ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I. PROJECT/PROGRAMME INFORMATION

Project/Programme Category:	Regular Country
Country/ies:	Republic of North Macedonia
Title of Project/Programme: agriculture approach.	Building climate resilience of the agricultural system in Radovish region through improved irrigation, land and water management
Type of Implementing Entity:	Multilateral Implementing Entity
Implementing Entity:	Food and Agriculture Organization of United Nations (FAO)
Executing Entity/ies:	Ministry of Agriculture, Forestry and Water Economy (MAFWE)
Amount of Financing Requested:	**9 991 711 (in U.S Dollars Equivalent)**

The Republic of North Macedonia is one of the smallest countries in the Southeast Europe region, with around 2.1 million people; as a Land-Locked Developing Country (LLDC), it is situated in the Southwestern part of the Balkan Peninsula. The country is a non-Annex I party to the United Nations Framework Convention on Climate Change (UNFCCC) and has signed (2015) and ratified (January 2018) the Paris Agreement. As one of the ten poorest countries in Europe, an estimated 455 600 people[1] live below the poverty line. It has the second-highest unemployment rate in the south-central European region; the national rate was 17.2 percent in 2019[2]. The impact of the COVID-19 crisis accentuates poverty and inequalities within the population, particularly affecting children and women.

Agriculture is the third most important sector, with an estimated contribution to the Gross Domestic Product (GDP) of 8.1 percent. Together with the processing industry, the share reaches 12 percent (compared to 1.7 percent in the EU 27). A significant portion of the population (42.3 percent in 2017)[3] live in rural areas, and 45 percent of the employed in the country work in rural areas (period 2017-2019). Macedonian agricultural production and food industry recorded a continuous, gradual increase in competitiveness in foreign markets with an increase in the value of exports of agri-food products by 28 percent, from 486.2 million euros in 2014 to 624.5 million in 2019, while imports in the same period increased by one percentage point more, from 649 million euros in 2014 to 837.2 in 2019[4]. With 193,000 registered family farms, a high figure for a country with such a small population, agriculture alone employs 17 percent of the rural workforce. Despite its importance in the rural and national economies, agriculture is highly vulnerable to present and future climate change and variabilities (European Environmental Agency, 2017; Third National Climate Change Communication 2014; World Bank 2013). The Second National Communication on Climate Change (2nd NCCC) and the Third National Communication on Climate Change[5] (3rd NCCC) identify the Southeast

[1] Rapid Socio-Economic Assessment of the Macedonian Enhanced NDC Targets/Measures (2021), Ministry of Environment and Physical Planning, SBN978-608-4860-01-3
[2] Enhanced Nationally Determined Contributions, 2020. Ministry of Environment and Physical Planning of the Republic of North Macedonia (MOEPP)
[3] Republic of Macedonia Ministry of Finance, Economic Reform Programme 2019-2021 Draft Chapter 4. Structural Reforms
[4] Ministry of Agriculture Forestry and Water Economy, National Strategy on Agriculture and Rural Development 2021-2027
[5] MoEPP (2014), Third National Communication on Climate Change, pg. 59-60

region as one of the most vulnerable to the negative impacts of climate change, with farmers disproportionately affected due to high exposure to climate change risks and shocks, and their relatively lower ability to adapt. The region has the largest share (29 percent[6]) of national gross value added in agriculture and the largest share of crop output (32.7 percent[7]), indicating importance and dependence on agriculture. However, the combination of arid climate and soils with low water-holding capacity, changing precipitation patterns, and increasing temperatures all reduce the amount of water available for agriculture, impacting crop yields. As a result, agricultural production remains caught in a low productivity – low-income trap, and socioeconomic vulnerabilities and climate change risks will exacerbate challenges faced by the sector and the rural population in the region. The Adaptation Fund (AF) project will be implemented in the Radovish valley (Figure1), which is the upper catchment of the Strumica River Basin (RB)[8] in the Southeast region.

Figure1: Radovish valley part of Strumica RB (left) and targeted villages in Radovish valley (right)

Current Climate. The climate in Radovish valley is moderate Mediterranean-continental, with hot and dry summers and cold and wet winters that vary depending on the altitude difference (400-707 m).

