the final selection of impacts (climate risks) that are likely to be significant in the future for the target project, create and organize a climate risk tree as shown in Figure 6 below.

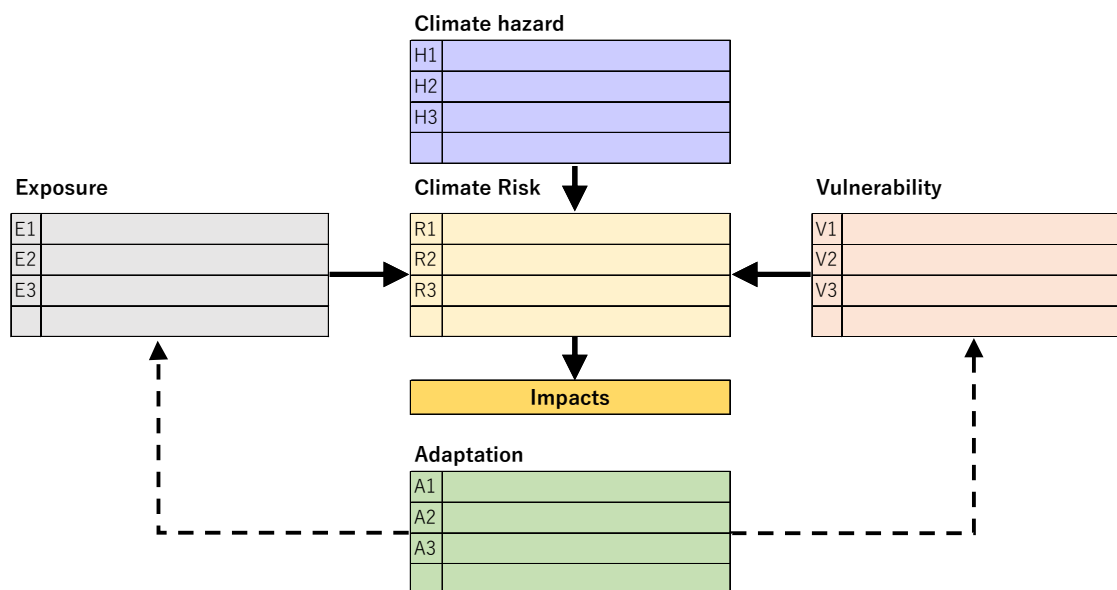


Figure 6 Climate Risk Tree

1. Enter the final selection of "climatic risks" in "Risk."
2. "Exposure" should include elements describing the selected "climatic risks" as exposure.
3. "Climate Hazard" should include elements describing the selected "climatic risks" as hazards.
4. "Vulnerability" should include elements of the selected "climatic risks" considered as "vulnerabilities assessment" that may contribute to the development of impacts.
5. Check the logic from climate hazard to risk for the climate risk tree that has been completed. Again, return from risk to climate hazard to see if the logic is sound.

(10) Consideration of Adaptation Measures

Consider possible measures (= adaptation measures) to reduce the final selection of "climate risks" and fill in Table 9 below for adaptation measures.

Table 9 Adaptation measures Review Table

Risk	Impact climate risks (ultimately selected) that are likely to be significant in the future for the target JICA project	Adaptation measures for climate risk	Corresponding SDGs items No.
1	Enter a summary of the selected "climate risks"	Adaptation measure 1 Enter adaptation measures to address climate risk (such as what to do and possible measures)	1, 11
		Adaptation measure 2	6

2	Adaptation measure 1	2
	Adaptation measure 2	7,14

- When filling out the adaptation measures in the table above, note the climate risks, hazards, and exposures associated with each adaptation option to make it easier to understand which items correspond.
- The adaptation measures considered need not be narrowed down at this stage, and all adaptation measures that may have been considered should be described. They will be considered more deeply in future investigations, such as the Preparatory Survey for Cooperation.
- For each adaptation, describe how the adaptation measure addresses "vulnerabilities" that contribute to climate risk.
- For each adaptation measure, the corresponding SDGs goal(s) is/are also to be listed.

As a next step, consider the priority of the adaptation measures listed, based on the criteria of urgency, economic performance, effectiveness, and feasibility, and finally make the selection of adaptation measures as a result of this consideration of climate risk assessment and adaptation measures.

At this stage, it is acceptable to have multiple adaptation measures. Since it is assumed that the climate risk assessment will be conducted at the initial stage of preparatory surveys and during the detailed planning survey (the initial stage for technical cooperation projects), the climate risk assessment is to be considered in greater detail, as required, at later stages after the preparatory surveys, taking into account the adaptation measures that were considered as candidates at this stage.

Table 10 Assessment criteria for adaptation measures

Perspective of valuing adaptive options	Description and Definitions
Urgency	Is it urgent to implement the adaptation measure? Or does there seem to still be some leeway?
Economic performance	Is the cost of implementing such adaptation measures realistic? Is it possible to expect an effect that is worth the cost?
Effectiveness	Is the chosen adaptation plan an effective tool for the expected climate risk?
Feasibility	Is it technically feasible (technical perspective) and systematically feasible (policy and institutional perspectives). Is it possible from an environmental perspective?

Compare the candidate adaptation measures to ensure that the residual risk is acceptable for the project. Discuss, analyze, and evaluate the effectiveness of adaptation measures regarding the likelihood of occurrence and impact of risks, as well as the feasibility from a cost-effective, technical, and social standpoint.

Figure 7 is an example of a table that is one of the organizational methods for visualizing the effects of adaptation measures and the evaluation of the degree of difficulty in realizing them (including economic aspects).

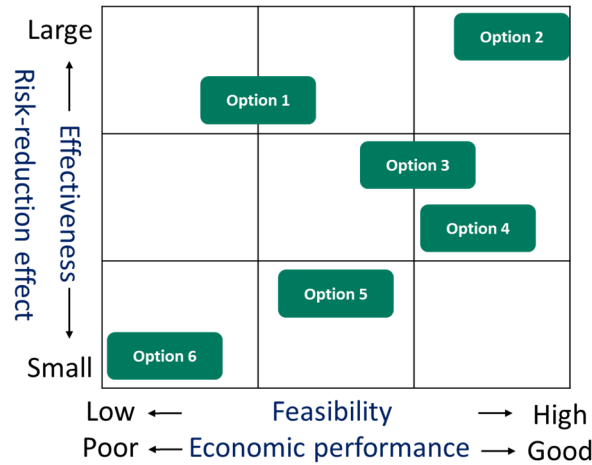


Figure 7 Evaluation criteria of adaptation measures (Including Economic Perspectives)

(11) Fill in the climate risk tree with adaptation measures

Fill in the Climate Risk Tree created in (9) with adaptation measures determined to be of high priority. It is noted that Adaptation measures do not address the climate hazards in the climate risk tree (climate stabilization is achieved by mitigation measures) and therefore will address exposures or vulnerabilities.

