CLIMAAX
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Deliverable Phase 1 – Climate risk assessment

Climate Resilience Enhancement in Dairy Farming (CliResDairy)

Türkiye, Aydin

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Document Information

Deliverable Title	Phase 1 – Climate risk assessment
Brief Description	This report presents the findings of the Phase 1 Climate Risk Assessment (CRA) for Aydin's dairy sector, conducted under the CliResDairy Project. It identifies key climate hazards, including extreme heat, agricultural drought, heavy rainfall, and river flooding, and assesses their impact on livestock health, milk production, and farm sustainability. The report outlines data-driven adaptation strategies, including heat stress management, efficient irrigation systems, and early warning mechanisms, to enhance climate resilience. It serves as a foundation for policy integration, stakeholder collaboration, and sustainable dairy farming practices, ensuring the long-term viability of Aydin's agricultural sector in the face of climate change.
Project name	Climate Resilience Enhancement in Dairy Farming
Country	Türkiye
Region/Municipality	Aydin
Leading Institution	Cattle Breeders' Association of Aydin
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Abbreviations and acronyms

Abbreviation / acronym	Description
ADSYB CBAA	Aydin İli Damızlık Sığır Yetiştiricileri Birliği Cattle Breeders' Association of Aydin
CBAM	Carbon Border Adjustment Mechanism
CliResDairy	Climate Resilience Enhancement in Dairy Farming
CRA	Climate Risk Assessment
DSI	Directorate General for State Hydraulic Works
FAO	Food and Agriculture Organization
IEA	International Energy Agency
GCM	General Circulation Model
RCM	Regional Climate Model
TSMS	Turkish State Meteorological Service

Executive summary

The **Climate Resilience Enhancement in Dairy Farming (CliResDairy) Project** aims to assess and mitigate climate-related risks in Aydin's dairy sector. This report presents the findings of **Phase 1: Climate Risk Assessment (CRA)**, which identifies key climate hazards, their impact on dairy farming, and data-driven adaptation strategies to enhance climate resilience.

The most significant climate risks affecting Aydin's dairy farming include extreme heat, agricultural drought, heavy rainfall, and river flooding. Rising temperatures exceeding 32°C reduce milk yields, while prolonged exposure above 38°C severely impacts cattle health and productivity. Declining soil moisture and groundwater levels increase feed costs, reduce crop yields, and threaten farm sustainability. Extreme precipitation events disrupt pasture conditions, damage infrastructure, and threaten the economic stability of dairy operations. Inefficient irrigation practices and excessive groundwater extraction exacerbate the region's vulnerability to prolonged drought conditions.

Adaptation strategies include implementing advanced cooling technologies, shade structures, and optimized feed rations to maintain livestock health. Promoting modern irrigation systems and rainwater harvesting can reduce dependency on groundwater. Developing digital monitoring tools will improve climate preparedness and risk mitigation. Strengthening collaboration between public institutions, universities, farmer cooperatives, and the private sector will enhance knowledge transfer and policy integration. Increasing access to climate finance and incentives for sustainable farming practices is also crucial.

Challenges such as the lack of high-resolution climate projections tailored for livestock farming, insufficient investment in modern cooling and irrigation technologies, and weak policy integration hinder adaptation efforts. Stronger coordination among policymakers, agricultural institutions, and research organizations is essential to mainstream climate resilience strategies into regional and national policies.

The CliResDairy project will further refine adaptation strategies, enhance stakeholder collaboration, and integrate findings into regional and national policy frameworks. By fostering sustainable, climate-adaptive dairy farming practices, the project aims to ensure long-term economic stability, food security, and resilience in Aydin's agricultural sector. This report contributes to the broader **CLIMAAX Project**, supporting a standardized approach to climate risk assessment across European agricultural regions.

1 Introduction

1.1 Background

Aydin province is one of the leading cities of Turkey in terms of agriculture and livestock activities. In the Büyük Menderes Basin, where Aydin Province is located, agriculture and animal husbandry activities are among the prominent activities. 46% of the 800,700 hectares of agricultural land irrigated by the Büyük Menderes River is within the borders of Aydin Province (365,794.8 hectares) *(Aydin Governorship, Environment, Urbanization and Climate Change Directorate, 2023)*. In addition, Aydin province has 16.92% of the cattle and 6.33% of the sheep in the Aegean Region.

Aydin province ranks 4th among the provinces in Türkiye in terms of the presence of cultural breed cattle. The number of dairy farming enterprises producing milk with 1-5 head of animals is around 17.000 and the number of beef cattle enterprises with 1-5 head of animals is around 1.500. Moreover, Aydin province ranks second after İzmir in the Aegean region with total milk production of 566.298,09 tons/year. In terms of average milk yield per milked cow (culture), Aydin province ranks fourth in the Aegean region with 3.965 kg/year. Therefore, Aydin province has an important role in the agricultural sector of both the Aegean region and the Türkiye *(Sevim, 2022).*

Aydın is increasingly vulnerable to climate change impacts such as prolonged droughts, extreme temperatures, and unpredictable weather events, threatening the sustainability of its dairy sector. Rising temperatures and declining precipitation have led to more frequent heatwaves and dry spells (*IPCC, 2022*). Inefficient irrigation practices, with nearly 99% relying on traditional flood methods, exacerbate water scarcity and groundwater depletion (*FAO, 2018*). Despite efforts to promote modern technologies, financial and infrastructural barriers limit adoption, leaving dairy farming highly susceptible to prolonged drought (*FAO, 2021*).

Basin Water Allocation Plans are comprehensive strategies prepared individually for each basin by the Ministry, incorporating the opinions of relevant institutions and organizations. These plans aim to ensure the fair and sustainable allocation of water resources among key sectors, including drinking and domestic use, environmental water needs, agricultural irrigation, energy, and industry *(Ministry of Agriculture and Forestry, 2023).* The primary objective is to manage water distribution at the basin level while planning for future demands and securing equitable water access for all sectors. While preparing basin water allocation plans, critical factors such as water quantity, quality, basin characteristics, and essential needs are carefully considered.

As part of the "Büyük Menderes Basin Water Allocation and Action Plan" project, the draft of the Basin Water Allocation Plan and Action Plan was opened to public consultation on February 27, 2023. The plan, covering the period from 2024 to 2041, outlines the allocation of water to various sectors under different conditions, including normal, slightly dry, moderately dry, severely dry, and extremely dry scenarios.

The sectoral water allocation amounts for districts within Aydin Province under the 2035 normal conditions and severe drought scenarios are presented in Table 1-1 and Table 1-2. According to the sub-basin-based sectoral water allocation projections for 2035, the livestock sector in Aydin Province is expected to receive 61.86 hm³ per year under severe drought conditions and 71.72 hm³ per year under normal conditions. It is anticipated that the livestock sector will face significant water allocation challenges in the future, particularly under scenarios of severe drought.

Table 1-1 2035 Normal Condition - Sectoral Water Allocation in Aydin (hm³/year) (Ministry of Agriculture and Forestry, 2023)

Sector	Akçay	Banaz	Buharkent Buldan	Çine	Çürüksu	Dandalas	Kufi	Nazilli Kuyucak	Söke
01- Drinking and Domestic Use	10.27	25.60	7.48	12.90	73.17	1.47	20.62	23.41	109.77
02- Environmental Water	202.02	31.66	335.53	196.98	51.13	19.45	224.88	215.61	362.57
03- Groundwater Irrigation	7.94	3.02	0.89	0.17	2.50	1.71	31.75	10.98	20.91
04- Surface Water Irrigation	102.69	47.40	18.66	115.75	63.45	17.57	173.02	162.91	625.49
05- Livestock	6.11	9.38	3.98	14.28	4.62	0.95	12.98	2.21	17.21

Table 1-2 2035 Severe Drought Condition - Sectoral Water Allocation in Aydin (hm³/year) (Ministry of Agriculture and Forestry, 2023)

Sector	Akçay	Banaz	Buharkent Buldan	Çine	Çürüksu	Dandalas	Kufi	Nazilli Kuyucak	Söke
01- Drinking and Domestic Use	9.07	20.05	7.13	5.01	46.84	1.31	19.65	21.11	64.17
02- Environmental Water	135.48	14.55	239.57	127.11	32.77	12.88	179.75	102.51	163.43
03- Groundwater Irrigation	2.90	0.11	0.44	0.00	0.48	0.65	9.85	2.17	1.00
04- Surface Water Irrigation	80.14	18.74	16.86	20.51	45.03	10.22	70.70	107.16	347.95
05- Livestock	5.15	8.32	3.88	7.23	4.55	0.95	12.93	2.17	16.73

Aydin's warm climate supports agriculture and tourism year-round, but dry summers and extreme heat waves in July and August heighten drought risks. Effective water management and adaptation to high temperatures are essential to maintain agricultural productivity and public health. 2024 Annual Climate Report published by the Turkish State Meteorological Service (TSMS) highlights a concerning trend in rising temperatures across the country, with 137 meteorological stations breaking their previous highest temperature records throughout the year. Notably, in Aydin Province, a new record was set on January 19, 2024, when the temperature reached 23.8°C, marking the fourth highest temperature ever recorded for that date *(TSMS, 2025)*. This unprecedented heat level, especially during the winter months, signals an increasing risk of heatwaves in the region. As climate change continues to intensify, heatwaves are expected to become more frequent and severe, posing a significant threat to dairy farming and rural livelihoods in Aydin.

