National Adaptation Plan of Peru:

An Input for Updating the National Strategy on Climate Change

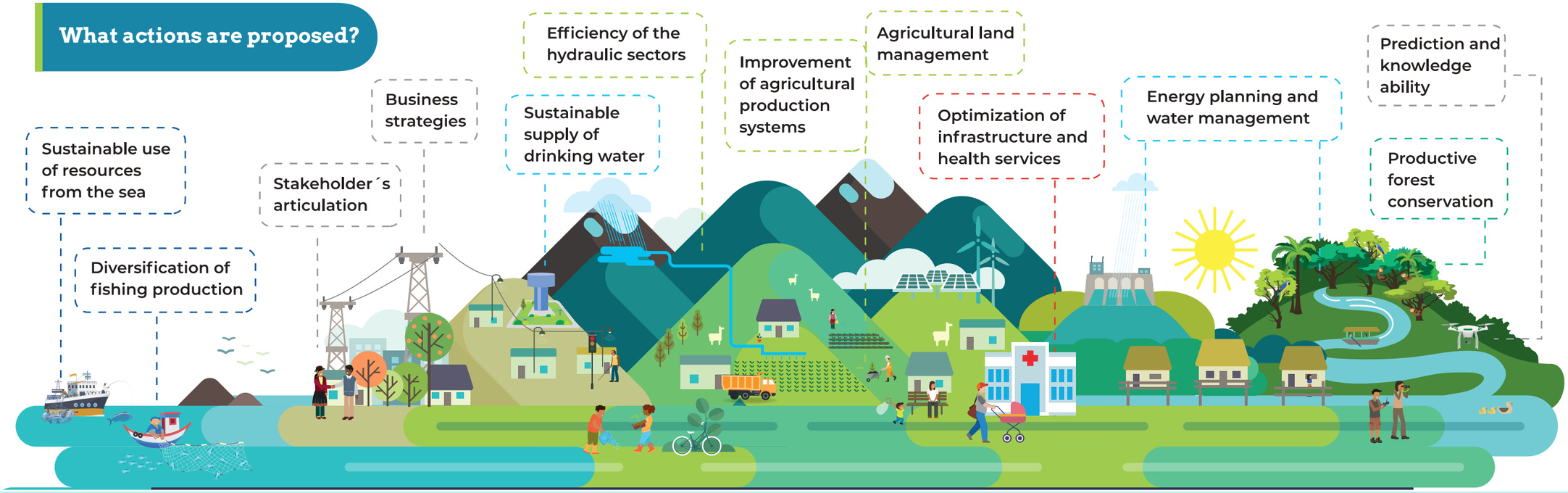
National Adaptation Plan of Perú

Guiding document for reduce and/or avoid current and future damages, losses and alterations generated by climate change and, at the same time, take advantage of its opportunities.

The NAP addresses **7 prioritized thematic areas:**

water | agriculture | forest | fishing and aquaculture | health | TRANSPORT | TOURISM

What actions are proposed?



What information provides?

1. Identification of climate change-related hazards and analysis of current and future climate scenarios.

2. Conceptual models of climate risk analysis by subject areas.

3. Analysis of exposure and vulnerability by vulnerable subjects.

4. Maps of current and future risks, by vulnerable subjects and dangers.

Why is the NAP important?

The guidance it provides helps reduce risks and seize opportunities to face climate change, **for the benefit of people, economy, livelihoods and ecosystems.**

What climate change-related hazards presents?

Mainly those associated with **changes in the climate averages and in the climatic variability of precipitation and temperature such as mass movements, floods, glacial retreat and changes in arid conditions.**

What is the NAP usefulness?

It contains information on risk scenarios and adaptation measures **for decision-making and incorporation into public and private investment plans, programs and projects.**

How will the NAP run?

With the implementation of Peruvian NDCs in terms of adaptation by 2030. The long-term goal is to be a country resilient to climate change by 2050.

Who the NAP focus on?

In subjects vulnerable to dangers associated with climate change, mainly in the thematic areas of water, agriculture, fishing and aquaculture, forests and health.

What NAP presents?

- 102 risk maps: current, 2030 and 2050.
- Strategic orientations and adaptation measures to climate change.
- Mechanisms for the implementation, monitoring, financing and strategic communication.

13 STRATEGIC ACTIONS

40 PRODUCTS

84 ADAPTATION MEASURES

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Executive Summary

Ministry of the Environment of Peru
Vice-Ministry of Strategic Development of Natural Resources
General Directorate for Climate Change and Desertification
Directorate for Adaptation to Climate Change and Desertification
August 2021

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List of acronyms

ABD	Agrobiodiversity
AFLS	Artisanal Fishing Landing Sites
BCR*	Central Reserve Bank of Peru
BP	Budgetary Program
CCAMs	Climate Change Adaptation Measures
Diris*	Directorate of Integral Health Networks
Diresa*	Regional Health Directorates
DRM	Disaster Risk Management
ENSO	El Niño-Southern Oscillation
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
FLCC	Framework Law on Climate Change
GDP	Gross Domestic Product
Geresas*	Regional Health Administrations
GHGs	Greenhouse Gases
GIS	Geographic Information System
GTM-NDC*	Multi-sectoral Work Group for the Implementation of Nationally Determined Contributions
IMWR	Integrated Management of Water Resources
Inaigem*	National Institute for Glacier and Mountain Ecosystem Research
INEI*	National Institute of Statistics and Computing
IPCC	Intergovernmental Panel on Climate Change
LCCP	Local Climate Change Plan
MEF	Ministry of Economy and Finance
MERESE*	Payment Mechanisms for Ecosystem Services
Midagri*	Ministry of Agricultural Development and Irrigation
Mimp*	Ministry of Women and Vulnerable Populations
MINAM*	Ministry of the Environment
Mincetur*	Ministry of Foreign Trade and Tourism
Minsa*	Ministry of Health
NAP	National Adaptation Plan
NCCS	National Climate Change Strategy
NDCs	Nationally Determined Contributions
NRW	Non-Revenue Water
NWA	National Water Authority
PNGRD*	National Disaster Risk Management Policy
PPICC*	Platform of Indigenous Peoples to Face Climate Change
Produce*	Ministry of Production
RCCSs	Regional Climate Change Strategies
RFLCC	Regulation of the Framework Law on Climate Change
SDGs	Sustainable Development Goals
Senamhi*	National Metereologic and Hydrologic Service of Peru
Serfor*	National Forestry and Wild Fauna Service
SPC	Service Providing Companies
UNFCCC	United Nations Framework Convention on Climate Change

*Acronym given in Spanish

Glossary

Adaptive capacity
Ability of a system to adjust to changes in climate conditions, including climate variability and extreme events, to lessen the potential losses, damages and alterations, and take advantage of the opportunities of a resilient development (RFLCC, 2019).

Study area
Basic unit of study of the different subjects of analysis.

Climate
Synthesis of the meteorological conditions at a given location, characterized by long-term statistics of the meteorological elements at that location (WMO, 1974).

Climate change
Climate change attributed directly or indirectly to human activities that produces a variation in the composition of the global atmosphere and adds to the natural variability of the observed climate during comparable periods of time (RFLCC, 2019).

Climate change adaptation
Process of adjustment to the real or projected climate and its effects on human or natural systems, in order to moderate or avoid the damages or take advantage of the beneficial aspects thereof (FLCC, 2018).

Climate change adaptation measures
Interventions planned by state and non-state actors that consist of actions, practices, technologies and services necessary to reduce or avoid severe alterations, losses and damages triggered by climate change-related hazards in populations, livelihoods, ecosystems, basins, territories, infrastructure, goods and services, and others, as well as to take advantage of the opportunities of resilient development (RFLCC, 2019).

Climate Change Focal Point
Body or unit designated by the sectoral authorities, regional or local governments in order to serve as a point of coordination with the national authority on climate change and other competent authorities and non-state actors (RFLCC, 2019).

Climate risk
In the context of assessing climate impacts, the term “risk” is often used to refer to the potential for adverse consequences of a climate-related hazard, on life, livelihoods, health and well-being, ecosystems and species, economic, social and cultural goods, services, and infrastructure. Risks are derived from the interaction of vulnerability, exposure over time, as well as hazards and the probability of their occurrence (IPCC, 2018).

In the national context, climate risk, referred to as “risk to the effects of climate change”, are the probable damages, losses and/or alterations that can be generated on a subject or subjects under analysis, as a consequence of the occurrence of a climate-related hazard, due to their exposure and vulnerability (RFLCC, 2019).

Cold spell (Friaje)
Extreme event linked to the sudden decrease in air temperature in the Amazon region, associated with the incursion of a cold air mass from the south pole. Once cold air enters the southern Amazon region (Madre de Dios), it progressively moves towards the central Amazon region and the northern Amazon region, generating increases in wind speed, rainfall, and significant decreases in air temperature. Cold temperatures tend to occur more frequently between the months of May and October; however, isolated cases have been recorded during summer time (Senamhi, 2019).

Conceptual model
Graphic representation of a thematic area through the interrelation of the exposed and vulnerable subjects of analysis, with climate change-related hazards and the damages caused by human activities.

Cross-cutting approaches
These are analysis tools that allow us to observe and act in the face of gaps due to gender, sex, age, ethnic, cultural and other aspects, which accentuate the vulnerability of certain population groups to the effects of climate change, limiting their adaptive capacity and their role in actions to contribute to the reduction of greenhouse gases. Within the framework of the Regulations of the Framework Law on Climate Change, cross-cutting approaches include three approaches: gender, intercultural and intergenerational.

Deforestation
Elimination of forest cover of a natural forest by human beings or nature (Law No. 29763, Forestry and Wildlife Law).

Drought
An extreme climatic event resulting from a considerably lower than normally registered precipitation, which generate negative impacts. When is prolonged in time (months and years), the availability of water is insufficient to satisfy the usual demands of society and the environment. Thus, droughts are classified as being meteorological, agricultural, socioeconomic, hydrological and ecological in nature (Senamhi, 2018a).

El Niño Phenomenon
The warm phase of the El Niño-Southern Oscillation (Senamhi, 2018a).

El Niño-Southern Oscillation
Global natural cycle of the ocean-atmosphere interaction climate that occurs in the Pacific Ocean. The intensity of its phases induces changes in normal rainfall patterns, in temperature, and in pressure systems of the tropical region of the Pacific Ocean, which affect the climate of the entire world (Senamhi, 2018a).

Enabling condition
Actions that facilitate or help overcome barriers in the implementation of adaptation and mitigation measures. These actions are related to institutional arrangements, capacity building, information, research, technological development and regulatory instruments, among others. (RFLCC, 2019).

Environmental damage caused by human activities
Anthropogenic hazards that could, on the one hand, exacerbate climatic hazards and, on the other, drastically alter the elements and systems that make up each of the thematic areas, as well as their associated impacts in terms of vulnerability and/or adaptive capacity.

Exposure
The presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social or cultural assets in places that could be negatively affected by climate change (RFLCC, 2019).

Flood
Overflow above the normal confines of a stream or other body of water, or perhaps the accumulation of water above areas that are not normally submerged. The different types of floods are river, flash, urban, rainwater, sewage, coastal, and glacial lake overflow (IPCC, 2014a).

Forest fire
Fire of great magnitude that spreads uncontrollably in any forest land. Unlike other types of fire, it spreads very quickly over large areas, changes direction suddenly, and can navigate large obstacles, such as rivers and roads (Aemet, 2018).

Frost
Frosts occur when the air temperature drops to 0° C or lower; this concept corresponds to the meteorological frost. Likewise, there is the agrometeorological frost, which is the drop-in air temperature to critical levels between crops, and can be higher than 0° C (Senamhi, 2019).

Greenhouse effect
Greenhouse gases efficiently absorb infrared radiation, emitted by the Earth's surface, by clouds and by the atmosphere itself, due to these same gases. This is a natural process that has kept the Earth's surface at an average temperature of 15° C. Life on the planet as we know it would not exist if not for the natural greenhouse effect. An increase in the concentration of greenhouse gases leads to a greater atmospheric opacity (greater opacity to outgoing radiation) and, therefore, an increase in the temperature of the Earth's surface (Senamhi, 2005).

Greenhouse gases
Any gas that absorbs infrared radiation in the atmosphere, a property that produces the greenhouse effect. Greenhouse gases are water vapor (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HCFC), ozone (O3), perfluorocarbons (PFC) and hydrofluorocarbons (HFCs) (Senamhi, 2005).

Climate-related hazard
Physical phenomenon, trend or disturbance in the environment due to gradual or extreme changes in the properties of climate, with the probability or potential of occurring in a specific place with certain characteristics and with the ability to cause damages or losses to a subject and/or severely alter their functioning. These changes in climate properties can be current and future (RFLCC, 2019).

Heat waves
Anomalous increase in temperatures for a minimum period of three days. In the Amazon region, the most frequent cases occur between September and October, while on the coastal region they occur in the summer season, especially associated with events such as El Niño (Senamhi, 2019b).

Indigenous or native peoples
Peoples that descend from populations that lived in the country at the time of colonization and that, whatever their legal situation, retain their own social, cultural and political institutions or parts of them (Mincul, 2020), and who at the same time, self-identify as such.

Interculturality
Process of exchange, dialogue and learning that seeks to generate equitable relationships between various ethnic-cultural groups that share a space based on the recognition and positive assessment of their cultural differences (Mincul, 2015).

La Niña Phenomenon
It is the cold phase of the El Niño-Southern Oscillation (Senamhi, 2018a).

Marine heat waves
Anomalous increase in sea surface temperature. These extreme events can have devastating effects on marine life, which can range from the uncontrolled proliferation of harmful algae, to the modification of routes or the places where various species live. They can occur anywhere in the ocean and at any time.

Mass movements
All movement of units of terrestrial materials driven and triggered by the presence of intense rains, steep slopes or by the saturation of the porous medium (debris flow, landslides, rock falls, among others) (Ingemmet, 2018).

Ocean warming
Absorption by marine waters of a large part of the heat generated on the planet, mainly by anthropogenic activities, due to its ability to act as a buffer against the effect of global climate change and which has a direct impact on an increase in the average temperature of the oceans. This increase affects ecosystems, by displacing species from their usual habitats or by causing loss of breeding areas, among others.

Vulnerable populations
Women, boys, girls and adolescents, older adults, people with disabilities, indigenous or native peoples, people deprived of liberty, migrants and those in poverty, whose economic, social and cultural conditions diminish their ability to adapt to and mitigate climate change, so they are more exposed to the impacts and risks of climate change (RFLCC, 2019).

Platform of Indigenous Peoples to Face Climate Change
Space for meeting and articulation among indigenous or native peoples and the competent authorities on climate change, in accordance with the provisions of Article 22 of the Framework Law on Climate Change and Articles 12, 14, 15, 16 and 17 of its regulations.

Probability
Possibility of a certain result occurring provided that it is possible to estimate it by probabilistic methods (IPCC, 2018a).

Representative Concentration Pathways
Representative Concentration Pathways (RCPs), also known as emission scenarios, encompass time series of emissions and concentrations for the full range of greenhouse gases and aerosols and chemically active gases, as well as land use and land cover. The word "representative" means that each representation trajectory presents one of the many possible scenarios that would lead to the specific characteristics of radiative forcing (IPCC, 2018).

Resilience
The ability of social, economic and environmental systems to cope with a hazardous phenomenon, trend or disturbance which respond or reorganize in such a way that they maintain their essential function, identity and structure, while at the same time preserving the capacity to adapt, learn and transform (RFLCC, 2019). The IPCC report 2014a postulates that resilience is a key concept that should be the objective of any process of adaptation to climate change.

Risk management to the effects of climate change
It is the process that seeks to anticipate and/or reduce current risks and/or avoid the generation of future climate risks in order to reduce or avoid potential damages, losses, and alterations in ecosystems, basins, territories, livelihoods, population, infrastructure, goods, and services. Concrete action focused on preventing, reducing, mitigating and managing the losses and damages of disasters generated by climate change in a social context susceptible to them (RFLCC, 2019).

Sea level rise
Positive changes in sea level, both globally and locally, as a result of: changes in the composition of ocean basins, changes in the volume of the ocean as a result of a change in the mass of ocean water, and changes in volume of the ocean because of the density of ocean water (IPCC, 2014a).

Snow
Solid precipitation in the form of ice crystals. For its occurrence, the air temperature must remain below 2º C and up to 3º C. If the temperature is higher, snow melts before reaching the ground (Senamhi, 2018b).

Snowfall
Meteorological event associated with the precipitation of snow that occurs in the Andes, in locations above 3,400 m.o.s.l. (Senamhi, 2018a).

Subject of analysis
Set of populations, populations' livelihoods, ecosystems, basins, territories, infrastructure, goods and/or services, among others, that are exposed and vulnerable to climate change-related hazards.

Traditional knowledge
Set of knowledge and practices of indigenous or native peoples of a collective, dynamic nature, linked to their cultural and spiritual values and customary norms, passed on from generation to generation and recognized by them as part of their culture, history and identity (Mincul, 2016).

Vulnerability
Propensity or predisposition to be negatively affected. Vulnerability comprises a variety of concepts and elements including sensitivity or susceptibility to damage and lack of responsiveness and adaptation (RFLCC, 2019). Encompasses a series of concepts that include sensitivity (susceptibility to damage) or lack of ability or capacity to adapt to the situation (IPCC, 2014a).

Warm spell or Veranillo
Periods with deficit or absence of rains that occur randomly during the normal rainy season (Senamhi, 2018a).

Introduction

The Government of Peru presents to the national and international community the Executive Summary of its National Adaptation Plan: an Input for Updating the National Strategy on Climate Change.

The Plan was approved on June 7, 2021 by Ministerial Resolution No. 096-2021-MINAM[1]. It constitutes a key milestone in the country's climate action, in compliance with Law No. 30754 - Framework Law on Climate Change (FLCC) and its Regulation (RFLCC).

Thus, Peru strengthens its leadership on the issue at the international level as the twelfth country in Latin America and the Caribbean and the thirty-sixth globally to present this document at the United Nations Framework Convention on Climate Change (UNFCCC). This is a clear example of Peru's commitment to the effective implementation of the Paris Agreement.

The main objective of this instrument is to guide the planning of adaptation to climate change at the country level, with clear priorities focused on reducing exposure and vulnerability, as well as increasing the adaptive capacity to climate change-related hazards and allowing the country to seize improvement opportunities.

Along with this, the Plan is framed within, and seeks to be an input in, the updating of the Long-Term Strategy

[1] For more information: https://www.gob.pe/institucion/minam/normas-legales/1955977-096-2021-minam

to 2050. To this end, it is aligned with the provisions of the Peruvian regulatory framework and international agreements on climate change. In this way, it contributes to reducing risks and vulnerability to the aforementioned challenge, mainly to the population and their livelihoods; ecosystems, basins and territories; and infrastructure, goods and services.

The Plan, approved on June 7, 2021 by Ministerial Resolution No. 096-2021-MINAM, constitutes a key milestone in the country's climate action. It is framed within, and seeks to be an input in, the updating of the Long-Term Strategy to 2050.

Likewise, this instrument will allow the effective implementation of the Nationally Determined Contributions (NDCs), which are the climate change adaptation measures to be executed by the year 2030 and which are part of our Update Report to the UNFCCC within the framework of the Paris Agreement. This report was approved on 16 December 2020 by the High-Level Commission on Climate Change.

In this renewed commitment, the increase in resilience and sustainable development until the year 2050 is promoted in a context characterized by the consequences of the COVID-19 pandemic and subsequent economic reactivation. The general objective of this Plan is to contribute to the global adaptation goal by reducing damage, possible alterations and consequent current and future losses, generated by climate change-related hazards on populations and their livelihoods; on basins, ecosystems and territories; and on the infrastructure, goods and services of the country. At the same time, it contemplates taking advantage of the opportunities that climate change offers for sustainable and resilient development.

For this, the plan has thirteen strategic actions that will ensure its implementation, which refer to: capacity building among the vulnerable population by strengthening capacity and knowledge in a context of climate change; strengthening the sustainable use of forest resources through training for indigenous, Afro-Peruvian and peasant peoples; implementing good management, improvement and conservation practices for agricultural production systems throughout the agricultural population; strengthening responsible fishing and aquaculture activities to contribute to the sustainable use of hydrobiological resources; and implementing measures for the management and conservation of forest ecosystems, which include Amazon rain forests, coastal forests, and Andean forests and mountains.

Its main objective is to guide the planning of climate change adaptation at the country level, with clear priorities focused on reducing exposure and vulnerability, as well as increasing adaptive capacity triggered by climate change-related hazards, in addition to allowing the leveraging of improvement opportunities.

In this respect, inter-institutional articulation and optimization of the water supply system for multi-sectoral use will be strengthened, good agricultural land management practices will also be implemented, and resilient infrastructures and planning processes will be developed, including climate change in healthcare, among other actions. In addition, it incorporates two new prioritized thematic areas: tourism and transport, in addition to those already established: water, agriculture, fishing and aquaculture, forestry and health.

Finally, it is pertinent to mention that the NAP is the result of a multi-sectoral, multilevel and multi-actor process led by the Ministry of the Environment (MINAM), as the National Authority on Climate Change, through the General Directorate of Climate Change and Desertification (DGCCD), and the joint participation of state and non-state actors: government sectors, regional governments; as well as representatives of non-state actors: academia, indigenous or native peoples, professional associations, Afro-Peruvian people, youth, women, the private sector, international cooperation and organized civil society coming together for a sustainable and climate-resilient development for the well-being of all Peruvians.

The National Adaptation Plan process

The main objective of the National Adaptation Plan (NAP) is to guide the planning of climate change adaptation at the country level, with clear priorities focused on reducing exposure and vulnerability, as well as increasing adaptive capacity triggered by climate change-related hazards, in addition to allowing the leveraging of improvement opportunities.

The Plan is aligned with the provisions of the Peruvian regulatory framework and international agreements on climate change and seeks to contribute to the updating of the ENCC (MINAM, 2015).

In this sense, the NAP orients its priorities around five vulnerable thematic areas that emerge from the NDCs in adaptation identified in the Final Report of the GTM-NDC[2] and make progress in adaptation at the national level. The five subject areas are: water, agriculture, forestry, fisheries and aquaculture, and health. The NAP presents a holistic vision and, additionally, presents additional adaptation needs from a national perspective and needs for participatory construction, integrating crosscutting gender, intergenerational and intercultural approaches.

The NAP aims to be a living and ambitious document, which is why

[2] Available at: https://www.minam.gob.pe/cambioclimatico/wp-content/uploads/sites/127/2019/01/190107_Informe-final-GTM-NDC_v17dic18.pdfPA%c3%91OL.pdf

1.

a horizon with a double temporality is proposed towards the years 2030 and 2050. The first-time horizon is aligned with the objectives of the NDCs and the second, more ambitious one, is proposed with a view to establishing a resilient development model over time.

The NAP orients its priorities around five vulnerable thematic areas: water, agriculture, forestry, fisheries and aquaculture, and health. It includes elements that will support the implementation of the instrument, such as monitoring and financing mechanisms, as well as communication actions.

The NAP has drawn on the work already carried out by other instruments, such as the NDCs in adaptation; progress at the sectoral, RCCSs and LCCP level in terms of adaptation; of the in-person and virtual participatory process carried out with different interest groups (National Climate Change Commission through the NAP working group, the sectors, the regional governments, the Platform of Indigenous Peoples to face Climate Change, academia, organized civil society, the private sector and international cooperation) receiving approximately 1200 contributions; and the public consultation where contributions were received from 24 state and non-state actors, with a total of 438 contributions.

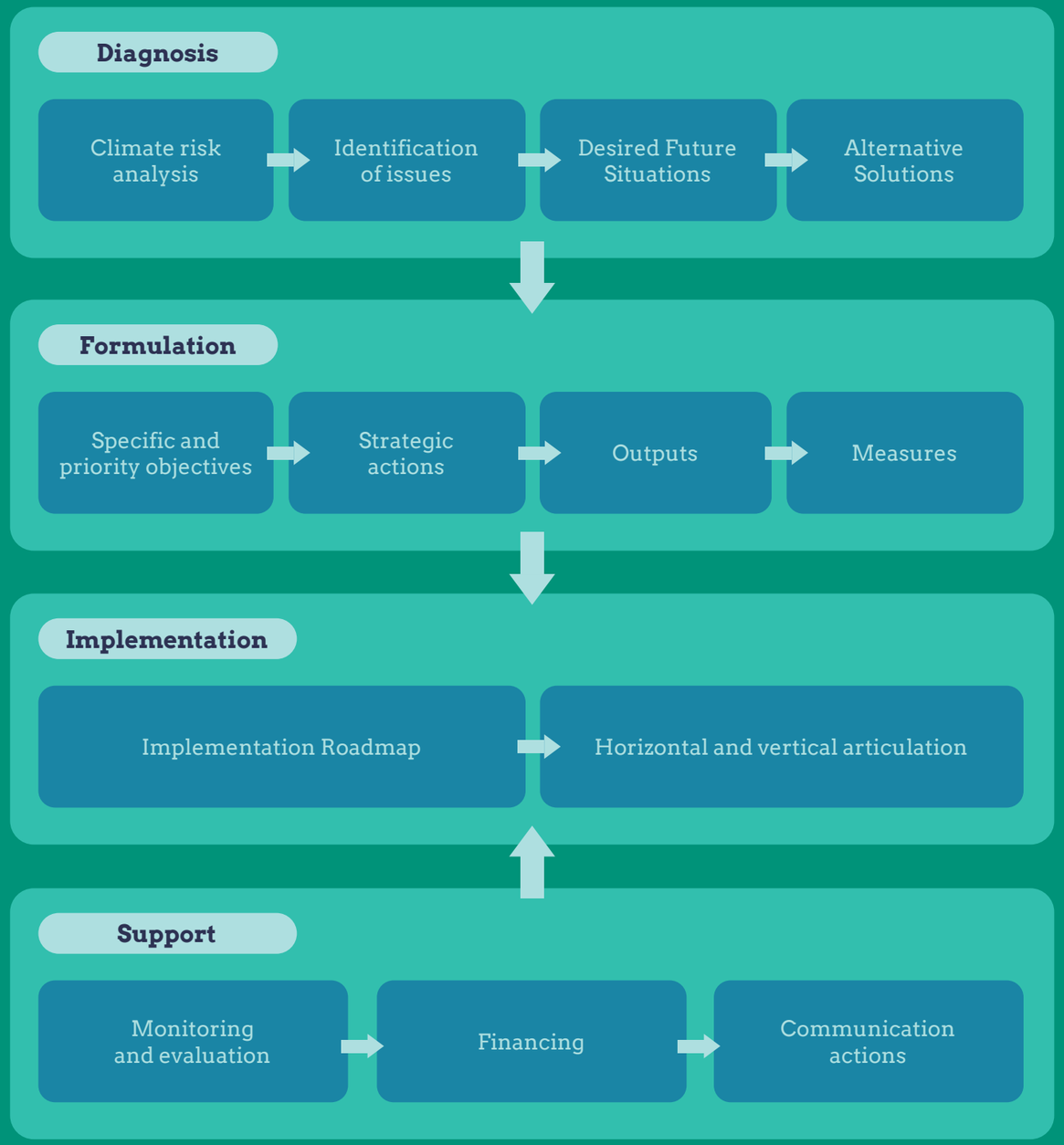
Likewise, the NAP reflects the convergence between adaptation to climate change and disaster risk management, in response to what the FLCC7[3] establishes as climate risk management, in order to have a preventive and planned management towards current risks and risk conditions in the future due to the alteration of climate hazards not currently foreseen (MINAM, 2018).

The construction of the NAP has followed a methodological route within the framework of a cycle of continuous planning improvement related to climate risk management, divided into three main phases: Diagnosis, Formulation and Implementation. The diagnosis phase includes climate risk analysis; the formulation phase includes the identification of guidelines for adaptation based on objectives, actions, outputs and measures; and, finally, the implementation phase proposes a roadmap and articulation mechanisms of articulation with the instruments of integral management of climate change and development recognized in the RFLCC for their progressive execution.

Additionally, the NAP includes elements that will support the implementation of the instrument, such as monitoring and financing mechanisms, as well as communication actions. Below is a figure with the general vision of this methodological roadmap:

[3] Taking into consideration the international framework, such as the 2030 Agenda, the Paris Agreement, the SDGs, the Sendai Framework for Disaster Risk Reduction; and the national framework, such as PNGRD and RLMCC.

FIGURE 1 METHODOLOGICAL ROADMAP OF THE NATIONAL ADAPTATION PLAN OF PERU



Source: Prepared by the authors based on the National Adaptation Plan (MINAM, 2021).

Climate risk analysis

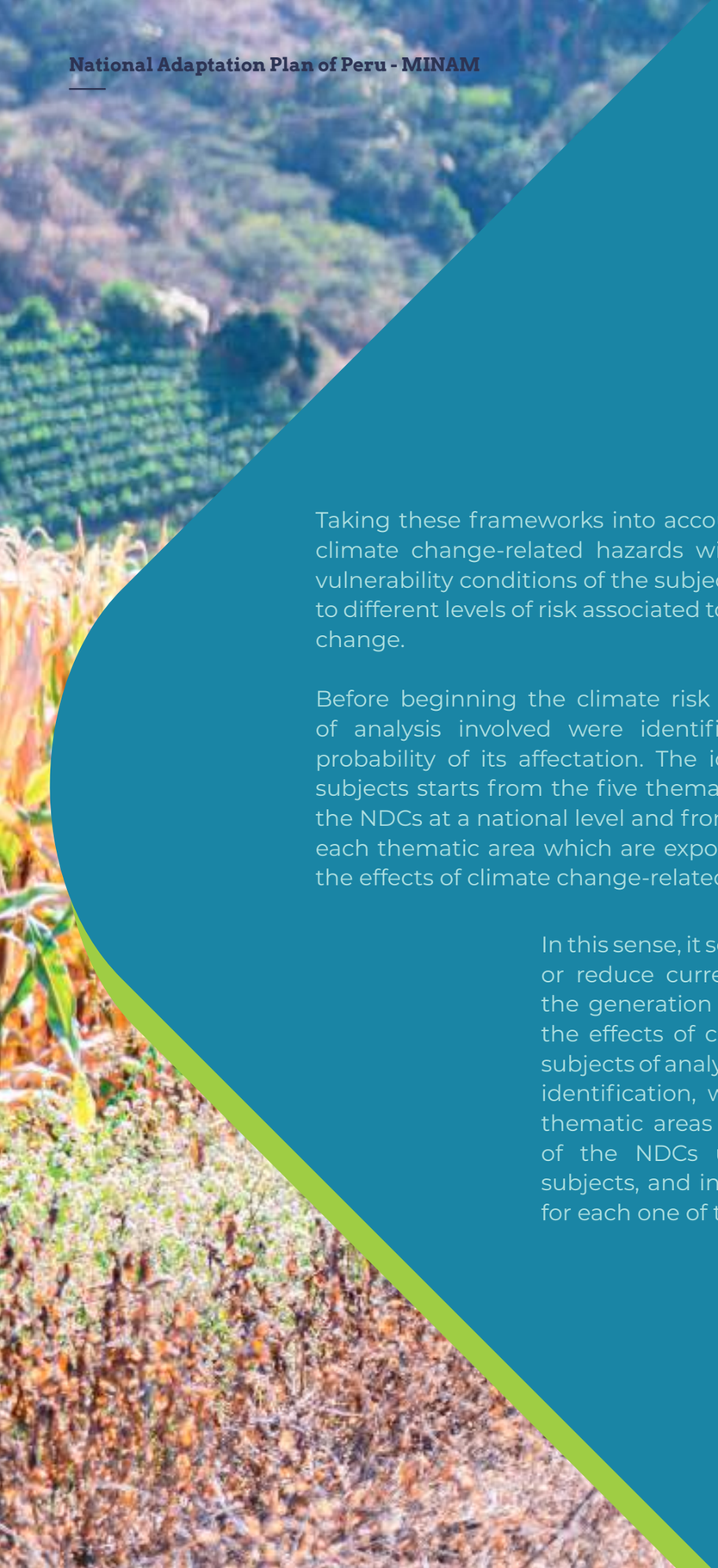
Adaptation to climate change focuses on reducing, preventing and avoiding current and future damages, losses or alterations generated by climate change-related hazards.

Adaptation to climate change focuses on reducing, preventing and/or avoiding current and future damages, losses and/or alterations generated by climate change-related hazards. The process seeks to anticipate current risks and/or avoid the generation of future risks to reduce or avoid potential damages, losses and alterations in ecosystems, basins, territories, livelihoods, populations, infrastructure, goods and services, as well as leverage the opportunities that adaptation to climate change offers for sustainable development.

The analysis of these risks by thematic area of the adaptation NDCs has been defined as the first step to identify the hazards and the affected subjects of analysis in the methodological roadmap. For this, it was necessary to develop an analysis that highlights these current and future risks considering the most up-to-date climate scenarios prepared by Senamhi.

In the preparation of the NAP, the conceptual and methodological framework recommended in the Fifth IPCC Report (2014c) has been applied so that the methodology is aligned with the most recent international methodology for risk assessment. This coincides with what has been established at the RFLCC.

2.



Taking these frameworks into account, the interaction of climate change-related hazards with the exposure and vulnerability conditions of the subjects of analysis give rise to different levels of risk associated to the effects of climate change.

Before beginning the climate risk analysis, the subjects of analysis involved were identified, determining the probability of its affectation. The identification of these subjects starts from the five thematic areas prioritized in the NDCs at a national level and from the components for each thematic area which are exposed and vulnerable to the effects of climate change-related hazards.

In this sense, it seeks to anticipate and/or reduce current risks and/or avoid the generation of future risks due to the effects of climate change, in the subjects of analysis. Table 1 collects this identification, which starts from the thematic areas and the components of the NDCs up to the identified subjects, and includes the study area for each one of them.

TABLE 1 COMPONENTS, SUBJECTS AND AREAS OF ANALYSIS OF THE FIVE THEMATIC AREAS PRIORITIZED WITHIN ADAPTATION

THEMATIC AREA	COMPONENT	SUBJECTS OF ANALYSIS	AREA OF ANALYSIS
HEALTH	Population		Provincial
	Health services	Health services (provision)	
	Infrastructure		
FORESTRY	Ecosystems		Ecosystems
	Society		Population
WATER	Water for consumption	Water availability and associated infrastructure	Cuencas hidrográficas
	Water for multi-sectoral use		
	Water for power generation		
	Water for agri-cultural use		
AGRICULTURE	Lands	Productive systems (management, crop agroforestry and livestock)	Provincial
	Agricultural systems		
	Value chain		
FISHERIES AND AQUACULTURE	Artisanal fisheries		Provincial
	Industrial fisheries		
	Aquaculture		

Source: National Adaptation Plan (MINAM, 2021).

In the NAP, a climate characterization of Peru has been carried out through different indicators at different time scales. Then, climate change-related hazards, which have the potential to cause damages, losses and/or alterations to the subjects of analysis identified by thematic area, were analyzed.

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Then, an exposure and vulnerability assessment of the subjects of analysis was conducted, to finally proceed to estimate the risk through the joint analysis of climate change-related hazards, exposure and vulnerability.

2.1 Climate change-related hazards Analysis

2.1.1 PERU'S CLIMATE CONDITIONS

Climate change-related hazards are identified from the analysis of Peru's climate and its variability. Peru presents particular climate conditions due to various factors such as the Peruvian or Humboldt Current, the Andes, and the dynamics of cyclones and anticyclones. This results in a great variety of climates in the territory.

However, this climate diversity can be summarized in three main categories: the coast, the highlands and the Amazon region. The coast is a dry region with little precipitation, except in the northern zone during El Niño events. The highlands present a diversity of climates from temperate to polar. The Amazon region is characterized by abundant

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rainfall and where a tropical climate predominates. It is important to highlight in this context the influence of the El Niño and La Niña events, which are related to climate variability.

The highest temperatures occur on the north coast and in the low Amazon region during December to May. On the contrary, the minimum temperatures occur in the central and southern highlands, specifically in the Altiplano, where the coldest period is between June and August. Regarding the temperature trends, it has been determined that both the maximum and minimum temperatures have shown an increase, with greater increases during the austral winter (June, July and August) and summer (December, January and February)

Regarding the trend in rainfall, the Amazon region shows practically uniform high values throughout the year; however, they show significant inter-annual differences, with alternating occurrence of droughts and floods, but with intensification of droughts in the 21st century.

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On an intra-seasonal scale, dry and wet days have also changed significantly during the 1980-2009 period. Wet days have increased, especially in the Marañón river basin, while the frequency of dry days have increased significantly in the central and southern part of the Ucayali basin.

2.1.2 CLIMATE SCENARIOS OF PERU

In Peru, the development and updating of national climate scenarios are officially delegated to Senamhi, a technical-scientific entity specialized in the study of climate. For the climate risk analysis, the climate scenarios at 10 km of spatial resolution developed by Senamhi during 2020 are considered, taking into account the high emission scenario RCP 8.5 and the medium and long-term periods (centered on 2030 and 2050, respectively), aligned with the double vision of this adaptation plan.

The minimum and maximum temperature scenarios by 2030 analyzed for Peru determine that, there will be increases between 1 and 2.5° C in minimum temperatures and between 0.5 and 2.5° C , with respect to the period of reference (1981-2005).. Also, maximum temperature increases will be higher in the Andes and the Amazon, while minimum temperature increases will be higher again in the highlands. For the 2050 horizon, there will be increases in both minimum and maximum temperatures with a similar spatial behavior.However, increases of up to 3° C will be observed in areas such as the Andes and the Amazon, while the coast will show more moderate increases between 1 and 2.5° C.

Climate change attributed directly or indirectly to human activities; the latter associated with human emissions of greenhouse gases.

In the case of precipitation, results show a differentiated behavior. The coast shows, for the most part, increases greater than 30% in both time horizons. Specifically, by 2030, in the Andes the total annual precipitation will show a decrease of up to 30%, which intensifies by 2050 up to 45%.

There is no consensus regarding the projections of extreme climate events due to the absence of climate models capable of realistically simulating current climate and the properties of the El Niño-Southern Oscillation (ENSO). This hinders the reliability of the projections; however, despite this lack of consensus, recent studies suggest a possible intensification in the frequency of extreme El Niño and La Niña and it is very probably that climate change influences the mean climate of the Pacific region (Bertrand et al., 2020).

2.1.3 CLIMATE CHANGE-RELATED HAZARDS

Four hazards were prioritized in the NAP according to the availability of information, relevance of each hazard, and its representativeness. The four identified hazards are mass movements, flooding, changes in aridity conditions, and glacial retreat.