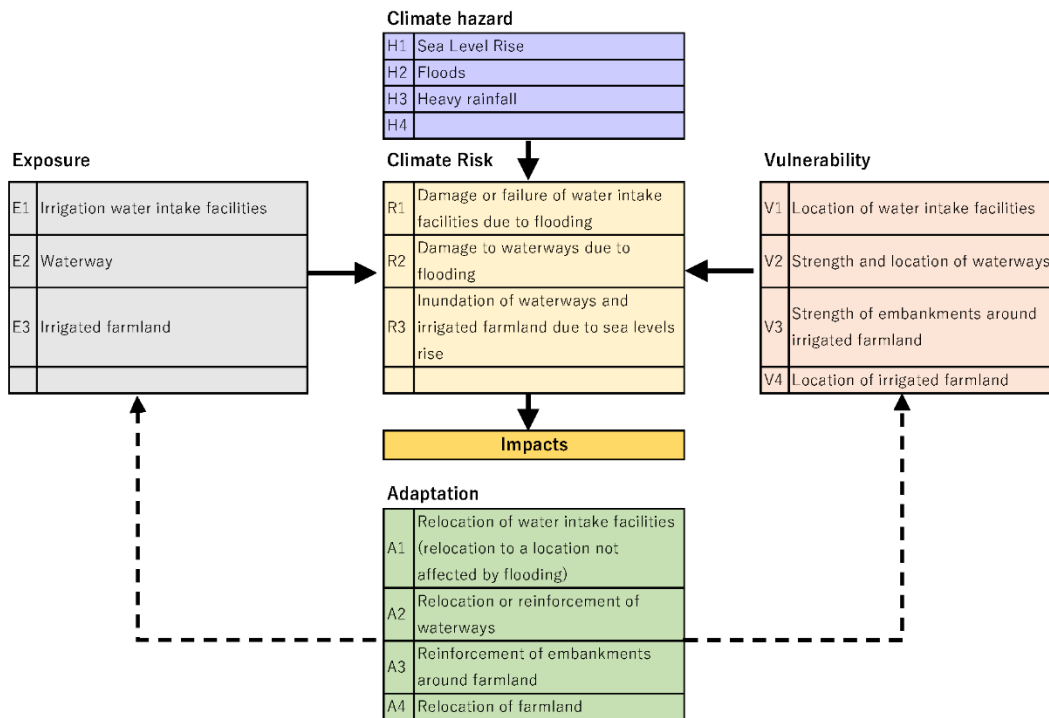


Figure 8 Completing the Climate Risk Tree Including Adaptation Measures

4) Detailed planning of adaptation measures

After selecting an adaptation measure deemed to be of high priority, the next step is to consider a more concrete plan for the adaptation measure, as required during the second half of the Preparatory Survey for Cooperation.

2.4. Beneficiaries Estimation

With respect to the evaluation of projects that contribute to adaptation to climate change (adaptation projects), the guidance aims to use indicators that allow cross-sectoral accumulation and comparison from the viewpoint of project accountability.

Therefore, in this guidance, the beneficiaries of adaptation measures, which is used as a cross-sectoral indicator by major donors (Adaptation Fund, Green Climate Fund, Climate Investment Fund, International Climate Fund, World Bank, GIZ etc.⁶), will be set as an indicator for evaluation of adaptation projects.

It is important to be able to logically explain the relationship between the beneficiaries that will benefit from the adaptation measures and how the measures will have an effect on the beneficiaries that will benefit from the measures. Additionally, beneficiary estimation for each project should be conducted on a case-by-case basis, emphasizing the importance of documenting the method and basis used for the estimation for future reference.

1) Definition of Beneficiaries

Number of beneficiaries of the adaptation project is defined as "Beneficiaries"⁷.

2) Beneficiaries estimation

Beneficiaries are estimated as below.

(1) in cases where the number of beneficiaries of the project is estimated at the project formation stage

Number of beneficiaries of the project as "Beneficiaries".

(2) In cases where the number of beneficiaries of the project has not been estimated at the project formation stage

Beneficiaries are estimated with reference to Table 11 below. Table 11 is an "example" with a typical project in each sector, and it is more desirable to set an appropriate beneficiary for each individual project based on its characteristics.⁸ Noted that the "Beneficiaries" in this guidance is not the actual number of beneficiaries, but an estimated number at the project preparation stage.

It should be noted that in both (1) and (2) above, the following concepts 1 and 2 should be taken into account.

1. If the number of beneficiaries based on the number of components related to the adaptation measures, the amount of money and scale of activities, etc. can be grasped as precisely as possible, and if it can be logically explained that the beneficiaries are those who will benefit from the effects of implementing the adaptation measures, then the number of that beneficiaries shall be defined as the "Beneficiaries". On the other hand, if it is difficult to grasp the scale of benefits, the number

⁶ Other donors such as the World Bank, ADB, Adaptation Fund, and Green Climate Fund (GCF) set indicators for adaptation measures in their respective sectors, one indicator commonly set by many organizations is the beneficiaries. As examples of other indicators, the Adaptation Fund may set indicators other than beneficiaries, such as the area covered and the number of municipalities for the introduction of early warning systems, or the area (ha) to be protected for adaptation measures through ecosystem protection.

⁷ Estimate by gender as much as possible.

⁸ The means of data collection on beneficiaries and the means of verification and its definition should be clarified at the time of setting the indicators.

of beneficiaries for the entire project shall be counted as the "Beneficiaries".

- The number of direct beneficiaries is basically used as the beneficiaries, but the number of beneficiaries who will be affected by the project purpose (final beneficiaries) can be assumed, and the relationship between the implementation of adaptation measures and the beneficiaries can be logically explained (e.g., the final beneficiaries live outside the project area, but the location where the adaptation measures are implemented and the location where the final beneficiaries live are geographically and topographically related, and may be affected by the same climate hazard), the total number of direct beneficiaries and final beneficiaries may be used as the "Beneficiaries"⁹. However, if the number of final beneficiaries is included in the beneficiary population, it is necessary to keep a record how the relationship between the implementation of adaptation measures and the beneficiaries are considered for future references.