1.2 Main objectives of the project

The primary objective of this project is to strengthen climate resilience in the dairy farming sector, with a specific focus on Aydin Province within the Aegean Region. By conducting comprehensive multi-risk climate assessments and formulating targeted adaptation strategies, the project aims to enhance the sustainability of agricultural livelihoods, mitigate vulnerabilities to climate risks, and reinforce local capacities to adapt to changing climatic conditions. By conducting comprehensive multi-risk climate assessments and developing targeted adaptation strategies, the project aims to:

- Improve the sustainability of agricultural livelihoods by identifying and mitigating key climate risks.
- Strengthen local capacities to adapt to changing climatic conditions through training and knowledge-sharing initiatives.
- Provide data-driven insights for policymakers, enabling the integration of climate adaptation strategies into regional and national agricultural planning.
- Promote sustainable water and resource management practices to reduce environmental stress and improve efficiency in dairy farming.
- Encourage the adoption of climate-smart agricultural technologies to enhance productivity and resilience in the sector.

By applying the CLIMAAX Handbook *(CLIMAAX, 2024)*, the project will leverage standardized methodologies for multi-risk climate assessment, ensuring that climate risks are evaluated comprehensively and systematically. This approach will help identify high-risk areas, determine priority adaptation measures, and support evidence-based decision-making for long-term sustainability.

1.3 Project team

Project Team:

- Project Coordinator: Hediye Cerit
- Technical Department of Cattle Breeders' Association of Aydin
- External Consulting Services:
    - Assoc. Prof. Nusret Demir: Technical Advisor (Geomatics & Industrial Engineer)
    - Dr. Çağrı Karaman: Technical Advisor (International Climate Analysis and Model Development Expert)
    - M. Kemal Demirkol: Technical Advisor (Climate Adaptation, Risk Assessment)
    - Engin Koç: Technical Advisor (Climate Adaptation, Risk Assessment)
    - Elif İrem Köse Kiper: Technical Advisor

1.4 Outline of the document's structure

This document is structured to provide a comprehensive climate risk assessment for dairy farming in Aydin. It begins with an introduction outlining the project's background, objectives, and stakeholders. The main section details the climate risk assessment, including hazard identification, risk analysis, and key findings. Preliminary conclusions summarize the severity, urgency, and capacity for adaptation. The document also includes a progress evaluation, highlighting key performance indicators and future milestones. Supporting documentation, references, and formatting guidelines are provided at the end.

2 Climate risk assessment – phase 1

2.1 Scoping

2.1.1 Objectives

The Climate Risk Assessment (CRA) for Aydin focuses on evaluating the impacts of climate change on the region's environment, economy, and society, with a strong emphasis on dairy farming—a key economic sector. By identifying high-risk areas, assessing priority threats, and developing targeted adaptation strategies, the CRA aims to enhance resilience and ensure the sustainability of dairy farming in the face of increasing climate risks such as drought, heat stress, and water scarcity. The findings will provide evidence-based insights to guide regional planning, infrastructure investments, and emergency preparedness, helping dairy farmers adopt climate-smart practices and strengthen their capacity to cope with environmental challenges.

Despite its importance, the CRA faces challenges such as gaps in high-resolution climate data, resource limitations, and legal barriers. Successful adaptation also relies on strong stakeholder involvement from local governments and agricultural organizations. Nevertheless, the CRA serves as a vital roadmap for protecting dairy farming and ensuring long-term resilience in Aydin's agricultural sector.

2.1.2 Context

Aydin, a key agricultural region in Türkiye, faces increasing climate risks such as drought, extreme temperatures, and water scarcity, posing serious threats to dairy farming. Climate assessments reveal a decline in soil moisture, groundwater levels, and precipitation, intensifying agricultural drought. Rising temperatures above 32°C reduce milk production, while prolonged exposure beyond 38°C harms cattle health (*Liu* et al., 2019). However, the lack of high-resolution climate projections and early warning systems limits targeted adaptation efforts. Additionally, inefficient water use—particularly reliance on traditional flood irrigation—exacerbates resource depletion, making dairy farming increasingly vulnerable. Despite efforts to introduce modern irrigation technologies, financial and infrastructural barriers hinder widespread adoption, while growing water demand is expected to strain resources further by 2040 (*Maddocks* et al., 2015).

Extreme weather events, such as storms and floods, disrupt dairy farming operations and supply chains, leading to economic losses. Despite existing policies, the lack of localized climate risk assessments hinders effective adaptation. To secure long-term sustainability, it is essential to strengthen data-driven resilience strategies, improve water management, and invest in climate-smart technologies, while integrating adaptation measures into regional and national policies.

The governance framework for climate risk management in Aydin is shaped by national policies and international commitments. The National Climate Change Adaptation Strategy (2023-2027), Agricultural Drought Strategy and Action Plan (2023-2027), and the Climate Change Action Plan (2024-2030) provide overarching policy guidance. The **2023-2027 Agricultural Drought Strategy and Action Plan**, introduced by the Ministry of Agriculture and Forestry, focuses on expanding early warning systems, promoting modern irrigation techniques, and providing financial support through drought insurance and risk mitigation programs (*Ministry of Agriculture and Forestry, 2023*).

The draft Climate Change Law, expected in 2025, aims to provide a comprehensive framework for climate adaptation and emission reduction. However, challenges in policy enforcement, coordination, and data access hinder regional adaptation efforts. Investing in digital climate monitoring and automated irrigation technologies is essential to enhance farm-level resilience. Beyond dairy farming, climate change is projected to affect various sectors within Aydin's economy.

Agriculture and crop production in Aydin, particularly olives, figs, and cotton, are experiencing yield declines of 10-15% due to rising temperatures and reduced water availability *(IPCC, 2021).* Water resources and energy production are also at risk, as increased drought frequency threatens both hydropower generation and drinking water supplies, with groundwater extraction exceeding sustainable recharge rates *(FAO, 2018).* Additionally, extreme weather events disrupt food processing and logistics, impacting storage and distribution while rising energy costs from increased cooling demands put additional pressure on food processors *(Cold Chain Technologies, 2020).*

External factors further shape the region's climate adaptation landscape:

- **European Green Deal & Carbon Border Adjustment Mechanism (CBAM):** Stricter environmental regulations may impact on agricultural exports to the EU, but investments in sustainable farming can enhance market access (**Hata! Başvuru kaynağı bulunamadı.**, *2017*). Failure to meet carbon reduction targets could result in increased taxation on exported dairy products, affecting profitability.
- **Regional Climate Resilience Projects:** IPARD-funded initiatives support precision irrigation, sustainable livestock management, and carbon footprint reduction strategies. Pilot programs in neighboring provinces have demonstrated up to 30% water savings through advanced irrigation techniques. (*Irrigation Today, 2020*)
- **National Climate Strategies:** Alignment with Türkiye's commitments under the Paris Agreement strengthens funding opportunities and policy coherence (*IPCC, 2022*). The implementation of climate-smart agricultural policies will be critical in the next decade.