Regarding mass movements is important to notice that this hazard, has conditioning factors such as geomorphological characteristics; and also, triggering factors such as precipitation. Thus, the highest levels of danger due to mass movements for the current scenario are mainly concentrated in the highlands and along the coast, where the steepest slopes are located and there is a greater susceptibility to the occurrence of hazards. The analysis also shows that the level of danger of this hazard will increase, specially, in the north coast and highlands by 2030 and 2050.

Along the same lines, for the flood analysis, the geomorphology was considered as a conditioning factor, and the precipitation information as a triggering factor. Thus, the current scenario shows that the highest levels of danger are concentrated in the Amazon region, where the characteristics of the terrain (low slope with active fluvial dynamics) favor the occurrence of the hazard, as well as in the north coast of Peru. Similar conditions are to be expected by 2030 and 2050 but with an increase in the danger levels over the north coast of Peru.

In relation to the change in aridity conditions hazard, the estimation of the levels of danger has been performed calculating the ratio between precipitation-and temperature for each climatic period analyzed. Thus, in recent decades, dry conditions have increased significantly on the southern coast of the country. The same behavior is to be expected by 2030 and 2050 due to the increase in temperatures and reduction in precipitation.

For the flood analysis, the current scenario shows that the highest levels of danger are concentrated in the Amazon region, where the characteristics of the terrain (low slope with active fluvial dynamics) favor the occurrence of the hazard, as well as in the north coast of Peru.

Glacial retreat is a climate-related hazard and a slow-onset event due to the increase in average temperature. For the current period, the level of danger is low; however, by 2030 and 2050 it is expected to increase.

2.2 Exposure and Vulnerability Analysis

Impacts represent the damages, losses and/or alterations that a certain subject of analysis from each thematic area may suffer. However, climate change impacts are not isolated events, but rather the result of a chain of impacts. It is a cause-effect relationship between a climate-related hazard and a specific subject of analysis. The chain of impacts makes it possible to systematize and prioritize the factors that lead to risk in a given system and facilitate the identification of indicators that will be used in the climate risk assessment.

In addition, the potential indirect impacts to the population in a position of vulnerability to climate change are included. Specifically, the potential impacts on the specific vulnerable populations are pointed out: women, girls, boys, adolescents and young people, the elderly, peasant communities, Afro-Peruvian people and indigenous or native peoples.

Climate change impacts are not isolated events, but rather the result of a chain of impacts. It is a cause-effect relationship between a climate-related hazard and a specific subject of analysis.

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
WATER	The water resource is spatially distributed in three large hydrographic regions (Pacific, Amazon and Titicaca), which make up 159 hydrographic units (hydrographic basins). Water supply is affected by variability and climate change. In recent decades, the increase in air temperature has triggered the retreat and loss of glaciers. As a consequence, Peru has lost 53.56% of its glacial surface in the last fifty years (Inaigem, 2018), therefore altering water behavior, evidenced in basins such as the Santa river, which shows a negative trend of 30% in flow level as a consequence of glacier surface reduction (ANA, 2020). Not only are fresh water reserves being lost in their solid state, but hazards are also being generated in the Peruvian Andes due to the formation of hanging ice masses and permafrost weakening. Other slow-onset hazards, such as precipitation average changes and rapid-onset hazards, have an impact on elements or activities associated with the supply and demand of different water uses and natural systems, such as glaciers, lagoons, rivers, springs and aquifers, which are essential for water supply.

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
WATER	Men and women, as a consequence of historically assigned gender roles, which, in turn, generate inequality in access to resources, experience the impacts of climate change differently. Currently and traditionally, women and girls are the ones who manage water resources within the household, while men are the ones who make decisions regarding water management for agricultural, industrial and hydro-energy use. In the case of women and girls, access to water allows them to carry out subsistence tasks, domestic tasks and unpaid care of the infant and elderly population. The reduced availability of water as a consequence of climate change could generate migrations in search of employment, which could lead to women and girls who remain in their communities of origin devoting more time to procuring water at home, increasing the time spent on domestic tasks and unpaid care, thus increasing the gender gap in access to water-related services.

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
AGRICULTURE	Agriculture is the second most important sector in the economy, contributing 5.5% of GDP, and is the single largest employment generator (World Bank, 2017; INEI, 2018). It employs a quarter of the total population of the country, mainly in family farming with land ownership of less than five hectares (INEI, 2018). Since the 1990s, this sector has grown at the same rate as the industry and services sectors, becoming a key element in the reduction of extreme poverty, due to the amount of population that it employs who are in conditions of poverty and extreme poverty. (World Bank, 2017). The agricultural population in Peru is mainly found in the highlands —followed by the coast and the Amazon region—, of which 31% are women and 69% men (INEI, 2013). Of this population, 41% need to supplement their income with other economic activities and only 5% receive training to improve their production systems. In addition, there are notable differences in infrastructure, since 85% of the productive units on the coast have irrigation systems, 43% have it in the highlands and only 10% in the Amazon region (Midagri, 2015).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
AGRICULTURE	In terms of water resource management, the agricultural population of the highlands has greater participation in irrigation commissions than with respect to the coast. In the case of the Amazon region, participation is very low. The same is replicated in the manner of work, since there is a greater willingness to form associations in the highlands (INEI, 2013). In the coast and in the Amazon region, more than 70% of agricultural production is intended for sale, while in the highlands almost 60% is for self-consumption (Midagri, 2015). Agricultural activity has followed a trend of development in basic products such as corn, potatoes, and rice, and an expansion in non-traditional high-value export products, such as quinoa, vegetables (asparagus and artichoke) and fruits (table grapes, mango, avocado and banana), as well as more traditional products such as coffee, cocoa and palm oil (World Bank, 2017).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
AGRICULTURE	Livestock activity is of fundamental importance for the food security of rural populations throughout the country, as it contributes to the generation of employment and income. In Peru, 79.2% of the population dedicated to small and medium-scale agricultural production places their products in the local market; 23.3% do so in the regional market; 8% in the markets of Lima; 5% in the foreign market; and 1.6% in agribusiness. 94.8% of this population has used labor to carry out agricultural and/or livestock activities, of which 61.8% used a mixture of paid and unpaid labor; 24.7% used only unpaid labor; and 13.6% only paid labor. Agriculture in Peru has potential for the green market or agrochemical-free market. 62% of the agricultural population uses organic fertilizer; 56% do not use chemical fertilizers (especially in the highlands and the Amazon region); 48% of organic crops are in the Amazon region; and 5% apply biological control (INEI, 2013). It is necessary to promote this type of agriculture and complement it with more efficient irrigation systems and good practices for the prevention of pests and diseases. Likewise, it is important to promote technologies like these that will allow adaptation to climate change-related hazards.

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
AGRICULTURE	If trends and projections regarding climate change-related hazards continue, these will have devastating effects on agricultural production, since the production of certain crops will decrease (rice, corn, potatoes, barley, bananas, among others) and, consequently, the price of produce and their production costs would rise, which would affect national and international food security. Likewise, 72% of agriculture emergencies are related to droughts, heavy rains, floods and frosts. Climate change presents obstacles and negative repercussions on agriculture, mainly on small-scale agriculture practiced by vulnerable populations. However, adaptation to climate change can create opportunities. The effects of climate change impact food production, so families are affected by not being able to meet their nutritional and economic needs. Furthermore, the gap in access to food will widen, especially for the populations furthest from urban and rural areas, mainly the indigenous communities of the highlands and the Amazon region. At the same time, it should be recognized that adaptation to climate change can create opportunities for economic and social development in this sector.

Source: National Adaptation Plan (MINAM, 2021).

The decrease in productivity and the increase in sea temperature would affect biomass levels and the capture of anchovy. Coastal communities will also be exposed to rising sea levels and heavy rains and anomalous waves caused by a greater frequency and intensity of El Niño events.

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
FORESTRY	In Latin America, Peru is the country with the largest forest extension and is the fourth one in area of forestry. At the national level, forests occupy 56.9% of the Peruvian territory. Within all this specific area, the Amazonian forests occupy the largest extension, followed by the inter-Andean and dry forests (Serfor, 2018). Forests provide ecosystem services toward biological diversity. However, there are potential impacts related to climate change hazards, as well as environmental damage caused by people, which increase the effects of climate change and have relevant negative effects for the socio-ecological system. Within the spectrum of possible events, the following should be noted: forest pests, reduction of forest cover and fires.

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
FORESTRY	The historical relationship of women and men with forest resources reinforces socially constructed gender roles. In the forest value chain, men tend to focus on the marketing of mainly timber products, while women are engaged in the use and management of non-timber forest products for subsistence, food and health activities. This dynamic has made it so that women have a more specialized knowledge of forests, acquiring greater experience on conservation practices (MIMP, 2015). Women living in rural areas have limited access to education and public services, since it is men who leave home to carry out hunting and procurement tasks. Limited access to education means that the illiteracy rate is higher among women than among men, a gap that is significantly larger in older generations (MIMP, 2015).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
FISHERIES AND AQUACULTURE	The Peruvian sea is considered the area with the highest productivity in the world due to the Peruvian or Humboldt marine current and El Niño (MINAM, 2014). These conditions give rise to a great biodiversity of species and, as a result, to a fishing activity that is among the four economic activities that generate the greatest amount of foreign exchange for Peru (approximately 6.5% of the total in 2017) (Produce, 2015b). Within the sector, artisanal and industrial fishing are the most relevant economic activities. They mainly lead the extraction of pelagic resources. Thus, 96% of the total extracted includes species such as the anchovy *Engraulis ringens*, the mackerel *Scomber japonicus* and the horse mackerel *Trachurus murphyi*. It is the anchovy (anchoveta in Spanish) fishery that registers 83% in the catch index. Various studies have indicated that the decrease in productivity and the increase in sea temperature would affect biomass levels and the capture of the Engraulis ringens anchovy (Brochier et al., 2013; Gutiérrez et al., 2019). Added to this, coastal communities will also be exposed to rising sea levels and heavy rains and anomalous waves caused by a greater frequency and intensity of El Niño events (Yánez et al., 2018).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
FISHERIES AND AQUACULTURE	Within the productive aspect, artisanal fishing meets national demand with approximately 80% of fresh fish resources (Galarza, 2014). Among the main resources for direct consumption are species such as bonito, horse mackerel, mackerel and perico (Produce, 2015a). On the other hand, marine and continental aquaculture could be affected by the effects of climate change on invasive species, greatly affecting native species (Rahel et al., 2008). The distribution of tasks within the fishing sector is still differentiated by socially constructed gender roles. Traditionally, men have dominated fishing as a productive activity. In this context, women from fishing families generally perform work considered 'informal' such as mending nets for which they receive little or no remuneration. Currently, there are studies that analyze the different employment opportunities for men and women in aquaculture and fishing companies, which show that the aquaculture market not only employs more women, but that there is a greater supply of permanent jobs for them in various fields (Mendoza, 2015). Despite the efforts to eliminate gender barriers, men are still the ones who work in greater percentage in continental and marine fishing. (FAO, 2016).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
HEALTH	The effect that climate change generates on human health results from a complex interaction of different factors. The consequences can be direct (heat waves, damage from extreme climate events such as floods, landslides and droughts) and indirect, through the effects on ecological systems (agricultural losses, the spread of disease-carrying vectors and the environmental conditions for their transmission), social systems (population displacement and conflicts derived from it) and economic systems. Characterizing the effect of climate change on populations' health is a com plex task when taking into account that health is not only the absence of disease but also human well-being, for whom environment is the main determinant of well-being (Minsa, 2017). Different studies mention that climate change would increase mortality and morbidity associated with heat, increase the frequency of epidemics after the occurrence of floods and have considerable effects on health after population displacements due to sea level rise and increased storm activity (IPCC, 2014b; Minsa, 2017).

Source: National Adaptation Plan (MINAM, 2021).

TABLE 2 ANALYSIS OF EXPOSURE AND VULNERABILITY BY THEMATIC AREA

THEMATIC AREAS	EXPOSURE AND VULNERABILITY
HEALTH	The effect of climate change on health not only occurs directly on the population, but also on health infrastructure and the inputs for the provision of healthcare (equipment, supplies and medicines). In turn, it should also be considered that the effects of climate change can affect the dynamics of care and health services' response (human potential of health workers). Indigenous or native peoples and the Afro-Peruvian people could be the most affected. Climate change alters the quality of natural resources such as water and agricultural cycles, mainly damaging the health of people living in poverty with limited access to adequate basic services. Risks associated with flooding from river overflows, rising sea levels, the appearance of food and waterborne diseases, and transmitted infectious diseases such as dengue, could be the main health impacts due to climate change. Thus, an increase in temperature would put the most vulnerable populations at risk, and could cause changes in food production related to agriculture, fishing and water supply, which would increase malnutrition and food insecurity. It is expected that the population sectors most affected will be girls, women, and the elderly. Strengthening health in these populations includes combating poverty and malnutrition, improving access to education, constant work for gender equality and the empowerment of women.

Source: National Adaptation Plan (MINAM, 2021).

2.3 Climate Risk Scenarios

The climate change-related hazards analysis, with the analysis of exposure and vulnerability, gives way to current and future climate risk scenarios at the national level, which have been structured for each of the prioritized thematic areas, for identified subjects of analysis, for prioritized type of hazard and for each time horizon evaluated.

In the NAP, three types of maps are presented for each subject of analysis:

1. Current risk map.
2. Risk map by 2030 (first temporal horizon of the NAP).
3. Risk map by 2050 (second temporal horizon of the NAP).

It should be noted that the description of the damages, losses and/or alterations of the hazards that have not been prioritized in this section can be found in greater detail in section 3.1.3 of the NAP, in which they can be also divided by thematic area and subjects of analysis.

The climate risk scenarios are attached to this Executive Summary.

2.4 Additional Thematic Area Guidelines

In the NAP, three types of maps are presented for each subject of analysis: current risk map, risk map by 2030, and risk map by 2050. For each one, it includes the trend of the level of risk and the areas of analysis most affected.

In Peru, tourism accounts for 3.9% of Gross Domestic Product (GDP) and domestic tourism consumption represents 6.9% of total expenditure in the economy. In addition, compared to non-traditional exports, inbound tourism is the second sector of contribution of foreign exchange to the country (Mincetur, 2016). However, it is subject to the effects of climate change, specifically, due to the effect that it has on the main attractions that tourists seek in Peru.

Although the NAP has focused on the five prioritized thematic areas, in the formulation process it identified two additional relevant areas to be included within the logical framework: tourism and transportation.

This is why it is essential to point out the importance of protecting nature tourism or ecotourism as future lines of action. One of the main identified hazards are the changes in climate averages that result in temperature increases, the retreat of glaciers and the occurrence of alluvium.

As a consequence, the need to carry out a risk analysis on this thematic area that focuses on the main subjects of analysis: the tourist resource, visitors, and tourist services is identified. Regarding general problems identified in this sector, the negative impact on tourist activity development is identified.

As for the transport sector, it is directly related to the economic growth and competitiveness of a territory and a country. In Peru, this sector employs 8.6% of the 17 million employed Peruvians, making transportation a relevant economic activity (INEI, 2017).

In addition, it is a sector whose production chain is vulnerable to the effects of climate change and is highly interdependent with other economic sectors in the country. This is because the impact on transport infrastructure can cause a chain of effects that end up affecting other thematic areas due to the loss of connectivity.

Ultimately, the need arises for project design guidelines, and corresponding institutional arrangements that guarantee a properly designed road infrastructure considering the ability to adapt to the effects of climate change. Preliminarily, two subjects of analysis are identified within the thematic area of transport, which are transport infrastructure, and operations. In conclusion, it is clear that the general problem in this thematic area lies in the negative impact of climate change on the infrastructure and operation of the transport service.

2.5 Climate Change-related issues

Climate change is a global problem, which has local consequences and has a direct effect on Peru's economy, society and environment. In this sense, the NAP refers to this general problem:

Peru is heading towards an increase in the risk to populations and their livelihoods, ecosystems, basins, territories, infrastructure, goods and services, among others, triggered by climate change-related hazards.

Additionally, specific problems have been identified that result from the particularization of the general public problem:

- "Increase in the frequency, intensity and extent of climate-related hazards".
- "Low adaptive capacity of the population climate change-related hazards".
- "High vulnerability of ecosystems, basins and territories to climate change-related hazards".
- "High exposure of infrastructure, goods, and services to climate change-related hazards".

In addition to the general problem and the specific problems, cross-cutting problems are defined in all the thematic areas mentioned in the NAP, which refer to the intercultural, intergenerational gender approach:

- Climate change affects people differently (considering gender variables) since it is women to a large extent who develop actions to guarantee access to water, food and sustain livelihoods, spending more hours in domestic and household work and unpaid care. This becomes a problem when it comes to participating in decision-making forums and actions that contribute to the comprehensive management of climate change.

- Regarding the intercultural approach, the limited capacities and knowledge to carry out adaptation actions against climate change stand out, as well as the limited protection, documentation, transmission and revaluation of traditional knowledge and the knowledge of a culturally diverse population.

- Finally, the intergenerational approach identifies gaps in access to physical and mental health, food security, housing, education, sanitation, employment, and adaptation to climate change in an equitable manner for all generations.

The determination of the problem gives way to the definition of the desired future situations. These are the descriptions of the most favorable and feasible situations to be achieved under climate change scenarios in the established time horizon to reduce risks and increase the adaptive capacity of the subjects of analysis.

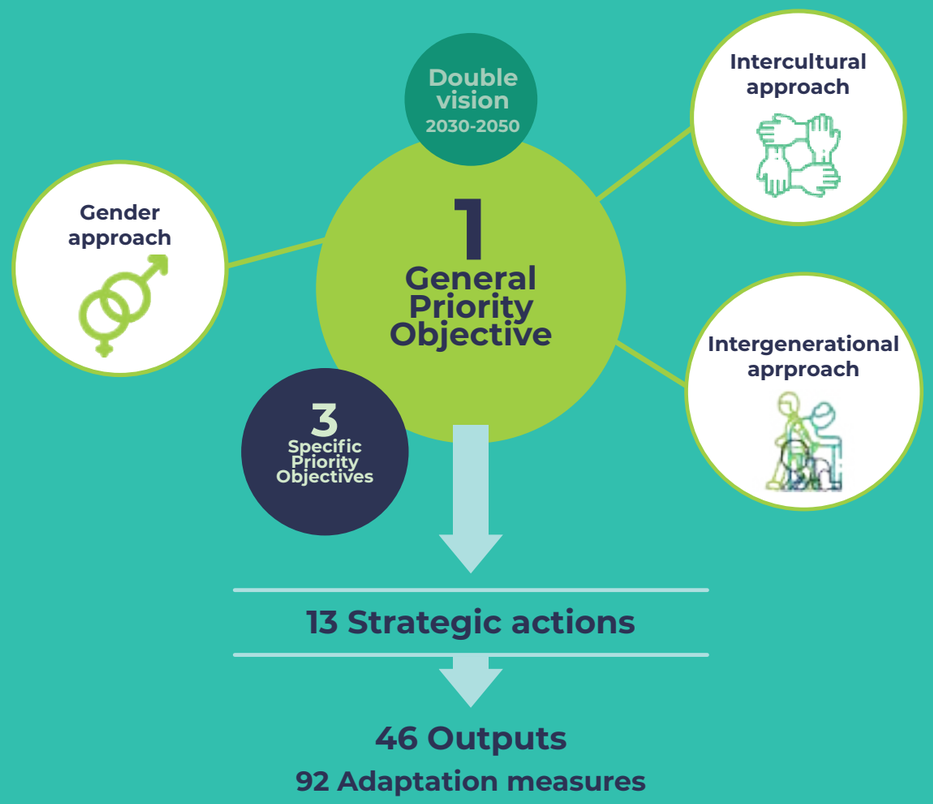
CLIMATE CHANGE ADAPTATION PLANNING PROCESS

In response to the risks of climate change, the NAP establishes one (01) general priority objective, three (03) specific priority objectives, thirteen (13) strategic actions, forty-two (42) outputs and ninety-two two (92) adaptation measures that include cross-cutting approaches to be implemented in the short, medium and long term.

3.

Next figure summarizes the guidance provided by the NAP to contribute to climate change adaptation in Peru.

FIGURE 2 GUIDANCE PROVIDED BY THE NAP



Vision of the National Adaptation Plan of Peru

VISION 2030-2050

By 2030 Peru reaches the implementation of all the climate change adaptation measures established in the NDCs and, as a result of the ambitious nature of the NAP, by 2050, it consolidates as a country adapted to the effects of climate change by the solid implementation of a climate change policy based on knowledge that has made it possible to take advantage of the opportunities offered by innovation, technological development, and ancestral knowledge.

This 2030-2050 vision of the NAP is based on three key cross-cutting approaches to achieve the three priority goals in a fair, inclusive, and comprehensive manner.

All of this journey will be possible if there is an involvement of state and non-state actors. These approaches are as follows: gender, intercultural, and intergenerational.

3.1 One General Priority Objective and Three Specific Objectives

The NAP has a general priority objective that makes it possible to face the general problem and achieve the desired general future situation. It also has three specific priority objectives to address specific public problems and achieve desired specific future situations. Peru's **general priority objective** in adaptation to climate change is defined as:

"To reduce and/or avoid current and future damages, losses and alterations triggered by climate change-related hazards in the livelihoods of populations, ecosystems, basins, territories, infrastructure, assets and/or services; as well as, to take advantage of the opportunities offered by climate change for sustainable and resilient development."

The three specific priority objectives are:

1.	"To reduce damages, possible alterations and consequent current and future losses generated by climate change-related hazards in populations and their livelihoods."
2.	"To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in ecosystems, basins and territories."
3.	"To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in infrastructure, goods and/or services."

3.2 Thirteen Strategic Actions

The strategic actions set to achieve priority objective 1 are the following:

1.	Develop conditions and capacities among the vulnerable population, strengthening modelling, prediction capacity, and knowledge in a context of climate change.
2.	Strengthen the sustainable use of forest resources through training for peasant communities, indigenous or native peoples and Afro-Peruvian people in the management of forest resources.
3.	Implement good management, improvement and conservation practices throughout the agricultural population in agricultural production systems.
4.	Strengthen responsible fishing and aquaculture activities to contribute to the sustainable use of hydrobiological resources.

The strategic actions set to achieve priority objective 2 are the following:

1.	Implement measures for the management and conservation of forest ecosystems, which include Amazonian rain forests, coastal forests, and Andean forests and mountains.
2.	Strengthen inter-institutional coordination and optimize the water supply system for the multi-sectoral user population.
3.	Implement good management practices for agricultural land.

The strategic actions set to achieve priority objective 3 are the following:

1.	Develop infrastructures and processes that facilitate energy planning and water management for agents linked to the energy sector.
2.	Strengthen and modernize the hydraulic sectors for agricultural use.
3.	Strengthen the sustainable drinking water supply service for population use.
4.	Implement business strategies for the adaptation of the agricultural value chain.
5.	Implement infrastructures and equipment that ensure quality health services.
6.	Diversify and strengthen added value to improve the productivity and production of fishing and aquaculture activities.

3.3 Outputs and Measures for the Achievement of the Priority Adaptation Objectives

The priority objectives and strategic actions defined for Peru seek to establish the desired future situations that must be achieved in the long term (year 2050). To reach this horizon, actions or measures must be specified for which short-medium-term goals (2030) will be set, which will allow monitoring the degree of achievement and progress of the priority objectives determined.

92 Climate Change Adaptation Measures (CCAMs) have been defined, all of them grouped into 46 goods or outputs whose provision responds to the achievement of the strategic actions proposed and the achievement of the specific objectives set, which are shown below:

SPECIFIC PRIORITY OBJECTIVE 1

To reduce damages, possible alterations and consequent current and future losses generated by climate change-related hazards in populations and their livelihoods.

STRATEGIC ACTION 1.1:

Develop conditions and capacities among the vulnerable population, strengthening modelling, prediction capacity, and knowledge in a context of climate change.

OUTPUT 1:

Entities in the health sector use information on climatic and environmental variables in public health surveillance related to the dangers and vulnerabilities associated with climate change.

Measures:

1. **Strengthening of the public health surveillance system in health networks that incorporate climate information in the situational room related to the dangers and vulnerabilities associated with climate change.**

OUTPUT 2:

Comprehensive climate change management incorporated into management documents and planning documents (POI, PEI, PESEM, PMI, etc.) for its institutionalization and sustainable development in public health.

Measures:

2. Incorporation of the integral management of climate change in the management documents of the entities of the health sector.

3. Incorporation of the integral management of climate change in the planning documents of the entities of the health sector.

OUTPUT 3:

Human Resources in Health (RHUS) of the National Health System trained in Comprehensive Management of Climate Change in Health.

Measures:

4. Strengthening of the training of the RHUS of the National System in Comprehensive Management of Climate Change in health.

OUTPUT 4:

Vulnerable families benefited from strategies and interventions to promote healthy practices in the event of hazards associated with climate change.

Measures:

5. Promotion of healthy practices in families vulnerable to increased exposure to extreme temperatures, vector-borne diseases, contaminated food and water, among others; as a result of the effects of climate change.

OUTPUT 5:

Vulnerable IPRESS implement their adaptive capacity in the structural, non-structural and functional component in the face of dangers associated with climate change.

Measures:

6. Implementation of intervention strategies for adaptation in the structural, non-structural and functional component of the IPRESS vulnerable to dangers associated with climate change.

STRATEGIC ACTIONS 1.2:

Strengthen the sustainable use of forest resources through training for peasant communities, indigenous or native peoples and Afro-Peruvian people in the management of forest resources.

OUTPUT 6:

Restored and preserved forest ecosystems with proper forest and wildlife management reduce climate risks and guarantee the ecosystem services of forest ecosytems

Measures:

7. **Implementation of control, surveillance and inspection actions in forests, to reduce vulnerability to climatic and non-climatic effects.**
8. **Implementation of options for restoring forest ecosystems to maintain the functionality of the landscape and reduce risks in the face of the effects of climate change.**
9. **Strengthen the use of technologies in the face of the effects of climate change.**

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OUTPUT 7:

Regional governments and local governments have timely information systems to implement actions to reduce the effects of extreme weather events in forest systems.

Measures:

10. Implementation of the national and sub-national early warning system for climate change-related hazards to reduce the impact on forest ecosystems[5].

OUTPUT 8:

Peasant and native communities trained in productive diversification can access markets and reduce climate risks.

Measures:

11. **Implementation of strategic production chains of peasant and native communities to reduce risks from the effects of climate change.**

[5] The inclusion of other ecosystems in the thematic area of forests may be carried out in future updates of the NDCs of the thematic area the competent entities.

STRATEGIC ACTIONS 1.3:

Implement good management, improvement and conservation practices throughout the agricultural population in agricultural production systems.

OUTPUT 9:

Producers have and implement good agricultural practices considering the effects of climate change.

Measures:

12. Productive diversification in crops and animals with greater vulnerability to climate change.

13. Integrated management of pests and diseases in crops and preventive management of diseases in animals, with greater vulnerability to climate change.

OUTPUT 10:

Producers adequately manage the feeding of animals in areas vulnerable to climate change-related hazards.

Measures:

14. Management of natural grasslands to ensure the feeding of animals and reduce their vulnerability to climate change.

15. Management and conservation of cultivated pastures as food supplementation for animals in vulnerable areas to climate change-related hazards.

OUTPUT 11:

Agricultural producers who can access services for the improvement and transfer of resistant genetic resources to adapt to climate change.

Measures:

16. Improvement and transfer of genetic resources of crops and animals to increase their resilience against climate change.
17. Onsite and off-site conservation of agrobiodiversity (ABD) to increase the resilience of crops against climate change.
18. Management of wild South American camelids (vicuñas) considering the effects of climate change.

OUTPUT 12:

Agricultural production areas with protection mechanisms against climate change-related hazards.

Measures:

19. Design and implementation of the Early Warning System (EWS) to reduce effects in vulnerable areas to climate change-related hazards.
20. Strengthening of agricultural risk transfer systems in the face of adverse weather events.

STRATEGIC ACTIONS 1.4:

Strengthen responsible fishing and aquaculture activities to contribute to the sustainable use of hydrobiological resources.

OUTPUT 13:

Artisanal fishing agents apply good fishing practices in a context of climate change.

Measures:

21. Strengthening of capacities in good practices of economic diversification and complementary activities for artisanal fishing.
22. Strengthening of capacities in good safety practices in artisanal fishing.
23. Capacity building for the use of selective fishing techniques and improved fishing gear.

OUTPUT 14:

Aqua-culturist apply good practices for the intensification of aquaculture in a context of climate change.

Measures:

24. Strengthening of aquaculture management in a context of climate change.

25. Capacity building in good aquaculture practices (health, quality and safety) in aquaculture.

26. Strengthening of capacities in good environmental practices.

OUTPUT 15:

Aqua-culturists reduce climate risks on aquaculture development.

Measures:

27. Current and future risk management associated with climate change in the evaluation of areas for aquaculture.

28. Strengthening capacities in the design and implementation of contingency plans for the prevention and response to extreme weather events.

OUTPUT 16:

Aqua-culturists apply technological knowledge transferred in the aquaculture production chain to climate change-related hazards.

Measures:

29. Implementation of technological knowledge to the production chain of aquaculture species in the face of climate change.

PRIORITY OBJECTIVE 2

To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in ecosystems, basins and territories.

STRATEGIC ACTIONS 2.1:

Implement measures for the management and conservation of forest ecosystems, which include Amazonian rain forests, coastal forests, and Andean forests and mountains.

OUTPUT 17:

Protected Natural Areas that have the necessary conditions to conserve their ecosystems, ensuring the provision of ecosystem services that adapt to the effects of climate change.

Measures:

30. **Recovery of ancestral knowledge and practices in the sustainable use of ecosystem goods and services to adapt to the effects of climate change.**
31. **Restoration of ecosystems to maintain landscape connectivity and reduce impacts from extreme weather events.**
32. **Implementation of a national forest monitoring program to measure the impact of climate change.**
33. **Implementation of sustainable practices for the conservation of ecosystems in hydrographic basins within the scope of Natural Protected Areas (ANP).**
34. **Implementation of the surveillance and control system in Protected Natural Areas (ANP) to reduce vulnerability to climate effects.**

OUTPUT 18:

Forest users implement phytosanitary surveillance actions in natural forest and forest plantations to reduce climate risks.

Measures:

35. **Implementation of a phytosanitary surveillance system in natural forests and forest plantations to reduce risks from hazards associated with climate change.**

OUTPUT 19:

The national government, regional governments and local governments implement risk management processes with a landscape approach to help reduce forest fires.

Measures:

36. **Strengthening of risk management processes with a landscape approach in the face of the effects of climate change to help reduce forest fires.**

STRATEGIC ACTIONS 2.2:

Strengthen inter-institutional coordination and optimize the water supply system for the multi-sectoral user population.

OUTPUT 20:

Basins vulnerable to climate change increase the supply of water in quantity, quality and opportunity for multi-sectoral users.

Measures:

37. **Implementation of larger hydraulic infraestructure for multi-sectoral use in basins vulnerable to climate change.**
38. **Conservation and recovery of natural infrastructure for the regulation and provision of water ecosystem services in basins vulnerable to climate change.**
39. **Implementation of early warning systems for floods, droughts, alluvium and hazards of glacial origin in basins vulnerable to climate change.**
40. **Implementation of monitoring and surveillance on water resources' quality in basins vulnerable to climate change.**

OUTPUT 21:

Multi-sectoral users of the basin use water efficiently and sustainably.

Measures:

41. Implementation of the hydrometric network for the collection and distribution of water in major and minor hydraulic infrastructure in basins vulnerable to climate change.
42. Modernization of the granting of water use rights in vulnerable basins so that they incorporate climate scenarios.

OUTPUT 22:

Multi-sectoral actors coordinate the use and sustainable use of water in basins vulnerable to climate change.

Measures:

43. Promote the increase of multi-sectoral and multi-actor articulation mechanisms for Integrated Management of Water Resources (IMWR) in the face of the effects of climate change.
44. Implementation of information services for multi-sectoral planning and management of water resources in basins vulnerable to climate change.

STRATEGIC ACTIONS 2.3:

Implement good management practices for agricultural land.

OUTPUT 23:

Agricultural soils conditioned with soil management and conservation practices improve their productive capacity in areas vulnerable to climate change-related hazards.

Measures:

45. Implementation of good soil fertilization practices in areas vulnerable to climate change-related hazards.

46. Implementation of technologies for the management and control of soil erosion in areas vulnerable to climate change-related hazards.

OUTPUT 24:

Agricultural producers who protect crop areas in critical areas against floods.

Measures:

47. Implementation of protection technologies for crop areas in critical areas against flooding.

OUTPUT 25:

Degraded soils salinized by intensive agricultural use are recovered for productive processes that are resilient to climate change-related hazards.

Measures:

48. Implementation recovery technologies for agricultural soils degraded by salinization in areas vulnerable to climate change.

PRIORITY OBJECTIVE 3

To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in infrastructure, goods and/or services.

STRATEGIC ACTIONS 3.1:

Develop infrastructures and processes that facilitate energy planning and water management for agents linked to the energy sector.

OUTPUT 26:

Agents of the hydropower generation sector increase their capacity to regulate water for the sustainability of the electricity service supply in hydrographic basins vulnerable to climate change.

Measures:

49. Promotion of infrastructure development that reduces the vulnerability of hydroelectric generation, especially in plants located in basins vulnerable to climate change.

50. Promotion of the implementation of protection infrastructure in the generation, transmission and distribution of electricity against the impacts of hazards associated with climate change in vulnerable hydrographic basins.

OUTPUT 27:

Sector agents efficiently and sustainably supply and consume the electricity service in a context of climate change.

Measures:

51. Implementation of good practices for efficient energy use in economic sectors.

52. Efficient use of hydroelectric energy in basins vulnerable to climate change.

53. Diversification of the energy matrix to reduce pressure on water resources.

OUTPUT 28:

Sector agents access information on hydropower potential considering the effects of climate change to promote sustainable investments.

Measures:

54. Implementation of a support service for the evaluation of the affectation of the hydro-energy resource due to the effects of climate change for planning purposes.

STRATEGIC ACTIONS 3.2:

Strengthen and modernize the hydraulic sectors for agricultural use.

OUTPUT 29:

Hydraulic sectors increase their storage capacity and provision of water for agricultural use in hydrographic basins vulnerable to climate change.

Measures:

55. Improvement and construction of reservoirs for the provision of water service for agricultural use.

56. Implementation of interventions for planting and harvesting water.

OUTPUT 30:

Efficient hydraulics sectors in irrigation systems for agricultural use in basins vulnerable to climate change.

Measures:

57. Implementation of hydraulic infrastructure for conduction, distribution and application of water for irrigation.

58. Implementation of protection infrastructure in the hydraulic sectors for agricultural use.

59. Implementation of technical irrigation systems.

OUTPUT 31:

Hydraulic infrastructure operators self-manage their hydraulic systems considering climate change adaptation actions.

Measures:

60. **Strengthening of the institutionality of the hydraulic sectors for the management of water for agricultural use.**
61. **Technical assistance and capacity building of agricultural producers for the sustainable use of water.**

STRATEGIC ACTIONS 3.3:

Strengthen the sustainable drinking water supply service for population use.

OUTPUT 32:

Population with water supply systems resilient to climate change.

Measures:

62. **Increase the availability of formal water in urban areas vulnerable to climate change.**
63. **Sanitation Service Provider Companies (EPS) that incorporate the Payment Mechanisms for Ecosystem Services (MERESE) model for the implementation of natural infrastructure for the conservation, recovery and sustainable use of water ecosystem services in areas vulnerable to climate change.**
64. **Expansion, optimization and/or improvement of the production capacity of drinking water systems.**
65. **Expansion, optimization and/or improvement of the regulation capacity of drinking water systems.**
66. **Implementation of redundant infrastructure in water supply systems.**

OUTPUT 33:

Management of the demand for drinking water in urban areas vulnerable to climate change.

Measures:

67. Increase in micro-measurement coverage in urban areas vulnerable to climate change.

68. Reduction of Non-Invoiced Water in sanitation services in urban areas.

69. Implementation of water saving technologies in urban areas.

OUTPUT 34:

Articulated and sensitized sector actors adequately manage sanitation services in areas vulnerable to climate change.

Measures:

70. Implementation of instruments for Disaster Risk Management (DRM) in urban sanitation services.

71. Implementation of instruments for Adaptation to Climate Change in urban sanitation services.

STRATEGIC ACTIONS 3.4:

Implement business strategies for the adaptation of the agricultural value chain.

OUTPUT 35:

Informed agricultural producers develop adaptive technological innovations to face climate change in agricultural value chains.

Measures:

72. Implementation of strategic agro-climatic information services for adaptation to the effects of climate change.

73. Implementation of adaptive technological innovation services to face climate change in agricultural value chains.

OUTPUT 36:

Organized agricultural producers access markets in agricultural value chains in areas vulnerable to climate change.

Measures:

74. Implementation of business strategies that incorporate risk and opportunity management to face climate change.

75. Added value of agricultural products in value chains in areas vulnerable to climate change.

STRATEGIC ACTIONS 3.5:

Diversify and strengthen added value to improve the productivity and production of fishing and aquaculture activities.

OUTPUT 37:

Anchovy fishing for indirect human consumption is used in a sustainable way within a climate change scenario.

Measures:

76. Implementation of an integrated traceability system for anchovy.

77. Strengthening of the anchoveta fishing quota system under an ecosystem approach.

OUTPUT 38:

Agents of the fishing and aquaculture sector access preventive information services for the sustainable use of hydrobiological resources facing the opportunities and climate change-related hazards.

Measures:

78. Strengthening of the early warning systems for early responses to extreme weather events associated with climate change.

79. Implementation of an early warning system for harmful algal blooms and sulphurous events to face to climate change-related hazards.

80. Strengthening of the market information system and real time oceanographic conditions.

OUTPUT 39:

Hydrobiological resources for direct human consumption are regulated for sustainable use within a climate change context.

Measures:

81. Management of artisanal fishing incorporating climate change.

82. Control, surveillance and inspection of the measures of ordering, regulation and conservation of hydrobiological resources for artisanal fishing.

OUTPUT 40:

Artisanal Fishing Landing Sites (AFLSs) adapted to climate risks.

Measures:

83. Design and implementation of planning and management instruments for disaster risk reduction in DPAs.

84. Implementation of physical protection measures to reduce disaster risks associated with climate change in DPAs.

Implementation
mechanisms of the NAP

4.1 Operational structure for the implementation

For the country to be able to implement adaptation measures, it is necessary to propose a guiding structure that facilitates their gradual implementation, according to the priorities and guidelines established in this document, as well as their follow-up through monitoring and evaluation.

The regulatory framework is established by the FLCC and the RFLCC, which point out the functions of the national authority on climate change, as well as the sectoral, regional and local authorities. They also set forth the necessary institutional framework for the comprehensive management of climate change, which includes adaptation.