Table 11 Examples of beneficiaries in each sector

Sector	Direct beneficiaries	Final beneficiaries
Agriculture	<ul style="list-style-type: none"> - Operators and users of infrastructure such as irrigation and water distribution facilities, agricultural roads, storage facilities, etc. - Farmers under the project for improvement of farming techniques - Farmers under the project for capacity building of research and development of varieties - Farmers and facility management organizations under the project for capacity building of irrigation facility management - Researchers in the field of agriculture 	<ul style="list-style-type: none"> - Employees in the facilities built in the project - Consumers of agricultural products from the project area - Beneficiaries of services provided by counterpart's personnel who have participated in the training - Residents of communities living near agricultural infrastructure such as irrigation facilities, roads, storage facilities, etc. - Farmers in the target area where the trained counterpart has independently expanded to areas outside of the project area
Water Resources: Water Supply and Integrated Water Resources Management	<ul style="list-style-type: none"> - Residents who will be newly supplied with water by new waterworks facilities (water storage, water purification, water distribution, etc.), wells, pumps, etc. - Personnel from the counterpart who will receive training on integrated water resources management and operation and maintenance of water supply facilities. 	<ul style="list-style-type: none"> - All residents in the target area who will receive water supply from the newly constructed facilities in addition to the existing facilities - Users who will benefit from improved water supply services by strengthening the water resource management and facility operation and maintenance capacities of the counterpart's relevant institutions
Environmental Management: Sewage	<ul style="list-style-type: none"> - Users of sewage facilities that have been improved, maintained, or newly constructed - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Residents of the target communities (including users of local facilities such as hospitals) who will benefit from the sewage services provided by the improved facilities. - Users who will benefit from improved services by strengthening the operation and maintenance capacity of the partner country's relevant institutions
Disaster prevention	<ul style="list-style-type: none"> - Users of the improved or newly constructed disaster prevention facilities/residents of the target area - Residents to whom the early 	<ul style="list-style-type: none"> - People living in the surrounding community and users of community/industrial/service facilities such as hospitals, etc., where disaster preparedness is expected to be

⁹ It is likely that some of the direct beneficiaries and some of the final beneficiaries will overlap, and it is desirable to avoid duplication whenever possible. However, if it is difficult to grasp the number of duplicates, it is necessary to clearly indicate that there may be duplicates.

	<p>warning system will be delivered</p> <ul style="list-style-type: none"> - Personnel from the counterpart who will receive training on operation and maintenance of the facility - Researchers in the field of disaster reduction 	<p>improved</p> <ul style="list-style-type: none"> - Residents of communities in the vicinity of the social infrastructure - Users who will benefit from service improvement by strengthening the operation and maintenance capacity of the counterpart's relevant institutions
Forest and Natural Environment Conservation	<ul style="list-style-type: none"> - Residents who receive income from agricultural and forestry products produced from forests as a result of forest conservation and afforestation - Residents for whom the impact of weather disasters (landslides, landslides, etc.) is mitigated as a result of forest conservation and afforestation. - Personnel from the counterpart attending training courses on forest management, etc. - Researchers related to forest and natural environment conservation 	<ul style="list-style-type: none"> - Residents and other stakeholders in the surrounding community who will benefit from the forest, nature, and environment conservation projects¹⁰ - Residents in the vicinity and downstream areas of the areas where forest conservation has been implemented - Users who will benefit from improved services through enhancement of the operation and maintenance capacity of the partner country's relevant institutions
Electricity (generation, transmission and distribution)	<ul style="list-style-type: none"> - Users receiving electricity directly from improved, upgraded, or newly constructed power generation facilities or grids - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Users of public facilities (hospitals, schools, economic facilities, etc.) that receive the electricity supply from the installed power transmission and distribution network - Users who will benefit from service improvement by strengthening the operation and maintenance capabilities of the counterpart's relevant institutions
Hydropower generation	<ul style="list-style-type: none"> - Users receiving electricity directly from improved, upgraded, or newly constructed power generation facilities or grids - Residents living in the downstream areas of the dam where flood risks are reduced - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Users of public facilities (hospitals, schools, economic facilities, etc.) that receive the electricity supply from the installed power transmission and distribution network - Users who will benefit from service improvement by strengthening the operation and maintenance capabilities of the counterpart's relevant institutions
Road	<ul style="list-style-type: none"> - Users of road infrastructure (highways, underground tunnels, bridges, etc.) that has been improved, maintained, or newly constructed - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Residents living in the surrounding community who will benefit from road improvement - Users who will benefit from service improvement by strengthening the operation and maintenance capacity of the counterpart's relevant institutions
Railway	<ul style="list-style-type: none"> - Users of the improved, maintained, or newly constructed railway - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Residents living in the surrounding community who will benefit from the railway improvement - Users who will benefit from service improvement by strengthening the operation and maintenance capacity of the counterpart's relevant institutions
Airport	<ul style="list-style-type: none"> - Users of the improved, maintained, or newly constructed airport - Personnel from the counterpart who 	<ul style="list-style-type: none"> - Users and industry-related stakeholders who will benefit from smooth transportation and logistics by improving airport facilities

¹⁰ E.g., Residents who benefit economically from the promotion of eco-tourism and forest resource utilization industries, etc.

	will receive training on operation and maintenance management	- Users who will benefit from service improvement by strengthening the operation and maintenance capabilities of the counterpart's related organizations
Port	<ul style="list-style-type: none"> - Users of the improved, maintained, or newly constructed port - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Users of shipping routes and ports, and industrial stakeholders who will benefit from the smooth transportation and logistics services provided by the improvement of port facilities, including dredging, etc. - Users who will benefit from service improvement by strengthening the operation and maintenance capabilities of the counterpart's related organizations
Industrial Park	<ul style="list-style-type: none"> - Employees of companies in the industrial park that have been improved, developed, or newly established - Personnel from the counterpart who will receive training on operation and maintenance management 	<ul style="list-style-type: none"> - Stakeholders who will benefit from stable supply of products, food, energy, etc. and improvement of services through the development of the industrial park - Users who will benefit from service improvement by strengthening the operation and maintenance management capacity of the counterpart's relevant institutions

*Unit: The basic unit of the beneficiaries is "number of people". The number of users shall be annual number of users. On the other hand, if it is difficult to determine the number of users, information on the number of households may be used as an alternative measure. In such cases, the number of users shall be estimated by multiplying the average number of persons per household in each country (standard multiplier of household size based on the latest census and household survey).