Table 2-1 Climate Risks Across the Dairy Value Chain & Adaptation Strategies

Dairy Value Chain Stage	Climate Risks	Adaptation Strategies
Feed Production	Drought reduces crop yields and limits water access (*FAO, 2018*).	Implementing drought-resistant feed crops and optimizing irrigation systems. Establishing regional fodder banks to mitigate supply fluctuations.
Storage	Increased temperatures cause spoilage (*FAO, 2021*).	Insulated storage facilities, temperature/humidity control, and improved ventilation. Adoption of predictive inventory management systems to reduce waste.

Transportation	Extreme weather disrupts logistics (*IPCC, 2022*).	Developing alternative logistics routes and increasing supply chain flexibility. Investment in climate-resilient transport infrastructure.
Animal Health	Higher temperatures increase disease prevalence (*University of Florida, 2021*).	Improved barn ventilation, cooling systems, and vaccination programs. Enhanced monitoring of heat stress indicators using AI-driven tracking tools.
Milk Production	Heat stress lowers milk yield (*University of Wisconsin-Madison, 2018*).	Shade structures, misting fans, and optimized feed rations. Genetic selection for heat-tolerant cattle breeds.
Processing	Power outages disrupt operations (*IEA, 2021*).	Investing in backup energy sources (solar, biogas) and energy efficiency measures. Automation of critical cooling and processing functions to reduce energy loss.
Marketing & Distribution	Heatwaves impact cold chain integrity (Cold Chain Technologies, *2020*).	Advanced refrigeration technologies and climate-resilient distribution planning. Expanded use of sustainable packaging materials to reduce temperature sensitivity.

Aydin's dairy sector faces significant challenges, including inadequate climate projections, limited heat stress mitigation, and insufficient early warning systems. The CliResDairy Project addresses these gaps by integrating data-driven risk assessments with targeted adaptation strategies, such as cooling technologies and efficient irrigation. It also focuses on capacity-building and knowledge transfer to empower farmers with science-based techniques. Achieving long-term sustainability will require incorporating climate resilience into local planning, enhancing financial support, and fostering collaboration among stakeholders. Improved climate data collection will support evidence-based policymaking, positioning Aydin as a model for climate-resilient dairy farming.

2.1.3 Participation and risk ownership

Sustainable dairy farming in Aydin Province relies on a network of key stakeholders, each playing a critical role in ensuring climate resilience across the value chain. The impact of climate change—ranging from rising temperatures to water scarcity—affects different actors within the sector, making their participation essential for adaptation efforts.

Figure 2-1 Dairy Farming Value Chain

Dairy farming value chains in Aydin involve multiple stakeholders, as illustrated in Figure 2-1. Climate-related risks in the dairy sector impact various stakeholders, requiring targeted adaptation measures. Feed producers face challenges from drought and erratic weather, increasing feed costs, while transport and logistics providers struggle with disruptions due to extreme weather. Farmers and dairy producers face financial strain from heat waves, water shortages, and disease outbreaks, while veterinarians must address rising disease prevalence with improved services and resilient livestock management. Processing facilities encounter efficiency losses from heat stress, requiring energy-efficient cooling technologies. Cooperatives support small-scale farmers with market access and technical assistance, while retailers and consumers influence climate-smart production through sustainable sourcing and purchasing decisions.

Strengthening collaboration among stakeholders is essential for integrating climate adaptation strategies into the dairy sector, ensuring long-term sustainability. Risk ownership in Aydin Province is managed through a multi-level governance framework, involving national, regional, and local actors. The Ministry of Agriculture and Forestry leads adaptation policies, while the Directorate General for State Hydraulic Works (DSI) oversees water resource management. The Aydin Provincial Directorate of Agriculture and Forestry implements localized measures, and the Aydin Provincial Directorate of Environment, Urbanization, and Climate Change develops regional climate policies. Local irrigation unions and cooperatives manage water distribution and conservation, while dairy farmers and agricultural organizations apply climate-smart practices guided by policy and research.

The CliResDairy Project has developed a comprehensive dissemination plan to ensure climate resilience strategies effectively reach decision-makers, farmers, researchers, and the public. For policy and decision-makers, the project will deliver policy briefs and reports to institutions like the Ministry of Agriculture and Forestry and DSI, ensuring that findings are integrated into adaptation strategies. Collaborative workshops with local governments will enhance policy integration, while scientific outputs will be shared with Aydin Adnan Menderes University and international research networks to support broader climate adaptation efforts.

Training and knowledge transfer will focus on workshops for agricultural consultants and farmer engagement programs, promoting climate-smart practices and stakeholder collaboration. Public awareness will be raised through NGOs, community events, and social media campaigns**. The project will also deliver final reports and policy documents, guiding future adaptation planning and fostering long-term resilience in the dairy sector. Through structured engagement and knowledge dissemination, the CliResDairy Project will facilitate policy integration, improve on-the-ground adaptation, and ensure that research findings lead to actionable climate resilience measures.

2.2 Risk Exploration

2.2.1 Screen risks (selection of main hazards)

Aydin has a typical Mediterranean climate with hot, dry summers and mild, wet winters. The average annual temperature ranges from 17 to 18°C, with July being the hottest month (36.3°C) and January the coldest (8.2°C). Extreme temperatures have reached a maximum of 45.1°C in August and a minimum of -11.0°C in January. Rainfall is concentrated in the winter months, with December and January averaging over 120 mm of precipitation, while July and August are the driest months with less than 10 mm. The average annual precipitation is approximately 609.3 mm, with 79.4 rainy days per year, and the highest recorded precipitation in 24 hours was 93.8 mm on January 4, 2009 (*Turkish State Meteorological Service, 2025*).

Aydin's climate is highly favorable for agriculture, particularly for crops that thrive in warm temperatures, but the dry summers necessitate irrigation. The combination of high summer temperatures and low rainfall increases the risk of drought, making water management crucial. Extreme heat waves in July and August pose challenges for both public health and agriculture. Overall, Aydin's climate supports tourism and year-round agricultural activities, though sustainable water management and adaptation to extreme heat events remain essential considerations.

2.2.2 Workflow selection

Regarding the climate-related hazards, the region is in western Turkey, characterized by its Mediterranean climate is particularly vulnerable to climate-related hazards such as heavy rainfall, agricultural drought, and river flooding and these hazards threaten agricultural productivity, water security as well as livestock farming. As part of the project, this study applies dedicated workflows to assess the risks associated with heavy rainfall, agricultural drought, and river flooding in Aydin. The region is a key agricultural hub in Turkey, known for its production of cotton, olives, figs, and citrus fruits, all of which are highly sensitive to changing precipitation patterns and water availability. Increasing climate variability, coupled with human-induced stressors such as water overuse and land-use changes, exacerbates the vulnerability of local communities to these hazards.

2.2.2.1 Heavy Rainfall

The Aydin region, located in the Büyük Menderes River Basin, is prone to flooding from excessive rainfall, damaging barns, shelters, and key agricultural products like wheat, corn, barley, and sorghum. Heavy rains increase risks of root rot, fungal diseases, and create humid conditions that promote disease agents like fungi, bacteria, and parasites. Flooded agricultural lands lead to production losses, significantly impacting farmers and livestock breeders. The Aydin region receives a total annual rainfall of 600-700 mm. However, in June 2022, approximately 100 mm of rain was measured in the region within a 2-hour period resulting in damage to the farms. Damage was higher, especially in the fields where wheat and cotton were in the harvest period *(Yeni Asır, 2022)*.

2.2.2.2 Drought

Increasing agricultural drought in the region is severely impacting the livestock sector, leading to reduced forage crop production and rising feed prices. Diminished availability of basic feed sources like hay, alfalfa, and corn silage raises feeding costs, affecting animal nutrition and productivity. Drought also lowers fertility rates in breeding animals by increasing stress levels and causing inadequate nutrition, resulting in low birth rates and weak offspring. Additionally, reduced water flow in ponds, underground resources, and streams limits animals' access to water, further threatening livestock sustainability. Compared to the long-term average (climate normal), it has been observed that a 100-day drought occurred in the Aydin region, where the rainfall should normally be 16.4 kg/m^2 in September, 45.2 kg/m^2 in October, and 86.5 kg/m^2 in November, and that agricultural lands and trees dried up due to lack of water (*Aydin Kent Haber, 2024*).