- The MINAM as the national authority on climate change: Its objective is to prepare, monitor, evaluate and update the NAP in coordination with the focal points on climate change.
- Sectoral climate change authorities: their functions include designing, defining, implementing and reporting the adaptation measures that make up the NDCs.
- Regional climate change authorities: their functions include preparing, approving, implementing, monitoring, evaluating and updating its RCCSs, as well as implementing the CCAMs at the regional level.

4.

- Local climate change authorities: their functions include preparing, approving, implementing, monitoring, evaluating and updating its LCCP, as well as implementing the CCAMs at the local level.

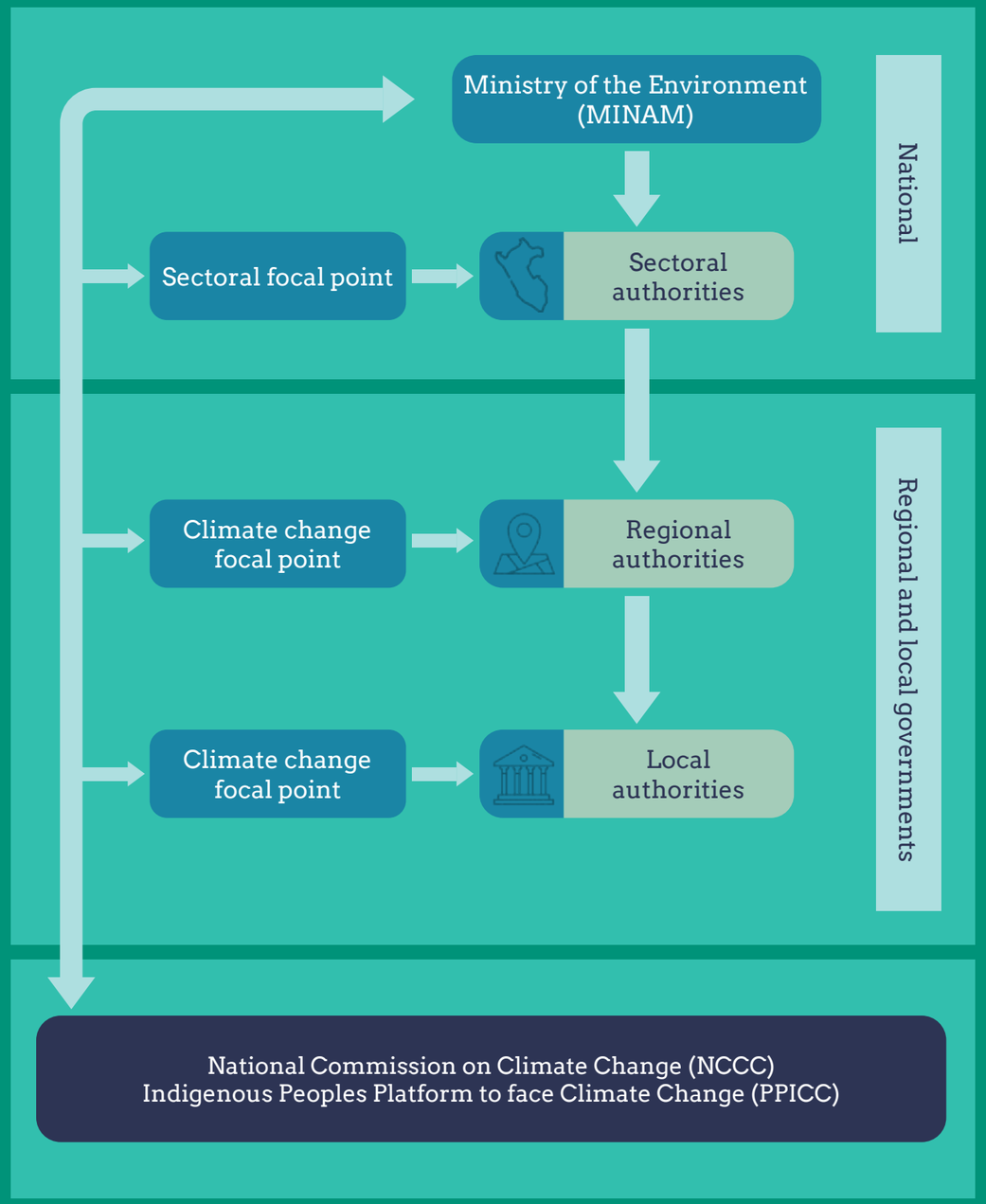
- The sectoral, regional and local focal points on climate change: their objective is to serve as coordinating points with the national climate change authority and other competent authorities and non-state actors for their integral management, which includes the adaptation component.

Additionally, the following are identified:

- The National Commission on Climate Change (NCCC): whose general function is to monitor the various sectors involved in the matter, as well as the design and promotion of National Climate Change Strategies (NCCSs).

- The Platform of Indigenous Peoples to face Climate Change (PPICC): which offers a space for indigenous and native peoples to manage, articulate, exchange, systematize, disseminate and monitor proposals for adaptation and mitigation measures.

FIGURE 3 GUIDING OPERATIONAL STRUCTURE FOR THE IMPLEMENTATION OF THE NAP

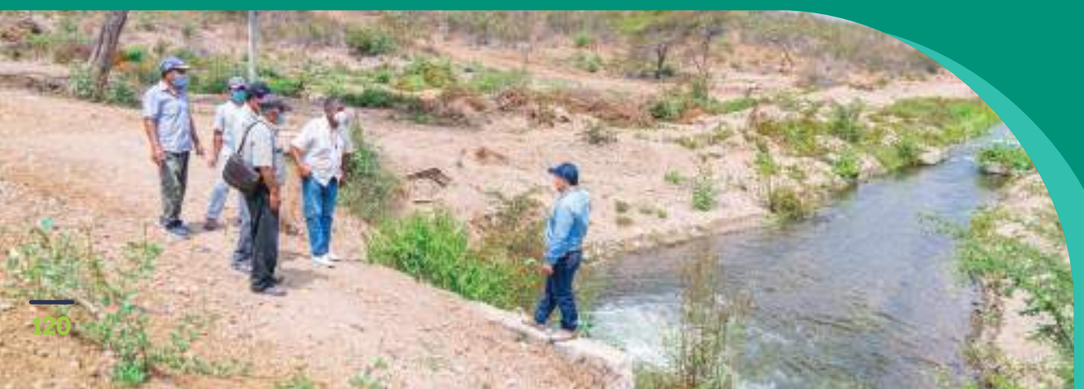


Source: Plan Nacional de Adaptación (MINAM, 2021).

4.2 Implementation path

For the implementation of the CCAMs in each of the priorities and guidelines established in this document, it is necessary to consider common elements that are part of the FLCC and the RFLCC. These are described below:

1. Generation and use of a climate risk analysis for each thematic area.
2. Coordination with development instruments at the national and sub-national level.
3. Prioritization of the adaptation measures.
4. Taking advantage of sources of financing and other forms of support for the implementation of the adaptation measures.
5. Follow-up of measurements.
6. Socialization and advocacy for institutional strengthening for adaptation.



4.3 Additional scopes for adaptation

Always bearing in mind the fact that the NAP is a living document, the identification of new adaptation needs becomes especially relevant to direct efforts towards feedback and increase the country's adaptation ambition. The adaptation of a territory is a global and holistic concept that is not limited to the thematic areas that are prioritized at the national level, that is, we should not lose sight of those thematic areas that, due to their characteristics, have other climate change adaptation needs.

At the same time, the territories, infrastructures, and populations undergo constant change and development, and must be contemplated within the management of adaptation, that is, what today is not a priority may be in the future.

Regarding the five prioritized thematic areas, key needs have been identified to generate convergences:

- Generation of regionalized climate forecasts for Peru.
- Promote synergies between thematic areas.
- Promote the exchange of knowledge at the national level.
- Assessment of additional hazards.
- Strengthening cross-cutting approaches at the subnational level.
- Inclusion of the concept of migration.
- Inclusion of the energy thematic area.
- Consideration of territorial and urban planning.
- Evaluation of the expansion of NDCs outputs and measures for adaptation.

Monitoring and evaluation of the adaptation to climate change

This implementation path goes hand in hand with the monitoring and evaluation of adaptation to climate change to know the progress made in adaptation over time.

Since the end of 2019, Peru has had a pilot system for monitoring the budget execution of the costs of climate change adaptation and mitigation. This system has catalogued the budgetary expenditures of the three levels of government in expenditures on adaptation, mitigation, and interventions with impacts in both areas.

5.

5.1 Monitoring

The NAP sets forth two moments, the first one provides the proposals to carry out the monitoring and evaluation of adaptation at a more aggregate level and with flexibility that allows adjustments to different territories and sectors. The second is aimed directly towards the plan itself, proposing the indicators for the monitoring scope and the guidelines for the evaluation stage.

Two results indicators have been proposed to carry out the monitoring and evaluation of adaptation, which are the following:

GENERAL PRIORITY OBJECTIVE	INDICATOR
To reduce and/or avoid current and future damages, losses and alterations triggered by climate change-related hazards in the livelihoods of populations, ecosystems, basins, territories, infrastructure, assets and/or services; as well as, to take advantage of the opportunities offered by climate change for sustainable and resilient development.	Indicator of the state of the adaptation to climate change management
	Indicator of damages, alterations and losses facing the effects of climate change

For the monitoring and evaluation of the NAP, in terms of the results of the three specific priority objectives proposed by it, three indicators have been proposed, which are shown below:

TABLE 3 AGGREGATED OUTPUT INDICATORS AT THE SPECIFIC PRIORITY OBJECTIVE LEVEL

SUBJECTS OF ANALYSIS	SPECIFIC PRIORITY OBJECTIVES		INDICATOR
POPULATIONS AND THEIR LIVELIHOODS	0.1	To reduce damages, possible alterations and consequent current and future losses generated by climate change-related hazards in populations and their livelihoods.	Percentages of CCAMs implemented directly related to people involved in the thematic areas of health, fishing and aquaculture, agriculture, water and forestry.
ECOSYSTEMS, BASINS AND TERRITORY	0.2	To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in ecosystems, basins and territories.	Percentages of CCAMs implemented that act directly on ecosystems, basins and territories.
INFRASTRUCTURE, GOODS AND/OR SERVICES	0.3	To reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in infrastructure, goods and/or services.	Percentages of the CCAMs implemented that act directly on the infrastructures, goods or services of the thematic areas of health, fishing and aquaculture, agriculture, water and forestry.

5.2 Evaluation

The NAP can be evaluated in terms of its effectiveness in converting Peru into a territory adapted to climate change, so that its implementation reduces the risk of climate change effects. The efficiency of the NAP will be evaluated considering the resources necessary for its implementation from a financial point of view, that is, analyzing the economic variable.

Quantifying the effectiveness of the NAP is, therefore, a clear objective in order to know the success of its implementation; however, the availability of relevant and effective information is a limitation when formulating these impact indicators.

The NAP formulates the need to have indicators that allow quantifying the reduction of impacts, as more and better information is available for a correct evaluation. That is why it has been proposed to use the monitoring indicator referring to damages, alterations and losses due to the effects of climate change for this purpose, focusing on the three subjects of analysis: the population and its livelihoods; ecosystems, basins and territories; and infrastructure, goods and/or services, since they will allow us to know the effectiveness through the implementation of the established measures.

Financing for adaptation

To ensure the effective implementation of the NAP throughout the country, the contribution of strategic communication that promotes the exchange of information and its socialization among the various actors and sectors is essential.

The different sources of financing are described below, emphasizing those that could be adjusted to the adaptation to climate change. Finally, the cost of the measures proposed by the GTM-NDC Report is presented, and the costs for measures 51 to 92 have been estimated due to the availability of information.

Climate financing comprises all types of financing (public and private; local, regional, national and international) aimed at climate change adaptation or mitigation. There are numerous funds that provide financing for adaptation and channel them through different mechanisms. These can be divided into: multilateral approvals from public projects, public-bilateral, public financing for developing countries, financial institutions for development, other international organizations, insurance and channels, and regional/national funds.

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When discussing the regionalization of the adaptation funds available in Peru, it is worth mentioning that, since the end of 2019, Peru has had a pilot system for monitoring the budget execution of the costs of climate change adaptation and mitigation. This system has catalogued the budgetary expenditures of the three levels of government in expenditures on adaptation, mitigation, and interventions with impacts in both areas.

The NAP describes the different sources of public and private, domestic and international financing, these include:

INTERNATIONAL PUBLIC FINANCING

In the United Nations Framework Convention on Climate Change (UNFCCC):

- Green Climate Fund (GFC)
- Adaptation Fund (AF)
- Global Environment Facility (GEF)

Outside the context of the United Nations Framework Convention on Climate Change:

- The World Bank
- Inter-American Development Bank
- Development Bank of Latin America

Regarding bilateral sources, the following list should be highlighted:

- Global Climate Change Alliance
- Germany: BMZ, KfW, IKI
- Denmark: Danida
- Sweden: SIDA
- Switzerland: Cosude
- United Kingdom: DFID, ICF
- United States: USAID
- France: AFD

DOMESTIC PUBLIC FINANCING

The National Public Budget System is the fundamental pillar of public finances, which is included in the framework regulations that regulate the planning, performance and evaluation of the entire system.

The budgetary programs (BP) consist of programming units for the actions of public entities that guide the provision of outputs to achieve a specific result and contribute to the achievement of a final outcome associated with a public policy objective. In this regard, a set of potential programs have been identified that could integrate adaptation to climate change measures into their operational structure, such as BP 0144 (conservation and sustainable use of ecosystems), BP 0068 (reduction of vulnerability and emergency assistance), BP 0017 (metaxenic and zoonotic diseases), BP 0104 (reduction of mortality due to emergencies and medical emergencies), BP 0042 (use of water resources for agricultural use), BP 0130 (competitiveness and sustainable use of forest resources and wildlife), BP 094 (adequate use of water and hydrobiological resources for aquaculture production), BP 095 (increase in the productivity of artisanal fishermen), among others, under the responsibility of the competent sector of each of the thematic adaptation areas.

Regarding public investment, there is Directive No. 001-2019-EF-63.01, approved by Directive Resolution No. 001-2019-EF-63.01, which is included in the Annex: "Minimum Content of a Pre-investment Study at the profile Level for Investment Projects", which establishes the development of climate risk analysis and management within a climate change context throughout the preparation of the pre-investment study. Some sectors have been incorporating it, such as the Midagri, which has "Guidelines for the incorporation of Risk Management within a Climate Change context in investment projects related to water for irrigation within the framework of the National Multi-year Programming and Management of Investment Systems", approved by Ministerial Resolution No. 0484-2019-Midagri, which is a significant step within the framework of Invierte.pe for the incorporation of adaptation measures in this typology of projects.

SOURCES OF PRIVATE FINANCING: DOMESTIC AND INTERNATIONAL

Different sources of financial resources are identified for the implementation of Climate Change Adaptation Measures:

- Commercial banks and financial service providers
- Responsible investing or ESG
- Insurance
- Payment Mechanism for Ecosystem Services
- Water funds
- Blended finance
- Impact investments
- Foundations and philanthropy
- Green Bonds
- Microfinance

Considering the information available to date, the costs of adaptation measures 51 to 92 have been estimated from the information available in the MEF Project Bank. The unit costs were estimated considering the goals for the years 2021, 2025 and 2030; in order to quantify the accumulated cost of implementing the measures by 2030; however, for more exact calculations, the work of the Sectors will be relevant, within the framework of their functions contemplated in the FLCC and its RFLCC, regarding the quantification of the direct and indirect costs and benefits of their adaptation measures.

TABLE 4 APPROXIMATE COSTS FOR THE CCAMS OF EACH SUBJECT AREA

ADAPTATION MEASURES	COSTED	APPROXIMATE COST (IN MILLIONS OF SOLES)
AGRICULTURE	15	11.508, 45
FORESTRY	12	49.419,75
FISHING AND AQUACULTURE	8	36,14
HEALTH	10	324,59
WATER	6	4.986,6
TOTAL	**51**	**66.275,53**

Source: Plan Nacional de Adaptación (MINAM, 2021).

COMMUNICATION ACTIONS FOR ADAPTATION

To ensure the effective implementation of the NAP throughout the country, a series of financial, institutional and social conditions are required, which are associated with the entire formulation stage. Along with this, the contribution of strategic communication that promotes the exchange of information, socialization through dialogue and empowerment among the various actors and sectors of the country through various communication products, activities, experiences, and channels is also essential.

This exercise is about a macro strategic analysis that makes visible the priorities at the national level; however, it does not mean that a high-risk point will necessarily suffer damage, but it does mean that this point presents a greater risk of suffering it than another classified as medium or low risk.

7.

7.1 Target audience, messages and activities

The communication actions establish the following specific objectives for each of the target audiences:

SPECIFIC OBJECTIVES
OBJETIVOS ESPECÍFICOS

• Public sector:

Communicate, among the implementing sectors, about the social and economic benefits of the implementation of the NAP, in a coordinated and cross-cutting manner in relation to the development initiatives.

• Private sector:

Disseminate adaptation to climate change as a business opportunity with returns, both economic and social and of prestige.

• Regional and local governments:

Generate spaces for dialogue for decision-making, in regions and localities, on the individual and collective benefits of adaptation to climate change.

• Peasant communities, Afro-Peruvian people and indigenous or native peoples:

Communicate the successful experiences of adaptation to climate change based on the knowledge of the peasant communities and the ancestral knowledge of the Afro-Peruvian people, and indigenous or native peoples, in order to assess, scale-up, or replicate these experiences.

• Women:

Communication on the ancestral and local knowledge and practices of women on adaptation to climate change, so that these may be assessed, scaled-up, or replicated, and guarantee their involvement in the NAP implementation process.

SPECIFIC OBJECTIVES

• Academia:

Disseminate the main research topics on adaptation to climate change in the country as an input for making informed decisions.

• Girls, boys and adolescents:

Communicate, based on concrete examples and stories of real people, the importance of adaptation to climate change as a priority element to ensure the well-being of our families, friends, community and country.

• Young Adults:

Disseminate their proposals, their activities and their involvement in the NAP implementation process through virtual spaces for dialogue to make the entire population aware of their active role in the adaptation to climate change.

Implement education on climate change through the development of workshops for young people in schools.

• NGOs:

Promote spaces for dialogue to generate advocacy regarding the implementation process of the climate change adaptation measures.

• Civil society:

Information regarding what adaptation to climate change is, what its measures are all about, and how to get involved to promote them.

Identified limitations and opportunities

The most current scientific evidence has been integrated and taken into consideration in the NAP to provide the best possible support to the entire analysis, ensuring the greatest possible integration with the comprehensive management instruments of climate change; however, certain limitations were found during the process that will facilitate continuous improvement:

8.1 In relation to the conceptual models

The analysis originates in, and starts from the NDCs. Between 2017 and 2018, the GTM-NDC generated the technical information required for the formulation of the NDCs. This information focused on five specific thematic areas on which the conceptual models have been developed: water, agriculture, forestry, fishing and aquaculture, and health. However, the issues derived from climate change are cross-cutting and require a holistic vision, since they affect the entire country in a global manner. Although this

8.

was a limitation, the NAP is a living document that will be updated regularly and to which the new identified adaptation needs will be incorporated.

8.2 In relation to the climate risk analysis

The climate information used for the NAP is a preview of the climate forecasts that Senamhi has developed for the year 2021.

Therefore, the available climate information is centered on average variables of maximum-minimum temperature and precipitation for the two-time horizons of the NAP (2030 and 2050), under the RCP 8.5 emissions scenario. In other words, there is no future climate information on the extremes; however, it is the most consistent and up-to-date information available at the national level.

It is relevant to consider that Peru is a very heterogeneous territory with many types of climates. The analysis of climate change-related hazards has been carried out by analyzing percentage changes in the precipitation and temperature variables. In this sense, in arid zones, where annual precipitation is scarce, a slight increase in these can cause very high percentage changes in precipitation. Therefore, this type of extreme percentage change is relative and can lead to overestimations or underestimations of the climate hazard, and, consequently, increase the climate risks.

This exercise is about a macro strategic analysis that makes visible the priorities at the national level; however, it does not mean that a high-risk point will necessarily suffer damage, but it does mean that this point presents a greater risk of suffering it than another classified as medium or low risk.

Although the conceptual models identified the universe of hazards that affect each of the thematic areas, not all hazards were quantitatively characterized in the climate risk analysis, since it was decided to prioritize those that had the best and more information available.

In any case, although it represents a limitation of the analysis, the prioritized hazards have a homogeneous representation between the different thematic areas. For this reason, the NAP, as part of the key points for the future, must receive regular updates for the development of new hazards and the improvement of current ones.

The methodology used for calculating climate risk is an adaptation of the one proposed by the IPCC in its fifth assessment report (AR5), also aligned with the RFLCC. In this sense, the final climate risk calculation has been carried out by means of a multi-criteria analysis that incorporates the hazard, exposure and vulnerability concepts. This quantitative analysis has been represented in Geographic Information Systems (GIS) to obtain hazards, exposure and vulnerability maps, and finally the risk that combines the previous three.

This type of analysis is associated with an intrinsic uncertainty and, therefore, it is a method that is considered as a heuristic procedure, which allows, in most cases, to obtain reasonable results for highly complex and relevant multi-criteria decision problems (Romero, 1996).

Thus, it is important to highlight that this exercise is about a strategic analysis that makes visible the priorities at the national level; however, it does not mean that a high-risk point will necessarily suffer damage, but it does mean that this point presents a greater risk of suffering it than another classified as medium or low risk.

With the objective of simplifying and grounding the evaluation to reality, the risk analysis has been structured for the different subjects of analysis identified in Peru. In this sense, the hydroelectric power generation infrastructure, as well as the water collection and transmission infrastructure, has been identified as a secondary analysis subject within the water thematic area. Although a specific analysis on this subject has not been prepared in this version of the NAP, we have identified the need to evaluate it in subsequent updates of the plan.

Similarly, the artisanal fishing subject of analysis has been evaluated from the marine point of view, since inland fishing represented only 1% of continental landings in 2012 (Produce, 2015b). Likewise, at present, the ecosystems included in the forestry thematic area exclusively contemplate the forested ecosystems in accordance with the tentative programming of the sector; however, the inclusion of the rest of the non-forested ecosystems of Peru in future updates of the corresponding programming is considered as a potential need.

8.3 In relation to monitoring and evaluation

Although impact indicators are not integrated and developed in the NAP, this line of work has been identified as a priority in future updates and, therefore, as part of the challenge that must be addressed in the future.

8.4 Regarding financing

Information limitations in relation to CCAMs have meant that 41 adaptation measures cannot be financed with the information currently available. This information limitation should therefore be a priority to guarantee and promote adequate resources, as well as for the correct implementation of the NAP as a whole.

Conclusions and guidelines

The NAP constitutes a key milestone for Peru's climate action, since it is an input for updating the NCCS. With its approval, a construction process culminates that, under the coordination of the MINAM, has combined a robust technical process with the diverse contributions from institutions, organizations, interest groups and individuals.

In this way, a well-grounded and consensus-based document has been obtained, which empowers it, especially, when establishing strategic guidelines to reduce climate risks on the population, livelihoods, economic activities, goods and services and the environment.

The NAP consolidates and guides the country agenda on adaptation to climate change, advancing in the implementation of the FLCC and the RFLCC. The need to align and give continuity to the development of the NDCs submitted to the UNFCCC, after the ratification of the Paris Agreement by Peru, has been especially considered during its preparation. Likewise, the document has been supplied with the necessary capacities to articulate it and to be effectively implemented at the subnational level, considering previous development efforts at the regional and local levels.

The spatial scope of the NAP extends to the entire national territory, considers

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the variety of environments and realities existing in the country and tries to contribute to sustainable development in terms of quality of life, reduction of the socioeconomic gap, equal opportunities and conservation of natural heritage. The proposed determinations are adjusted to a double time horizon, with a first goal of decided progress towards resilience by 2030 and a long-term vision that by 2050 Peru will have consolidated its position as a nation adapted to the effects of climate change, as the result of the solid implementation of a knowledge-based climate change policy, which has made it possible to take advantage of the opportunities offered by innovation and technological development.

The spatial scope of the NAP extends to the entire national territory, considers the variety of environments and realities existing in the country and tries to contribute to sustainable development in terms of quality of life, reduction of the socioeconomic gap, equal opportunities and conservation of natural heritage.

In order to adequately support the formulation and the development framework of the NAP, different exercises have been completed, among which we can highlight, in the first place, the construction of conceptual models to understand the problems associated with climate variability in relation to each of the five prioritized thematic areas: water, forestry, health, fishing and aquaculture, and agriculture. This effort, carried out in conjunction with the universe of competent interest groups for each sector, made it possible to define the hazards, the vulnerability criteria and the potential effects –positive and negative– that can be attributed in each case to climate triggers.

The generation of climate risk maps, based on the combination of hazards, exposure and vulnerability, has made it possible to spatially classify, and show in which regions of the country it will be appropriate to develop actions to improve the adaptive capacity of the different subjects of analysis considered against certain potential effects.

During the development of the NAP, two additional thematic areas, to the five prioritized, were highlighted: tourism and transportation. The identification of the significant effects of climate change on these two new areas led to their inclusion in this NAP. However, although they do not have a complete analysis as the prioritized thematic areas, their basic guidelines of impacts and damages due to exposure to climate change-related hazards were developed, in order to take the first steps to place them on the agenda when future adaptation measures specific to these two thematic areas are developed.

The evolution of the historical record of temperatures and precipitation, and of the projections of change in these parameters for the coming years, points to the need to provide effective adaptation strategies to face climate change-related hazards that will not be less severe than those recorded and already known. The generation of climate risk maps, based on the combination of hazards, exposure and vulnerability, has made it possible to spatially classify, and show in which regions of the country it will be appropriate to develop actions to improve the adaptive capacity of the different subjects of analysis considered against certain potential effects.

The adaptation strategy proposed by the NAP seeks, in general terms, to reduce and/or avoid the damages, losses and alterations triggered by climate change-related hazards, as well as to take advantage of the opportunities it offers for sustainable and resilient development, always keeping in mind an inclusive and integrating approach with respect to gender, cultural diversity and different generations.

This has been specified in the following three priority objectives:

1. Reduce damages, possible alterations and consequent current and future losses generated by climate change-related hazards in populations and their livelihoods.

2. Reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in ecosystems, basins and territories.

3. Reduce damages, possible alterations and the consequent current and future losses, generated by climate change-related hazards in infrastructure, goods and/or services.

These priority objectives have been developed in a pyramid fashion through a large set of 13 strategic actions, 46 outputs and 92 adaptation measures.

However, for the NAP to achieve its implementation in the short, medium and long term, key aspects have been included to make the strategic proposal viable, through its implementation, monitoring, financing and communicative action mechanisms. In this way, the NAP is a starting point to articulate multi-sectoral (even for non-prioritized thematic areas), multilevel (country, region, province) and multi-stakeholder (different interest groups) climate action.

Like any strategic document, it is a living instrument, which must be periodically reviewed and updated. This will facilitate improving it, expanding and renewing its capacity and value, in order to guarantee the climate resilience conditions necessary to advance on the path of sustainable and climate-resilient development for the well-being of all Peruvians.

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ANNEX:

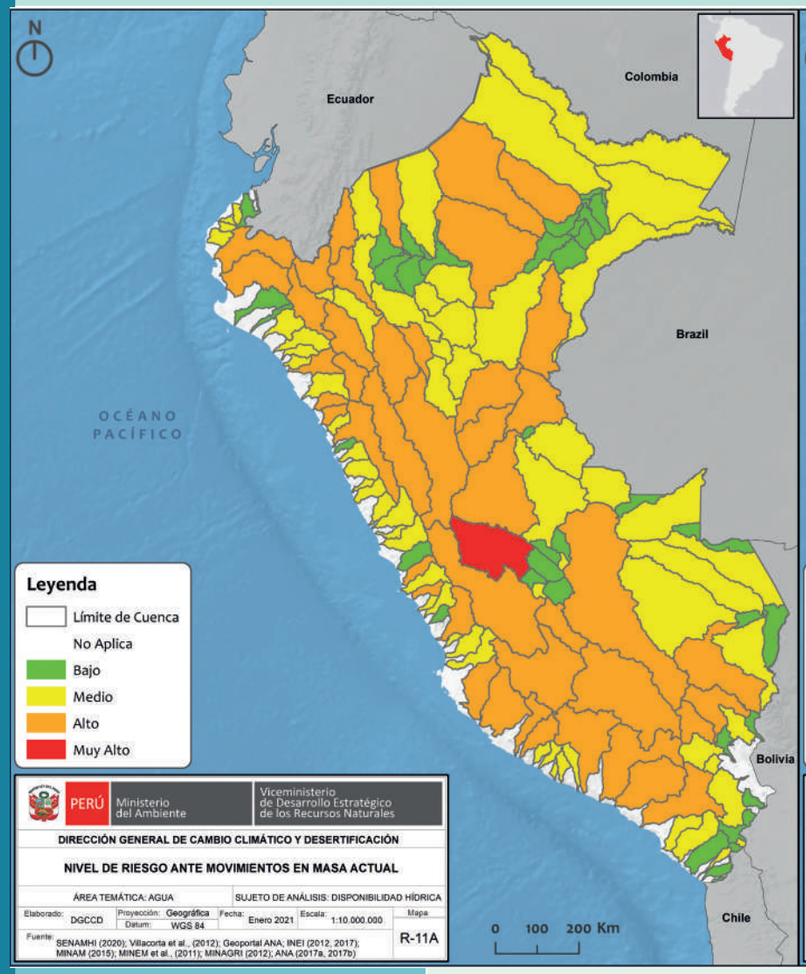
Climate risk scenarios

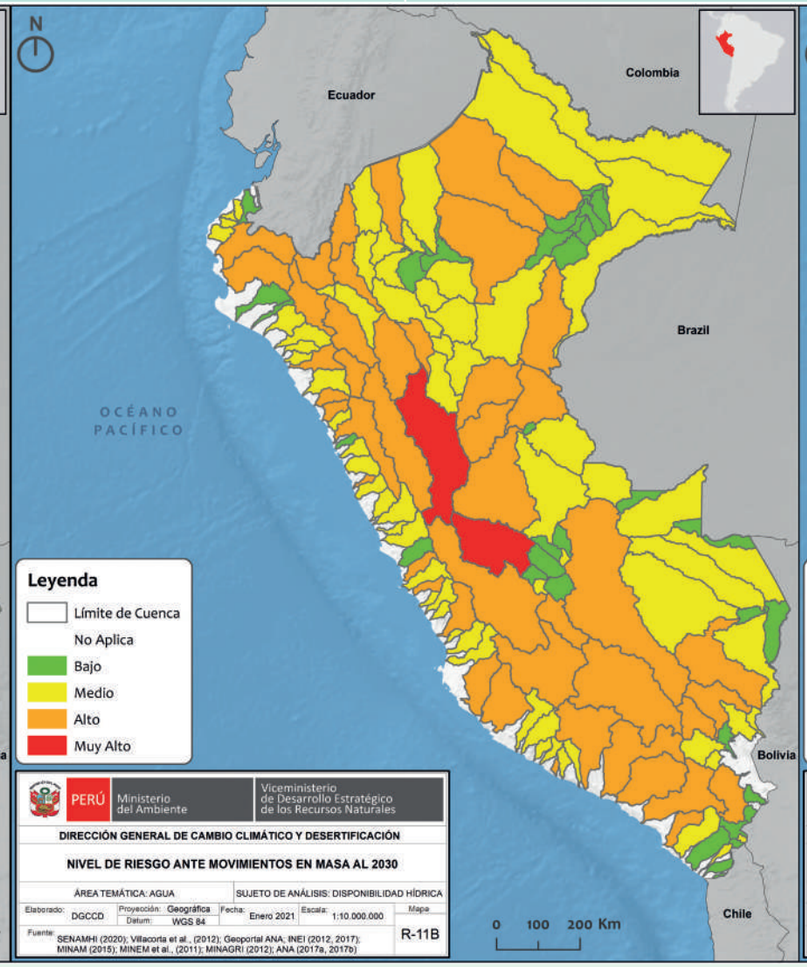
11.

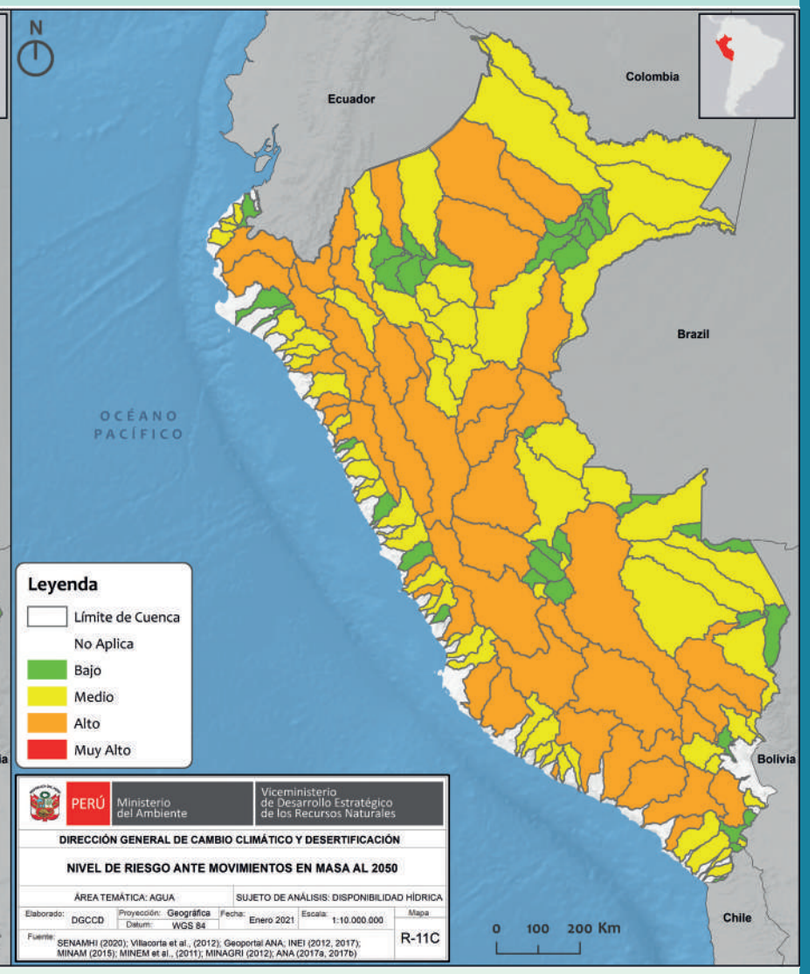
CLIMATE RISK SCENARIO OF WATER AVAILABILITY DUE TO MASS MOVEMENTS

Thematic area: water

Subject of analysis: water availability	Hazard: mass movements







Probable trend in the level of risk	The level of risk due to mass movements for the ***water availability*** subject of analysis is higher along the highlands (sierra), because the hazard level is higher in this area, as well as the levels of exposure, which are represented by the size of the basin. Comparing the current scenario with future scenarios, we can observe that the risk level would increase in the medium term (2030); however, in the long term (2050), this increase is not so high. This difference in the risk level is due to the response recorded by the climate trigger (mean annual total precipitation).

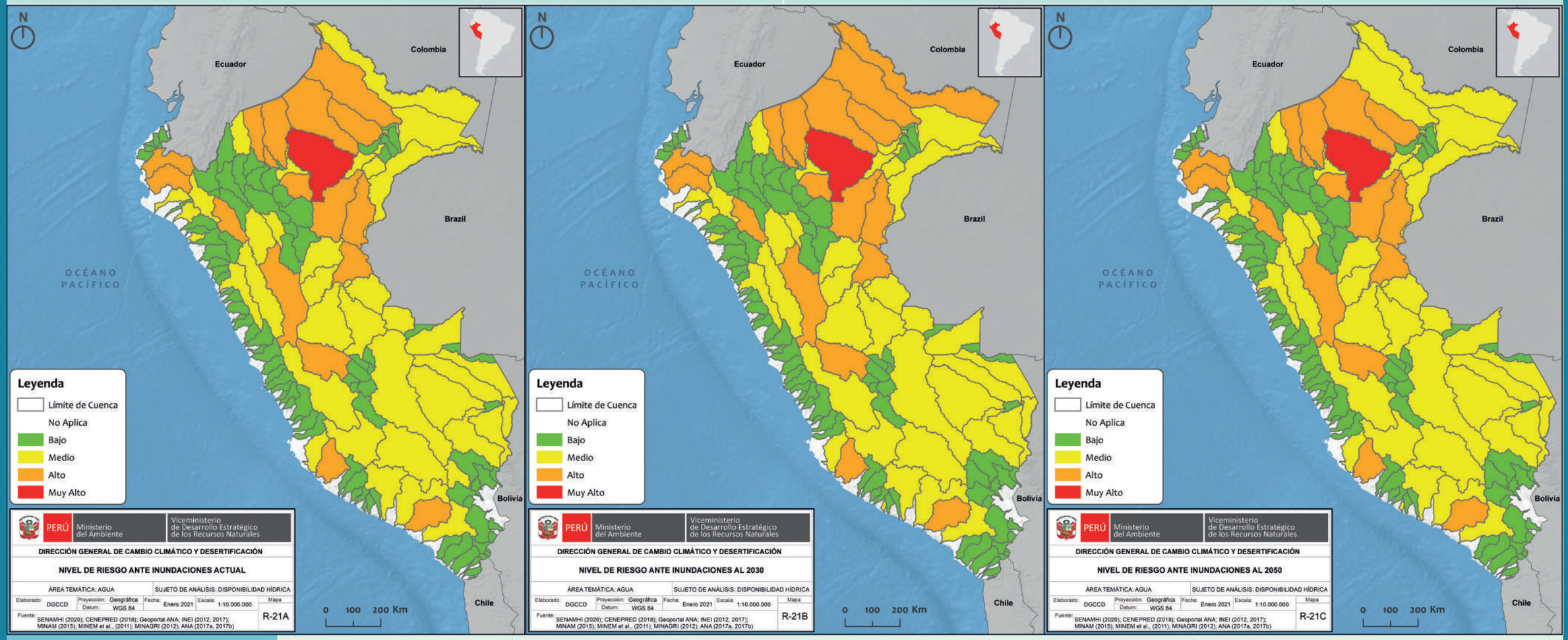
Basins with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	Perené basin.	Alto Huallaga basin and Perené basin.	N/A.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF WATER AVAILABILITY DUE TO FLOODS

Thematic area: water

Subject of analysis: water availability	Hazard: floods



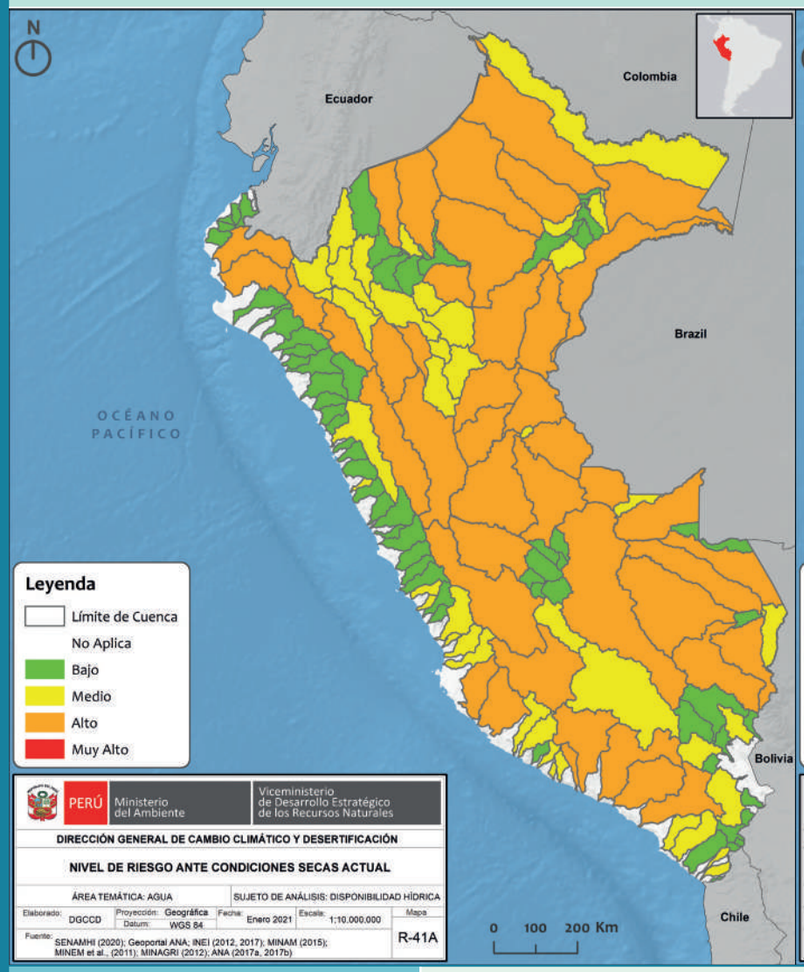
Probable trend in the level of risk	The level of risk due to floods for the ***water availability*** subject of analysis is higher in the Amazon region (specifically in the department of Loreto) due to a high exposure that is associated with the size of the basins and a high hazard level, which is conditioned by the characteristics of the relief, which give rise to a periodic flood in the area. Comparing the current scenario with future scenarios, we can observe that by 2030 and 2050, the level of risk increases in the center and north of the highlands (sierra), as well as in the northern zone of the Amazon region. This increase is higher during the medium-term time horizon (2030) due to an increase in the climatic trigger (average annual total precipitation) during this period compared to the long-term period (2050).		
Basins with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Lower Marañón middle inter-basin.	Lower Marañón middle inter-basin.	Lower Marañón middle inter-basin.