*Data: The data to be used are (i) survey data for each project and (ii) national statistics (in principle, the priority order is (i), followed by (ii)). However, the most appropriate data will be used as appropriately depending on the project. The citation shall be recorded with the information used so that it can be examined later (to ensure reproducibility).

References

Example 1: Water Supply Facilities in Local Areas

- Business objectives: Improve access to safe water at target sites and thereby contribute to improving the living environment, such as reducing the risk of aquatic diseases.
- Expected Results:
 - Pipe water supply facilities are established at about 20 sites.
 - Technical guidance on the maintenance and management of water supply facilities will be provided.
 - Basic information for sustainable maintenance and management of water supply facilities is compiled.
- Project: Deep well drilling, construction of pipeline water supply facilities (water source facilities and water distribution facilities), maintenance and maintenance equipment

		Hazard		Vulnerability	Climate Risk	Potential Adaptation Options
		H1 Flood	H2 Lightning			
		Likely to occur in upstream states	Affects existing facilities at the target site			
Current status of hazard occurrence (frequencies)		+	+			
Prospects for the future of the Hazard		➔	➔			
Exposure	E1 Elevated water tank To be installed at higher elevation from the ground	0 ➔	0 ➔ The impact of lightning are not expected.			
	E2 Solar pumping facilities To be installed on the ground	1 ➔ Multiple facilities are planned in the upstream region and may be affected by flooding	2 ➔ There have been about 10 cases in the past in which controllers of solar water supply systems have failed. The time required for recovery is up to two days.	In anticipation of the damage caused by lightning strikes during the rainy season, the operation company has prepared sufficient spare parts for the operation and maintenance of past projects.	<ul style="list-style-type: none"> The possibility of damage due to lightning strikes on solar pumping facilities is also assumed in this project. Frequency and locations of lightning occurrence would change in the future. Damage by flooding may occur in the upstream area. 	<ul style="list-style-type: none"> Preparations for damage caused by lightning strikes at solar pumping facilities have been made in previous projects. Therefore, similar measures could be taken in this project as well, and the occurrence of lightning strikes should be monitored. If any changes in lightning occurrence are observed, consideration should be given to such changes. Since there is a possibility of flood damage in the upstream region, the
	E3 Water distribution facilities To be installed on the ground	1 ➔ Multiple facilities are planned in the upstream region and may be affected by flooding	0 ➔ The impact of lightning are not expected.			

Example 2: Flood Alarm System

- Project Goals: Strengthen the Integrated Data Management Capabilities of the Meteorological Agency's Hydrology Department and the Flood Prediction Alarm Centers in the target area.
- Expected Results:
 - Strengthening of the capacity of the Japan Meteorological Agency's hydrology department to develop a flood forecasting and warning system.
 - Strengthening of the quality control and storage capacity of climate data at flood forecasting warning centers in the Meteorological Agency's hydrology department and target areas.
 - Standardization of the organizational structure and operation guidelines of the flood forecast warning center in the target area and the development standard (draft) of equipment and facilities according to the level of the flood forecast warning system.
 - Strengthening of flood forecasting warning capacity for target watersheds in the Climate Department of the Japan Meteorological Agency.
 - Increased data management capacity required for flood forecasting warnings at the flood forecasting warning center of the target area.
- Project Plan:
 - Implementation of activities to strengthen the capacity of the Japan Meteorological Agency to prepare plans for the development of flood forecast warning systems
 - Implementation of activities to strengthen the quality control and storage capacity of climate data at flood forecasting warning centers in the Meteorological Agency's hydrological department and target areas
 - Implementation of activities related to the standardization of the organizational structure and operational guidelines of the flood forecast warning center, and standards for maintenance of equipment and facilities according to the level of flood forecast warning system
 - Implementation of activities to strengthen flood forecasting warning capacity for target watersheds of the Meteorological Agency's hydrological department

- Implementation of activities to foster the data management capacity required for flood forecasting warnings at flood forecasting warning centers in target watersheds

		Hazard		Vulnerability	Climate Risk	Potential Adaptation Options
		H1 Flood	H2 Change in rainfall patterns			
Current status of hazard occurrence (frequencies)		++	++			
Prospects for the future of the Hazard		↗	↗			
Exposure	E1 Quality control and Storage capacity of Climate data and Flood Prediction Alarm Centers in the Meteorological Agency's Hydrology Department and target areas	0 ↑ Sometimes values at the headquarters and at branch offices are observed to be different due to data transfer errors, etc. Some of them are not known to be corrected. These issues are expected to have some impacts on the flood warning forecast.	0 ↑ Implementation agency faces challenges on confirmation of the occurrence of flash flood caused by the certain amount of rainfall and its intensity in the upstream region, and utilization for warning. They may not be possible to confirm and consider to data based on the rainfall pattern and the amount of rainfall that change with the climate change.	• Quality control is implemented through manual checking of stored data, but there are no quality control criteria.	Floods and changes in rainfall data due to climate change may occur in the future. If it is impossible to confirm and examine data of a tendency different from that of the past regarding quality control of data, there is a possibility that an appropriate forecast alarm might not be issued.	Capacity will be strengthened so that observational data can be reviewed in a timely manner and standards in response to climate change can also be reviewed.
	E2 Organizational structure and operation guidelines of flood forecast warning centers in the target areas, and standards for the development of equipment and facilities.	1 ↑ The lack of standards for regional flood warning centers has led to differences in service levels across centers.	2 ↑ The lack of standards for regional flood warning centers has led to differences in service levels across centers.	There is no standard for information transmission method in the regional flood warning center in the flooding, and it is planned to be formulated in the project.	With regard to the establishment and operation of local flood forecasting warning center, changes in flood and rainfall data due to climate change may occur in the future. In the event of a different trend of flooding or rainfall pattern, it might not be possible to issue an appropriate early warning.	Enhance capacity to consider standards for climate change in the establishment and operation guidelines of regional centers in a timely manner.
	E3 Observation equipment used to collect hydrometeorological data	1 ↑ Although the installation of observation equipment is expanding, it is insufficient in the target basin, and it is not sufficient to prepare for the occurrence of floods.	0 ↑ Although the installation of observation equipment is expanding, it is insufficient in the target basin, and it is not sufficient to prepare for the changes in rainfall pattern.	Although the number of the installed observation equipment are increasing, they are absolutely shortage in quantity.	Due to the inability of data collecting and analyzing, it is difficult to take appropriate response measures and to make out appropriate warning signals.	Increase the number of observation equipment installation.