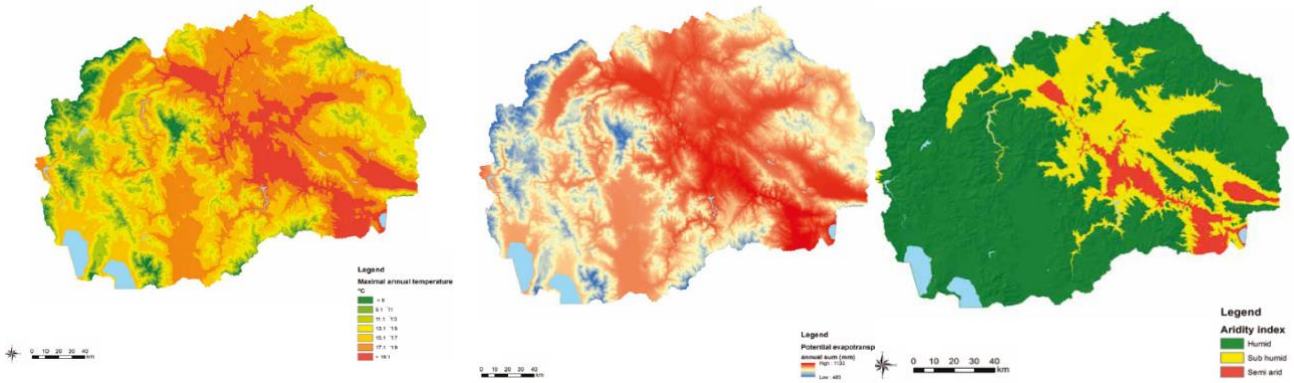

Figure 2: North Macedonia – maximum annual temperature (left), potential evapotranspiration (centre), and aridity index (right) (Source: Askoy et al., 2020)[9]

The average annual precipitation is 563 mm with large fluctuations from year to year and between the mountains and the valley. The region has 2,326 sunshine hours per year, 6.4 hours per day (on average), and 112 sunny days a year. According to the 20-year range (1991–2010), the Strumica RB is one of the warmest regions in the country (Figure 2, right). The warmest months are July and August, when the temperature averages 31°C, and frequently reaches 40°C[10]. The coldest month is January, with an average temperature of 1.2°C. The climate in the Radovish valley falls under the dry sub-humid class (0.5–0.65) because of its high potential for evapotranspiration (Figure 2, centre) and high aridity index (Figure 2, left).

[6] National Strategy on Agriculture and Rural Development 2021-2027, Ministry or Agriculture, Forestry and Water Economy
[7] https://www.stat.gov.mk/PrikaziSoopstenie_en.aspx?rbrtxt=116
[8] Strumica RB covers an area of 1649 km^2 or 6.4percent of the territory of the country
[9] Aksoy, E., Arsov, S., Mincev, I., Fang C. 2020. Agro-ecological atlas of the Republic of North Macedonia. Rome, FAO
[10] Municipality of Radosevich 2021 https://radovis.gov.mk/

The annual evapotranspiration is 677mm and is higher than the average annual precipitation (563mm); hence current climatic conditions indicate that agricultural production is highly dependent on irrigation water to meet the crop demand.

Historical Climate Analysis[11]

Temperature. The historical climate analysis shows that the average mean annual temperature for the most recent 30 year period (1981-2010) is from 0.2° to 0.5°C warmer as compared to the 1961 to 1990 period, indicating a trend in the increase in temperature, with increases higher in the already hottest summer months.