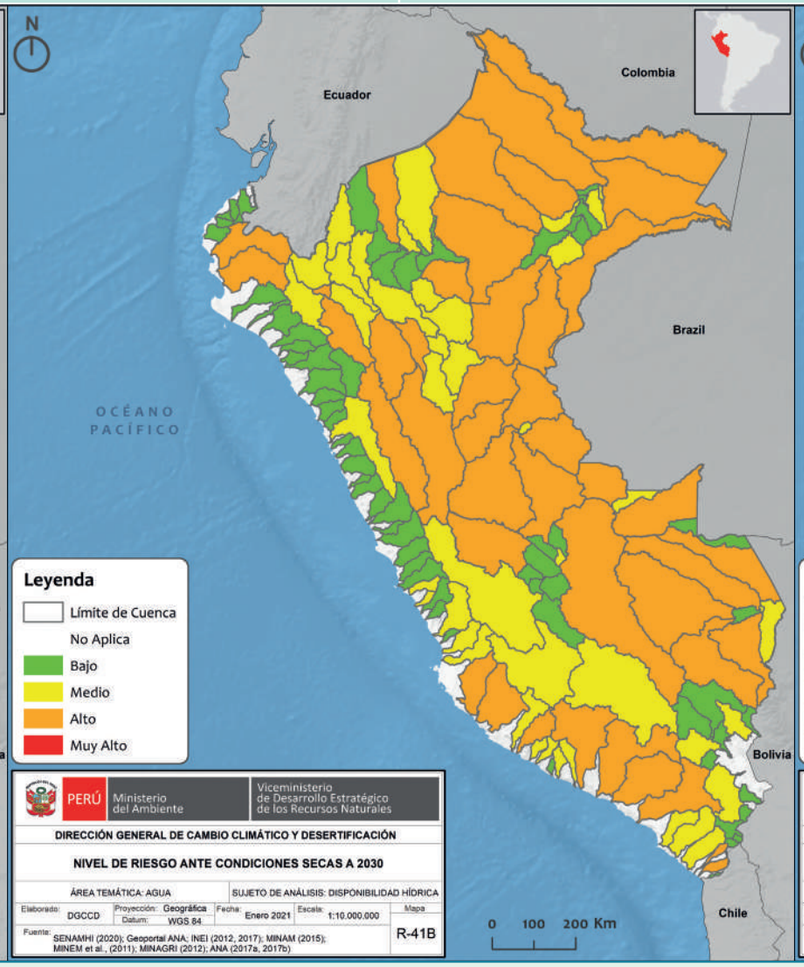
Source: Plan Nacional de Adaptación (MINAM, 2021).

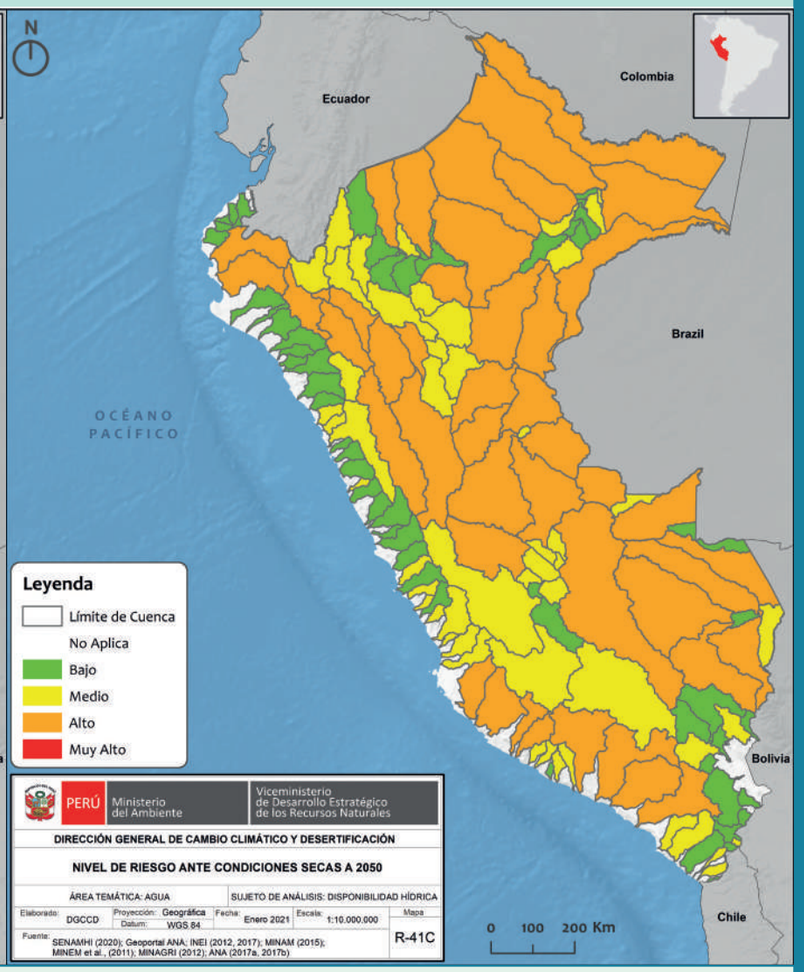
CLIMATE RISK SCENARIO OF WATER AVAILABILITY DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: water

Subject of analysis: water availability	Hazard: change in aridity conditions







Probable trend in the level of risk	The level of risk due to a change in aridity conditions for the ***water availability*** subject of analysis is higher in the Amazon region, the highlands and some southern coastal basins. Due to a high exposure that is associated with the large size of the basins and a high hazard level, there is a generalized risk in a large part of the country, with the exception of some medium and low risk basins. Comparing the current scenario with the future scenarios, we can observe that by 2030 and 2050, the level of risk increases in the north of the Amazon region (Loreto department), but decreases slightly in intermediate basins in the center of the highlands. This increase is higher during the medium-term time horizon (2030) due to an increase in the climatic trigger (average annual total precipitation) during this period compared to the long-term period (2050).

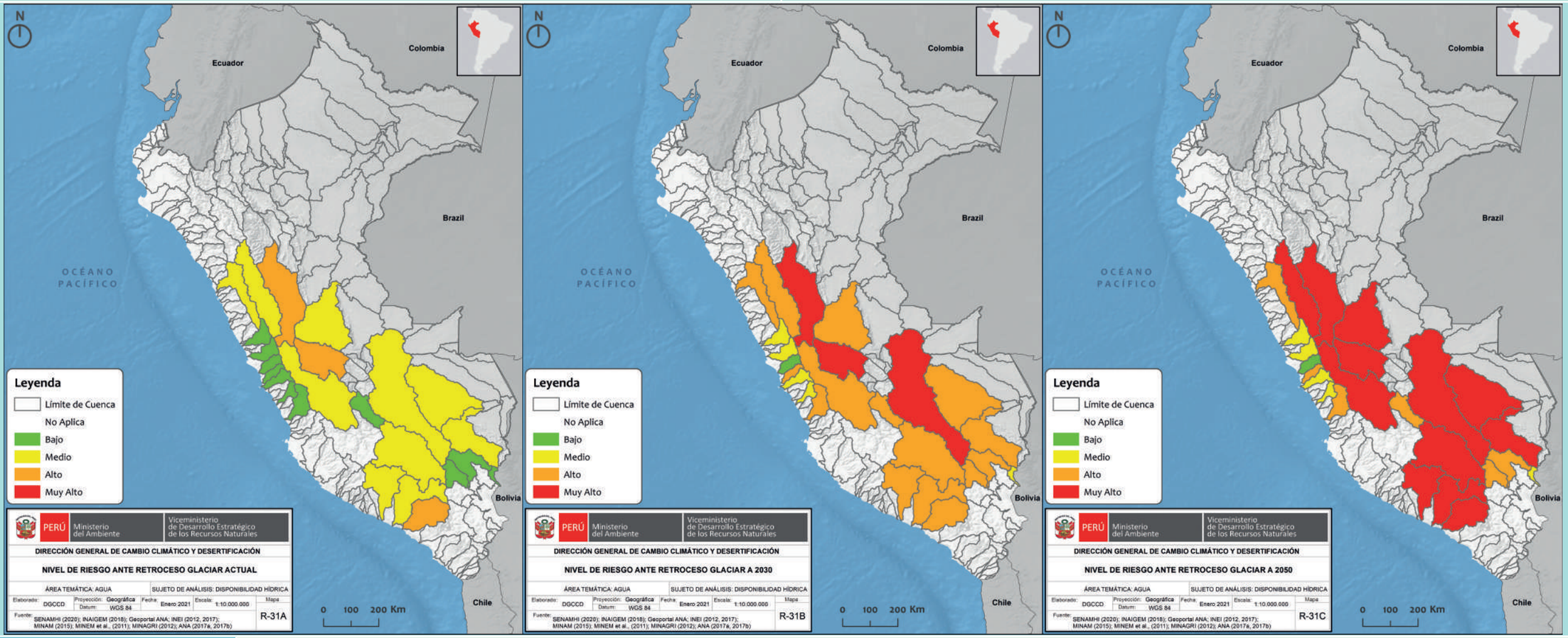
Basins with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF WATER AVAILABILITY DUE TO GLACIAL RETREAT

Thematic area: water

Subject of analysis: water availability	Hazard: glacial retreat



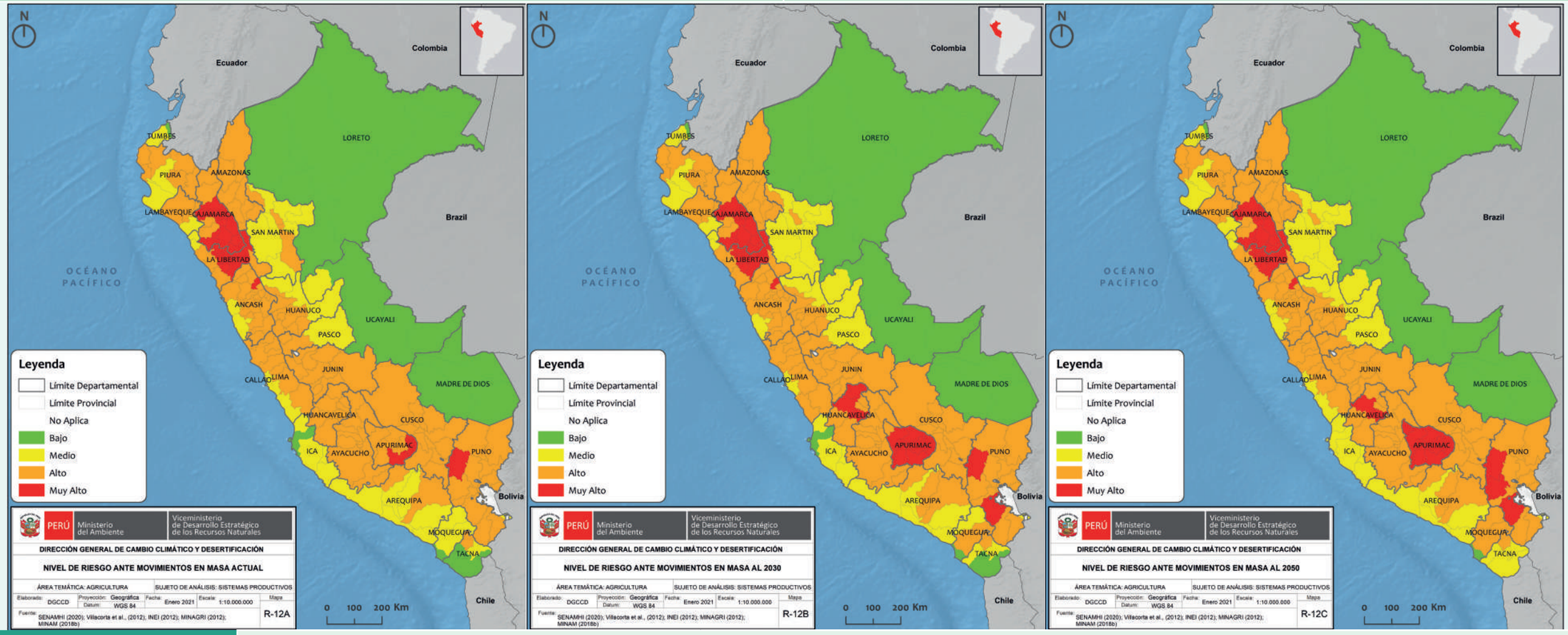
Probable trend in the level of risk	The level of risk due to glacial retreat for the ***water availability*** subject of analysis is higher in the highlands. The main reason is because the highest hazard levels are concentrated in this area. Likewise, the vulnerability levels are the highest, mainly due to higher demand and lower water supply. Comparing the current scenario with the future scenarios, an increase in the level of risk is observed as the time horizon increases. This increase is due to the increase in average temperatures as the time horizon increases.		
Basins with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	Alto Huallaga inter-basin, Perené basin and Urubamba basin.	Alto Marañón V inter-basin, Alto Huallaga inter-basin, Pachitea basin, Mantaro basin, Perené basin, Urubamba basin, Alto Madre de Dios inter-basin, Alto Apurímac inter-basin, Ocoña basin, Canamá basin, Quilca - Visor - Chili basin and Inambari basin.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF PRODUCTIVE SYSTEMS DUE TO MASS MOVEMENTS

Thematic area: agriculture

Subject of analysis: productive systems | **Hazard: mass movements**



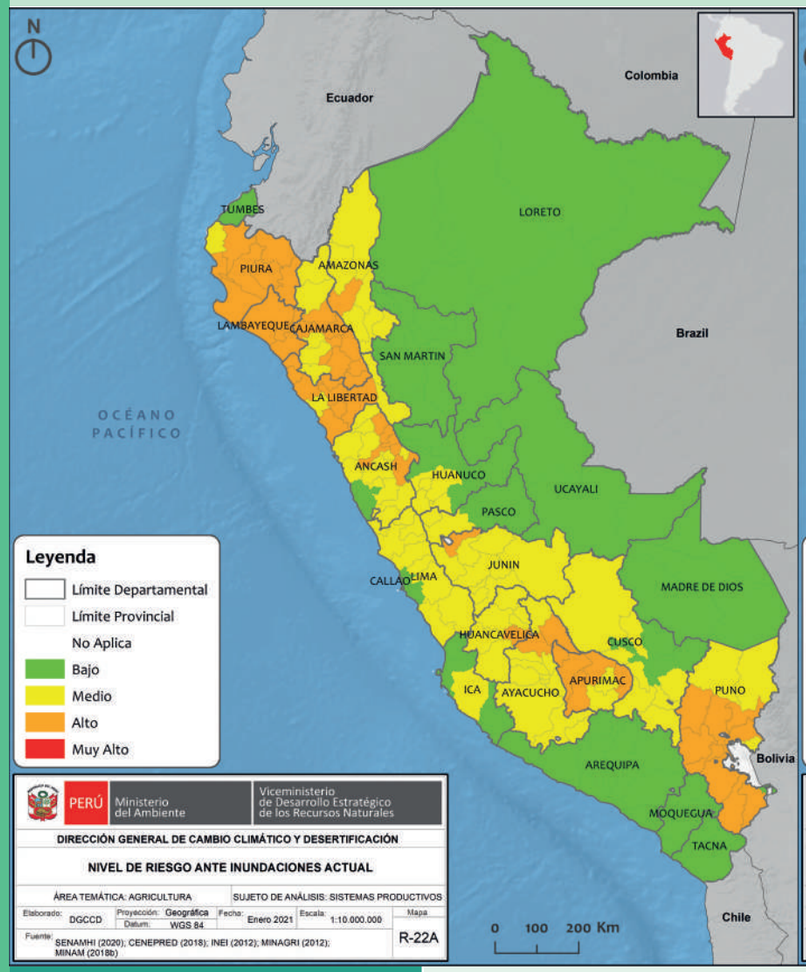
Probable trend in the level of risk	The level of risk due to mass movements for the ***productive systems*** subject of analysis is higher in the highlands, which coincides with the highest hazard, exposure and vulnerability levels. In the regions, we can particularly highlight the high/very high exposure that is associated with the large size of the agricultural area and the high density of agricultural producers. Comparing the current scenario with future scenarios, an increase in the level of risk in the highlands is observed during the future time periods. This fact is due, once again, to the response registered by the trigger (mean annual total precipitation) in the highlands, which increases for future scenarios.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Antabamba, Bolívar, Cajabamba, Cajamarca, Celendín, Chota, Contumaza, Cotabambas, Cutervo, Gran Chimú, Hualgayoc, Julcán, Melgar, Otuzco, Pomabamba, San Marcos, San Pablo, Sánchez Carrión and Santiago de Chuco.	Abancay, Andahuaylas, Angaraes, Antabamba, Aymaraes, Bolívar, Cajabamba, Cajamarca, Celendín, Chota, Contumaza, Cotabambas, Cutervo, Gran Chimú, Grau, Hualgayoc, Huancavelica, Julcán, Melgar, Otuzco, Pomabamba, Puno, San Marcos, San Pablo, Sánchez Carrión and Santiago De Chuco.	Abancay, Andahuaylas, Angaraes, Antabamba, Aymaraes, Bolívar, Cajabamba, Cajamarca, Celendín, Chota, Contumaza, Cotabambas, Cutervo, Gran Chimú, Grau, Hualgayoc, Huancavelica, Julcán, Melgar, Otuzco, Pomabamba, Puno, San Marcos, San Pablo, Sánchez Carrión and Santiago De Chuco.

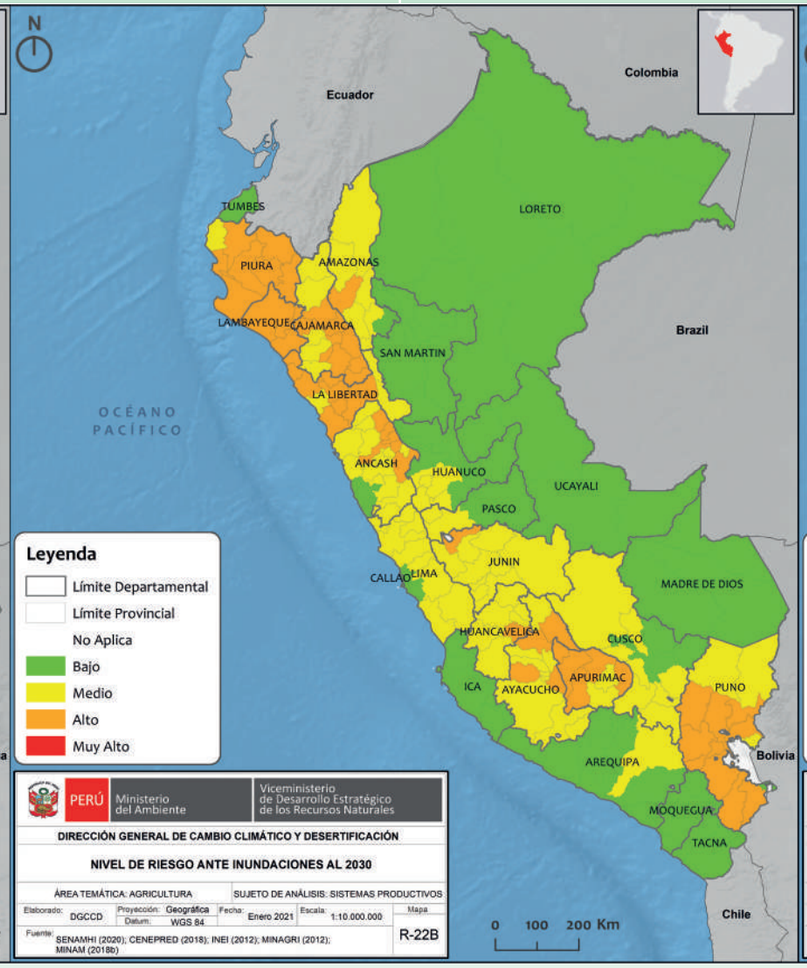
Source: Plan Nacional de Adaptación (MINAM, 2021).

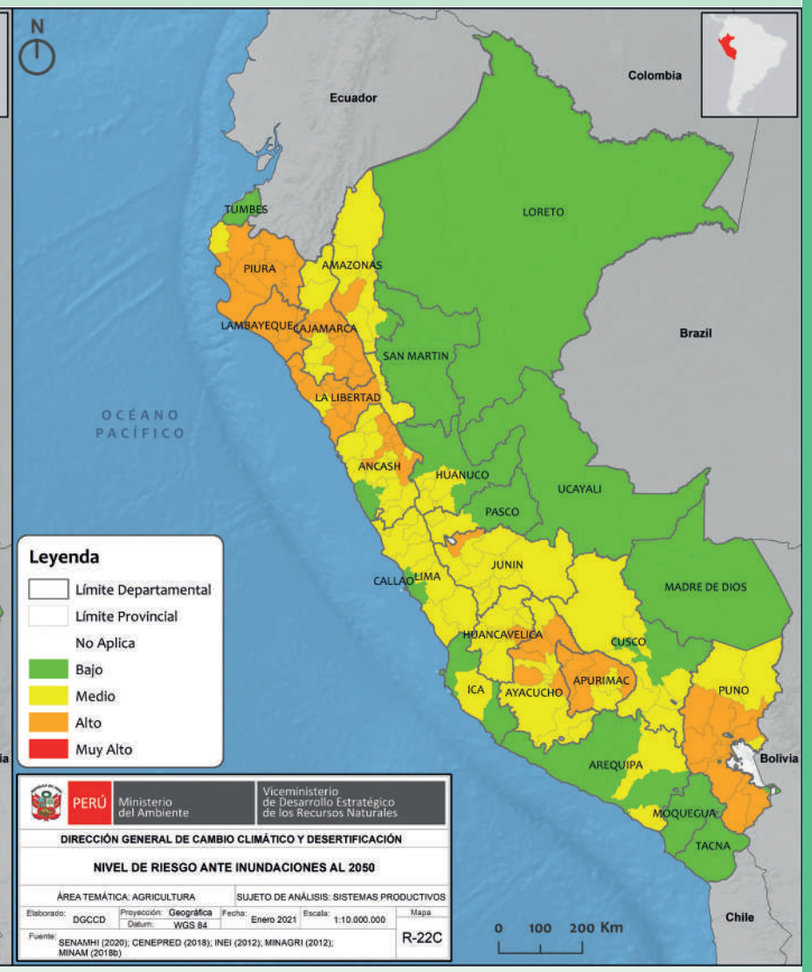
CLIMATE RISK SCENARIO OF PRODUCTIVE SYSTEMS DUE TO FLOODS

Thematic area: agriculture

Subject of analysis: productive systems	Hazard: floods







Probable trend in the level of risk

The level of risk due to floods for the ***productive systems*** subject of analysis, which comprises the value chain, agricultural land and producers, is higher in the northern coastal areas and the highlands due to a high level of exposure and vulnerability in both areas and a high hazard level in the northern coast of Peru. In the regions, we can specially highlight the high/very high exposure that is associated with the large size of the agricultural area and the high density of agricultural producers. Comparing the current scenario with future scenarios, a slight increase in risk can be seen in the center of the highlands, due to the behavior registered by the climatic trigger (mean total annual precipitation) with respect to the reference period.

Provinces with very high-risk levels

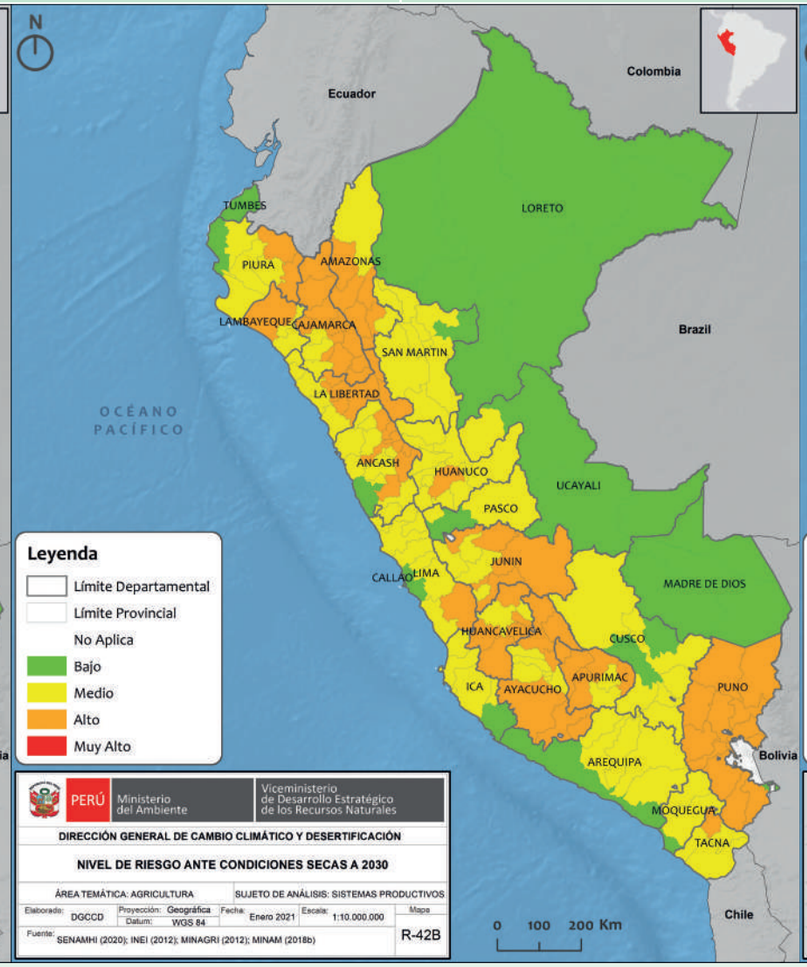
CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
N/A.	N/A.	N/A.

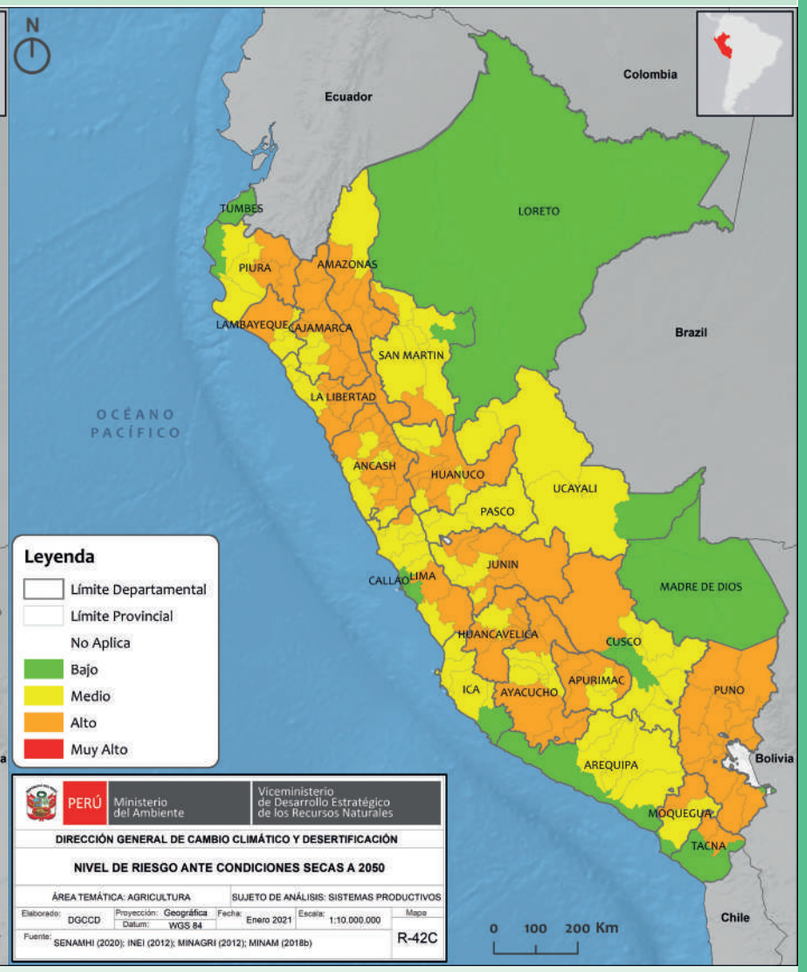
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF PRODUCTIVE SYSTEMS DUE TO CHANGES IN THE ARIDITY CONDITIONS

Thematic area: agriculture

Subject of analysis: productive systems	Hazard: change in aridity conditions





Probable trend in the level of risk

The level of risk due to change in aridity conditions for the ***productive systems*** subject of analysis is higher both in coastal areas and in the highlands, characterized by high levels of hazard, exposure and vulnerability climate change in arid conditions. In the regions, we can particularly highlight the high/very high exposure that is associated with the large size of the agricultural area and the high density of agricultural producers. Comparing the current scenario with the future scenarios, the appearance of new areas identified with a high level of risk can be seen both in the center and in the south of the coastal and highland areas. This difference in the level of risk is due to the increase in temperature and the decrease in precipitation during the climate change scenario, which favors an increase of arid conditions.

Provinces with very high-risk levels

CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
N/A.	N/A.	N/A.

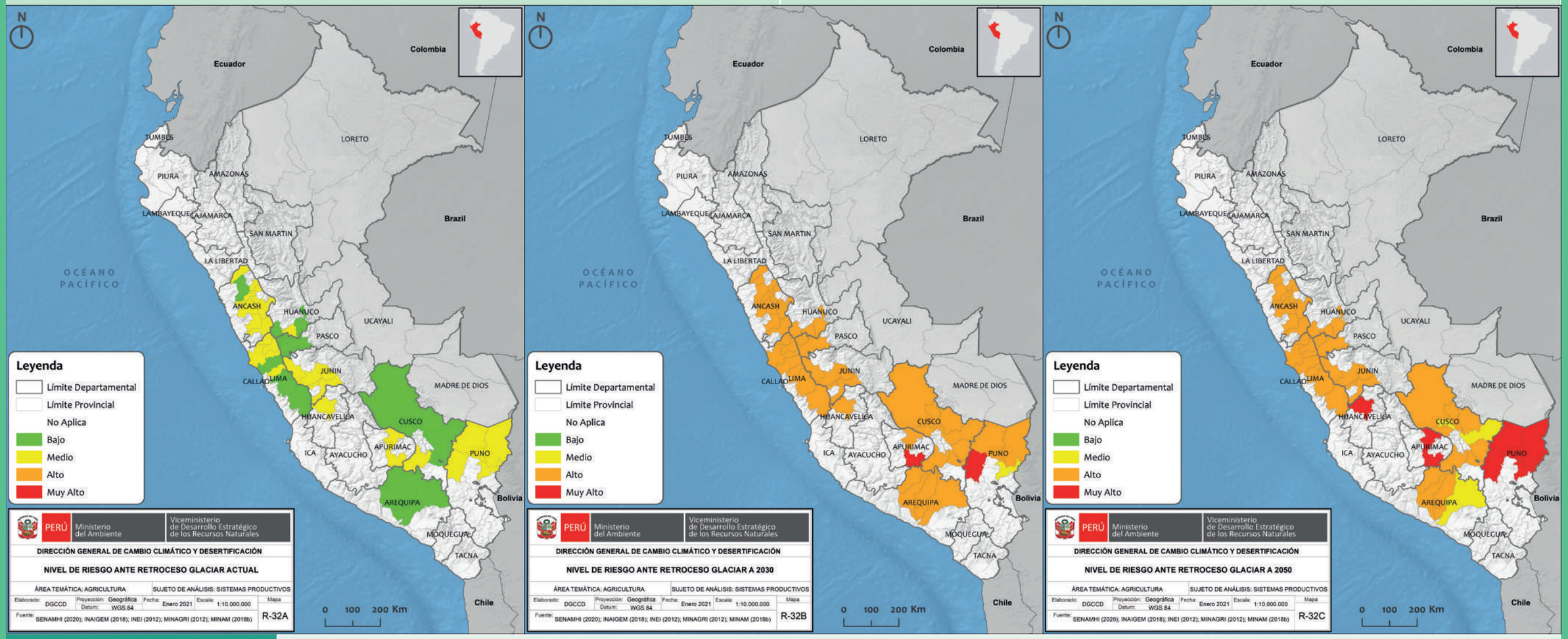
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF PRODUCTIVE SYSTEMS DUE TO GLACIAL RETREAT

Thematic area: agriculture

Subject of analysis: productive systems

Hazard: glacial retreat



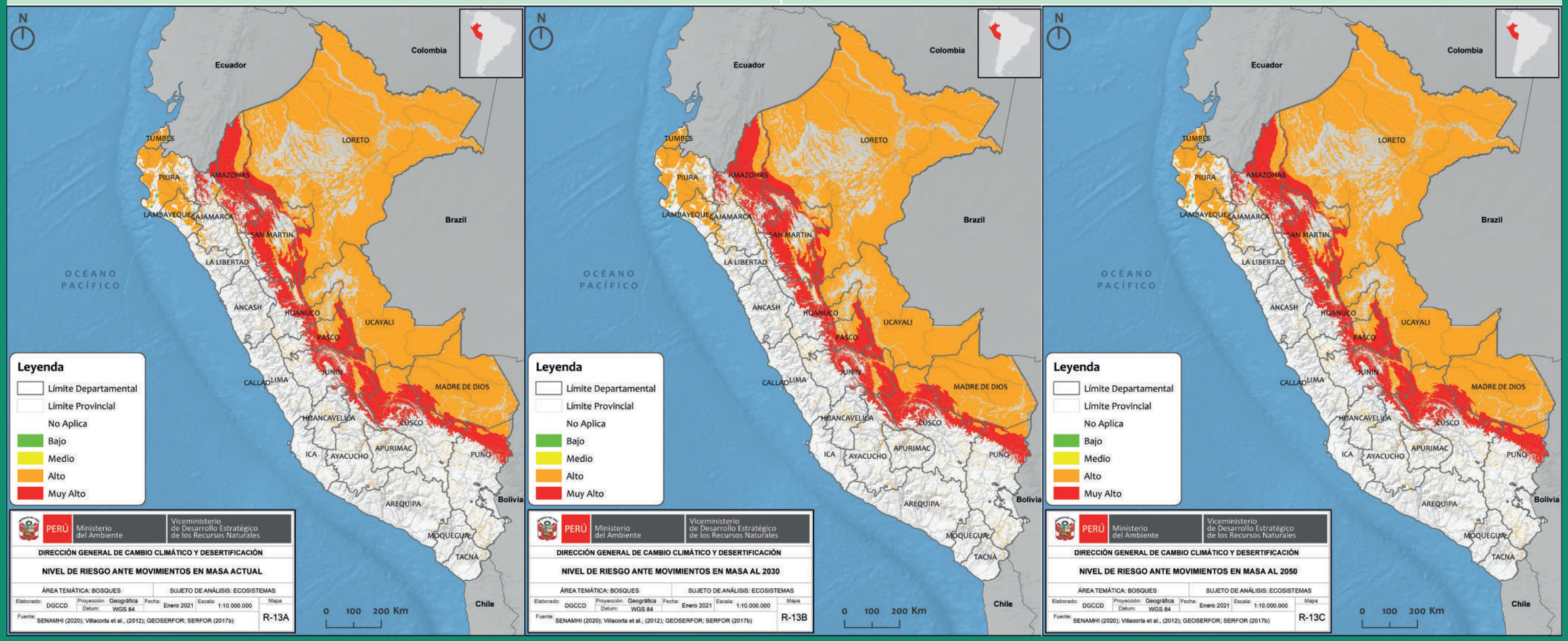
Probable trend in the level of risk	The level of risk due to glacial retreat for the ***productive systems*** subject of analysis is higher in the highlands, since the highest hazard, exposure and vulnerability levels are observed in this area. In the regions, we can specially highlight the high/very high exposure that is associated with the large size of the agricultural area and the high density of agricultural producers. Comparing the current scenario with the future scenarios, an increase in the level of risk is observed in the three scenarios (current, 2030 and 2050) as the time horizon increases due to the increase in measured temperatures.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	Antabamba and Melgar.	Abancay, Antabamba, Carabaya, Huancavelica, Melgar, San Antonio De Putina and Sandia.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ECOSYSTEMS DUE TO MASS MOVEMENTS