2.5. Reporting of the Results of Climate Risk Assessment, Consideration of Adaptation Measures and Beneficiaries Estimation

2.5.1. Reporting

The results of the climate risk assessment, consideration of adaptation measures and beneficiaries estimation for the target project are assumed to be included in the following report. Specific locations in the report will be adjusted with other items in each project as appropriate.

Table 12 Type of report

JICA project schemes	Type of report
Loan aid projects	• Preliminary Cooperation Survey Report (Progress Report, Draft Final Report, etc.)
Grant Aid Projects	• Preliminary Cooperation Survey Report (Progress Report, Draft Final Report, etc.)
Technical cooperation projects	• Detailed Plan Establishment Investigation Report • Inception Report, Progress Report, Project Completion Report, etc. (Report after Project Start)
Other (Private Partnership Projects, etc.)	• Interim report of investigation, work completion report, etc.

2.5.2. Report Content

It is envisioned that the report on the climate risk assessment, consideration of adaptation measures and beneficiaries estimation will contain the following content in a chapter entitled "Climate Risk Assessment, consideration of Adaptation Measures and Beneficiaries estimation".

1) Results of climate risk assessment

- Briefly describe "climate hazard" "exposure," "vulnerability," and "climate risk" pertaining to the results of the climate risk assessment, together with explanations and reasons as well as the climate risk matrix and climate risk tree that were prepared so that logic of climate risk assessment is appropriate and clear...
- Regarding "climate hazards" "exposure" "vulnerability" and other items, confirm that they have been covered in sections on "natural conditions" and "socioeconomics, facilities and equipment" in the report of the preparatory survey for the project.

2) Possible "adaptation measures" considered based on results of the climate risk assessment

- Briefly describe the "adaptation measures" that were considered based on the results of the climate risk assessment, also prioritizing them in terms of urgency, economic performance, effectiveness, and feasibility.
- In survey-related interim term reports (progress reports, etc.) summarize and describe what information is needed for consideration, regarding the inclusion of provisionally prioritized candidates for adaptation measures in the project plan.
- Also, briefly describe whether the "adaptation measures" considered have been integrated into project plans, facilities and facilities plans, etc. If not finally incorporated into the project plan, etc., include an explanation of the reason(s) why.
- Describe the results of explanation and discussion about the results of climate risk assessment and adaptation measures.

3) Results of Beneficiaries estimation

- Indicate the date of the estimation of the beneficiaries
- Describe the estimated beneficiaries. If the number of beneficiaries can be estimated for each component related to the adaptation measure, it shall be stated for each adaptation component. If the final beneficiaries are also included in the estimation, the total number of direct beneficiaries, final beneficiaries, and the sum of them shall be stated.

4) Materials/documentation used for climate risk assessment, consideration of adaptation measures and beneficiaries estimation

- Include information such as titles and URLs for materials referenced in the assessment of climate risk and the consideration of adaptation measures.
- List all other data used to estimate the beneficiaries in the reference. If data was collected by a third party, this should also be noted.

Table 13 Review points for the results of climate risk assessment, consideration of adaptation measures and beneficiaries estimation

	Category	Viewpoint of confirming in the JICA
1	Assessment elements	Have all aspects of the project (project components, activities, etc.) that could be relevant for a climate risk assessment been ascertained and described?
2	Climate Hazard	Given the situation of the target country or region, have climate hazards that should be considered in a climate risk assessment (heat waves, torrential

	Category	Viewpoint of confirming in the JICA
		rainfall, storms, droughts, flood, sea level rise, etc.) been identified and considered?
3	Exposure	Among the assessment elements, have the items (project components, activities, etc.) that could be exposed to "climate hazards" been identified and considered?
4	Vulnerability	Have the vulnerabilities to "climate hazards" that involve "exposure" been ascertained and described?
5	Climate risk	Have the potential significant future impacts on the project been considered and the results explained, using "climate hazards," "exposures" and "vulnerabilities" pertaining to the project?
6	Adaptation measures	Have "adaptation measures" to address potentially significant impacts on the project been considered and explained?
7	Communication with Counterparts on Climate Risk Assessment	How have the climate risk assessment and adaptation measures been discussed with the partner organizations (counterparts) of the target project? (Example) <ul style="list-style-type: none"> • This study was carried out jointly with the counterpart during the execution process of climate risk assessment. • The results of the climate risk assessment carried out by the survey team were explained to the counterpart, and an understanding was reached.
8	Beneficiaries	Have the beneficiaries of "adaptation measures" in the target project been considered and the concept of estimation explained?

3. Understanding of the future climate and impacts of the target region and reference information resources

3.1. Understanding of the current and future climates

Climate risk assessment will evaluate the current frequency of climate hazards and the future frequency of climate hazards when considering climate hazards (heavy rains, high temperatures, droughts, etc.) related to the target JICA project. Future climate hazards are based on confirming future climate forecasts in accordance with the RCP Scenarios used in the Fifth Assessment Report (AR5) and the SSP Scenarios used in the Sixth Assessment Report (AR6) of the IPCC.

RCP (Representative Concentration Pathways) scenarios

The RCP scenario refers to a scenario in which one representative route (representative concentration route) of future levels of greenhouse gas stabilization, and the course taken to reach those levels, is selected based on policy measures to mitigate greenhouse gas emissions.

The IPCC Fifth Assessment Report provides climate forecasts and impact assessments based on this category of scenarios. For the RCP scenario, four scenarios were selected: the "High Reference Scenario" (RCP8.5), where radiative forcing continues to increase after 2100; the "Low Stabilization Scenario" (RCP2.6), where radiative forcing peaks by 2100 and then declines; and the "High Stabilization Scenario" (RCP6.0) and "Medium Stabilization Scenario" (RCP4.5), which are located between these scenarios and stabilize after 2100.