2.2.2.3 Heatwaves

Extreme heat negatively impacts breeding livestock by reducing feed intake, lowering milk yield, and causing heat stress, which leads to health problems and decreased productivity. Livestock farmers face higher costs due to the need for cooling systems, shaded areas, and improved water access. Economic losses are further exacerbated by increased disease incidence and reduced reproductive efficiency. Heat stress can lead to animals being sent for early slaughter, disrupting long-term breeding plans. During the 2014 heatwave, a noticeable decline in milk production among cows was observed. To mitigate the effects, cooling methods such as cold-water showers were introduced to improve both the health and milk yield of the cows (*Milliyet, 2014).*

2.2.2.4 Flooding

Floods pose a significant risk to agriculture in Aydin, causing damage to barns and shelters and increasing the risk of drowning for cattle and sheep. The rapid rise in the Büyük Menderes River discharge heightens flood danger, threatening nearby agricultural lands and settlements. Submerged pastures and forage production areas suffer long-term usability loss, impacting agricultural productivity. According to flood records, 304 flood events have been documented in the Büyük Menderes Basin, with 190 of them occurring in Aydin and its districts. During the 2019 flood in the region, approximately 600-700 decares of cultivated land were submerged. In total, around 2500 decares of land used for forage crops and wheat cultivation were affected by the floodwaters. Additionally, the overflow of the Kısır Creek caused further damage to forage crops and wheat fields, resulting in losses affecting 10,000-12,000 decares of land (*Ministry of Agriculture and Forestry, 2019*).

2.3 Risk Analysis

2.3.1 Extreme Precipitation

Table 2-2 Data overview extreme precipitation

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
Projected increase in heavy rainfall events (e.g., 100 mm/24h return period changes)	Sensitivity of dairy cattle to extreme weather conditions	Number and location of dairy farms in flood-prone areas	Increased risk of flooding in dairy farms

2.3.1.1 Hazard assessment

The analysis utilized EURO-CORDEX (EUR-11) climate projections at a 12 km spatial resolution under two emission scenarios (RCP4.5 and RCP8.5). Focusing on the Aegean region of Turkey, with specific time series for Aydin city, the study analyzed 30-year frames of daily precipitation data for the periods 1976-2005 (baseline) and 2041-2070 (mid-century).

The KNMI-RACMO22E regional climate model (RCM, *(KNMI , 2017)),* driven by the ICHEC-EC-EARTH general circulation model (GCM, *(EC-Earth, 2014*)), has been selected for analysis due to its ability to provide finer-scale simulations for the European region. *Hazelegeret al. (2012)*highlighted that the ICHEC-EC-EARTH model effectively captures large-scale climate variability in the Mediterranean region, including Turkey, accurately representing seasonal temperature patterns and the influence of major circulation systems. Additionally, *Seddiqe al. (2023)* examined climate projections over the Marmara region of Turkey using RACMO22E, driven by ICHEC-EC-EARTH, under RCP4.5 and RCP8.5 scenarios. Their findings indicate that the model successfully simulates seasonal precipitation patterns.

Aydin region is in the Büyük Menderes Basin with a basin area approximately 25.900 km^2. Therefore, daily rainfalls pose a greater risk in the area compared to flash floods in Büyük Menderes River. However, in the urban regions, severe urban floods with numerous casualties and significant socio-economic damage are becoming more frequent. Therefore, a change in the 24-hr precipitation and return periods of events (i.e. 100-year) is significant for the region. The map of expected precipitation for 24hr duration for 100-year return period for historical (1976-2005) and future (2041-2070) for based on RCP4.5 (not shown) and RCP8.5 scenarios are presented in Figure 2-2.

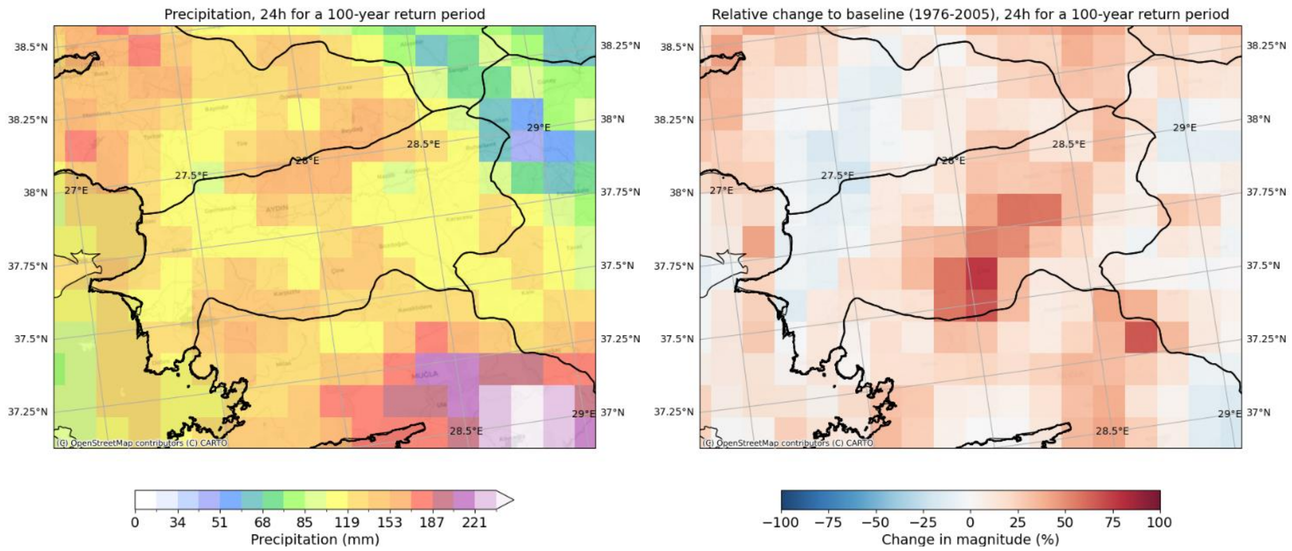

Figure 2-2 : The map of expected precipitation for 24hr duration for 100-year return period for historical (1976-2005) and future (2041-2070) periods in Aydin Region

The most significant increases are observed in the central and eastern regions of Aydin. However, some locations exhibit minimal change, while a few scattered areas might experience slight reductions in both scenarios. The rcp8.5 scenario is expected to result in more positive changes, whereas the rcp4.5 scenario demonstrates both positive and negative changes. Climate change is likely to increase the frequency and magnitude of extreme precipitation events.

2.3.1.2 Risk assessment

A threshold of 100 mm/24 hours has been established as the critical point for extreme precipitation in the region. Given the rising frequency of such events, coupled with their associated impacts and the number of warnings triggered annually, this workflow assesses the potential impact of climate change on historical critical thresholds. The analysis was expanded to cover the entire Aydin region.

This broader scope provides insights into the overall impact of extreme precipitation across the area. The aim is to determine how the critical rainfall threshold of 100 mm/24 hours varies with different return periods under the effect of climate change. Figure 2-3 shows the current return periods for the 100 mm/24h rainfall threshold across Aydin, while the right map displays the expected return periods for the same threshold under the future climate scenario, RCP85 (2041-2070).

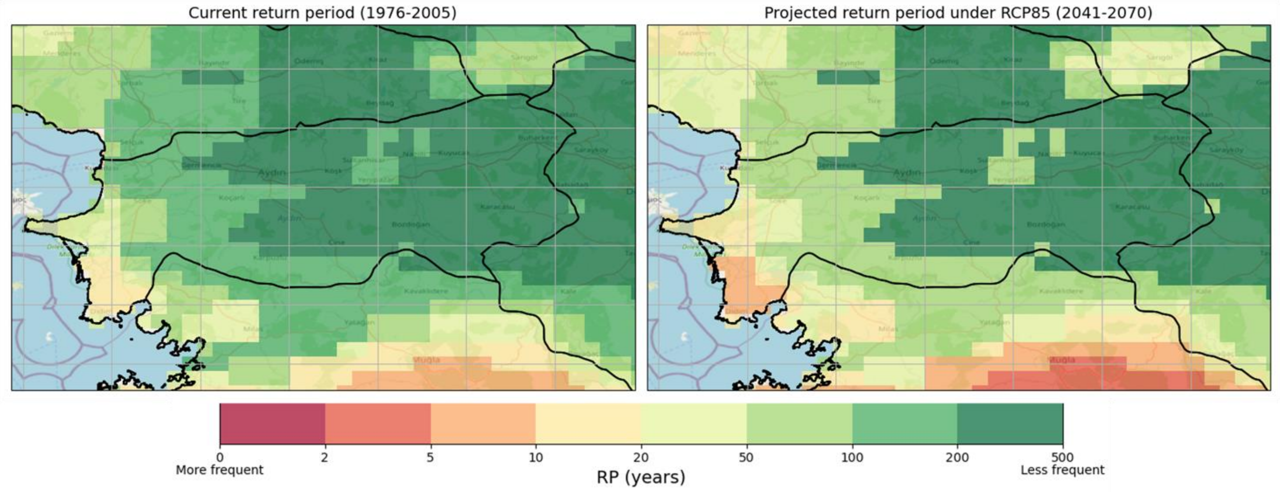

Figure 2-3 : Projected Changes in Return Period (Frequency) for 100mm/24h Events: 1976-2005 to 2041-2070 \n Model Chain: ICHEC-EC-Earth / RACMO22E | Scenario: RCP85