Thematic area: forestry

Subject of analysis: ecosystems	Hazard: mass movements



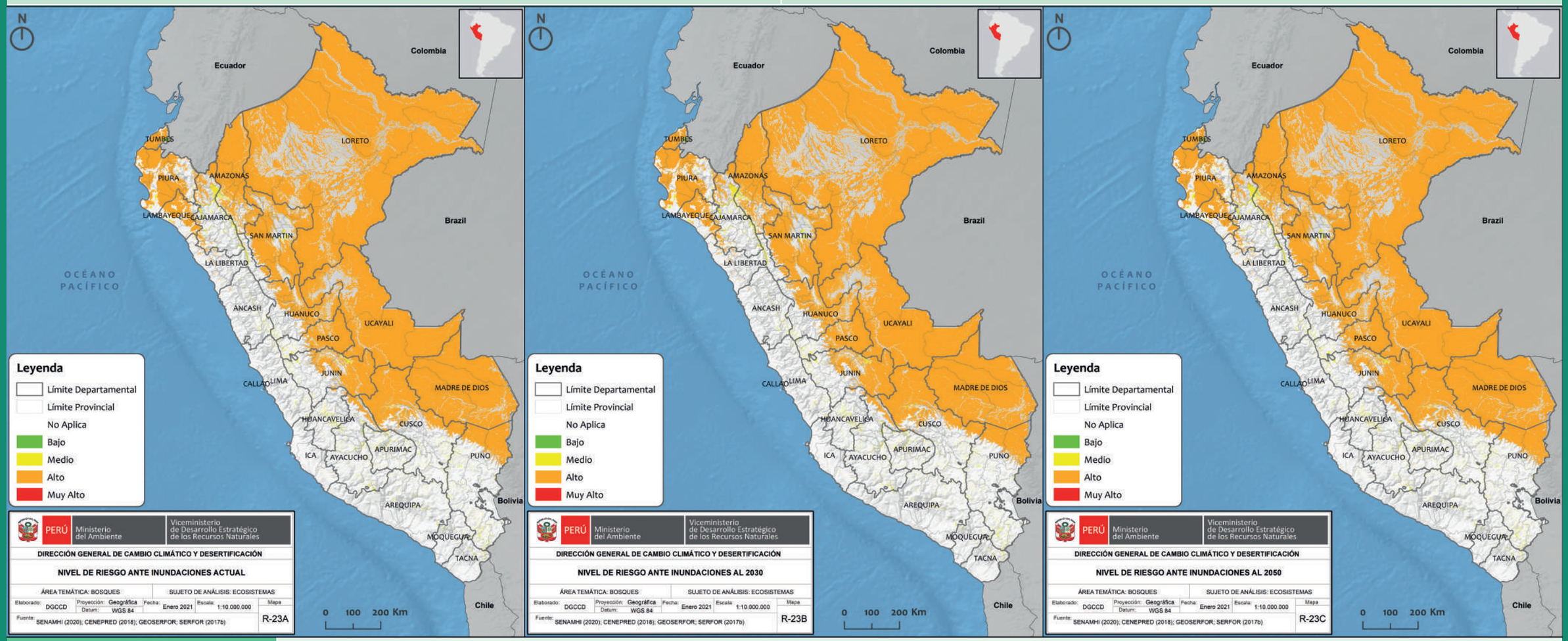
Probable trend in the level of risk	The level of risk due to mass movements for the ***ecosystems*** subject of analysis is higher on the eastern side of the High-Andean-lands due to the fact that the hazard level reaches the highest levels in this area and there is, in turn, the highest exposure (or, in other words, greater surface of ecosystems) and vulnerability (high presence of fragile ecosystems, high fragmentation of forests and high deforestation). Comparing the current scenario with the future scenarios, we can observe that in the different scenarios (current, 2030 and 2050) there is a similar behavior, since the hazard level remains relatively stable in the areas where the ecosystems are located.		
Ecosystems with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Yunga forest.	Yunga forest.	Yunga forest.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ECOSYSTEMS DUE TO FLOODS

Thematic area: forestry

Subject of analysis: ecosystems	Hazard: floods



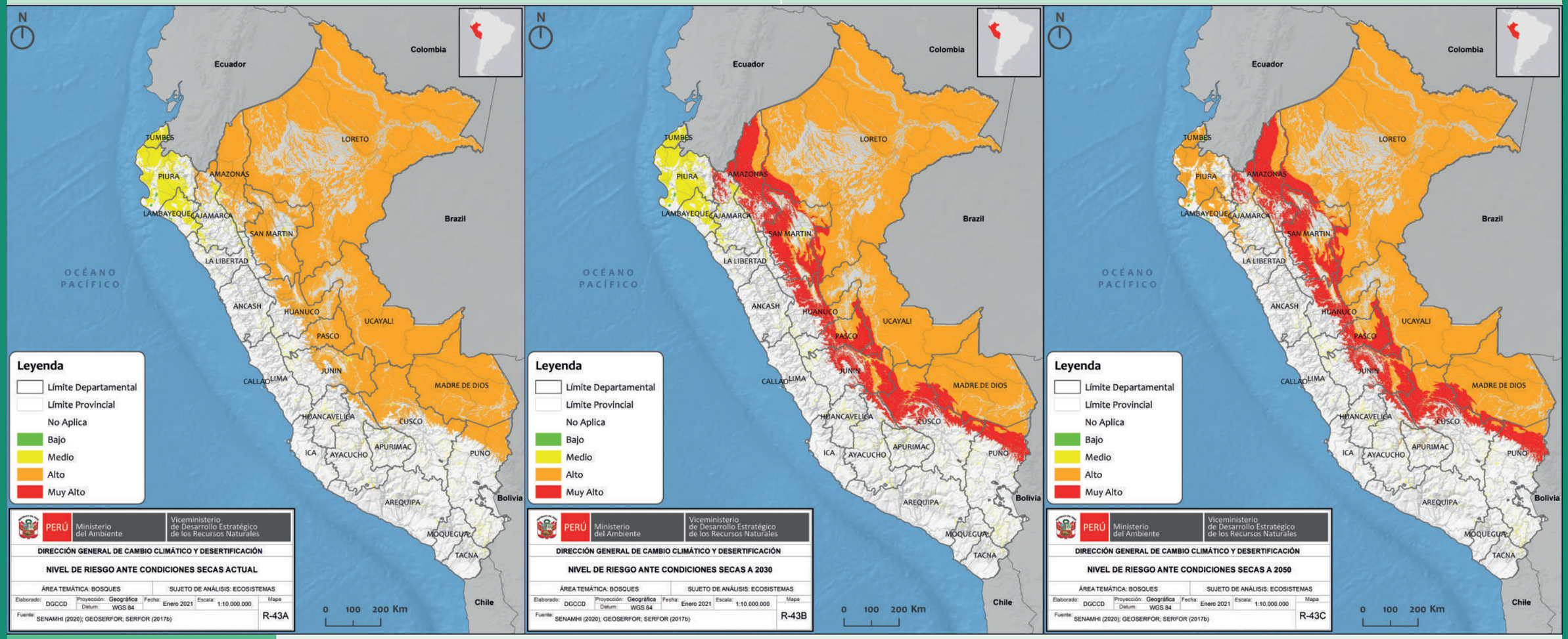
Probable trend in the level of risk	The level of risk due to floods for the ***ecosystems*** subject of analysis is higher mainly in the low Amazon region, coinciding with the location of the high hazard level due to floods. In the same way, it coincides with the main exposed areas (or, in other words, the ecosystems with the largest surface area) and with the most vulnerable areas (high presence of fragile ecosystems, high fragmentation of forests and high deforestation). Comparing the current scenario with future scenarios, we can observe that in the different time horizons there is an increase in risk in the medium time horizon (2030) and a decrease in risk in the long term (2050). This difference in risk level is due, once again, to the response recorded by the trigger.		
Ecosystems with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	N/A.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ECOSYSTEMS DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: forestry

Subject of analysis: ecosystems	Hazard: change in aridity conditions



Probable trend in the level of risk	The level of risk due to a change in aridity conditions for the ***ecosystems*** subject of analysis is higher mainly in the area of the highlands and the Amazon region. These areas coincide with the main exposed areas (or, in other words, the ecosystems with the largest surface area) and with the most vulnerable areas associated with the presence of fragile ecosystems, high fragmentation of forests and high deforestation. Comparing the current scenario with the future scenarios, a change in the aridity conditions is observed as the time horizon increases, which increases the risk in 2030 and 2050 with respect to the current period, mainly in the northern and southern highlands. In addition, there is an increased risk over the northern area where the Dry Forests are located. This difference in the level of risk is due, once again, to the increase in temperature and the decrease in precipitation in the future, which favors an increase of arid conditions.

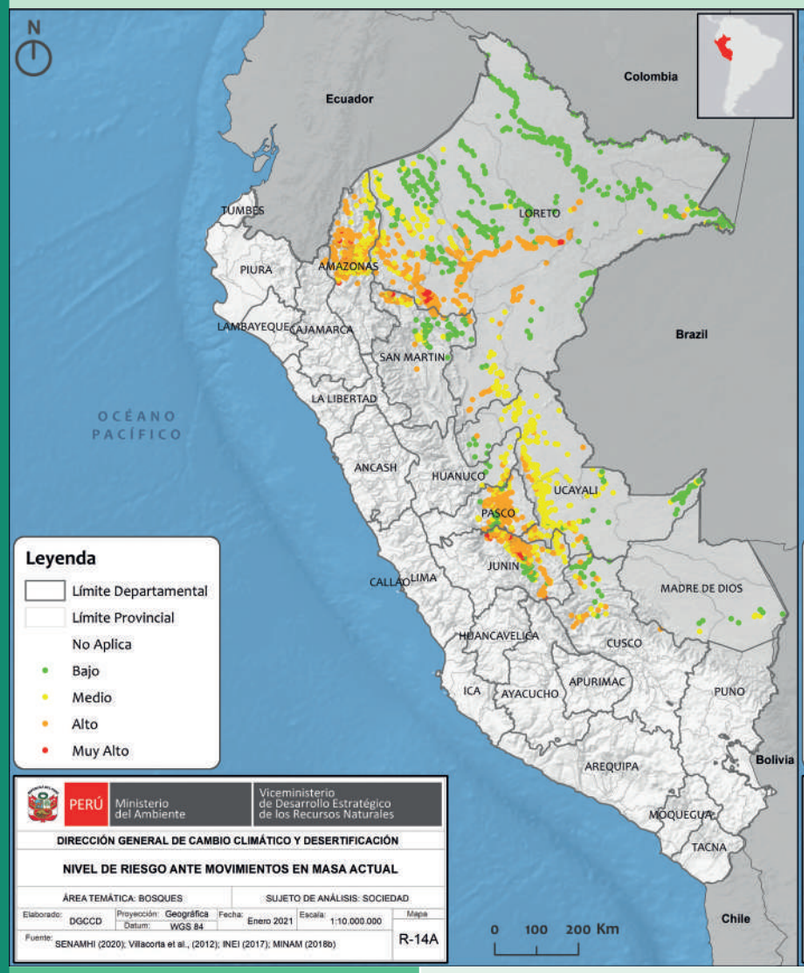
Ecosistemas con niveles de riesgo muy alto	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	Yunga forest.	Yunga forest.

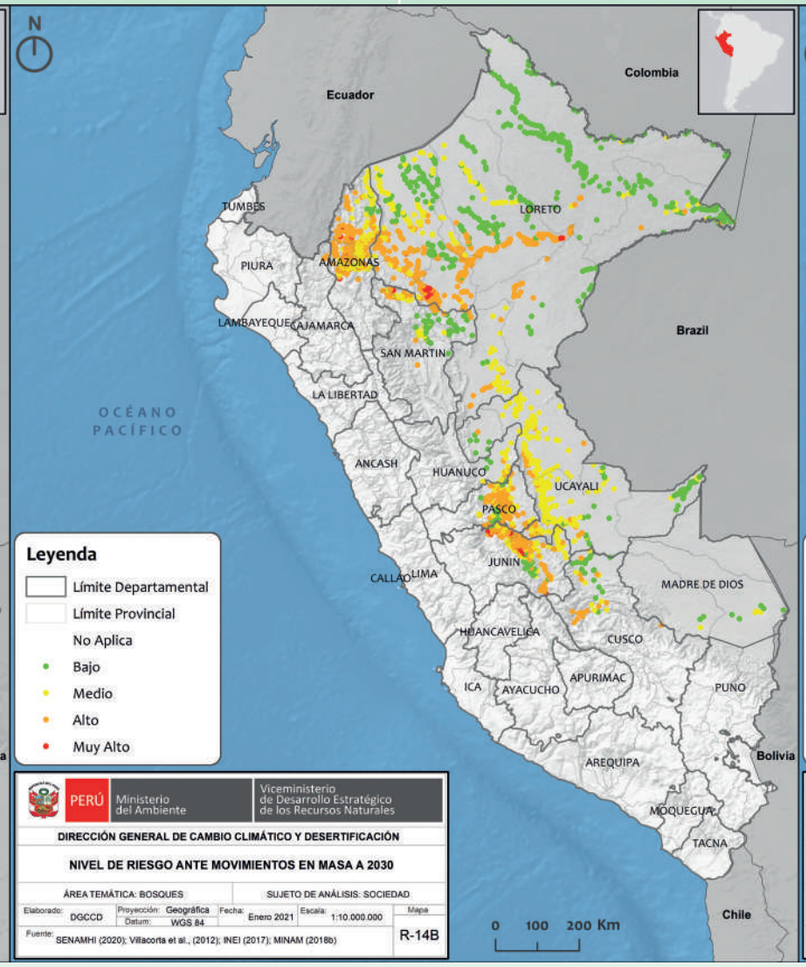
Source: Plan Nacional de Adaptación (MINAM, 2021).

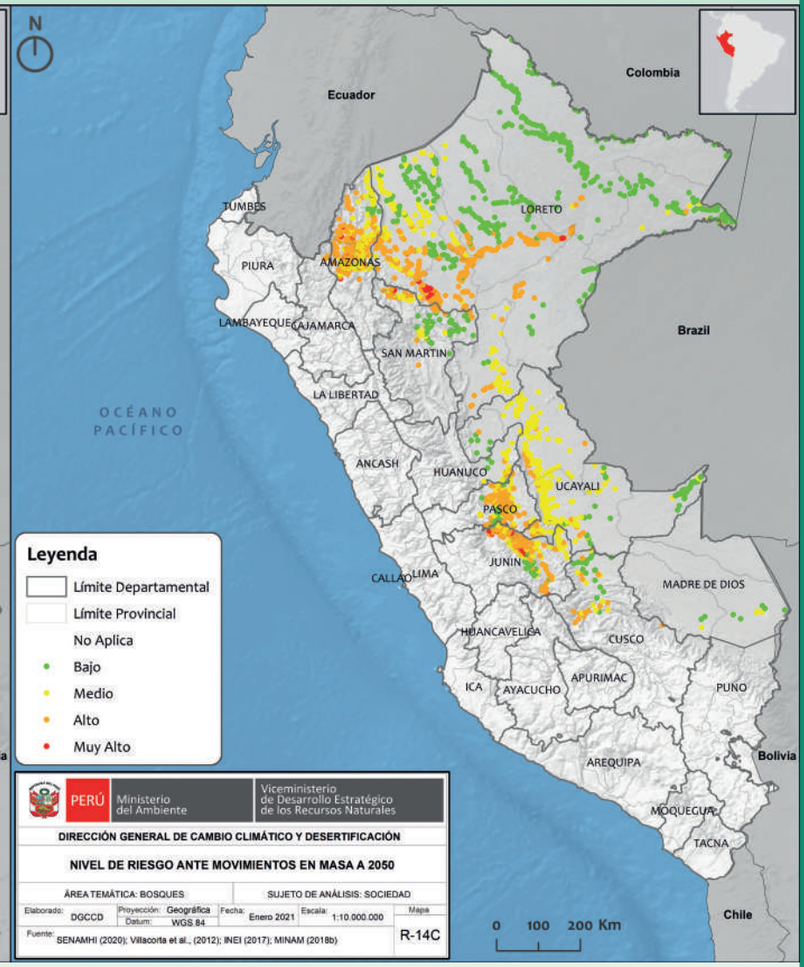
CLIMATE RISK SCENARIO OF SOCIETY DUE TO MASS MOVEMENTS

Thematic area: forestry

Subject of analysis: society	Hazard: mass movements







Probable trend in the level of risk

The level of risk due to mass movements for the ***society*** subject of analysis is higher in the Amazon region areas of northern and central Peru, and more specifically in the departments of Pasco, Junín, Amazonas and Loreto due to the very high exposure and high hazard due to mass movements in the indicated areas. These very high exposure areas are mainly due to a high number of communities identified in the census. Comparing the current scenario with the future scenarios, a similar behavior is observed, since the hazard level remains relatively stable under the different time horizons.

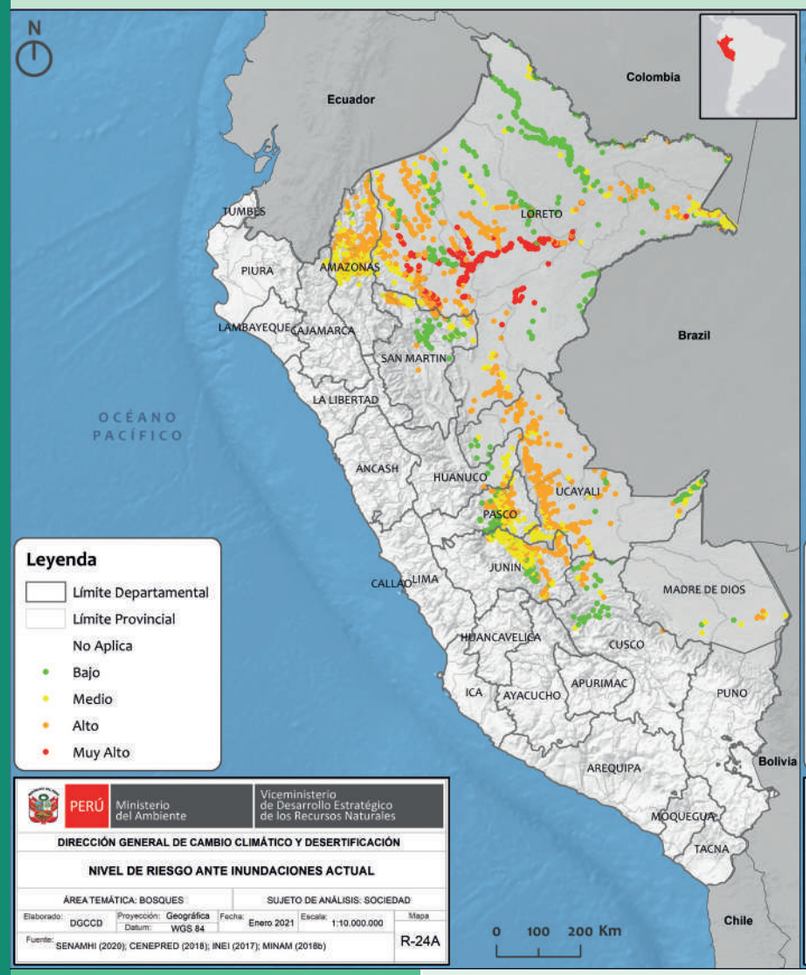
Social systems with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	Ashaninka, Shawi, Awajun and Kukama Kukamiria.	Ashaninka, Shawi, Awajun and Kukama Kukamiria.	Ashaninka, Shawi, Awajun and Kukama Kukamiria.

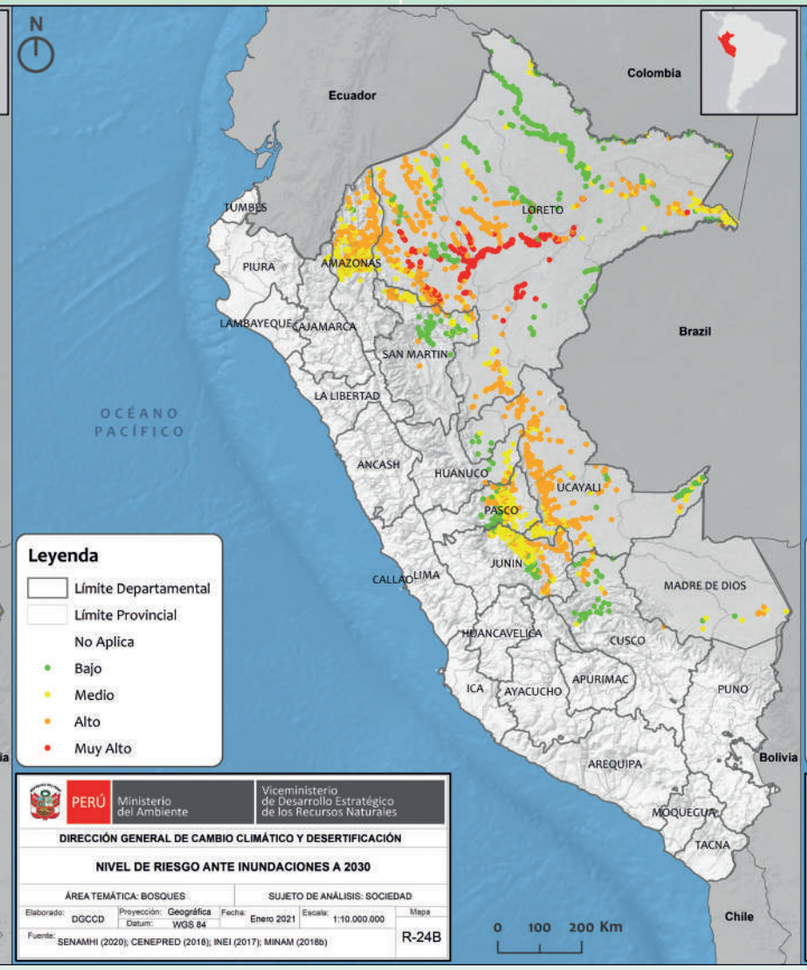
Source: Plan Nacional de Adaptación (MINAM, 2021).

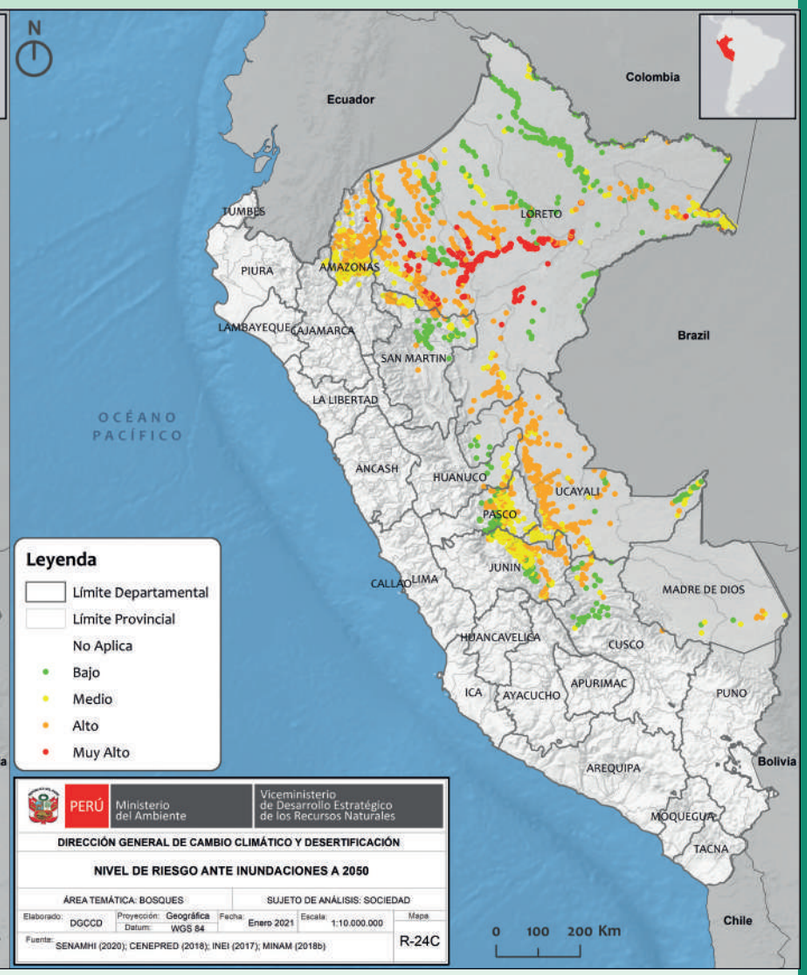
CLIMATE RISK SCENARIO OF SOCIETY DUE TO FLOODS

Thematic area: forestry

Subject of analysis: society | **Hazard: floods**







Probable trend in the level of risk

The level of risk due to floods for the ***society*** subject of analysis is higher in the Amazon region areas of northern and central Peru, and more specifically in areas such as Pasco, Junín, the north-western area of Ucayali, Amazonas and Loreto. This is due to the very high/high exposure (due to a high number of communities registered in the census) and the very high flooding hazard in these areas, as a result of the characteristics of the relief (low slope) and the fluvial dynamics of the rivers that change their waterways every year. Comparing the current scenario with the future scenarios, we observe that the risk of floods increases under the climate change scenario, and it gradually reduces within this scenario as the horizon analyzed expands. Thus, due to the reduction in total annual precipitation as the time horizon increases, the very high-risk level in the medium term (2030) is limited to the southwestern area of Loreto, Junín and Pasco; and southwest of Loreto for the long-term scenario (2050).

Social systems with very high-risk levels

CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
Shawi and Kukama Kukamiria.	Shawi, Awajun and Kukama Kukamiria.	Shawi, Awajun and Kukama Kukamiria.

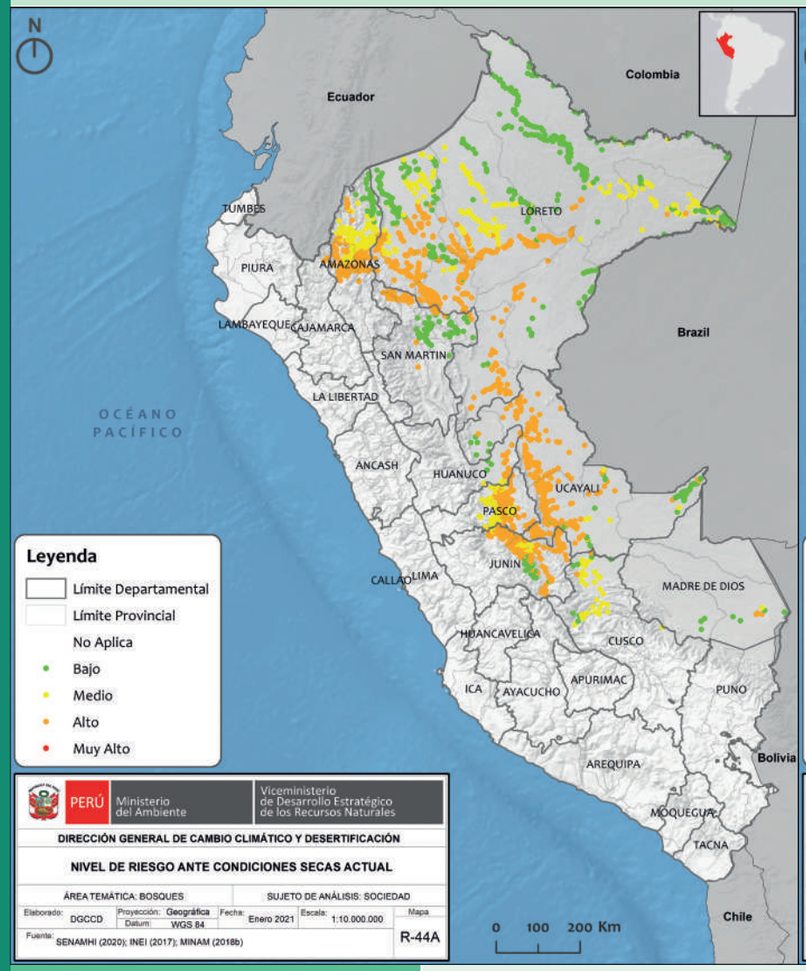
Source: Plan Nacional de Adaptación (MINAM, 2021).

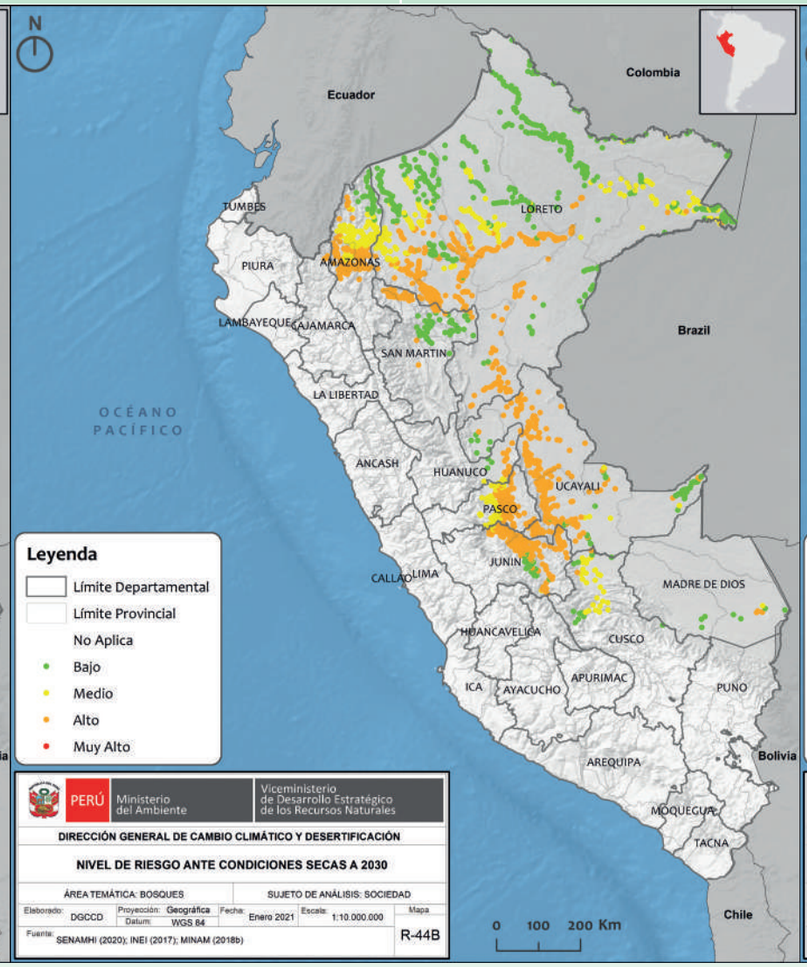
CLIMATE RISK SCENARIO OF SOCIETY DUE TO CHANGE IN THE ARIDITY CONDITIONS

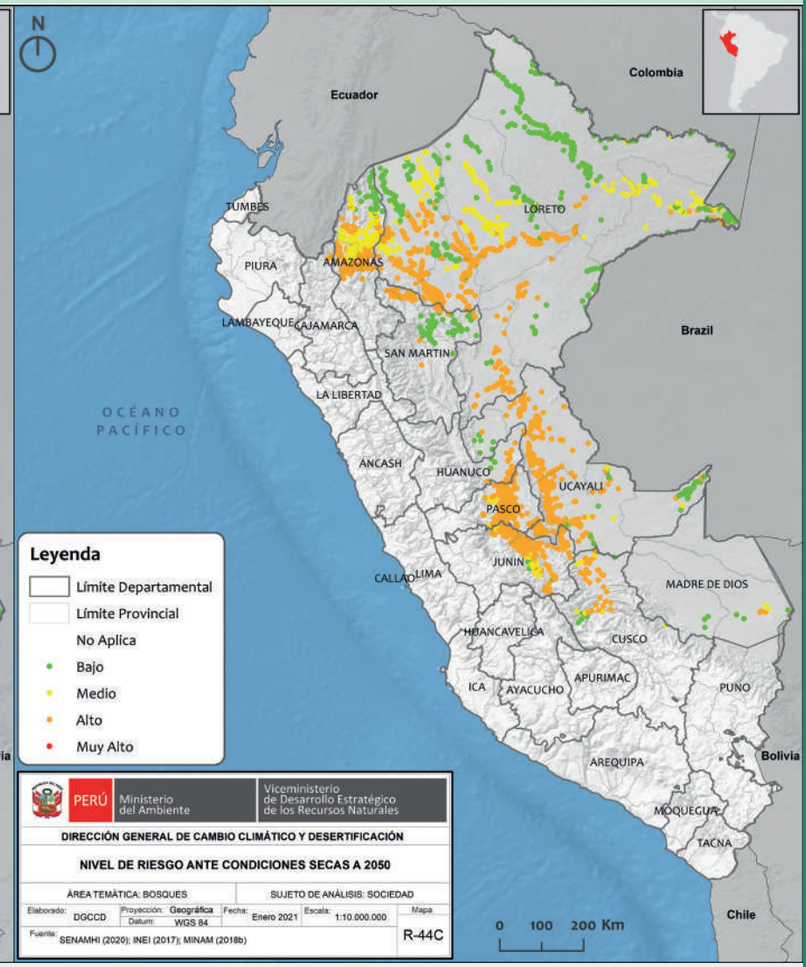
Thematic area: forestry

Subject of analysis: society

Hazard: change in aridity conditions







Probable trend in the level of risk

The level of risk due to a change in the aridity conditions for the ***society*** subject of analysis is higher in the Amazon region areas of northern and central Peru, and more specifically in the departments of Junín, Ucayali, San Martín, Amazonas and the southwest area of Loreto due to its very high/high exposure and medium/high vulnerability to the hazard of arid conditions. The location of the high exposure is due to a high number of communities registered in the census, while the high vulnerability values correspond to low percentages of property titles, communication services, the existence of educational and health institutions. When we compare the current scenario with the future scenarios, there are no major differences. This is because, despite the differences between the different scenarios, they are not important enough to be visible in the risk result.

Social systems with very high-risk levels

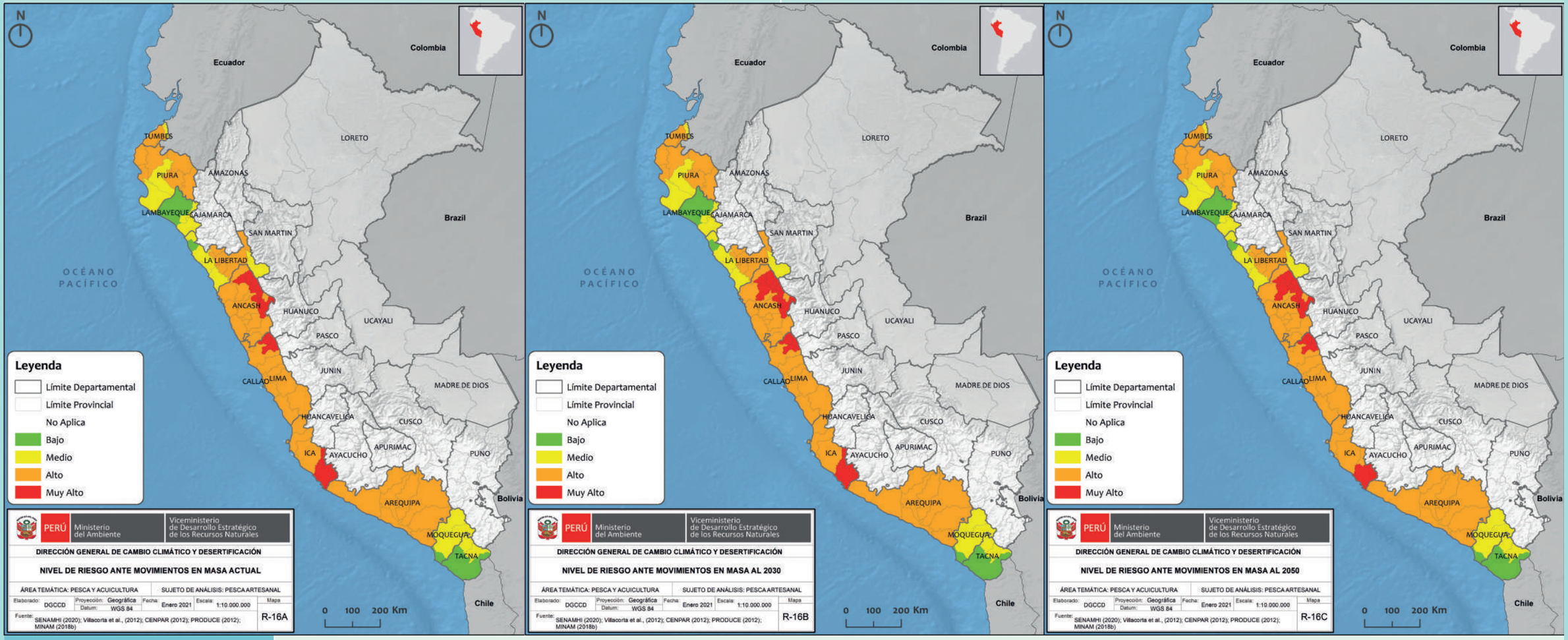
CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
N/A.	N/A.	Kukama Kukamiria.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ARTISANAL FISHING DUE TO MASS MOVEMENTS

Thematic area: fishing and aquaculture

Subject of analysis: artisanal fishing | **Hazard: mass movements**



Probable trend in the level of risk	The level of risk due to mass movements for the ***artisanal fishing*** subject of analysis is high and very high along the entire Peruvian coast, and the departments of Ancash, Lima and Ica show the highest risk due to their high and very high exposure and the high mass movements hazard located in the highest altitudes. These regions have high and very high exposure values that are associated with a high number of fishermen and a high number of loading points. When we compare the current scenario with the future scenarios, no major differences can be observed. Only in one part of the territory of Piura, in the north, is the risk of mass movements reduced due to a reduction in precipitation for the long-term time horizon (2050).		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Asunción, Cajatambo, Carlos Fermín Fitzcarrald, Corongo, Huari, Mariscal Luzuriaga, Nazca, Oyon, Palpa, Pomabamba and Sihuas.	Asunción, Cajatambo, Carlos Fermín Fitzcarrald, Corongo, Huari, Mariscal Luzuriaga, Nazca, Oyon, Palpa, Pomabamba, Sihuas and Huaylas.	Asunción, Cajatambo, Carlos Fermín Fitzcarrald, Corongo, Huari, Mariscal Luzuriaga, Nazca, Oyon, Palpa, Pomabamba and Sihuas.