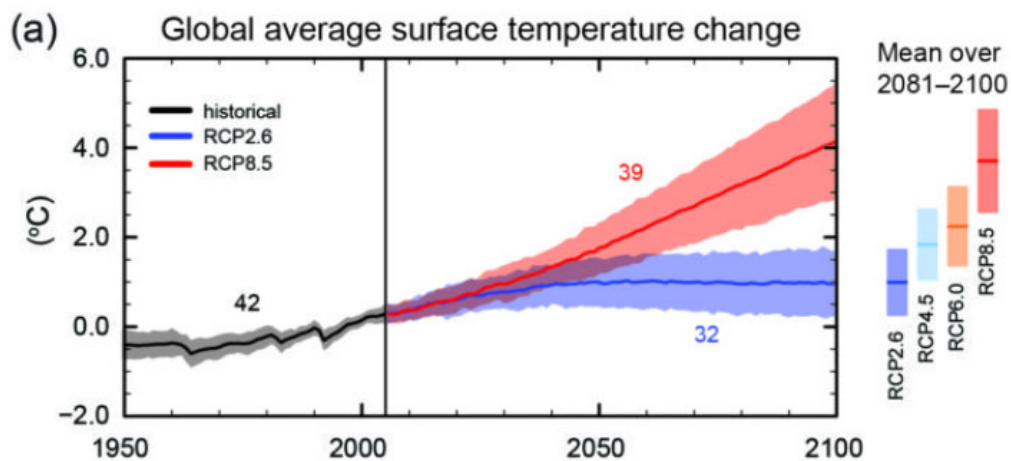


Figure 9 Global Average Ground Temperature Changes over 1986-2005 Average

Time series simulated by CMIP5 models (1950 to 2100)

(Source: AR5 WG1 Figure SPM.7)

Table 14 RCP Scenarios

Name of the scenario	Summary	Amount of temperature rise (Increase in average global surface temperature from 2081 to 2100 relative to 1986 to 2005 average)
RCP 2.6	<u>Low stabilization scenario</u> The radiative forcing at the end of the 21st century is assumed to be 2.6W/m ² (peaking at about 3W/m ² before 2100, then declining to about 2.6W/m ² by around 2100). Expectation to reduce the temperature rise to less than 2°C compared with pre-industrialization times	0.3°C~1.7°C
RCP 4.5	<u>Medium Stabilization Scenario</u> Radiative forcing at the end of the 21st century is assumed to be 4.5W per m ²	1.1°C~2.6°C
RCP 6.0	<u>High-level stabilization scenario</u> The radiative forcing at the end of the 21st century is assumed to be 6.0W per m ²	1.4°C~3.1°C
RCP 8.5	<u>High-level reference scenario</u> Assuming no policy mitigation	2.6°C~4.8°C

Shared Socioeconomic Pathway (SSP) Scenarios

AR6 (Working Group I Report), published in 2021, uses the following five scenarios for cross-sectoral use, mainly from new socio-economic scenarios that combine "Shared Socioeconomic Pathways" scenarios and radiative forcing.

Table 15 SSP Scenarios¹¹

Scenario	Summary	Projection of average temperature for the period 2081-2100 (Annual average temperature increase relative to 1850-1900)
SSP1-1.9	A scenario with sustainable development where the temperature rise can be kept below 1.5°C - Assuming that policies are introduced to reduce the temperature rise to below 1.5°C (relative to pre-industrial levels) by 2100, with CO ₂ emissions expected to reach net zero in the middle of the 21st century.	Best estimate (°C): 1.4°C Very likely range (°C): 1.0 to 1.8°C
SSP1-2.6	A sustainable development scenario with the temperature rise kept below 2°C - Assuming that policies are introduced to reduce the temperature rise to below 2.0°C (relative to pre-industrial levels) by 2100, with CO ₂ emissions expected to reach net zero in the second half of the 21st century.	Best estimate (°C): 1.8°C Very likely range (°C): 1.3 to 2.4°C
SSP2-4.5	A middle-of-the road development scenario with climate policies introduced - Includes nearly the maximum emissions, aggregated from Nationally Determined Contributions (NDCs) up to 2030.	Best estimate (°C): 2.7°C Very likely range (°C): 2.1 to 3.5°C
SSP3-7.0	A scenario with regional rivalry, without climate policy introduced - Emissions of aerosols and other GHGs besides CO ₂ are also high	Best estimate (°C): 3.6°C Very likely range (°C): 2.8 to 4.6°C
SSP5-8.5	A fossil fuel-dependent development scenario with maximum emissions and without climate policy introduced	Best estimate (°C): 4.4°C Very likely range (°C): 3.3 to 5.7°C

¹¹ Source: Publication of the Report of Working Group I of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (Natural Science Basis) Reference Materials (Overview of IPCC and expressions used in the report), Ministry of the Environment Japan, <http://www.env.go.jp/press/109850/116630.pdf>, accessed at 2025/3/21 and the IPCC WG1 AR6 Report.

When confirming information on future climate forecasts (such as temperature and rainfall), first obtain data on the applicable scenario (such as SSP2-4.5, RCP4.5) and forecast models for the scenario. Then, after referencing the relevant climate components, obtain data on future forecasts. It is recommended that multiple climate scenarios and climate models should be reviewed.

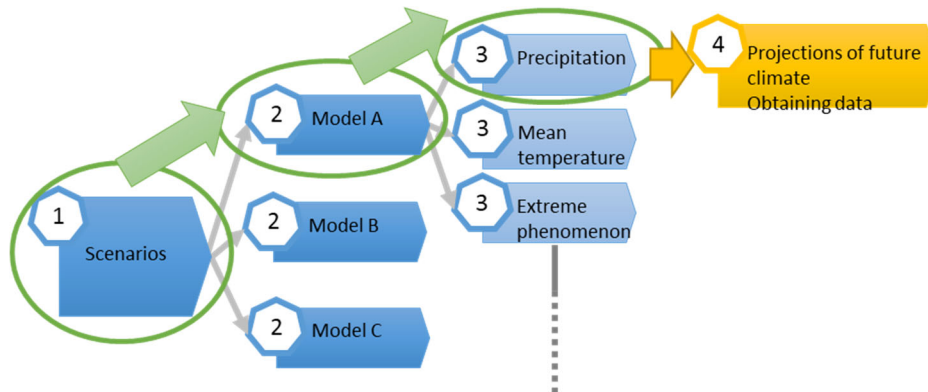


Figure 10 Image of Identification of Future Climate Forecast Information

Information resources available for future climate forecasts and climate risk assessments

Table 16 and Table 17 provide information on future climate forecasts, historical weather data, hazards and vulnerabilities that can be used for climate risk assessment, and exposure information (for specific instructions on how to navigate each site, see Appendix 3: Overview of online information platform for Climate Risk Assessment). Appendix 1: Examples of Climate-Related Indicators for reviewing hazard provides reference indicators for considering hazards based on data such as temperature and rainfall.

Climate risk assessment will be carried out in combination with information obtained locally, making appropriate use of such online information platforms. Consider which RCP scenarios to use with climate forecasts, based on the opinions of technical engineers within the survey team and relevant parties of the implementing agencies.