The RCP85 scenario reveals a significant decrease in return periods, especially in the southern and coastal areas. Extreme rainfall events are projected to become more frequent in these regions, with return periods down to below 10 or even 5 years in some locations. This shift suggests a heightened risk of heavy rainfall and potential flooding in the future.

Figure 2-4 illustrates the percentage shift in precipitation within the Aydin region, highlighting the most significant changes in the frequency of 100 mm/24h events across the dairy locations.

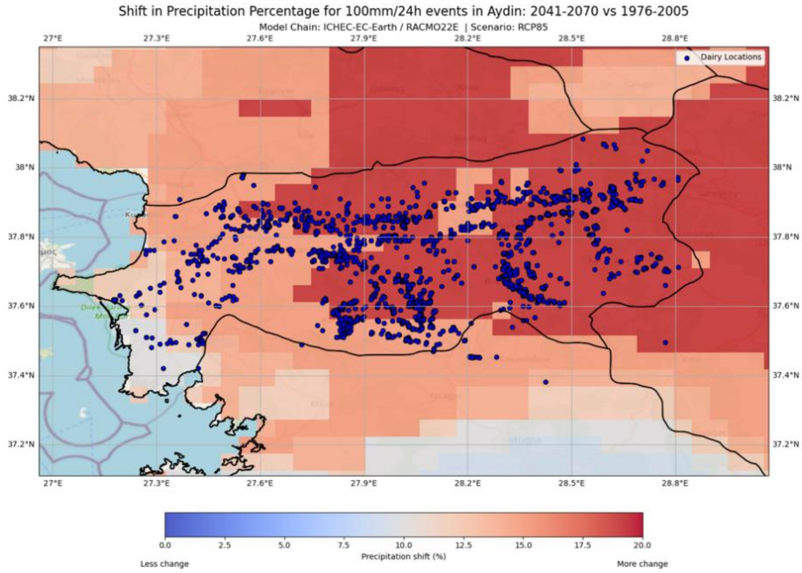

Figure 2-4 : Projected difference in return periods for 100mm/24h events in Aydin: 2041-2070 vs 1980-2010 \n Model Chain: ICHEC-EC-Earth / RACMO22E | left: RCP45 right: RCP85

Many of the dairy farms are concentrated in areas experiencing some of the highest increases in extreme rainfall. This possesses a possible risk about potential impacts on infrastructure, pasture conditions, and overall dairy production. Increased heavy rainfall could lead to flooding and possible damage to supply chains and transportation networks, posing risks to the sustainability of dairy operations.

2.3.2 Heatwaves

Table 2-3 Data overview Heatwaves

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
KNMI-RACMO22E RCM (ICHEC-EC-EARTH GCM). The xclim methodology to calculate heatwave metrics such as frequency, average length, and total yearly heatwave days for the historical, and projected periods under RCP 4.5 and RCP 8.5. Heatwaves were defined as periods of at 3 days with daily maximum temperatures above 35°C and minimum temperatures above 20°C.	Dairy farm density in the Aydin region. Farms are classified as low vulnerability (1) and high vulnerability (10).	Euroheat bias-adjusted climate projections with population density data.	10x10 risk matrix, combining heatwave occurrence data with dairy farm vulnerability. .

2.3.2.1 Hazard assessment

The heatwave hazard in Aydin (27.84, 37.84) was evaluated using a workflow based on EURO-CORDEX EUR-11 (12km) climate projections from the KNMI-RACMO22E RCM (ICHEC-EC-EARTH GCM). The xclim library was used to define and calculate heatwave metrics *(Bourgault et al., 2023)*. Specifically, the frequency, average length, and total yearly days of heatwaves were determined for the historical (1976-2005) and projected (2006-2100) periods, under RCP 4.5 and RCP 8.5. Heatwaves were defined as periods of at least three days with daily maximum temperatures above 35°C and daily minimum temperatures above 20°C. The results of these calculations are visualized in Figure 2-5 (Number of the heatwave days and heatwave index are not shown).

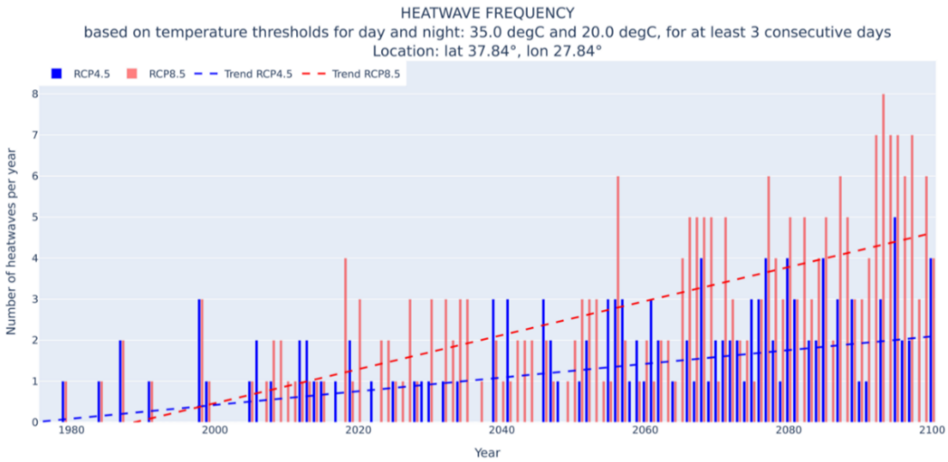

Figure 2-5 : Heatwave frequency in Aydin based on RCP 4.5 and RCP 8.5 scenarios

Heatwave frequency in Aydin, is projected to increase from the historical period (1976-2005) into the future under both RCP 4.5 and RCP 8.5 scenarios. Historically, heatwaves were rare. From the beginning of the century, heatwave frequency rises, with RCP 8.5 showing a more pronounced increase. Under RCP 4.5, heatwaves increase to about 2-3 per year by mid-century and around 4 by late-century. Under RCP 8.5, heatwave increases to 3-5 per year by mid-century and can exceed 6-8 by late-century. This suggests a dramatic rise in heatwave events posing risks to dairy farms.

2.3.2.2 Risk assessment

The risk assessment workflow integrates hazard Euroheat data with vulnerability population data to estimate the risk for the current and projected climate scenarios (rcps 4.5 and 8.5) in the Aydin region. The Euroheat data is derived from a bias-adjusted EURO-CORDEX dataset which was used in the analysis *(World Health Organization, 2009)*. The Euroheat statistics are averaged over a 30-year period, resulting in a time series from 1986 to 2085. Base period is selected as 1986-2015 and relative change in RCP 4.5 (not shown) and RCP8.5 scenarios versus base period is calculated for entire region. The change then classified from 1 to 10 (1-very low change, 10-very high change). The vulnerable dairy farm density in the Aydin region is also classified from 1 to 10 (1-very low, 10-very high). Figure 2-6 shows dairy farms density (left) and heatwave occurrence change for RCP8.5 scenario between (2046-2075). The risk is based on the 10x10 risk matrix, which combines the heatwave hazard occurrence with data from vulnerable population data. Figure 2-7 shows the potential projected increase of the heatwave risk to vulnerable dairy farms among the selected regions. This result is based on the combination of the projected magnitude of change in the heatwave occurrence with the distribution of the dairy farms.