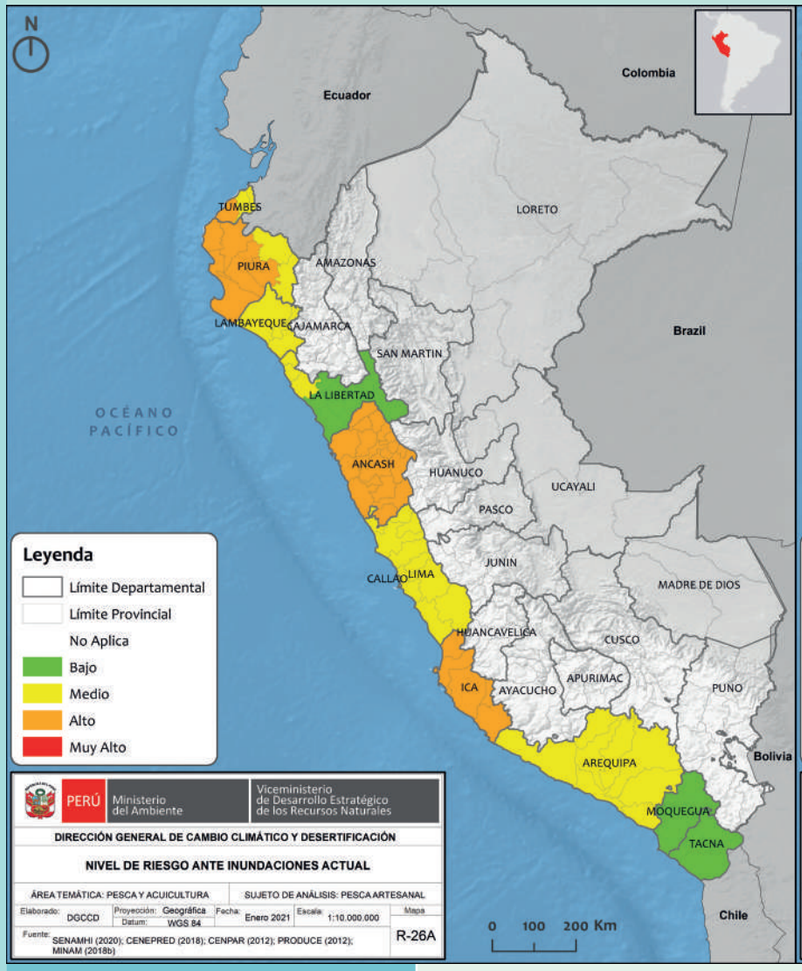
Source: Plan Nacional de Adaptación (MINAM, 2021).

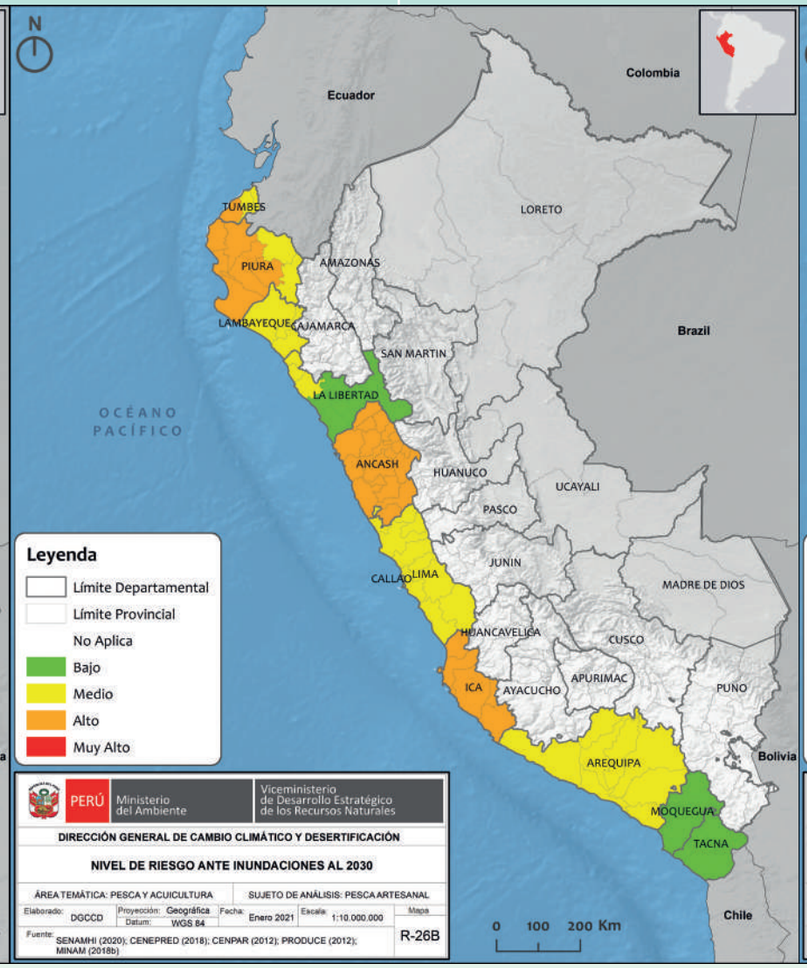
CLIMATE RISK SCENARIO OF ARTISANAL FISHING DUE TO FLOODS

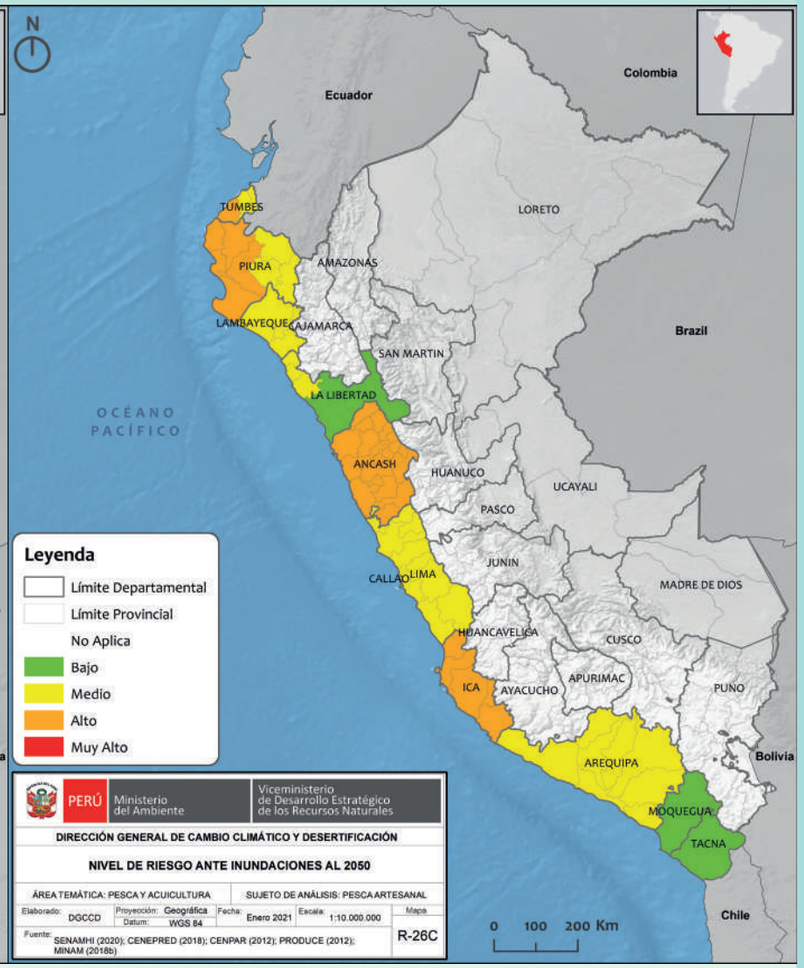
Thematic area: fishing and aquaculture

Subject of analysis: artisanal fishing

Hazard: floods







Probable trend in the level of risk

The level of risk due to floods for the ***artisanal fishing*** subject of analysis is higher in the northern (department of Piura) and central (department of Ancash and Ica) areas of the Peruvian coast due to their high/very high exposure, high vulnerability and the high flooding risk in the area. Especially noteworthy is the high vulnerability value in these areas, which is determined by a lower presence of communication systems and basic services, as well as a greater number of fish extracted by artisanal fishermen. When we compare the current scenario with the future scenarios, we observe major differences. Only in one part of the territory of Piura, in the north, is the flood risk reduced due to a reduction in precipitation for the long-term time horizon (2050).

Provinces with very high-risk levels

CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
N/A.	N/A.	N/A.

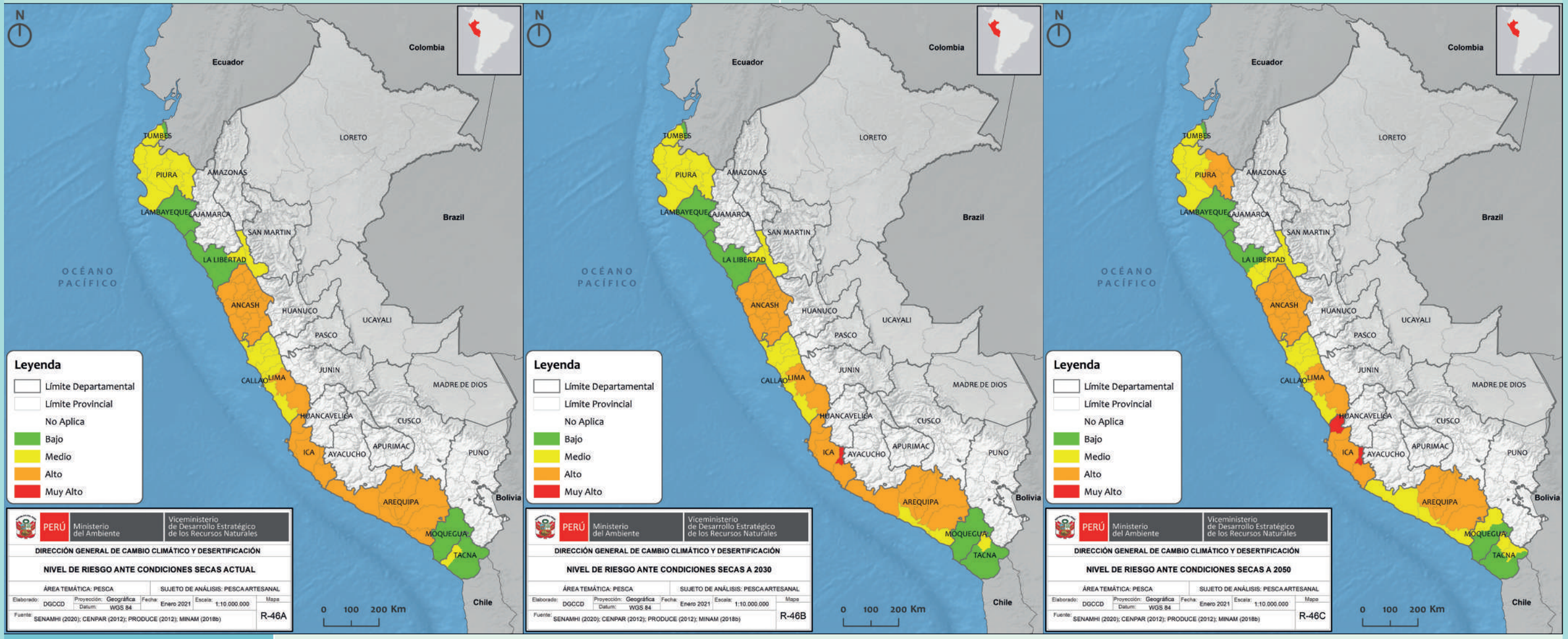
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ARTISANAL FISHING DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: fishing and aquaculture

Subject of analysis: artisanal fishing

Hazard: change in aridity conditions



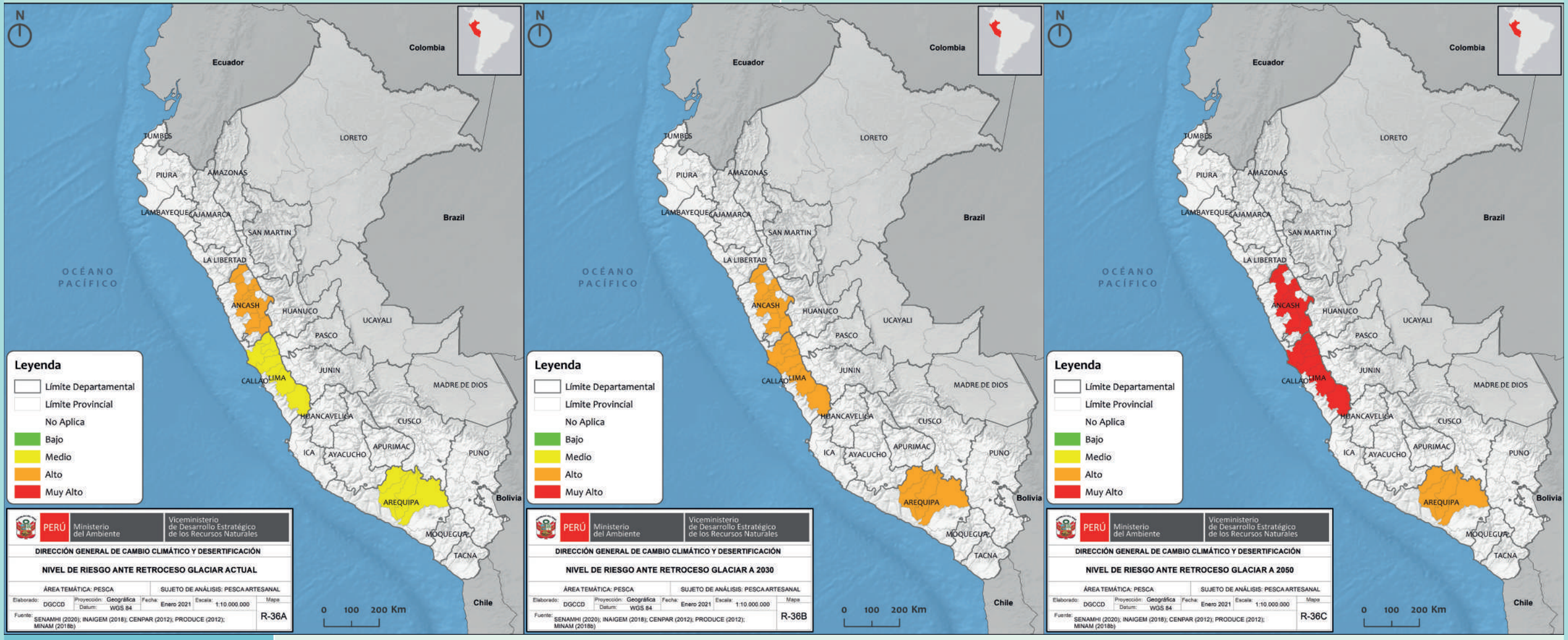
Probable trend in the level of risk	The level of risk due to the change in the aridity conditions for the ***artisanal fishing*** subject of analysis is greater in the center and south of the Peruvian coast. The risk is especially high in the departments of Ancash, Ica and Arequipa and part of the provinces of Lima, due to their high/very high exposure (due to a high number of fishermen and a high number of loading points) and the high hazard from changes in aridity conditions. Comparing the current scenario with the future scenarios, a slight difference is observed that is reflected in the increase in dry conditions as the time horizon increases. The main reason is due to the behavior recorded in precipitation, which decreases to a greater extent over the long-term horizon.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	Palpa.	Palpa and Chincha.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF ARTISANAL FISHING DUE TO GLACIAL RETREAT

Thematic area: fishing and aquaculture

Subject of analysis: artisanal fishing | **Hazard: glacial retreat**



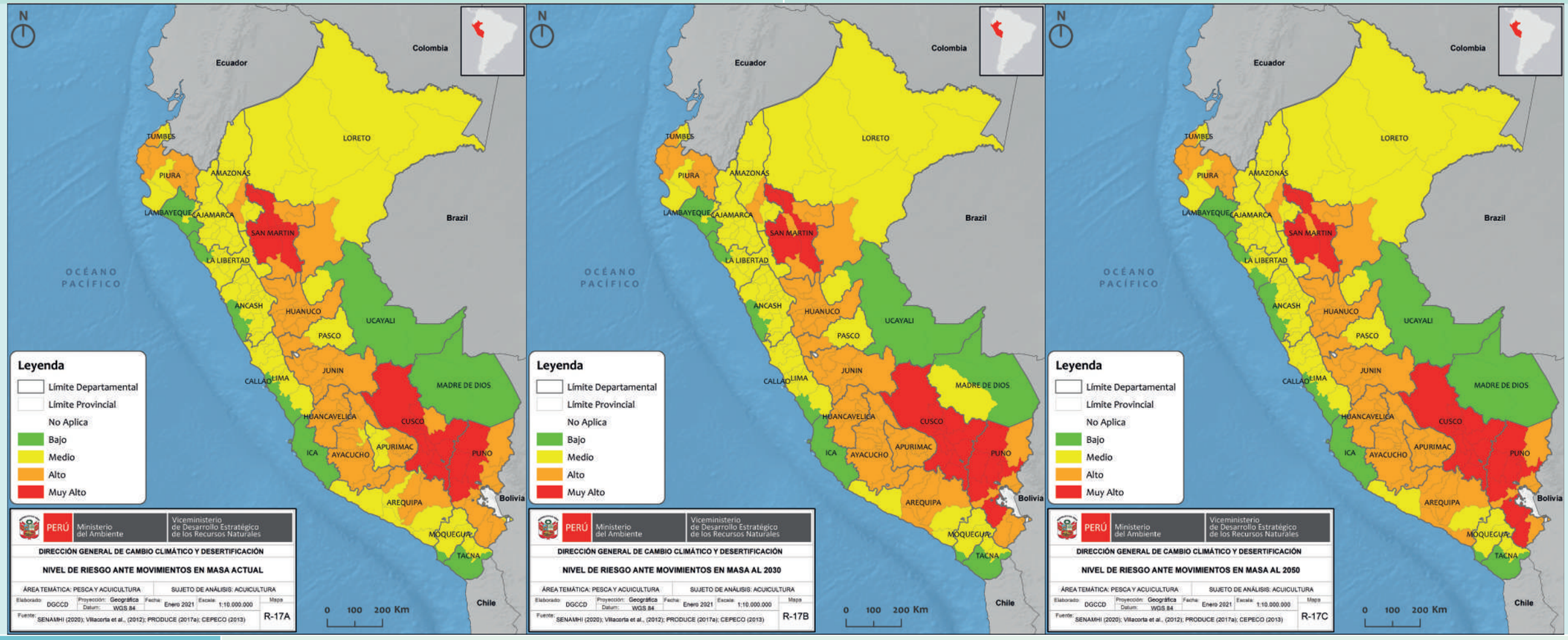
Probable trend in the level of risk	The level of risk due to glacial retreat for the ***artisanal fishing*** subject of analysis is greater in the center of the Peruvian coast. The risk is especially high in the department of Ancash and Lima, due to their high/very high exposure (due to a high number of fishermen and a high number of loading points) and the high/very high hazard due to glacial retreat. Comparing the current scenario with the future scenarios, there is an increase in the level of risk in the medium and long term due to the increase in measured temperatures as the time horizon increases.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	Asunción, Bolognesi, Cajatambo, Canta, Carhuaz, Corongo, Huaral, Huaraz, Huari, Huarochirí, Huaura, Huaylas, Mariscal Luzuriaga, Oyon, Pallasca, Pomabamba, Recuay, Yauyos and Yungay.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF AQUACULTURE DUE TO MASS MOVEMENTS

Thematic area: fishing and aquaculture

Subject of analysis: aquaculture | **Hazard: mass movements**



Probable trend in the level of risk	The level of risk due to mass movements for the ***aquaculture*** subject of analysis is high in certain areas of the north and south of the Peruvian highlands. More specifically, in several provinces of the departments of San Martín in the north and Cusco and Puno in the south, due to their very high exposure, high vulnerability and the high/very high mass movements hazard of the Eastern Mountain Range and the strip that covers the northeast portion of Ayacucho, Apurímac, the central region of Cusco and the north of Puno. These areas are especially defined by high vulnerability levels, which are associated with a higher harvest and less productive diversity. Comparing the current scenario with the future scenarios, similar risk levels are observed, with the exception of some provinces of Junín, which present a slight increase in the hazard level in the medium-term period.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Acomayo, Anta, Azángaro, Bellavista, Calca, Canas, Canchis, Carabaya, Chumbivilcas, Cusco, El Dorado, Espinar, Huallaga, La Convención, Lampa, Mariscal Cáceres, Melgar, Moyobamba, Paruro, Picota, Quispicanchi, Rioja and Urubamba.	Acomayo, Anta, Azángaro, Bellavista, Calca, Canas, Canchis, Carabaya, Chumbivilcas, Cusco, El Dorado, Espinar, Huallaga, La Convención, Lampa, Mariscal Cáceres, Melgar, Moyobamba, Paruro, Picota, Quispicanchi, Rioja, Urubamba, San Antonio de Putina and Paucartambo.	Acomayo, Anta, Azángaro, Bellavista, Calca, Canas, Canchis, Carabaya, Chumbivilcas, Cusco, El Collao, El Dorado, Espinar, La Convención, Lampa, Mariscal Cáceres, Melgar, Moyobamba, Paruro, Paucartambo, Picota, Puno, Quispicanchi, Rioja, San Antonio De Putina and Urubamba.

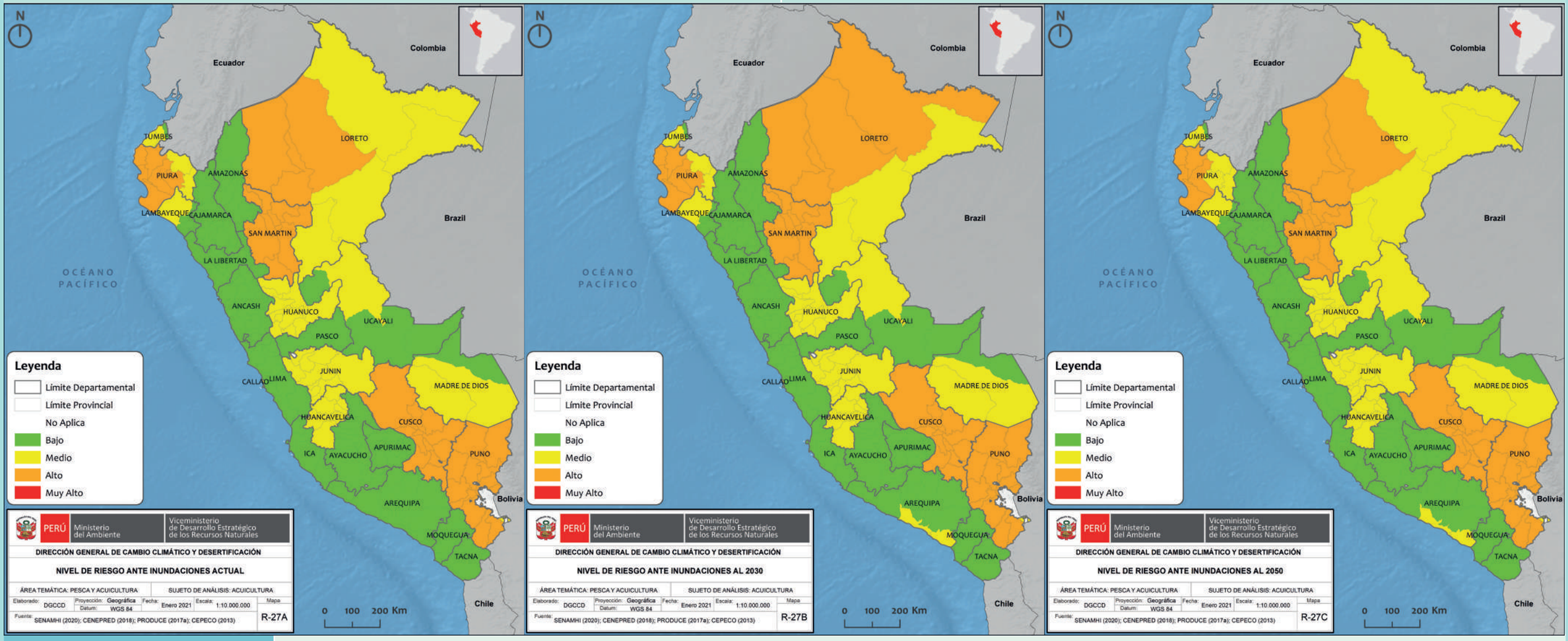
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF AQUACULTURE DUE TO FLOODS

Thematic area: fishing and aquaculture

Subject of analysis: aquaculture

Hazard: floods



Probable trend in the level of risk	The level of risk due to floods for the ***aquaculture*** subject of analysis is greater in the coastal and Amazon region areas of northern and southern Peru. The risk is especially high in the northeast Amazon region of the department of Loreto where a very high exposure is concentrated with a high hazard related to floods due the characteristics of the relief (low slope) and the fluvial dynamics of the Amazon River that changes its waterways every year. Moreover, these areas are especially defined by high vulnerability levels, which are associated with a higher harvest and less productive diversity. Comparing the current scenario with the future scenarios, an increase in the risk level is observed for the future, and it then decreases for the 2050-time horizon due to a reduction in precipitation.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	N/A.

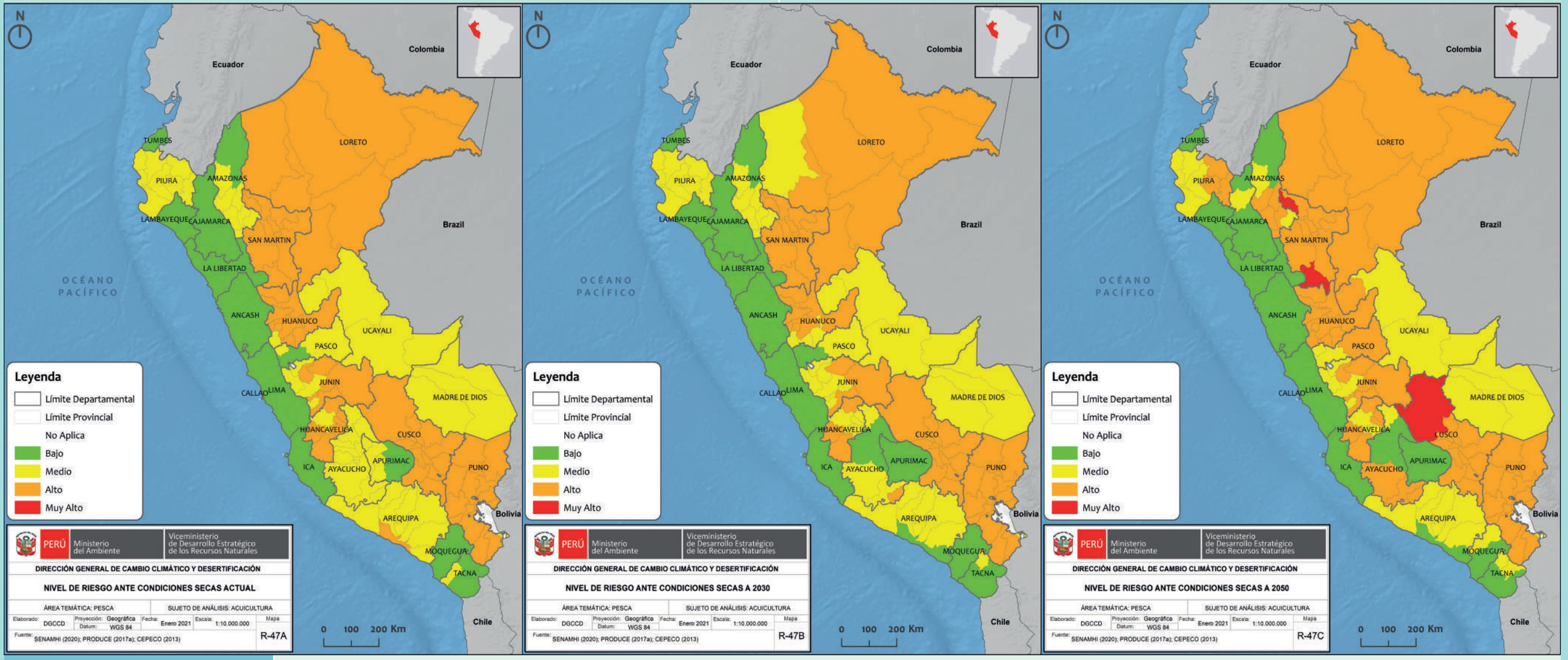
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF AQUACULTURE DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: fishing and aquaculture

Subject of analysis: aquaculture

Hazard: change in aridity conditions



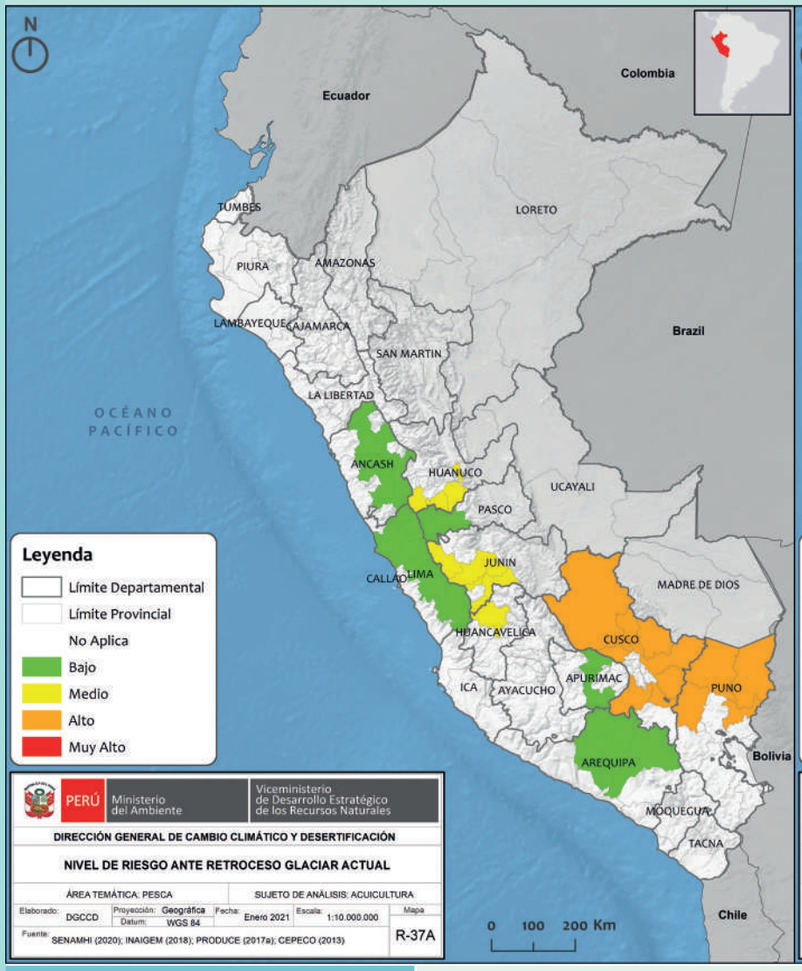
Probable trend in the level of risk	The level of risk due to the change in the aridity conditions for the ***aquaculture*** subject of analysis is greater in the north and south of Peru, predominantly comprising the Amazon region and highland areas. The risk is especially high in parts of the departments of San Martín, Cusco and Puno, where, in addition to having a very high exposure, they have high or very high hazard levels due to changes in the aridity conditions. These areas are defined by high vulnerability levels, which are associated with a higher harvest and less productive diversity, and with very high exposure values, which are related to a greater number of aquaculture rights. Comparing the current scenario with the future scenarios, a slight difference is observed that is reflected in the increase in dry conditions as the time horizon increases. The main reason is due to the behavior recorded in precipitation, which decreases to a greater extent during the long-term horizon.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	La Convención, Rioja and Tocache.

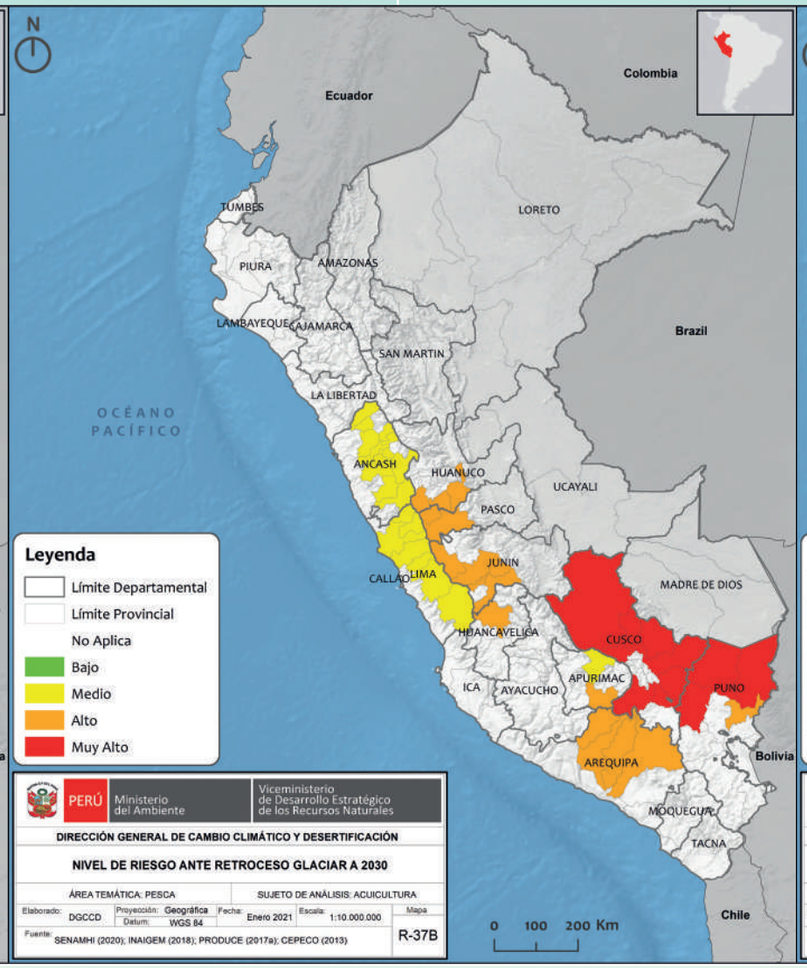
Source: Plan Nacional de Adaptación (MINAM, 2021).

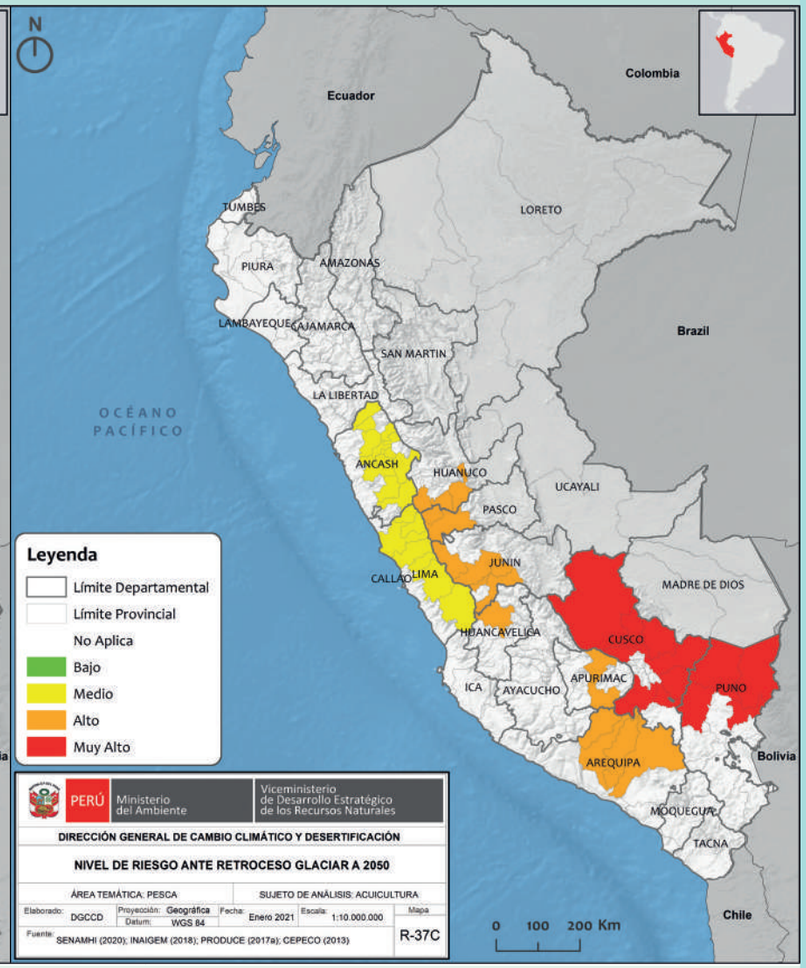
CLIMATE RISK SCENARIO OF AQUACULTURE DUE TO GLACIAL RETREAT

Thematic area: fishing and aquaculture

Subject of analysis: aquaculture | **Hazard: glacial retreat**







Probable trend in the level of risk

The level of risk due to glacial retreat for the ***aquaculture*** subject of analysis is higher in the southern part of Peru, specifically in the departments of Cusco and Puno, presenting a high-risk level on the present horizon. In these areas, there is a very high exposure value, due to a higher harvest and less diversity, and a high level of vulnerability due to a greater number of aquaculture rights. Comparing the current scenario with the future scenarios, we can observe that that for the future short and medium term horizons the risk increases one level for all the affected provinces, reaching the category of very high, due to a strong increase in the combined hazard level with a very high exposure and vulnerability in these areas. The greatest risk occurs in the southeastern region, but also in the highlands and coastal areas of central Peru.

Provinces with very high-risk levels

CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
N/A.	Urubamba, Anta, Canas, Calca, Canchis, Chumbivilcas, Paucartambo, Melgar, Quispicanchi, Carabaya, Sandia and La Convención.	Anta, Calca, Canas, Canchis, Carabaya, Chumbivilcas, La Convención, Melgar, Paucartambo, Quispicanchi, San Antonio De Putina, Sandia and Urubamba.