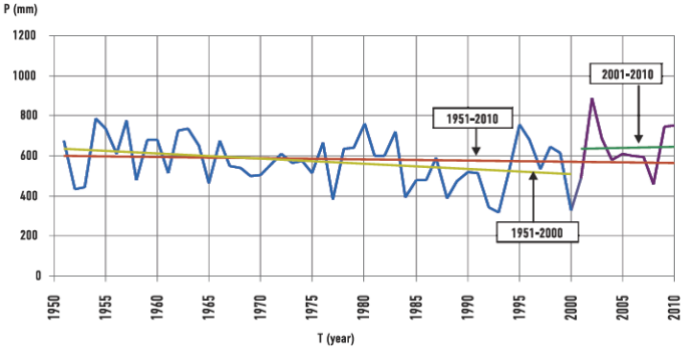

Figure 3: Precipitation trends for Strumica from 1950 to 2010 (Source: 3rd NCCC, 2014)

Precipitation. Inter-annual variability in rainfall and a decreasing trend in rainfall is observed, especially from May to November. In Strumica meteorological station, the closest to the targeted area, a precipitation decrease of -20.9mm is observed during the 1971-2000 period as compared to the period from 1961-1990 (3rd NDC, 2014), with the highest decrease in spring. While the year to year seasonal and regional variability in precipitation is high, records indicate a general trend of decreasing average annual precipitation (USAID, 2018[12]) with average annual precipitation for Strumica RB for the period 1951-2010 of 583 mm (Figure 3), as compared to the 732 mm national average.

Extreme events. Radovish valley is characterised by an increased frequency of drought periods, lasting 10-15 days (85 percent), 16-21 days (20 percent), 21-25 days (6 percent) and over 30 days (4 percent)[13]. Floods frequency and intensity is also increasing due to heavy rains, and during the flood in 2015 (Jan-Feb), the damages in Radovish valley to agriculture and agricultural infrastructure amounted to 336,616 Euro and to irrigation and drainage to 230,894 Euro[14]. The historical analysis points to a decrease in the number of cold waves, an increase in the number of summer days with Tx>25°C (Fig. 4), and an increase in heat waves and the number of tropical nights. This leads to an increase in evapotranspiration, a decrease in soil moisture and an increased need for irrigation. Regional historical climate analysis indicates that the frequency of hot days has almost tripled and the length of summer heat waves has doubled since 1880. The number of warm days increased between 4-10 days per decade between 1961 and 2012 (USAID, 2018). Men and women farmers in Radovish valley also reported observing changes and large variations in temperature and their observations align with scientific evidence on historical climate analysis and projections. Farmers reported observing more frequent extreme events (floods, dry spells, early and late frost, hailstorms, heavy rains later in the season). They also observed more frequent droughts and increases in temperature and an earlier start of the season (Community Consultations, 2021)[15].

[11] 3rd National Communication on Climate Change. Ministry of Environment and Physical Planning, 2014. Historical climate analysis was conducted based on the historical data from 1971 to 2000, and from 1981 to 2010, and compared with the period from 1961 to 1990
[12] USAID. 2019
[13] UNDP. 2016. Flood Risk Management Plan for Strumica River Basin
[14] Government of Republic of Macedonia, 2015, Rapid Damage and Needs Assessment Report
[15] As part of Adaptation Fund Concept Notedevelopment, FAO conducted Community Consultations; forteen focus groups discussions with 142 men and women farmers, and three focus group discussions with women only were organized in targeted villages. Data on farmers observations on climate change, impact on agriculture, barriers to adaptation and priority adaptation options was collected

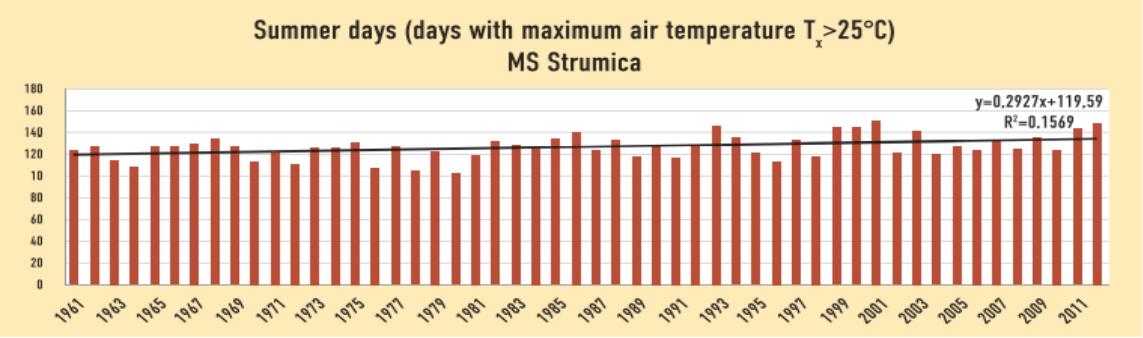

Figure 4: Historical analysis number of summer days in Strumica (Source: 2nd NDC, 2014)