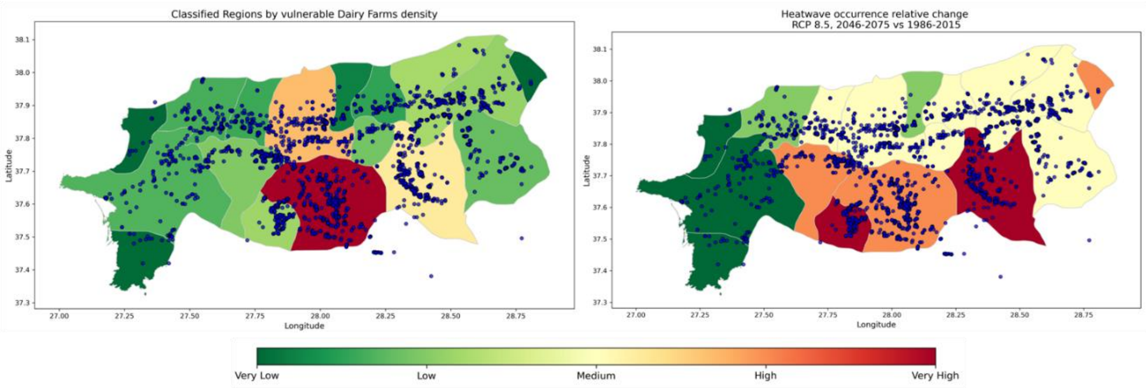

Figure 2-6 : Dairy farms density (left) and heatwave occurrence change for RCP8.5 scenario between (2046-2075)

The central and southeastern parts of Aydın are the most vulnerable to increasing heatwave risk, putting many dairy farms at greater exposure to intense heat stress. In contrast, the western and northern areas show relatively lower vulnerability, offering potential refuges from extreme heat impacts.

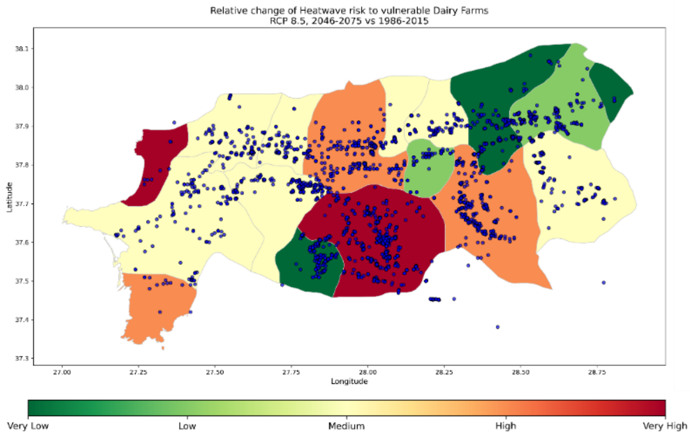

Figure 2-7 : Heatwave risk to vulnerable dairy farms model chain: ICHEC-EC-Earth / RACMO22E | RCP85

2.3.3 Agricultural Drought

Table 2-4 Data overview Agricultural Drought

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
Precipitation deficit leading to yield loss in maize, wheat, sorghum, and barley. Daily mean precipitation, temperature, relative humidity, solar radiation, wind speed. Soil available water capacity, elevation, and thermal climate zone	Share of cropland with irrigation systems.	Crop distribution and economic value data Global Agro-Ecological	Revenue losses from irrigation deficit expressed as 'lost opportunity cost' in thousand euros.

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
		Zones (GAEZ).	

2.3.3.1 Hazard assessment

Drought is reducing forage crop production, which raises feed prices. This increase in feeding costs is challenging for breeders. Therefore, this workflow assesses the impact of water deficit on crop yields in Aydin region where the crucial crops for the dairy are maize, wheat, sorghum and barley. The EURO-CORDEX EUR-11 (12km) climate projections from the KNMI-RACMO22E RCM (ICHEC-EC-EARTH GCM) were used in this workflow of daily mean precipitation flux, maximum and minimum temperature, 2 m relative humidity, surface downward solar radiation and 10 m wind speed. as well as data on soil available water capacity (*Gupta et.al., 2019*), elevation (*Danielson et.al., 2011*) and thermal climate zone (*FAO*, *2022*). The RCP4.5 (not shown) and RCP8.5 scenarios were evaluated for future periods, specifically focusing on two distinct time frames: 2046-2050 and 2066-2070.

In hazard assessment, the impact of precipitation deficits on yield loss for four key crops in the region is analyzed. Maize, wheat, sorghum, and barley are the most important crops cultivated in the region, playing a crucial role in sustaining dairy farming. Figure 2-8 presents maize and wheat yield loss due to precipitation deficit in the region between 2046-2050 under the RCP8.5 scenario.

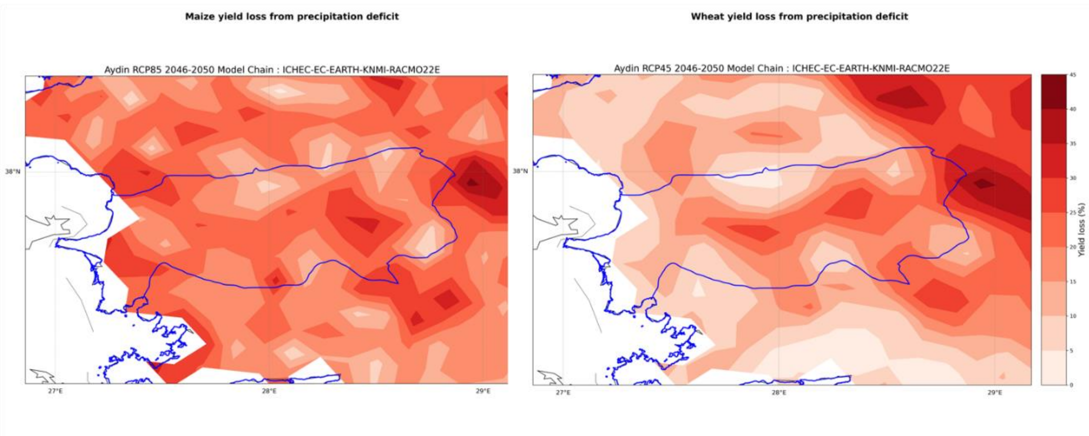

Figure 2-8 Maize (left) and Wheat (right) yield loss from precipitation deficit in the region between 2046-2050 for RCP8.5 scenario.

The spatial distribution of yield loss percentages indicates reductions across the region, with varying intensities. The results suggest that some areas might experience yield losses exceeding 40%, particularly in the northeast for wheat and in central and southern parts for maize. Maize and wheat are critical components of livestock feed, and substantial losses due to precipitation deficits could lead to increased feed costs and reduced local availability.

2.3.3.2 Risk assessment

The risk analysis of the workflow is followed to investigate the potential revenue losses from irrigation deficit Aydin region for the studied crops, emission scenario and future period. Losses are expressed as the 'lost opportunity cost' in thousands of euros if crops are grown under non-irrigated conditions. The maps also show the share of cropland in each grid-point with irrigation systems already implemented in 2010 as an indicator of vulnerability to rainfall scarcity. The Global production of crops from MapSPAM repository (*International Food Policy Research Institute, 2019*) and crop aggregated value [US$] from the FAO-IIASA Global Agro-Ecological Zones data repository (GAEZ) were used to determine the exposure of different crops to precipitation scarcity *(International Food Policy Research Institute, 2019)*. Figure 2-9 presents maize and wheat revenue loss due to precipitation deficit in the region between 2046-2050 under the RCP8.5 scenario.

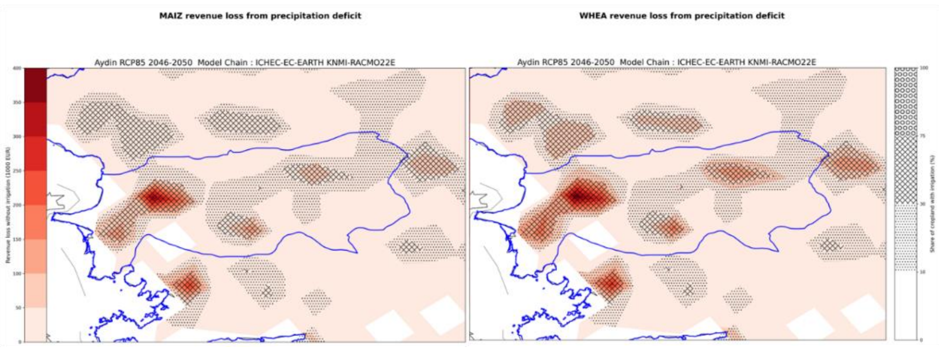

Figure 2-9 : Maize (left) and wheat (right) revenue loss due to precipitation deficit in the region between 2046-2050 under the RCP8.5 scenario.