Table 16 Online information platform on current climate and future climate projection, and other relevant information for climate risk assessment (Part 1)

Site name	Preparation and Management Organization	Publication information																	Specification				Site overview	URL						
		Hazard (Climate related)					Hazard (including direct impacts of climate factors)					Socio-Economic Relations				Geographic and natural environment-related			Effect	Interactive map	Target area				Resolution					
		Historical temperature	Historical precipitation	Historical wind speed	Historical sea surface temperature	Future climate (projection)	Flood / inundation	Drought	Storm / cyclone	Land slide	Sea level rise	Population / population density	Water stress	Urban / human settlement area	Impervious surface	Land use / crop land	Elevation / topography	Sea surface currents			Water body / seasonality / depletion	Fires			Natural productivity	Soil moisture	Evaporation over land	Vegetation / land cover	All over world	Particular region
Climate Change Knowledge Portal (CCKP)	World Bank	○	○			○	○	○	○	○	○	○								○					○	○			World Bank's Climate Change Information Portal Site. Countries and main watersheds provide climate information, hazard-related information, and summary information on the impacts of climate change.	https://climateknowledgeportal.worldbank.org/
Climate Inspector	National Center for Atmospheric Research					○																						○	The point selection may graphically display the temperature and rainfall forecast for AR5 RCP scenario. Data can be saved in CSV format for Excel.	https://gisclimatechange.ucar.edu/inspector
Climate Information Platform (CIP)	Climate System Analysis Group	○	○			○																						○	Predictive data obtained by downscaling past meteorological observation data and global climate model (GCM) at meteorological observation stations in the continent of Africa can be displayed graphically.	https://cip.csag.uct.ac.za/webclient/2/app/
Adaptation Layer (Weadapt)	Stockholm Environment Institute	○	○			○																						○	Previous meteorological observation data at meteorological stations around the world other than Africa and forecast data obtained by downscaling GCM can be displayed graphically.	https://www.weadapt.org/placemarks/maps
KNMI Climate Explorer	Royal Netherlands Meteorological Institute	○	○			○																						○	Local weather data, future climate data, and the processing of these data can be performed on the web. It is used in various climate change impact assessments and climate change-related reports. It is possible to use a wealth of data and display the calculation results on maps and graphs. In addition to RCMs, future projections can also display RCM projection information.	https://climexp.knmi.nl/start.cgi
IPCC Atlas	Intergovernmental Panels on Climate Change (IPCC)	○	○			○	○	○	○	○	○																	○	Current and future climate change conditions can be analyzed spatially and temporally, and displayed using previously observed and projected climate change information, from the Working Group I report of the IPCC Sixth Assessment Report.	https://interactive-atlas.ipcc.ch/
ClimoCast	Ministry of the Environment Japan, National Institute for Environment studies	○	○			○																						○	An online tool for viewing future regional climate projections based on the latest climate data (CMIP6 data). Allows one to compare four major emission scenarios (SSP1-2.6 to SSP5-8.5) and compare results of 10 different climate models, and to download the corresponding data (CSV).	https://a-plat.nies.go.jp/ap-plat/cmip6/global.html
Climate Impact Viewer	Ministry of the Environment Japan, National Institute for Environment studies, Office for Coordination of Climate Change Observation					○																						○	Displays the results of climate change impact assessments in various sectors, for current climate, water resources, vegetation, agriculture, health, etc.	https://a-plat.nies.go.jp/ap-plat/asia_pacific/index.html
ClimatView - a tool for viewing monthly climate data	Japan Meteorological Agency, WMO	○	○																										Provides global monthly climate data (statistics on monthly average temperature, annual precipitation, monthly average of daytime temperature highs and lows, and standard precipitation index (SPI), for all monitoring sites where data are available)	http://ds.data.jma.go.jp/gmd/tcc/tcc/products/climate/climatview/frame.php

* Each URL was accessed at 2025/3/21.

Table 17 Online information platform on current climate and future climate projection, and other relevant information for climate risk assessment (Part 2)

Site name	Preparation and Management Organization	Publication information																				Specification				Site overview	URL			
		Hazard (Climate related)					Hazard (including direct impacts of climate factors)					Socio-Economic Relations					Geographic and natural environment-related					Effect	Target area		Resolution					
		Historical temperature	Historical precipitation	Historical wind speed	Historical sea surface temperature	Future climate (projection)	Flood /inundation	Drought	Storm / cyclone	Land slide	Sea level rise	Population / population density	Water stress	Urban / human settlement	Impervious surface	Land use / crop land	Elevation / topography	Sea surface currents	Water body / seasonality / depletion	Fires	Natural productivity		Soil moisture	Evaporation over land	Vegetation / land cover			Interactive map	All over world	Particular region
ClimPACT	UNSW, Climate extremes, WMO, GCF																											An application developed using the open source package "R" that uses weather data (daily minimum and maximum temperatures, daily precipitation) to calculate the frequency, duration and intensity of various extreme events relevant to each field, on a monthly or yearly basis. It is also available on the web at ClimPACT.	https://climpact-sci.org/	
Global Surface Water Explorer	European Commission						○											○					○	○				Sites that map waters and submerged waters during the period 1984 to 2018.	https://global-surface-water.appspot.com/map	
Aqueduct Water Risk Atlas	World Resources Institute						○	○					○										○	○				Current and future (2030, 2040) water-related risk information can be displayed on the map. 1) Water stress 2) Groundwater table decline 3) Interannual variation 4) Seasonal variability 5) Drought 6) Flood risk	https://www.wri.org/aqueduct/	
Permanent Service for Mean Sea Level (PSMSL) Data Explorer	United Kingdom National Oceanography Centre									○													○	○				The changes over time of current and past observed data of sea level around the world can be graphically displayed. It can be used as a reference information for consideration of sea level rise.	https://www.psmsl.org/data/obtaining/map.html	
Earth Observing System Data and Information System (EOSDIS) Worldview	National Aeronautics and Space Administration	○		○	○						○			○					○	○		○	○	○	○				Various maps can be displayed on the basis of the images of the Earth Observation Systems Satellites (EOSDIS) provided by the NASA. Information such as population density, population prediction, vegetation, land use, altitude, wind, ocean current, landslide, temperature, and rainfall can be displayed on the map.	https://worldview.earthdata.nasa.gov/
ESA Climate Change Initiative (CCI) Land Cover website	European Space Agency														○								○	○				Global land-coverage maps (land cover map) based on satellite-image analysis from 1992 to 2015 provided by the European Space Agency can be displayed. Exposure to hazards and vulnerabilities at project sites can be exploited.	http://maps.elie.ucl.ac.be/CCI/viewer/index.php	
ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30)	Japan Aerospace Exploration Agency																						○	○				Altitude maps Digital Surface Model (DSMs) can be displayed based on JAXA provided satellites (ALOS) images. It is possible to grasp the outline of the topography in the vicinity of the target land. It can be used to investigate exposure to hazards and vulnerabilities.	https://www.eorc.jaxa.jp/ALOS/jp/dataset/aw3d30/aw3d30_j.htm	

* Each URL was accessed at 2025/3/21.