Climate Change Projections. The projected annual average temperature is expected to increase to 15.75°C by 2050 in Strumica RB, an increase of 8 percent as compared to historical long-term average temperature (3rd NCCC, 2014). An increase in mean monthly temperatures is expected, with the intensity of change greatest in the already warmest period of the year from May to October (i.e., the growing season). Hence, the summers will be warmer and the rise in temperature will be greater (Table 1).

Table 1: Predicted seasonal and annual changes in air temperature at the national level *Source: 3rd NCCC, 2014*

	DJF /A				MAM /A				JJA /A				SON /A				Yeat/A			
	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100
High	1.1	2.4	3.8	5.0	1.4	3.0	4.6	6.2	2.4	4.8	7.9	10.0	1.5	3.0	5.0	6.7	1.6	3.3	5.3	7.1
Medium high	0.9	1.9	3.0	3.9	1.1	2.4	3.6	4.8	1.9	3.8	6.2	8.2	1.2	2.4	3.9	5.2	1.3	2.6	4.2	5.5
Medium	0.8	1.5	2.2	2.7	1.0	1.8	2.7	3.3	1.7	3.0	4.6	5.8	1.1	1.9	3.0	3.7	1.2	2.0	3.1	3.9
Medium low	0.7	1.0	1.5	1.7	0.9	1.3	1.9	2.1	1.6	2.1	3.4	3.9	1.0	1.3	2.2	2.5	1.1	1.4	2.2	2.5
Low	0.5	0.8	1.1	1.1	0.7	0.9	1.4	1.4	1.2	1.5	2.4	2.7	0.7	1.0	1.6	1.8	0.8	1.0	1.6	1.7

DJF=winter, MAM=spring, JJA=summer, SON=autumn

A decrease in precipitation is predicted for the period 2025-2050 (Table 2) in all seasons and annually, with a maximum decrease in the summer season (JJA), resulting in drier summers and possibly some summer months with extended dry spells and no precipitation (3rd NCCC, 2014). In addition, climate change will increase year to year inter-seasonal precipitation variability and will likely increase the frequency and intensity of droughts, with the probability of severe annual drought likely increasing by 2060 (3rd NCCC, 2014).

Table 2: Projected seasonal and annual changes in precipitation at the national level *Source: 3rd NCCC, 2014*

	DJF /A				MAM /A				JJA /A				SON/A				Yeat/A			
	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100	2025	2050	2075	2100
Low	-1	-3	-2	-1	-2	-5	-7	-9	-4	-12	-29	-36	-1	-5	-8	-9	-2	-6	-8	-8
Medium low	-1	-4	-3	-2	-2	-6	-10	-12	-6	-15	-38	-47	-1	-7	-10	-13	-3	-8	-10	-12
Medium	-3	-6	-7	-9	-3	-8	-13	-17	-13	-25	-46	-57	-2	-9	-14	-20	-4	-10	-15	-19
Medium high	-4	-8	-11	-16	-4	-9	-17	-23	-20	-38	-54	-66	-4	-11	-21	-27	-5	-11	-21	-27
High	-5	-10	-14	-20	-5	-12	-21	-29	-25	-48	-68	-80	-5	-14	-25	-34	-6	-14	-25	-33

DJF=winter, MAM=spring, JJA=summer, SON=autumn

The predicted increase in Strumica RB in the number of hot days, hot nights, and heatwaves and projected 7 percent decrease in annual average precipitation by 2050, with a 17 percent decrease expected in summer (3rd NCCC, 2014), would lead to increased damage to fruits and crops and a yield reduction, with a severe impact on rural population dependent on agriculture, providing water demand is not met.