The map highlights areas where revenue losses are expected to be most severe, with some regions showing losses exceeding 400 USD per hectare for maize and substantial losses for wheat as well. The losses concentrated in the southwestern and central parts of the region. A significant portion of maize cultivation in the region will experience substantial financial strain due to decreased precipitation. However, the maps show that wheat production is slightly more resilient to precipitation deficits compared to maize. Since maize and wheat are critical feed sources for dairy farms in the region, these projected revenue losses could have cascading effects on the local dairy industry.

2.3.4 River Flooding

Table 2-5 Data Overview River Flooding

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
High-resolution flood maps for Europe from JRC, flood extents for different return periods (10, 50, 100, 200, 500 years), flood hazard in Aydin region, particularly along the Büyük Menderes River.	Global flood depth-damage functions (vulnerability curves) from JRC (Huizinga et al., 2017).	Land use/land cover map from JRC (LUISA Base Map 2018) for urban areas,	Flood Risks to build infrastructure, flood and associated damages maps for extreme

Hazard data	*Vulnerability data*	*Exposure data*	*Risk output*
		agricultural fields, infrastructure, and water bodies.	event in Aydin (10, 50, 100, 200, 500 years)

2.3.4.1 Hazard assessment

In the river flooding hazard workflow, high-resolution flood maps for Europe from JRC were used (*Dottori et al., 2022)*. Flood extents under extreme events with different return periods (10, 50, 100, 200, 500 years) were retrieved for the Aydin region. The impact of climate change on river flood hazards under different climate scenarios was not assessed due to the low resolution of Aqueduct Floods' coarse-resolution flood maps for future periods in the region. As a result, distinguishing flood hazard changes over time was not feasible. Therefore, this assessment was conducted solely for current climate conditions. River flow potential for different return periods (10,50 and 100 years) focusing on the Büyük Menderes River were given in Figure 2-10.

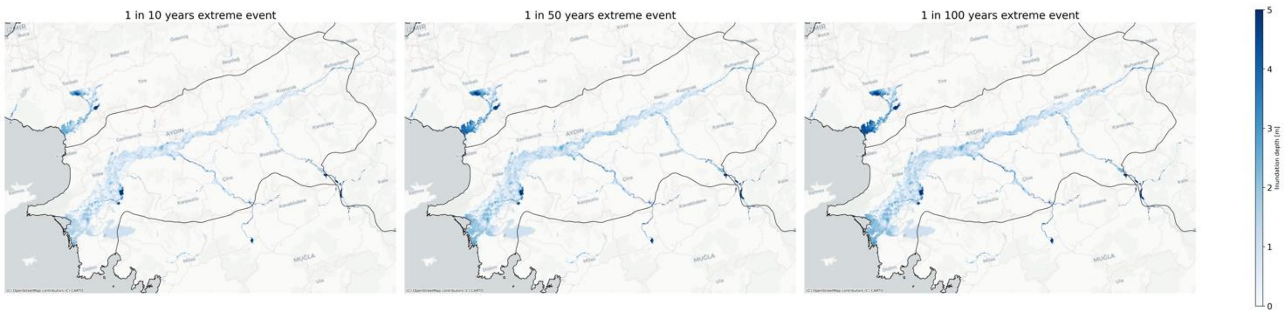

Figure 2-10 River flow potential for different return periods in Aydin region (1, 50, 100 years)

Flood-prone areas along the river expand significantly from the 10-year to the 100-year extreme event scenario, showing the impact of rarer but more severe floods. The delta region (coastal area) and certain low-lying areas shows deeper inundation. The flood hazard in the Aydin region, particularly along the Büyük Menderes River, are significant, especially for higher return periods indicating that extreme rainfall events significantly impact the region.

2.3.4.2 Risk assessment

Risk assessment was assessed to visualize risks to build infrastructure presented by river flooding in the region. High-resolution flood maps for Europe from JRC were used for inundation (Dottori et al., 2022), land use/land cover map developed and produced by the JRC (LUISA Base Map 2018, (*Pigaianiet.al.„ 2021*)) were used for various types of urban areas, natural land, agricultural fields, infrastructure and waterbodies. Additionally, for risk analysis global flood depth-damage functions (vulnerability curves) were used by JRC *(Huizinga et al., 2017)* . Figure 2-11 show the maps of flood and associated damages for extreme river water level scenarios in current climate 1 in 100-year extreme event for Aydin Region. The extent of damage shown in this map suggests that farms located near rivers and low-lying regions need proactive flood adaptation measures. In overall, these maps highlight the need for strategic planning in dairy farming to mitigate flood risks.

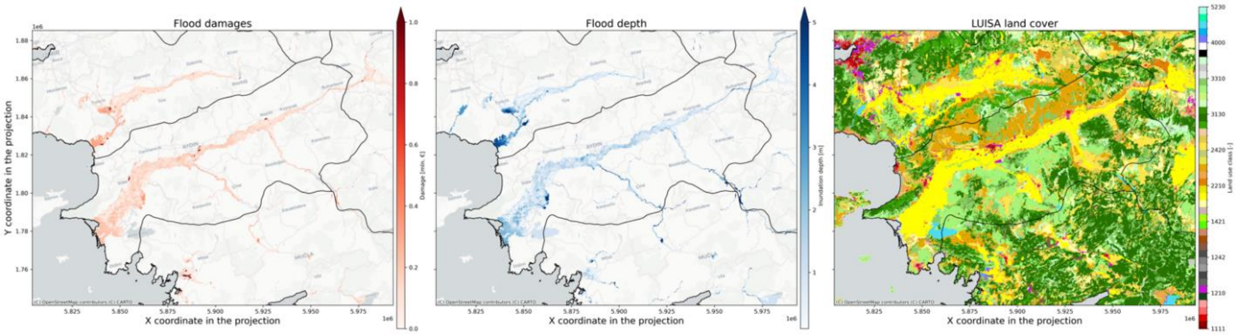

Figure 2-11 The maps of flood and associated damages for extreme river water level scenarios in current climate 1 in 100-year extreme event for Aydin Region.

2.4 Preliminary Key Risk Assessment Findings

2.4.1 Severity

The hazard and risk analysis indicates that Aydin is vulnerable to multiple climate-related hazards, including heavy rainfall and flooding, agricultural drought, heatwaves, and river flooding. These hazards have a significant impact on agriculture, water security, and especially dairy farming. Among the various climate risks, heatwaves pose the greatest threat to the region, as evidenced by historical events and their effects on dairy farms. Rising temperatures and an increasing frequency of heatwave projected to reach 6-8 events per year by the late century under the RCP8.5 scenario—lead to heat stress in livestock, reducing productivity and causing substantial economic losses. Rising temperatures also contribute to increased drought in the region, leading to water scarcity and reduced agricultural yields. These impacts could increase the existing vulnerabilities, particularly in agriculture and livestock farming, where water availability is crucial for sustaining productivity.

2.4.2 Urgency

The risks associated with heatwaves on dairy farming are already evident and are expected to intensify over the coming decades. Even in the near term, rising temperatures will lead to more frequent and prolonged heatwaves, exacerbating heat stress in livestock. Heatwaves represent a sudden-onset hazard occurring over short periods, but their increasing frequency and intensity are driven by slow-onset climate change. Therefore, immediate adaptation is crucial to ensure the sustainability of dairy farming in the region.