3.2. Grasping data other than meteorological data

Sector	Information source	
	International agencies	Local
Agriculture, Forestry and Fisheries	<ul style="list-style-type: none"> ● FAOSTAT (FAO) <ul style="list-style-type: none"> - Statistical database of agriculture, forestry and fisheries, food aid, land use, and population related to global food and agriculture, forestry and fisheries - Approximately 240 countries, up to 50 years of data available http://www.fao.org/faostat/en/	Local Ministry of Agriculture, Forestry and Fisheries Annual Report
Fishery	<ul style="list-style-type: none"> ● FISHSTAT(FAO) Fisheries Statistics Database http://www.fao.org/fishery/statistics/software/fishstatj/	Annual Report on Local Fisheries Competent Ministries and Agencies, etc.
Economic indicator	<ul style="list-style-type: none"> ● World Bank Open Data (World Bank) Data on changes in production, trade and demand structures and macroeconomic conditions in more than 200 countries and regions (GDP, percentage of GDP by industry), http://data.worldbank.org/	Local Statistics Bureau
Economic forecast	<ul style="list-style-type: none"> ● World economic outlook (International Monetary Fund) IMF's World Economic Forecast Report (published twice a year) http://www.imf.org/en/publications/weo	Annual Report of the Ministry of Economy, Trade and Industry
Forest area	<ul style="list-style-type: none"> ● Global Forest Resources Assessment http://www.fao.org/forest-resources-assessment/en/	Annual Report of Ministries and Agencies Competent with Local Forests, etc.

* Each URL was accessed at 2025/3/21.

4. Points to Consider in Implementing Climate Risk Assessment

4.1. Concept of Responding to Uncertainties

Uncertainties are associated with future forecasts and impacts of climate change and future social trends, and therefore there are uncertainties in this risk assessment. On the other hand, choosing an adaptation measure with respect to risk reduction alone may result in enormous costs. Therefore, it is important to judge comprehensively the degree of uncertainty and the cost of implementation when selecting an adaptation measure.

In addition, it is necessary to be able to respond more flexibly to climate change over time, such as by reviewing additional options through discussions with stakeholders and reviewing an adaptation implementation plan at every step, such that only the best options are chosen.

Uncertainties in climate projections may include the following factors: In all cases, research is still being conducted to quantify and reduce uncertainty.

- **Uncertainties in Greenhouse Gas Emissions Scenarios**

To project future climate change, assumptions must be made about how future greenhouse gas emissions will change. AR5, published in 2015, uses Representative Concentration Pathways (RCP) scenarios as emission scenarios to determine future atmospheric concentrations of anthropogenic greenhouse gases.

AR6 (Working Group I Report) published in 2021, uses five scenarios for cross-sectoral use, mainly from new socio-economic scenarios that combine "Shared Socioeconomic Pathways" scenarios and radiative forcing.

For all scenarios, it is desirable to envision multiple scenarios for greenhouse gas emissions, as greenhouse gas emission scenarios will vary greatly depending on humanity's future socioeconomic development choices.

- **Climate Model Uncertainties**

Climate model is a generic term for simulation software that computes the behavior of climate system components such as atmosphere, oceans, and land. Climate models include Global Climate Models (GCMs), which simulate the climate of the entire Earth, and Regional Climate Models (RCMs), which only simulate specific regions. Climate models are used to make future climate projections using a variety of physical equations for the climate system, and many parameters such as temperature, wind speed, cloud cover, soil moisture, and sea water salinity, etc. It is desirable to assume multiple models for different regions and uses, as there are various climate models for different regions and applications, and the outputs of these models also vary.

Climate models also involve uncertainties due to aspects of current science that are not sufficiently understood in terms of the physical processes involved in climate change.

- **Internal Climate Change Uncertainties**

Natural climate variability is the inherent uncertainty of the climate system and the internal variation naturally present in the climate system. El Nino and La Nina are also among the uncertainties of natural climate variability.

Also, the contribution of the above three factors to uncertainty will vary depending on the time

period and spatiotemporal scale over which the forecast is made¹².

Besides the above uncertainties, there is uncertainty in impact assessments conducted in each sector. For example, the outputs of models that analyze storm surges and high waves will differ due to differences in parameters used. For impact assessments of inundation due to flood scenarios, the potential (uncertainty) exists for tide levels, wave heights, and assumptions about the scale and path of future tropical storms and typhoons to differ from assumptions.

Therefore, for climate risk assessments and consideration of adaptation measures, it is desirable to take note of the existence of the uncertainties indicated so far, and to collect the best available information and data and make assessments of multiple GHG emission scenarios, multiple climate models, and impact assessments in each sector, taking into account the nature of the project being considered and the level of reduction of the climate change impacts being sought.

However, the climate risk assessments and consideration of adaptation measures in the context of Climate-FIT do not require accurate future climate projections and climate change impact assessments. It is recommended to keep in mind the existence of the above-mentioned uncertainties and approaches to deal with them when compiling and analyzing information, assessing climate risk, and considering adaptation measures while coordinating with the project division. On the other hand, if it is possible to conduct a detailed risk analysis using existing studies, data, tools, etc.,¹³ it does not exclude the use of such detailed analysis to conduct an elaborate climate risk assessment and adaptation measures consideration.

¹² Source: Japan Climate Change 2020: Observation and Prediction Assessment Report on Atmosphere, Land and Ocean (Detailed Version) December 2020, Japan Meteorological Agency, Ministry of Education, Culture, Sports, Science and Technology, p221 Appendix 1.3 Uncertainty of future projections, https://www.data.jma.go.jp/cpdinfo/ccj/2020/pdf/cc2020_shousai.pdf, accessed at 2025/3/21

¹³ E.g. Utilizing "Database for Policy Decision making for Future Climate change (d4PDF)" etc.