Climate Change Impact on Agriculture and Water Supply and Demand. Agricultural production in Radovish is contingent on the availability and management of water resources. Considering climate change projections (i.e., increase in temperature, dry spells, and hot days) and that evapotranspiration (677 mm) is already higher than rainfall (563 mm), water demand will increase, resulting in shortages. The greatest deficits are expected in summer (Jul-Aug), leading to decreased soil moisture and more frequent and severe

agricultural drought, with serious management implications for water resources users. Hence, functional and climate-resilient irrigation systems will be critical to mitigating climate shocks to agricultural production. Considering that the current irrigation system is characterized by outdated and limited water-saving enabling technology and that water demands are increasing, a negative impact on annual crops is expected. Past extreme events (i.e., heat waves and dry periods in 2008 and 2012) led to significant production losses. **The increase in temperature** will lead to an early start of the agricultural season and negatively impact crop growth cycles by reducing the amount of time available for crops to develop. The results of crop modelling for the targeted region predict a dramatic shift in the growing season for wheat and maize, with decreases in yield of 21 percent and 56 percent (without irrigation), respectively, by 2025 (USAID, 2018). An increase in the frequency and severity of flood events will be particularly problematic during the spring months, causing delays in planting summer crops and during late summer, when it can prevent timely harvesting or cause waterlogging of roots and damage harvest. Radovish men and women farmers already observed severe impact on agriculture and noted: (i) increase in demand for frequent irrigation, (ii) hot weather causing early blooming and late frost damaging orchards, (iii) increase in temperature and heavy rains, both causing increased incidence of pests and diseases (e.g., spots on apples, green worm infestation), (iv) strong sun causing damage to pepper crops, resulting in low yield and quality and reduced income from sale, (v) warm weather causing hyperproduction, resulting in the sale of peppers at a lower price, and (vi) increase in the cost of production and increase in workload, especially for women (Community Consultations 2021).

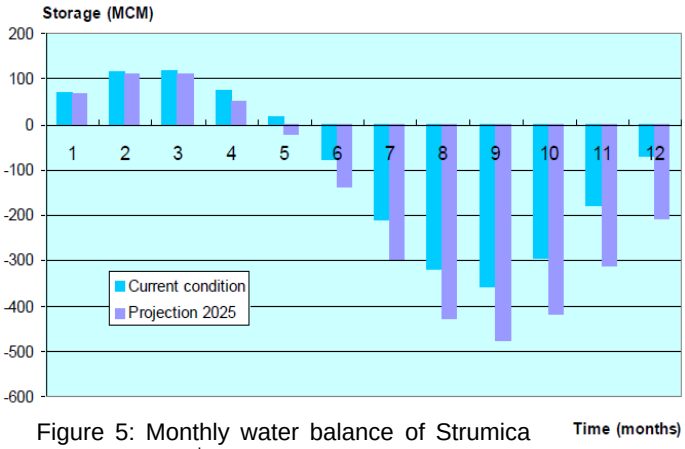

Figure 5: Monthly water balance of Strumica RB (Source: 3rd NCCC) 2014)

Evapotranspiration projection in the Strumica RB is 706.8 mm, an increase of 29.8 mm (4.4 percent) compared to the average current evapotranspiration (677 mm). Long-term average annual precipitation estimated at 583.1 mm is expected to decrease by 7 percent by 2050 (558.36 mm by 2025 and 554.40 mm by 2025). Based on the outputs from the global climate model, the annual run-off can decrease up to 5.1 percent (3rd NCCC, 2015). While there are currently no water shortages in the January-May period that falls outside the irrigation season, all other months already experience shortages, most significant in the August-September period.

The climate-induced risks and water demand up to 2025 (Figure 5) will result in an estimated water shortage of 478 million m^3 in September (25 percent increase) and in all months during the irrigation season (June to October), with average annual shortages of around 257.47 million m^3 (3rd NCCC, 2014). Climate change projections point to an increase in water shortfalls between 13.2 percent (low-impact scenario) to 22.2 percent (high-impact scenario) by the 2040s (Sutton et al., 2014). Hence, without an effective irrigation system able to make efficient use of water and respond to water demands in a timely manner, water stress will impact crop yield due to: (i) direct impacts associated with temperature and rainfall changes, (ii) increased demand for timely irrigation to address water shortages and extreme events, and (iii) water shortages due to increased evapotranspiration, lower rainfall, and increased demand.