2.4.3 Capacity

The climate risk management framework for Aydin's dairy sector is built on collaboration among the Ministry of Agriculture and Forestry, local institutions, universities, and farmer organizations. These partnerships focus on reducing climate vulnerabilities through financial, social, human, physical, and natural resource-based strategies. Financial support and subsidies, such as the "From Animal Fertilizer to Clean Energy: Aydin Atlas" project and the IPARD Program, promote renewable energy integration, irrigation modernization, and climate-resilient livestock management. Social collaboration emphasizes stakeholder engagement, training programs, and support for vulnerable farmer groups to enhance climate-smart practices *(Atlas Renewable Energy, 2021)*. The project focuses on enhancing physical and human capital through precision irrigation, drought-resistant crops, cooling systems, and climate-adaptive livestock housing, supported by training on sustainable practices. Stakeholder consultations identified key challenges such as drought, heat stress, and gaps in water management and renewable energy adoption. By uniting public institutions, universities, cooperatives, and the private sector, the project aims to build climate resilience through data-driven strategies and practical solutions.

2.5 Preliminary Monitoring and Evaluation

During the initial consultations, stakeholders identified agricultural drought and extreme heat as the most critical climate risks for the dairy sector. They highlighted the urgent need for improved water management, heat stress mitigation, and access to climate-resilient technologies. Existing irrigation efforts were deemed insufficient, requiring better crisis management and data-driven decision-making. Expanding climate advisory services and increasing the role of environmental and agricultural organizations were also emphasized. Stakeholders pointed out the need for financial incentives and infrastructure modernization to support climate-friendly farming practices. The project has engaged a diverse group of stakeholders, including public institutions, research organizations, agricultural cooperatives, private sector representatives, and NGOs. Moving forward, the next phase will focus on integrating stakeholder insights into policy recommendations, strengthening collaboration, and enhancing support for climate-smart farming practices, irrigation upgrades, and renewable energy adoption to ensure long-term resilience in Aydin's dairy sector.

3 Conclusions Phase 1- Climate risk assessment

The Climate Resilience Enhancement in Dairy Farming (CliResDairy) project has conducted a comprehensive Climate Risk Assessment (CRA) for Aydin's dairy sector, identifying the most pressing climate risks affecting livestock health, milk production, and overall farm sustainability. The assessment highlights extreme heat, agricultural drought, heavy rainfall, and river flooding as the key hazards impacting the region. Rising temperatures above 32°C have been found to reduce milk yields, while prolonged exposure beyond 38°C severely affects cattle health, fertility, and productivity. Water scarcity and declining soil moisture levels have intensified agricultural droughts, limiting forage crop yields, increasing feed costs, and straining the financial viability of dairy farming. Additionally, heavy rainfall and river flooding have been shown to damage pastures, disrupt dairy infrastructure, and threaten farm operations, further exacerbating economic and operational risks.

Despite ongoing adaptation efforts, several critical challenges remain unaddressed. The lack of high-resolution climate data and livestock-specific adaptation strategies hinders the development of targeted solutions to mitigate heat stress and optimize resource use. The absence of advanced early warning systems and real-time climate monitoring tools limits the ability of farmers and policymakers to implement timely interventions in response to extreme weather events. Financial and infrastructural constraints continue to slow the adoption of climate-smart agricultural technologies, modern irrigation systems, and heat-resistant forage crops, leaving the sector vulnerable to prolonged droughts and extreme heat conditions.

To overcome these challenges, the CliResDairy project integrates scientific data, stakeholder collaboration, and evidence-based adaptation strategies. Key actions undertaken during this phase include the development of heat stress management techniques, implementation of water-efficient irrigation systems, and the design of early warning mechanisms for climate-related risks. Additionally, the project emphasizes capacity-building initiatives, knowledge transfer programs, and financial support mechanisms to help dairy farmers transition toward climate-smart practices. These strategies align with national and regional policies, ensuring that climate resilience is embedded in Aydin's agricultural planning framework.

Moving forward, the project will refine and expand its adaptation strategies, incorporating new climate projections, strengthening policy integration, and fostering broader stakeholder engagement. Future phases will focus on enhancing climate data accessibility, scaling up financial support for sustainable farming practices, and increasing investment in infrastructure modernization. By strengthening collaboration between public institutions, research organizations, farmer cooperatives, and private sector stakeholders, the project aims to create a model for climate-resilient dairy farming in Türkiye. Through a data-driven, multi-stakeholder approach, CliResDairy seeks to secure the long-term sustainability of Aydin's dairy industry, ensuring that it remains resilient in the face of evolving climate risks while contributing to national food security and economic stability.

4 Progress evaluation and contribution to future phases

During Phase 1, we conducted preliminary analyses to identify the primary climate risks affecting the dairy farming sector in Aydin Province, with a particular focus on breeding cattle farming. This phase allowed us to assess how these risks might impact various stakeholders along the value chain, providing a foundation for targeted risk management strategies.

The insights gained in Phase 1 will directly inform Phase 2, where we will conduct stakeholder meetings to validate our findings and gather local data. These meetings will enable us to cross-check the preliminary risk analysis with on-the-ground realities, involving key actors such as farmers, cooperatives, agricultural experts, and local authorities. The data collected during these meetings will enhance the accuracy of our climate risk models and support the development of localized adaptation strategies. To maximize stakeholder engagement, we will ask targeted questions about climate impacts on production, feed availability, animal health, and infrastructure vulnerability, as well as explore potential adaptation measures already in practice. Following the completion of Phase 2, the project will transition to Phase 3, where the primary focus will be on developing risk management strategies based on the validated data and stakeholder input. These strategies will be tailored to address the most critical risks identified, ensuring practical and context-specific solutions for improving climate resilience within the dairy farming sector.

Table 4-1 Overview key performance indicators

Key performance indicators	***Progress***
Multi-risk climate assessment successfully conducted by the end of Phase 1.	*Achieved*
Local data integration completed to refine the multi risk climate assessment by Phase 2.	*Phase 2*
Climate adaptation strategy developed and implemented by the end of Phase 3.	*Phase 3*
Workshop; conducted for stakeholders, including lead farmers, policymakers, relevant agricultural organizations, sector stakeholders, and local government representatives, to increase climate risk awareness and participation.	*Phase 2*
Policy Note; developed and shared with local governments to incorporate climate resilience into regional planning.	*Phase 2*
Scientific Article; published based on project findings to contribute to academic research.	*Phase 3*
Policy Brief; developed and shared with local governments to guide climate adaptation measures.	*Phase 2*
Press Release; issued to increase public awareness and highlight project progress and results.	*Phase 2*

Key performance indicators	*Progress*
Training Session; for agricultural consultants to enhance their capacity to support farmers in climate adaptation strategies.	*Phase 2*
Stakeholder Congress; organized to disseminate the project results and foster collaboration among key participants.	*Phase 3*

Table 4-2 Overview milestones

Milestones	*Progress*
M1: Completion of the multi-risk climate assessment by the end of Month 6.	*Achieved*
M2: Successful integration of local data into the climate assessment by the end of Month 16	*Phase 2*
M3: Workshop for stakeholders (including lead farmers, policymakers, agricultural organizations) completed by Month 16.	*Phase 2*
M4: Training session for agricultural consultants completed by Month 16.	*Phase 2*
M5: Policy Note developed and shared with local governments by Month 16.	*Phase 2*
M6: CLIMAAX workshop in Barcelona attended in June 2025	*Phase 3*
M7: Climate adaptation strategy developed and implemented by Month 22.	*Phase 3*
M8: Scientific article based on project findings submitted for publication by Month 21.	*Phase 2*
M9: Stakeholder Congress conducted by Month 21, bringing together 100 participants to discuss project results and foster collaboration.	*Phase 2*
M10: CLIMAAX workshop in Brussels attended in Dec 2026 to present final project results to policy and decision-makers.	*Phase 3*

5 Supporting documentation

The additional documents and datasets have been uploaded to the Zenodo platform. The content of the files are as follows:

- Main Report (PDF or Word)

Visual Outputs (infographics, maps, charts)

- Heavy Rainfall (extreme precipitation) Workflow (Maps and Graphs)
    - Hazard Workflow Outputs
    - Risk Assessment Outputs
- Heatwaves Workflow (Maps and Graphs)
    - Hazard Workflow (xclim) Outputs
    - Risk Assessment (climate projections) Outputs
- Agricultural Drought (Maps and Graphs)
    - Hazard Workflow Outputs
    - Risk Assessment Outputs
- River Flooding (Maps and Graphs)
    - Hazard Workflow Outputs
    - Risk Assessment Outputs
- Datasets Collected
    - Location of dairy farms in Aydin Region
    - Aydin region boundary
    - Return Periods of 100mm precipitation threshold in Aydin based on historical observations

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