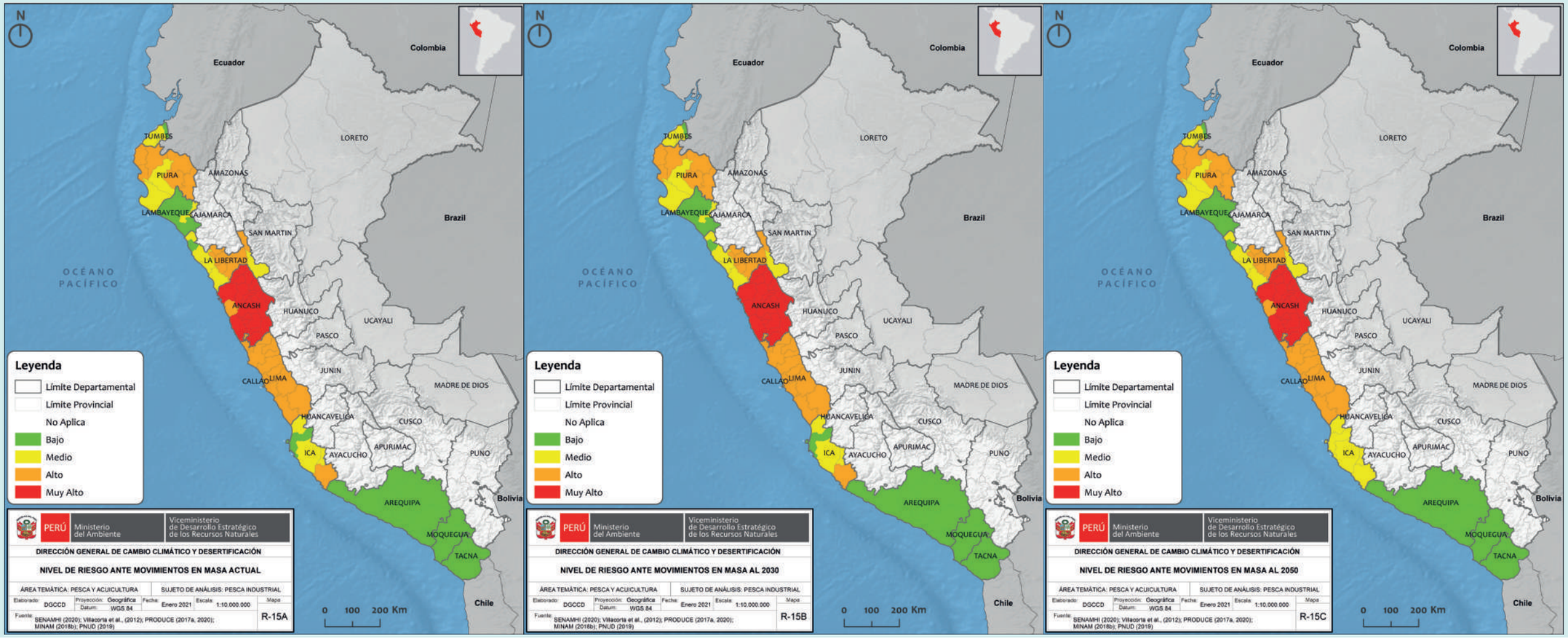
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF INDUSTRIAL FISHING DUE TO MASS MOVEMENTS

Thematic area: fishing and aquaculture

Subject of analysis: industrial fishing

Hazard: mass movements



Probable trend in the level of risk	The level of risk due to mass movements for the ***industrial fishing*** subject of analysis is high in certain areas of the north and center of the Peruvian coast. More specifically, in the provinces of the department of Piura in the north, and of La Libertad, Ancash, Lima and Ica in the center. mainly associated with the high number of industrial fishing establishments (high exposure) located in these regions, with the high landings of resources and the high capacity of the industrial fishing fleet (high sensitivity), as well as the high mass movements hazard the highlands have. Comparing the current scenario with the future scenarios, slight variations are observed in the department of Ancash and Ica that respond to the increase experienced by the climate trigger (total annual precipitation) during the medium-term time horizon (2030).		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Aija, Antonio Raymondi, Asunción, Bolognesi, Carhuaz, Carlos Fermín Fitzcarrald, Corongo, Huaraz, Huari, Huarmey, Huaylas, Mariscal Luzuriaga, Ocros, Pallasca, Pomabamba, Recuay, Santa, Sihuas and Yungay.	Aija, Antonio Raymondi, Asunción, Bolognesi, Carhuaz, Carlos Fermín Fitzcarrald, Corongo, Huaraz, Huari, Huarmey, Huaylas, Mariscal Luzuriaga, Ocros, Pallasca, Pomabamba, Recuay, Santa, Sihuas, Yungay and Casma.	Aija, Antonio Raymondi, Asunción, Bolognesi, Carhuaz, Carlos Fermín Fitzcarrald, Corongo, Huaraz, Huari, Huarmey, Huaylas, Mariscal Luzuriaga, Ocros, Pallasca, Pomabamba, Recuay, Santa, Sihuas and Yungay.

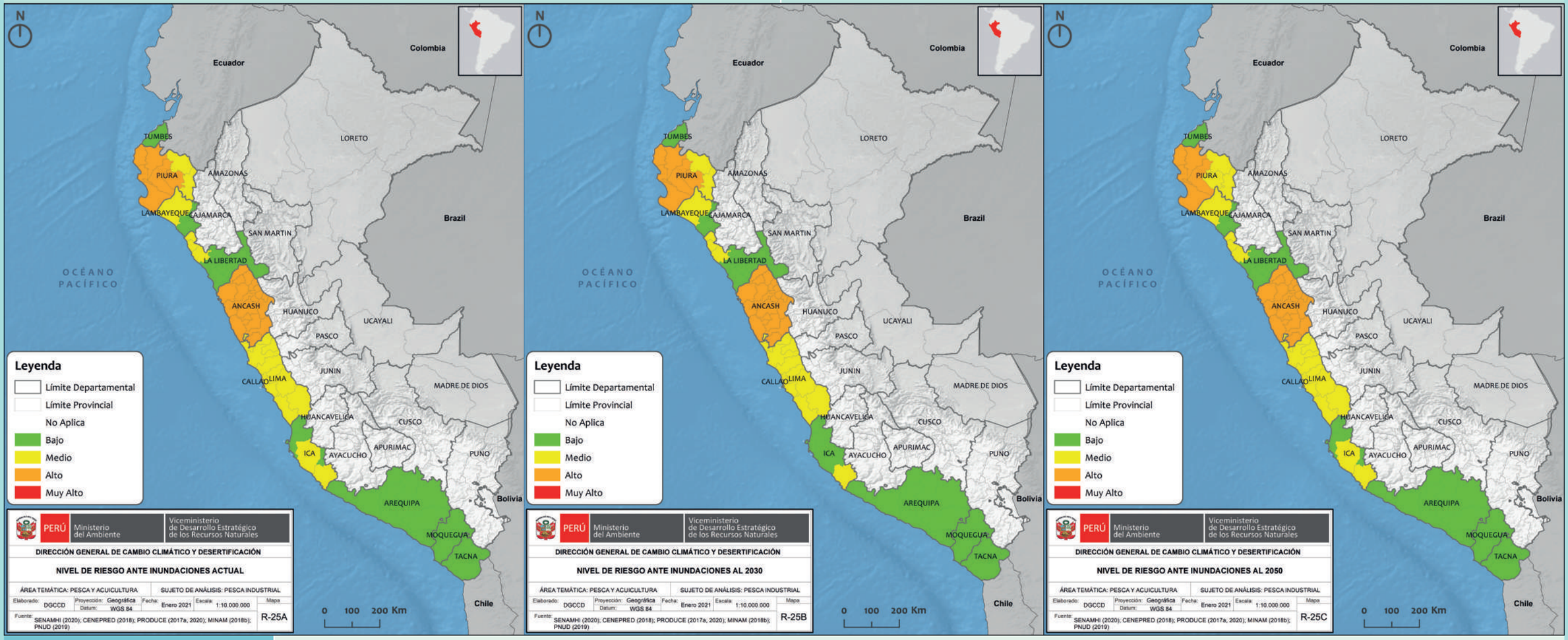
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF INDUSTRIAL FISHING DUE TO FLOODS

Thematic area: fishing and aquaculture

Subject of analysis: industrial fishing

Hazard: floods



Probable trend in the level of risk	The level of risk due floods for the ***industrial fishing*** subject of analysis is high in the areas of the north and center of the Peruvian coast. Particularly, in the provinces of the department of Piura in the north, and of Ancash in the center, mainly associated with the high number of industrial fishing establishments (high exposure) located in these regions, as well as the high landings of resources and the high capacity of the industrial fishing fleet (high sensitivity) Comparing the current scenario with the future scenarios, slight variations are observed in the departments of Piura and Ica. On the one hand, the risk in the department of Piura decreases for the long-term horizon (2050) due to the decrease experienced by the climate trigger (mean total annual precipitation). And, on the other hand, the risk increases in some provinces of the department of Ica due to increased precipitation.

Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

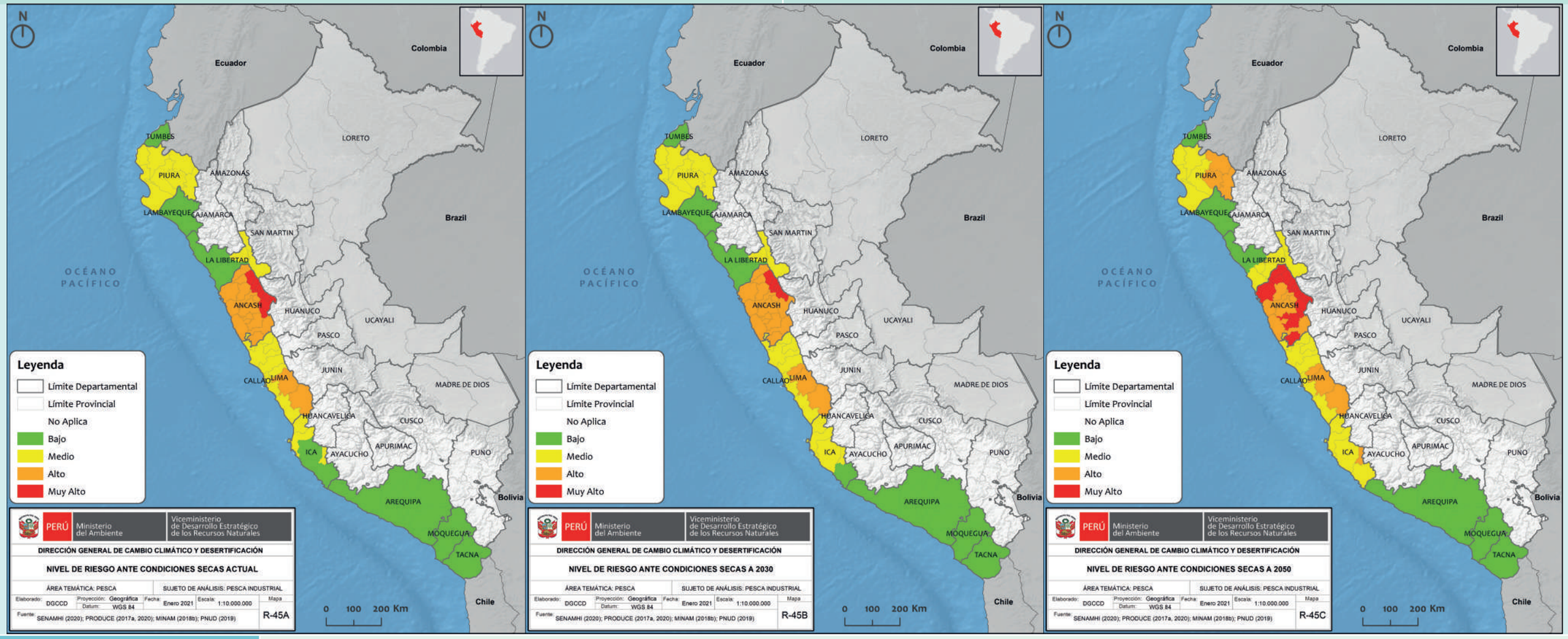
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF INDUSTRIAL FISHING DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: fishing and aquaculture

Subject of analysis: industrial fishing

Hazard: change in aridity conditions



Probable trend in the level of risk	The level of risk due to the change in the aridity conditions for the ***industrial fishing*** subject of analysis is greater in the center of the Peruvian coast. The risk is particularly high in the department of Ancash and part of the provinces of Lima, and mainly associated with the high number of industrial fishing establishments (high exposure) located in these regions, with the high landings of resources and the high capacity of the industrial fishing fleet (high sensitivity), as well as the high hazard due to the changes in the aridity conditions. Comparing the current scenario with the future scenarios, differences can be observed due to the increase in dry conditions as the time horizon increases. The main reason is due to the behavior recorded in the temperatures that increase during the long-term horizon (2050).		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Antonio Raymondi, Carlos Fermín Fitzcarrald, Huari, Mariscal Luzuriaga, Pomabamba and Sihuas.	Antonio Raymondi, Carlos Fermín Fitzcarrald, Mariscal Luzuriaga, Pomabamba and Sihuas.	Aija, Antonio Raymondi, Carlos Fermín Fitzcarrald, Corongo, Huari, Mariscal Luzuriaga, Ocros, Pallasca, Pomabamba, Recuay, Santa and Sihuas.

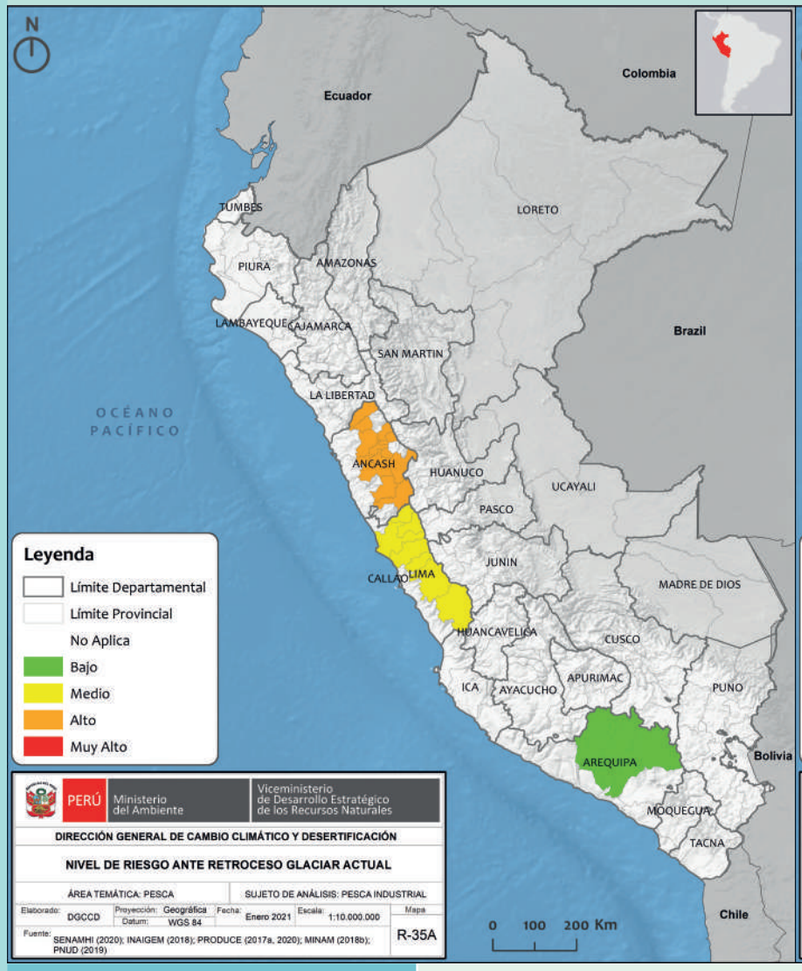
Source: Plan Nacional de Adaptación (MINAM, 2021).

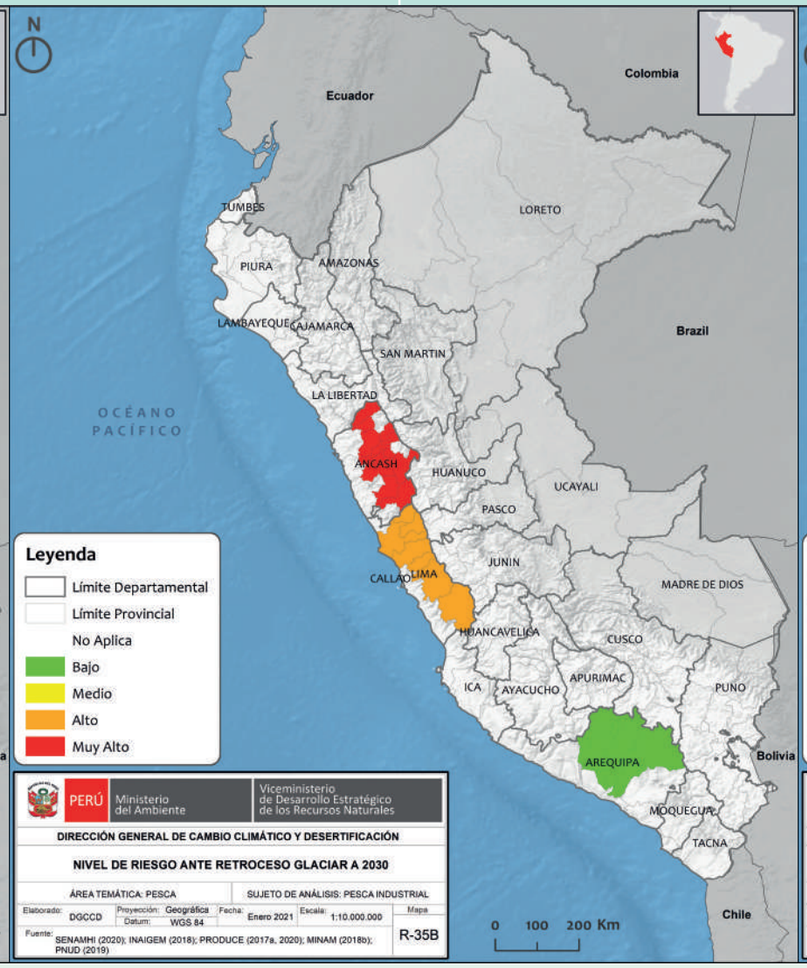
CLIMATE RISK SCENARIO OF INDUSTRIAL FISHING DUE TO GLACIAL RETREAT

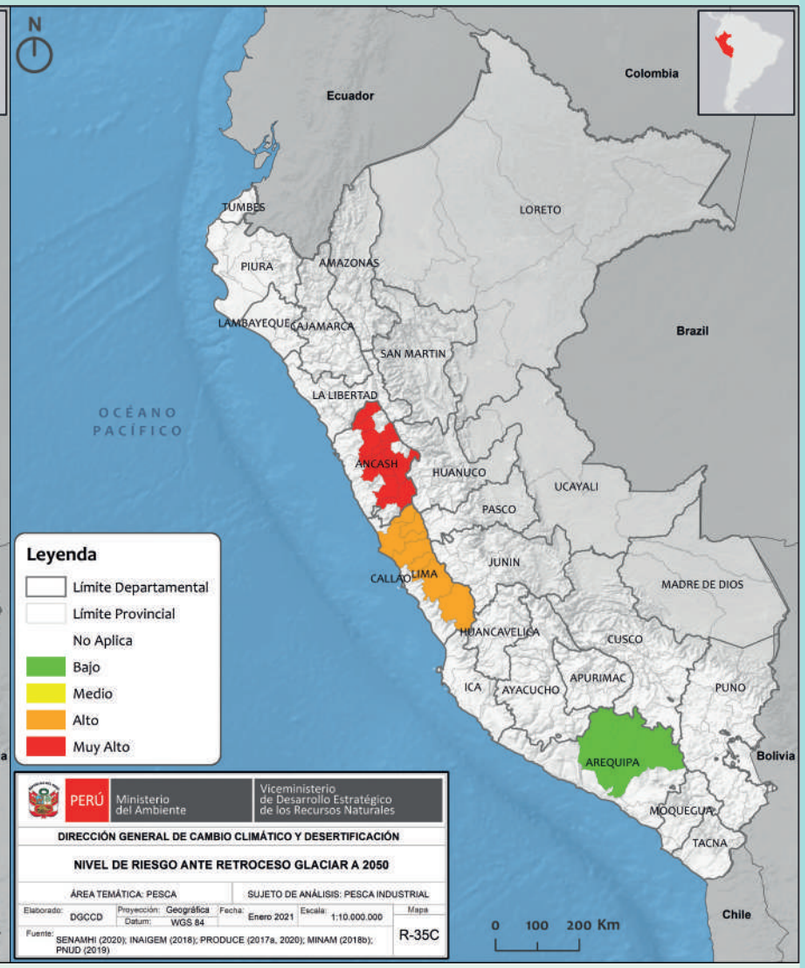
Thematic area: fishing and aquaculture

Subject of analysis: industrial fishing

Hazard: glacial retreat







Probable trend in the level of risk	The level of risk due to glacial retreat for the ***industrial fishing*** subject of analysis is greater in the center of the Peruvian coast. The risk is particularly high in the department of Ancash and of Lima, mainly associated with the high number of industrial fishing establishments (high exposure) located in these regions, with the high landings of resources and the high capacity of the industrial fishing fleet (high sensitivity), as well as the high/very high hazard due to glacial retreat. Comparing the current scenario with the future scenarios, there is an increase in the level of risk as the time horizon increases, due to the increase registered in the measured temperatures as the time horizon increases.

	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
Provinces with very high-risk levels	N/A.	Asunción, Mariscal Luzuriaga, Carhuaz, Pomabamba, Corongo, Yungay, Pallasca, Huaylas, Recuay, Huaraz, Huari and Bolognesi.	Asunción, Mariscal Luzuriaga, Carhuaz, Pomabamba, Corongo, Yungay, Pallasca, Huaylas, Recuay, Huaraz, Huari and Bolognesi.

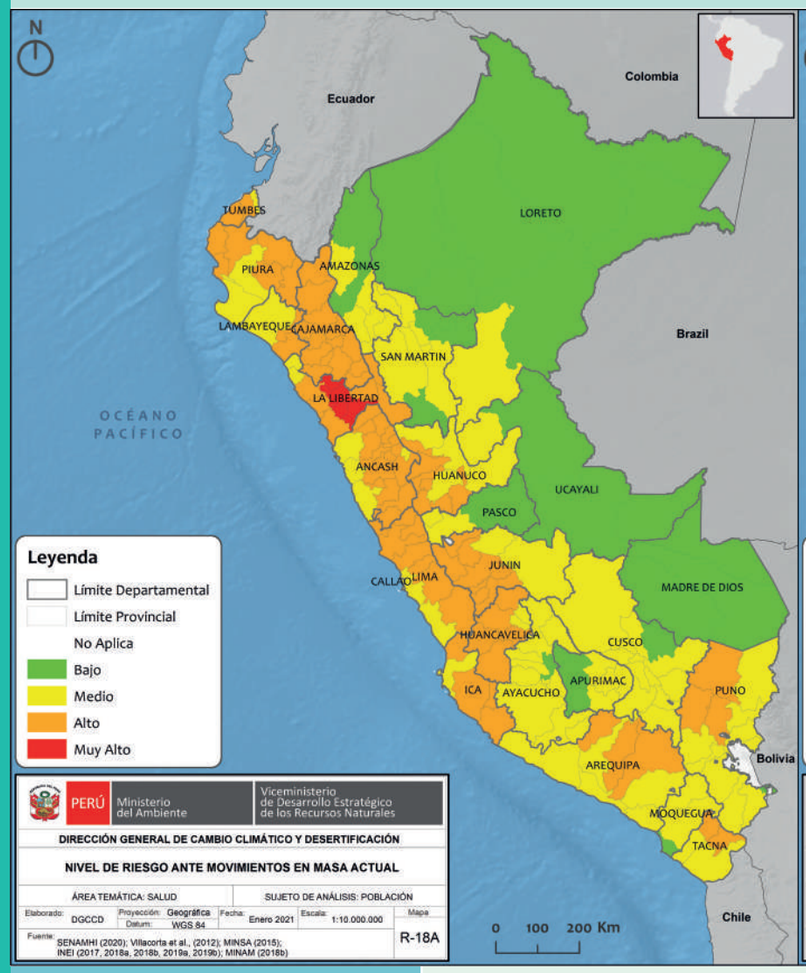
Source: Plan Nacional de Adaptación (MINAM, 2021).

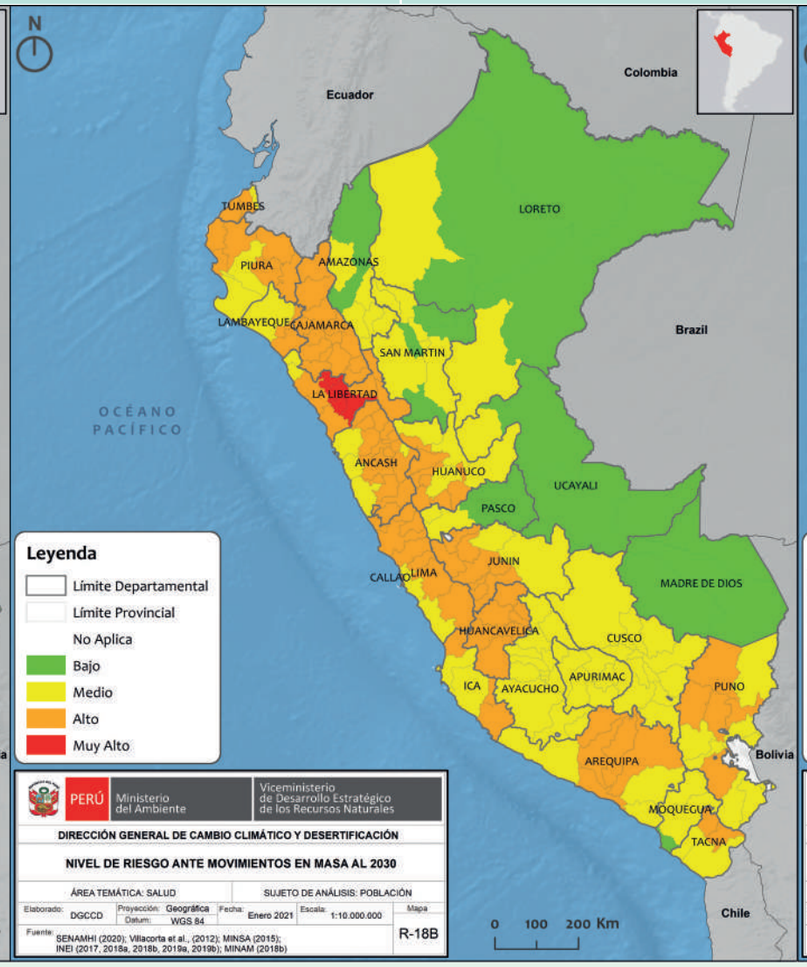
CLIMATE RISK SCENARIO OF THE POPULATION DUE TO MASS MOVEMENTS

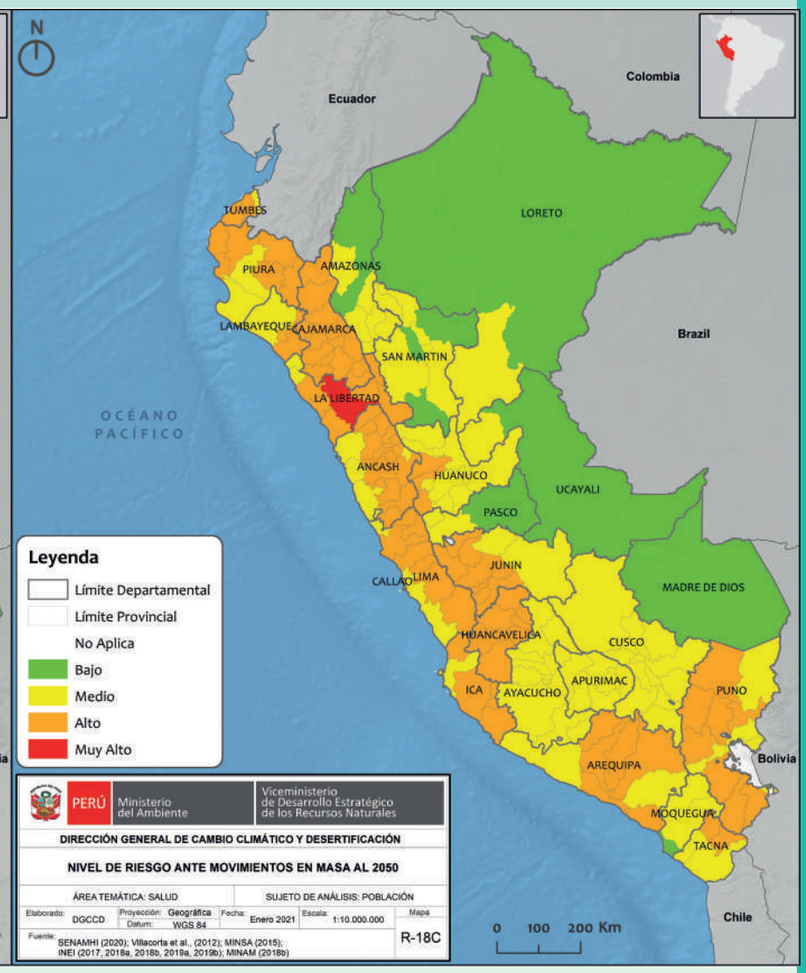
Thematic area: health

Subject of analysis: population

Hazard: mass movements







Probable trend in the level of risk	The level of risk due to mass movements for the ***population*** subject of analysis is higher mainly in the northern zone of the coast of Peru, and specifically in the Peruvian highlands, due to a higher exposure and a higher hazard level. In the Amazon region, on the contrary, there are low socioeconomic conditions in the population (high vulnerability), the exposure (population density) and the hazard level is low, therefore the risk level is low. Comparing the current scenario with the future scenarios, we can observe that the risk level increases in the medium term (2030); however, in the long term (2050), this increase is not so high. This difference in risk level is due, once again, to the response recorded by the trigger (total annual precipitation).

Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	Gran Chimú, Julcán, Otuzco and Santiago de Chuco.	Gran Chimú, Julcán, Otuzco and Santiago de Chuco.	Gran Chimú, Julcán, Otuzco and Santiago de Chuco.

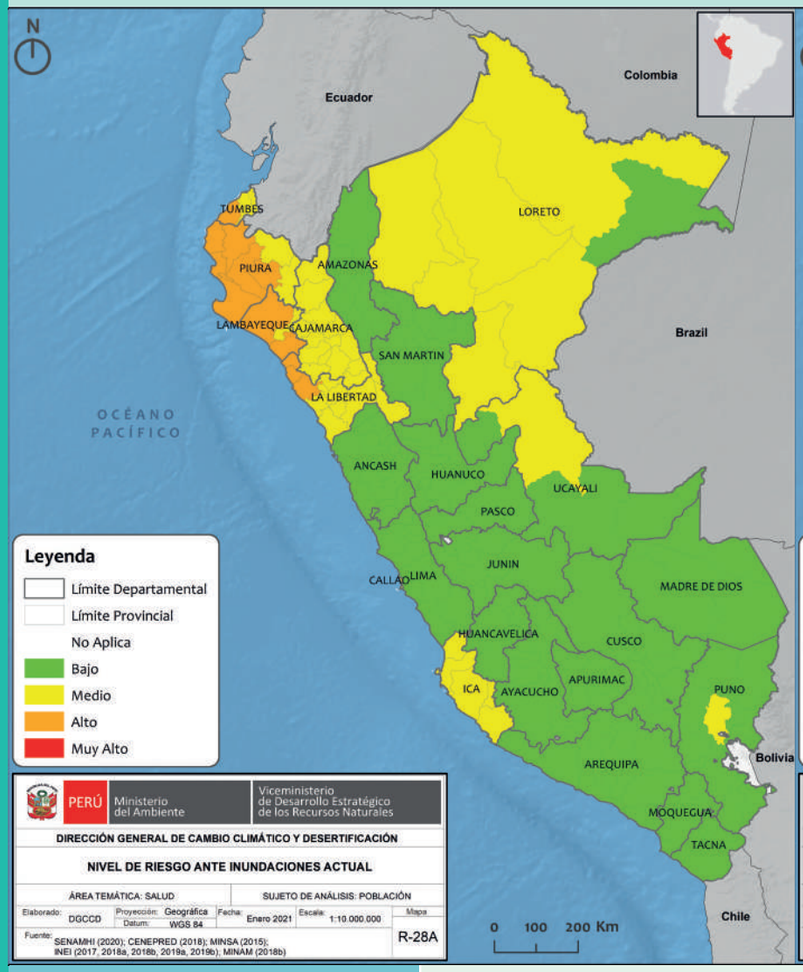
Source: Plan Nacional de Adaptación (MINAM, 2021).

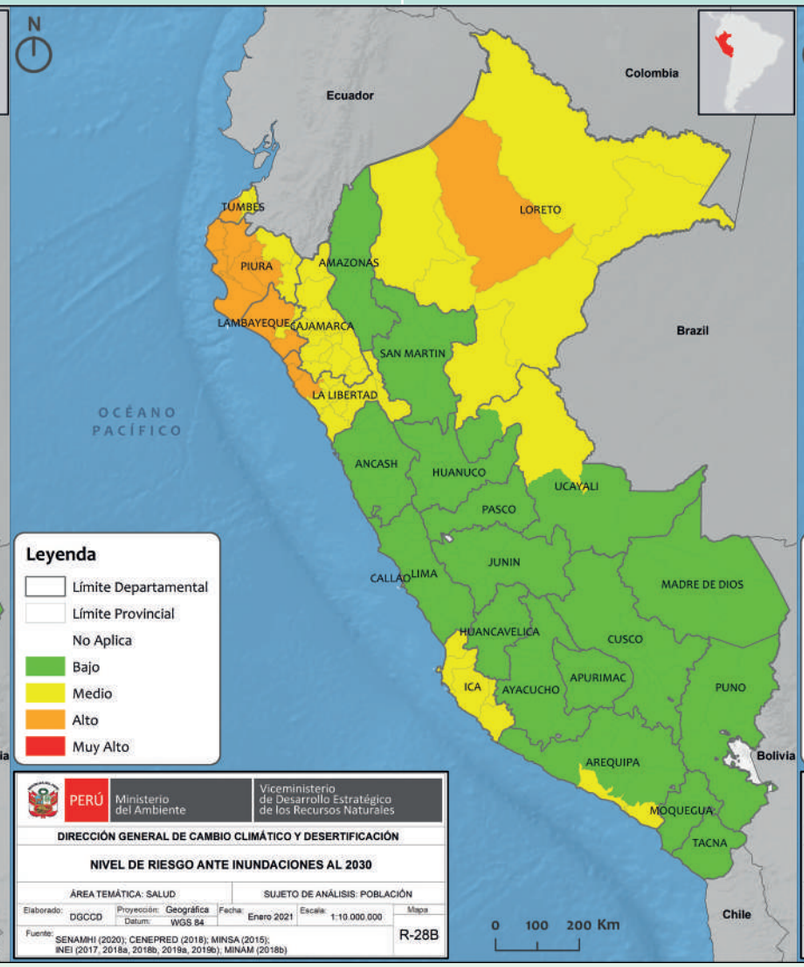
CLIMATE RISK SCENARIO OF THE POPULATION DUE TO FLOODS

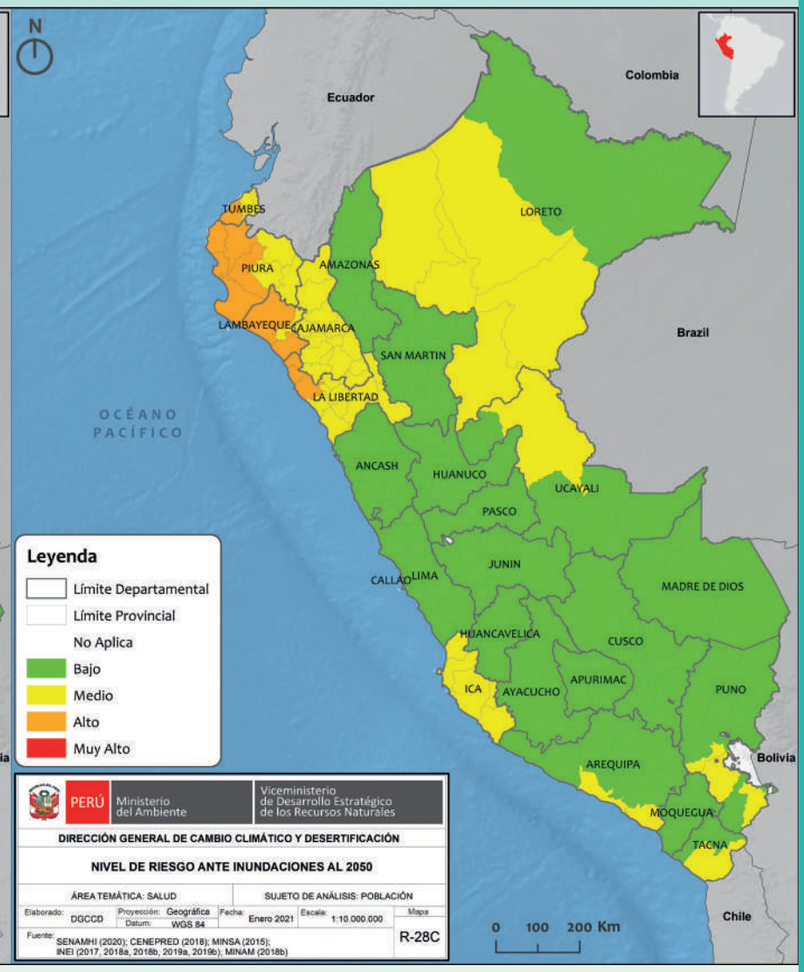
Thematic area: health

Subject of analysis: population

Hazard: floods







Probable trend in the level of risk	The level of risk due to floods for the ***population*** subject of analysis is higher on the north coast and in the easternmost Amazon region area of Peru. The reason is due to a high hazard level, low socioeconomic conditions in the population (high vulnerability) in the Amazon region and a high population density (high exposure) on the coast, which causes the risk to be concentrated in the aforementioned areas. Comparing the current scenario with the future scenarios, we observe that the level of risk increases due to the behavior experienced by the climate trigger. This behavior shows, once again, a higher risk level during the medium term (2030) compared to the long term (2050).

Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

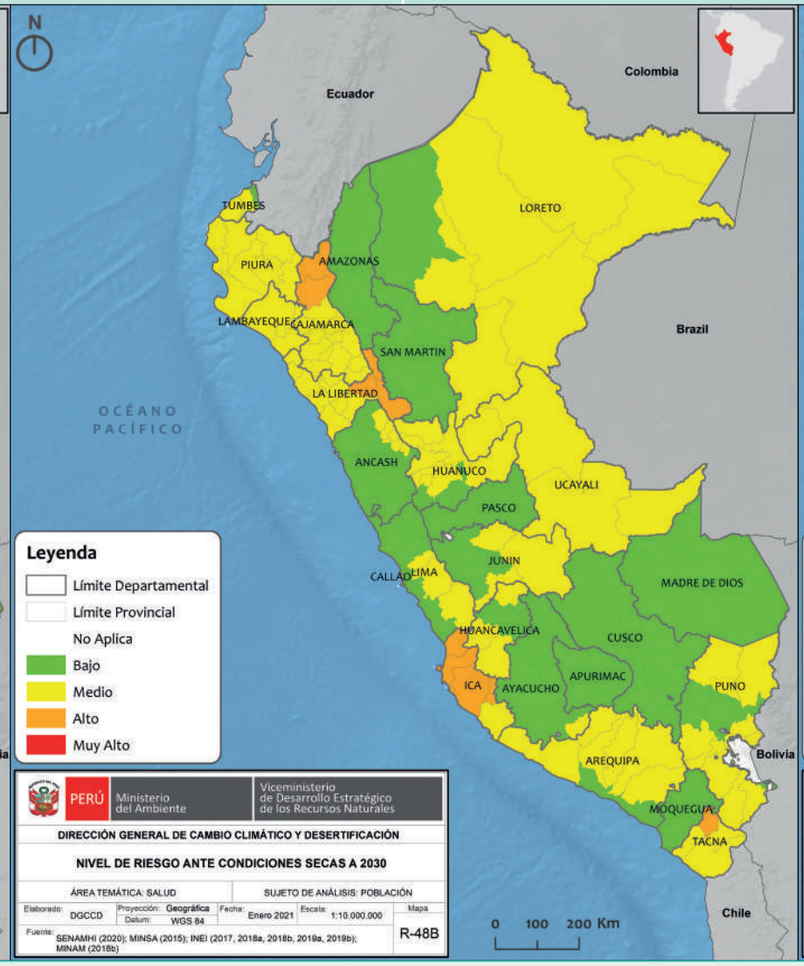
Source: Plan Nacional de Adaptación (MINAM, 2021).

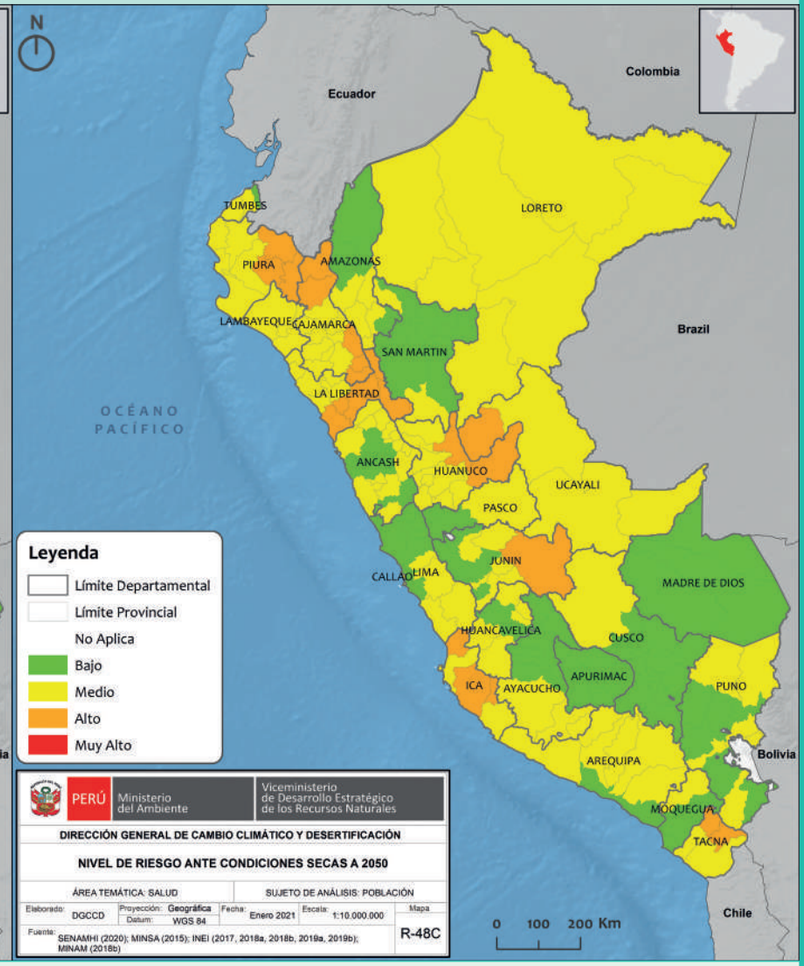
CLIMATE RISK SCENARIO OF THE POPULATION DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: health

Subject of analysis: population

Hazard: change in aridity conditions





Probable trend in the level of risk	The level of risk for the ***population*** subject of analysis, due to the change in the aridity conditions, is higher along the coastal zone of Peru, mainly due to a high hazard level and a high population density (high exposure). Comparing the current scenario with the future scenarios, a certain difference is observed, especially in the long-term period (2050) with an increase in risk in the north of the coastal zone. The reason is due to an increase in temperatures and a reduction in precipitation, which lead to more arid conditions in the future.

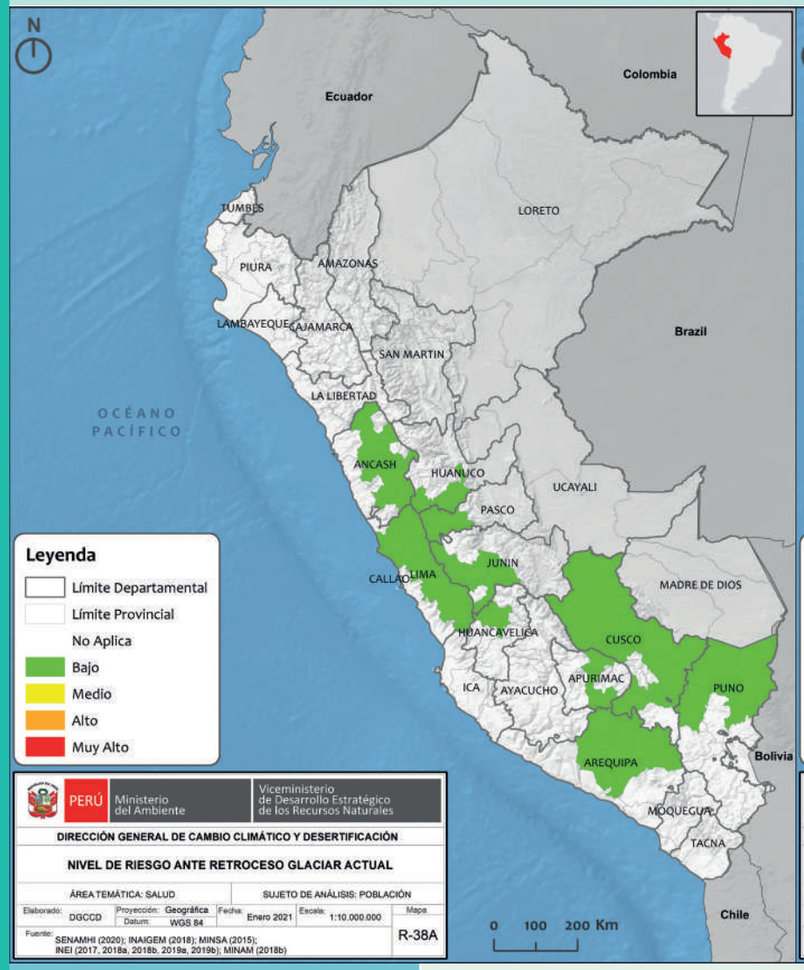
Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

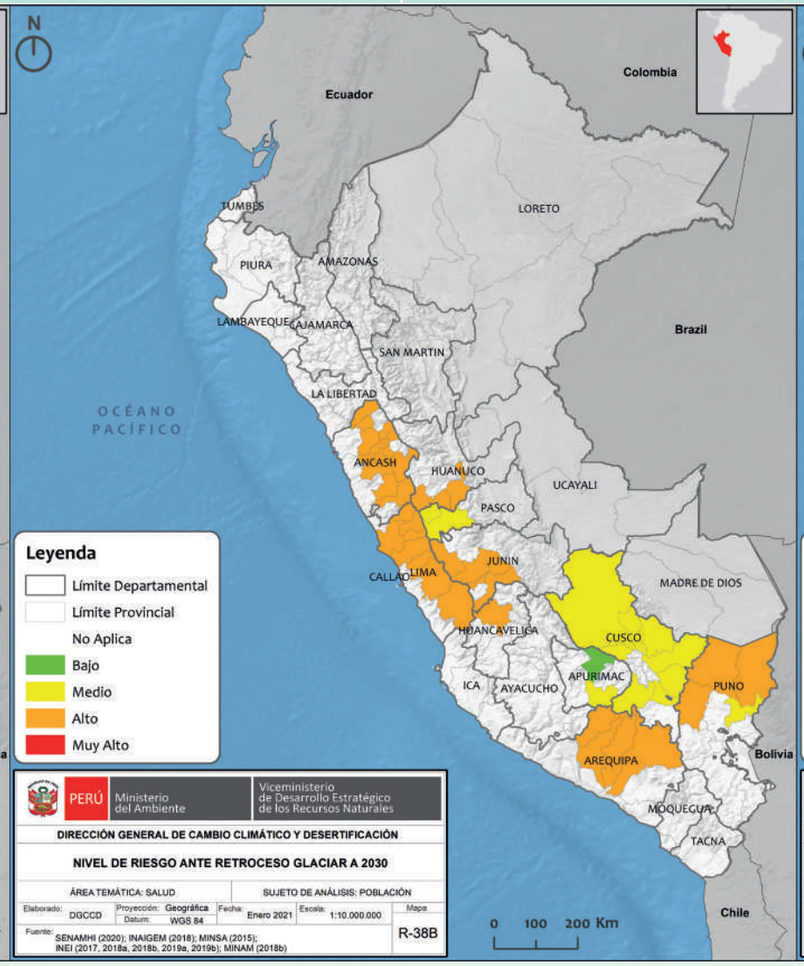
Source: Plan Nacional de Adaptación (MINAM, 2021).

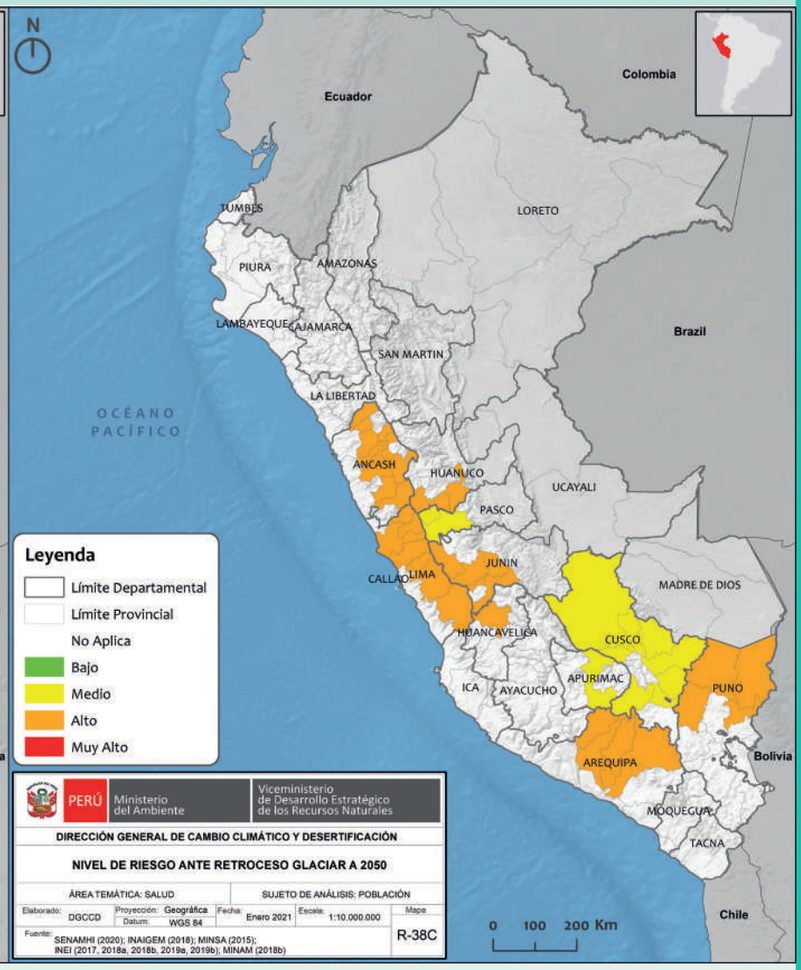
CLIMATE RISK SCENARIO OF THE POPULATION DUE TO GLACIAL RETREAT

Thematic area: health

Subject of analysis: population | **Hazard: glacial retreat**







Probable trend in the level of risk	The level of risk for the ***population*** subject of analysis due to glacial retreat is higher in the central and southern areas of Peru. With the exception of Lima and La Libertad, exposure only reaches medium or low values, as does vulnerability. On the current horizon, the risk is low, coinciding with the low hazard level due to glacial retreat. Comparing the current scenario with the future scenarios, we observe that, for the medium and future horizons, the risk shoots up from low to high, following the expected changes due to climate change. In any case, although there is a high exposure in coastal regions linked to a high population density, none of the provinces reach a very high level of risk.

Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

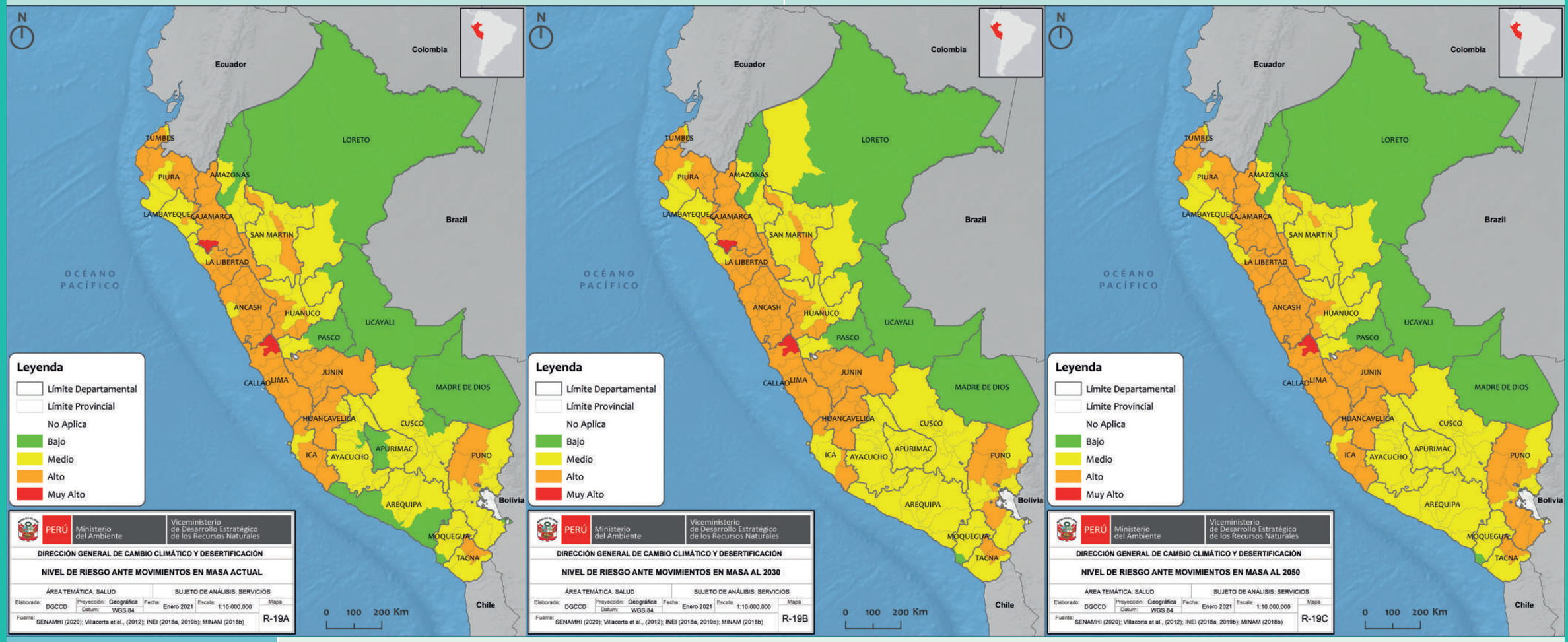
Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF HEALTH SERVICES DUE TO MASS MOVEMENTS

Thematic area: health

Subject of analysis: health services

Hazard: mass movements



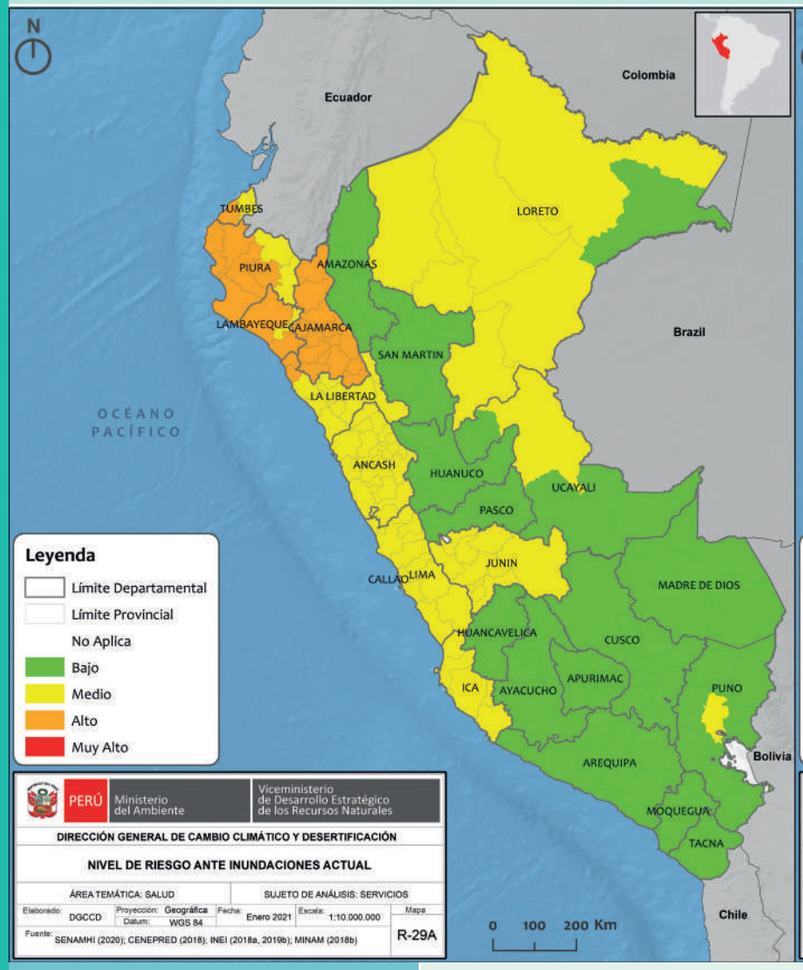
Probable trend in the level of risk	The level of risk due to mass movements for the ***health services*** subject of analysis is higher in northern and central Peru, reaching very high-risk levels in the departments of Cajamarca and northern Lima. This is due to the high and very high exposure of these regions, and to a high and medium vulnerability, where the physical conditions are characterized by steep slopes. Comparing the current scenario with the future scenarios, the fundamental difference lies in the increased risk for the two future horizons in the southern zone of the Peruvian coast. In addition, in the department of Loreto there is a higher risk for the 2030 horizon compared to 2050, as a result of a greater increase in precipitation for the medium horizon.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	Cajatambo, Contumaza and Oyón.	Cajatambo, Contumaza and Oyón.	Cajatambo and Oyón.

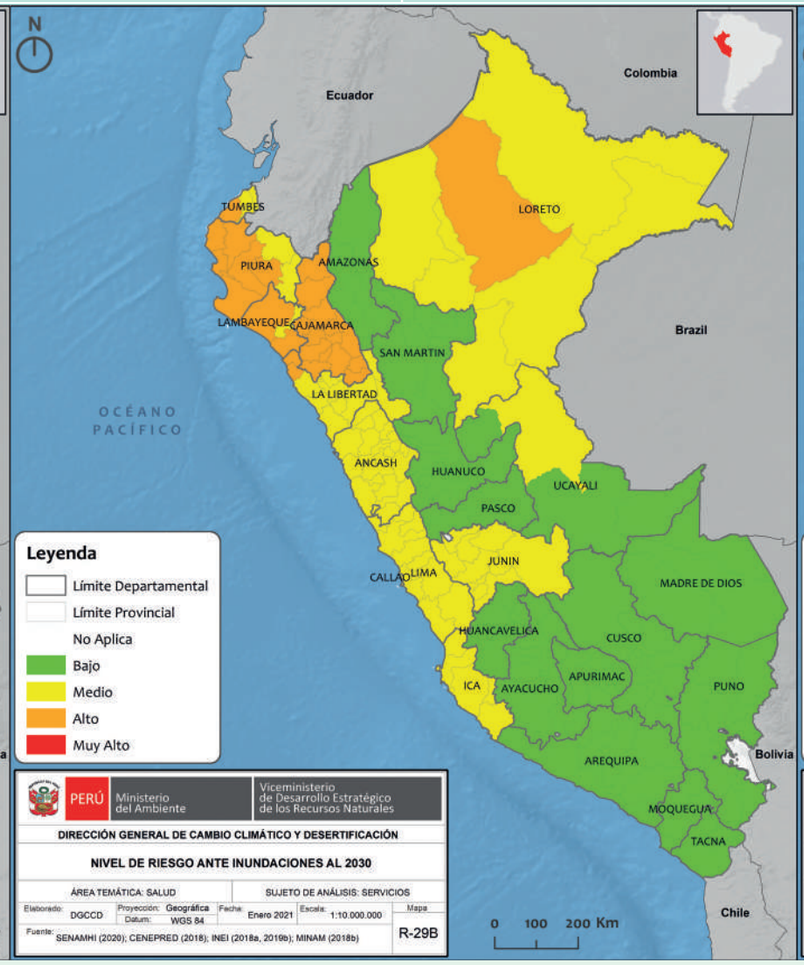
Source: Plan Nacional de Adaptación (MINAM, 2021).

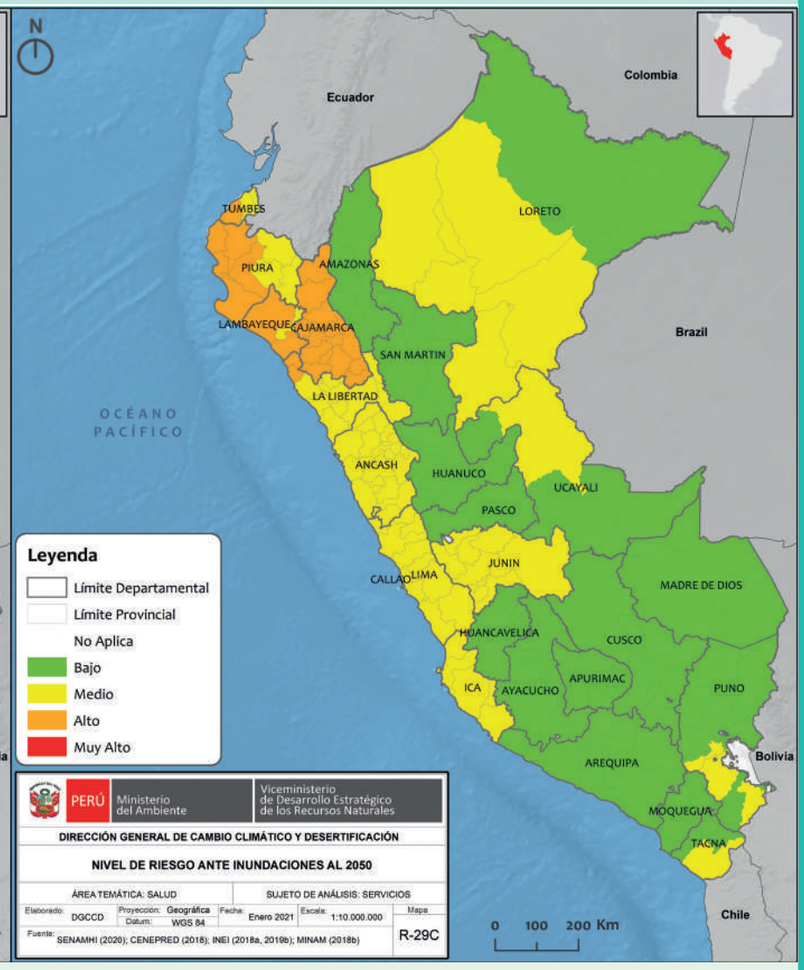
CLIMATE RISK SCENARIO OF HEALTH SERVICES DUE TO FLOODS

Thematic area: health

Subject of analysis: health services	Hazard: floods







Probable trend in the level of risk	The level of risk due to floods for the ***health services*** subject of analysis generally low and medium for all of Peru, except for the northern coastal zone, where it reaches high levels of risk. This is influenced by the low density of health resources and the number of health centers per 10,000 inhabitants (high vulnerability). Both for the current scenario and for the future scenarios, the risk levels remain constant, with the exception of the Loreto province where there is an increase in the risk level from medium to high by 2030, and the southern provinces of Tacna and Puno, increasing from low to medium by 2050. This is due to the increase in average precipitation in the future.

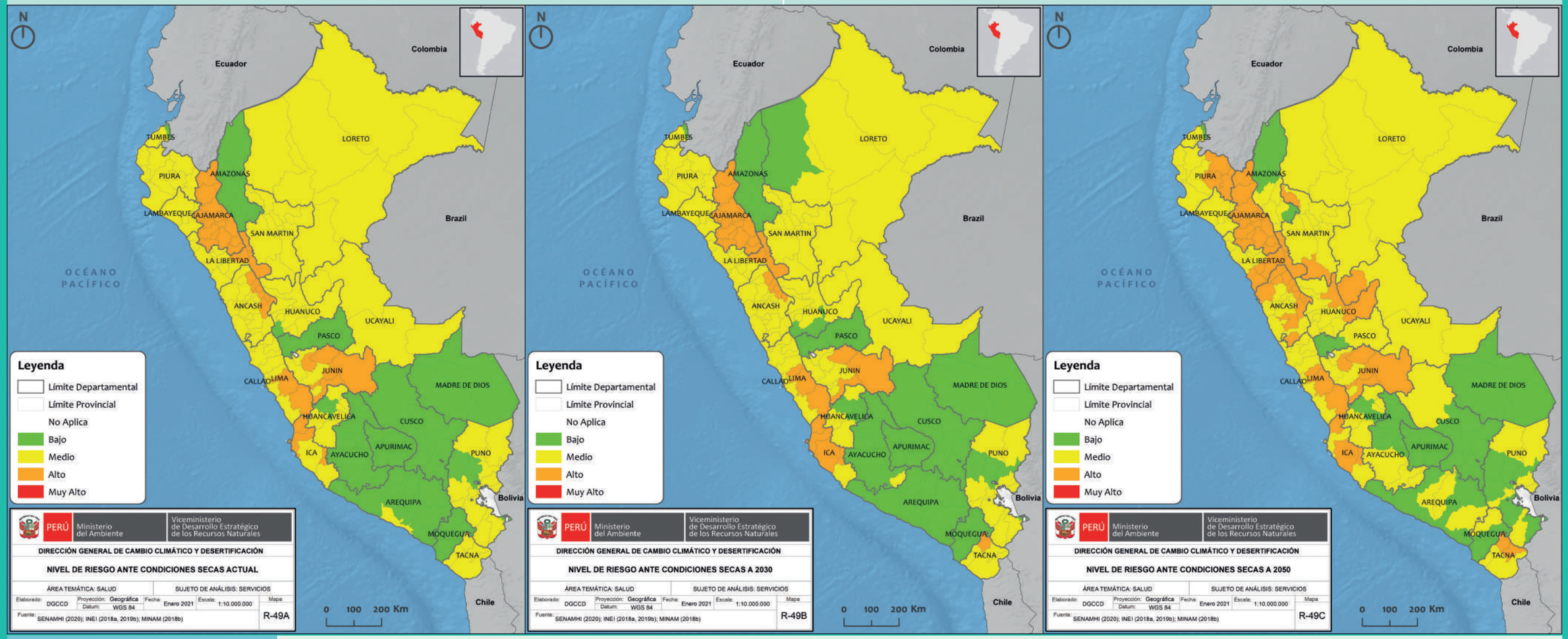
Provinces with very high-risk levels	CURRENT PERIOD	PERIOD UP TO 2030	PERIOD UP TO 2050
	N/A.	N/A.	N/A.

Source: Plan Nacional de Adaptación (MINAM, 2021).

CLIMATE RISK SCENARIO OF HEALTH SERVICES DUE TO CHANGE IN THE ARIDITY CONDITIONS

Thematic area: health

Subject of analysis: health services	Peligro: cambios en las condiciones de aridez



Probable trend in the level of risk	The level of risk on the ***health services*** subject of analysis, due to the change in the aridity conditions, is higher in the northern and central part of the highlands, and in the central part of the coast, reaching a maximum level of high risk. This is influenced by the low density of health resources and the number of health centers per 10,000 inhabitants (high vulnerability). Comparing the current scenario with the future scenarios, we can observe that the combination of high and medium exposure and vulnerability (very high exposure for Lima and very high vulnerability for San Martín), with an increase in the maximum and minimum temperature, results in high risk levels for the central coastal area, and the central and northern highlands. The number of affected provinces increases in 2050, while by 2030 it remains more or less stable in reference to the current scenario.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	N/A.

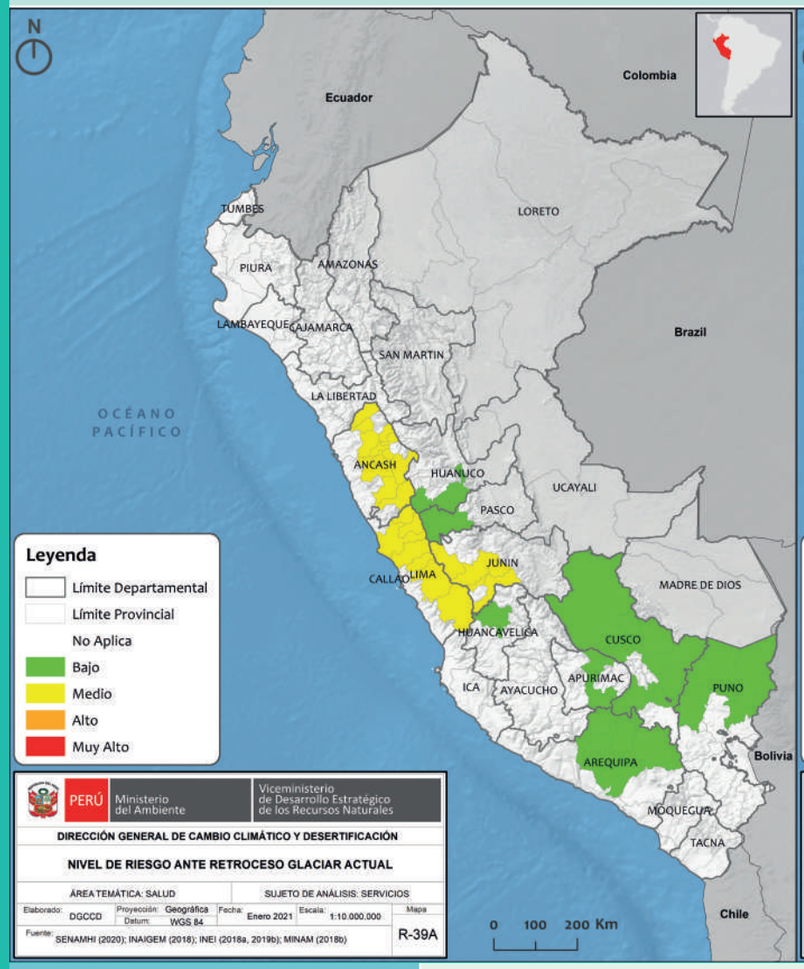
Source: Plan Nacional de Adaptación (MINAM, 2021).

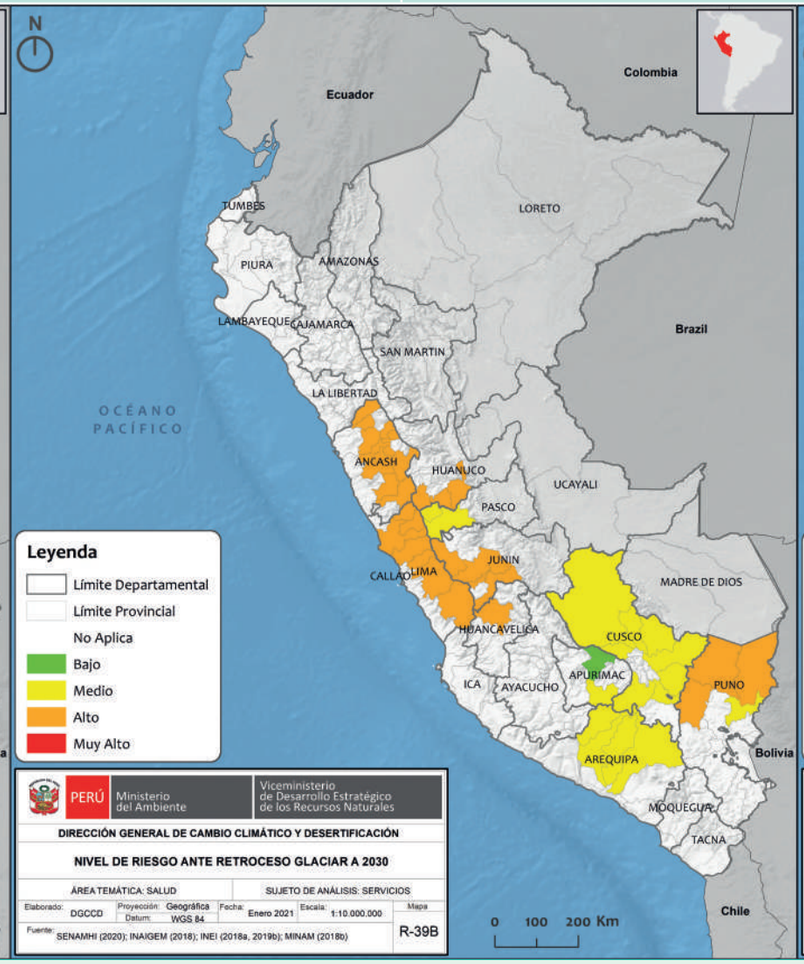
CLIMATE RISK SCENARIO OF HEALTH SERVICES DUE TO GLACIAL RETREAT

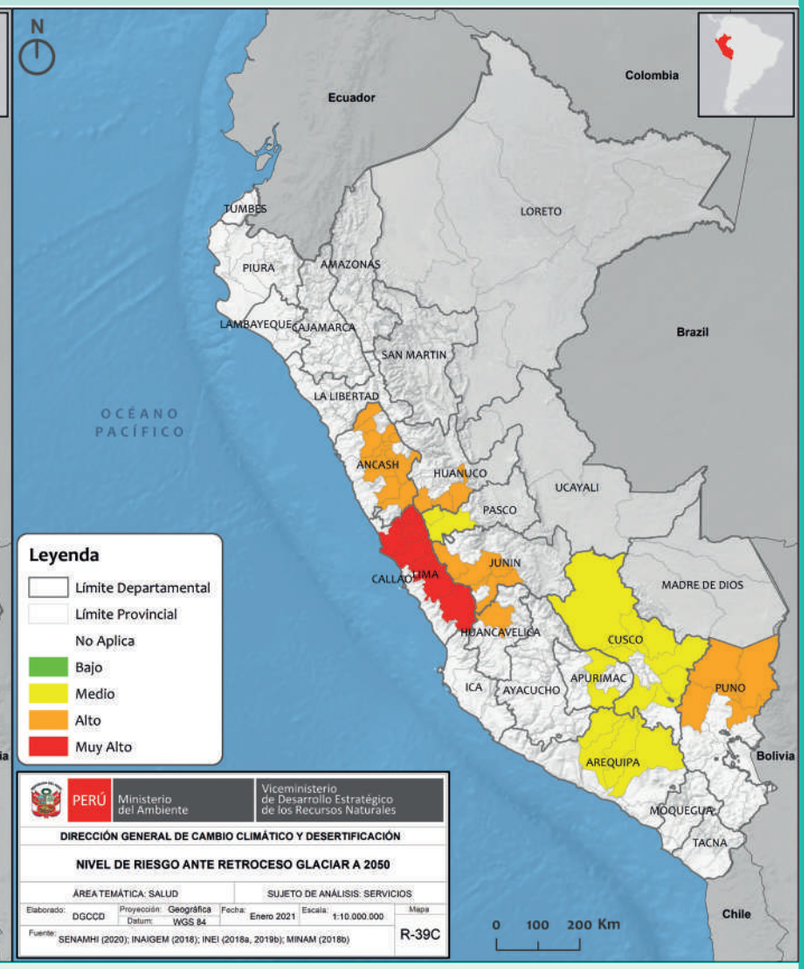
Thematic area: health

Subject of analysis: health services

Hazard: glacial retreat







Probable trend in the level of risk	The level of risk for the ***health services*** subject of analysis, due to glacial retreat, is higher in the central and southern areas of the highlands, reaching the highest risk level in the department of Lima for the 2050 horizon. Currently, it has a low-medium risk, and due to an increase in temperatures, there is an upward trend for the climate change scenarios, both for 2030 and 2050. Likewise, the risk is clearly influenced by a high density of health centers in the central provinces of Peru such as Lima, Ancash, or Junín (high exposure). Comparing the current scenario with the future scenarios, we observe that there is a jump from low risk (current) to high risk (2030) in the provinces belonging to the departments of Huánuco, Huancavelica and Puno, and once it reaches that level it stabilizes by 2050.		
Provinces with very high-risk levels	**CURRENT PERIOD**	**PERIOD UP TO 2030**	**PERIOD UP TO 2050**
	N/A.	N/A.	Cajatambo, Canta, Huaral, Huarochirí, Huaura, Oyón and Yauyos.

Source: Plan Nacional de Adaptación (MINAM, 2021).

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IISD

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AICCA Proyecto Adaptación a los impactos del cambio climático en recursos hídricos en los Andes

Construimos el legado del agua para los Andes

Financiado por: Liderado por: En alianza con:

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CAF BANCO DE DESARROLLO DE AMÉRICA LATINA

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Proyecto de cooperación entre Perú e Italia para la adaptación y mitigación del cambio climático

PNUD

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

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Agencia Suiza para el Desarrollo y la Cooperación COSUDE

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PERÚ Ministerio del Ambiente

Siempre con el pueblo

Por encargo de:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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