Addressing the need for timely irrigation and responding to climate shocks is dependent on accurate and valid climate services. However, Radovish municipality does not have an agrometeorological station and depends on the Strumica station for weather and seasonal forecasts. Therefore, the accuracy of the service, due to changes in altitude, is not guaranteed (Climate Change Strategy 2016-2025, Municipality of Radovish). Farmers are not receiving timely and context-specific expert advisories that would support decision making around the timing of planting and harvest, fertiliser and pesticide and irrigation application, and protection from extreme events. Without proper support, yields decrease, the quality of production is low, and the workload and cost of production increase. The irrigation system in Radovish region is part of the state-owned irrigation systems managed by the JSC "AD Vododstopanstvo," through its subsidiary, "Radovishko pole" (Figure 6). Constructed in 1978 with hydrant-type outlets, the system is in poor condition

and due to low pressure, does not allow for efficient on-farm irrigation (i.e., drip, sprinkler) that would conserve water. Section of the system, in lower areas, that consist of a high-pressure system, despite an opportunity for on-farm water-saving irrigation technology, uses surface irrigation, with a minimal application of drip system. (Technical Consultations, 2021[16]).

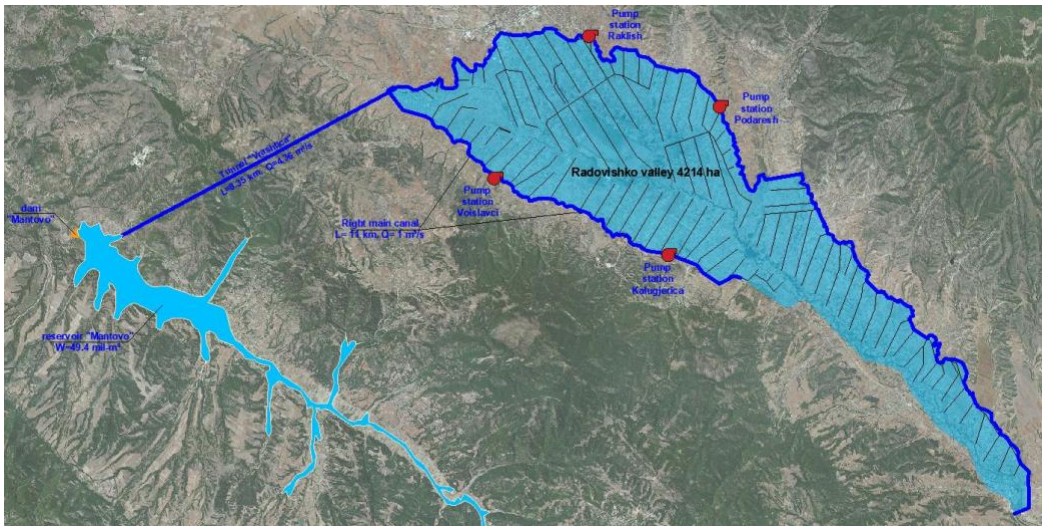

Figure 6: Irrigation systems in Radovishvalley, as part of HS Mantovo (Source: FAO, 2021)

The irrigation network has the capacity to irrigate an area of 4,214 ha, but due to outdated and damaged hydromechanical equipment (valves, air valves, hydrants, regulators, etc.), lack of functioning pumps in the system and water losses by poor conveyance efficiency, only 500-600 ha are currently irrigated. Climate change-induced demand for water for agriculture and competition for water with other users results in water shortages and restrictions on the amount of water available for irrigation. With the mentioned climate change projections, a climate-proofed irrigation system that is able to meet water demand and conserve water will be critical to build the resilience of the agriculture system in Radovish. The complexity of the climate-change-induced risks to agriculture in Radovish calls for context-specific farm and landscape level adaptation. However, due to excessive land fragmentation of both land ownership and land use and size, agricultural productivity, opportunities for sustainable adaptation, and cost-effectiveness of the adaptation at farm and landscape levels are compromised. The number of parcels in Radovish below 0.5 ha accounts for 94 percent of the total number of parcels while 5 percent of the total number of parcels are sized from 0.5 to 1 ha. Parcels above 1 ha account only slightly above 1 percent. (Figure 7.). Furthermore, it is assessed that around 1/3 of all arable land in the region is currently unutilized (i.e., abandoned). These structural problems in agriculture call for improving the local farm structures integrated with the climate change adaptation efforts.

[16] As part of AF CN development FAO conducted an initial assessment of the state of the Radovishko pole irrigation system. Assessment meetings with Vodostopanstvo - Radovishko pole irrigation department were held, on-site inspections of the infrastructure conducted, irrigation maps were analyzed and drown and photographic evidence collected

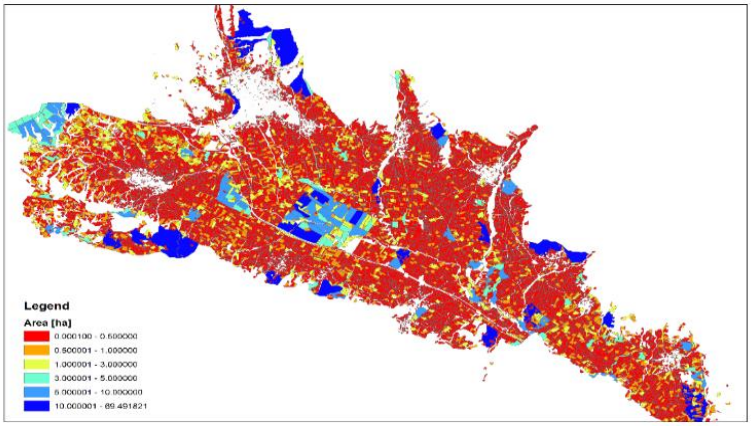

Figure 7 Distribution of parcel size in Radovish valley (Source: FAO, 2021)

The shape of the agricultural parcels is mostly irregular, usually narrow and long, which has an unfavourable impact on the agricultural activities (land works, equipment deployment and input application) and the use of adequate and contemporary production technologies and machinery. The unfavourable farm structure with excessive land fragmentation, small farm sizes and widespread land abandonment jeopardise agricultural production competitiveness and hinder the farm and landscape level opportunities for adaptation. Excessively small land size also entails a loss of agricultural lands that are currently used for infrastructure (production frontiers, access roads, built up structures etc.). Furthermore, the generally small parcel size limits on-farm adaptive capacity due to insufficient economies of scale to invest in adaptive measures, such as localized monitoring equipment, transfer of climate-smart agriculture measures and tertiary irrigation systems that would address climate change risks, reduce erosion and increase yield. This, in turn, demotivates farmers, especially young farmers, to invest in climate-smart technologies and results in low-yield and low profitability, perpetuating a negative feedback loop, often resulting in outmigration from the rural areas. In addition, opportunities for landscape-level interventions are limited in a fragmented landscape. Well recognized by national strategies, in particular, the National Agricultural and Rural Development Strategy 2021-2027 and the new Water Management Strategy under formulation, the rejuvenation of the agriculture sector is of strategic importance to provide employment opportunities for the young population in rural areas, prevent the outmigration of youth, lower the country's dependency on food import and allow the introduction of sustainable and climate-resilient technologies.

Project / Programme Objectives:

This project aims to address the identified issues through the establishment of a climate-resilient agricultural system in Radovish valley by removing structural land barriers to adaptation and minimizing threats to agricultural production due to climate-change-induced water demand increase and technological, information, and knowledge gaps. This will be achieved through integrated and simultaneously reinforcing components, leading to enhanced climate resilience. The project will target eleven adjacent villages in Radovish municipality, with a specific focus on young farmers (18 to 40 years old) and women farmers. The information, knowledge, tools, and evidence generated at the project site will be disseminated at regional and national levels to facilitate scaling up and mainstreaming climate adaptation into policies and plans.

Component 1: Creating an enabling environment for climate adaptation in Radovish valley and regional and national levels through **generating evidence, building capacity, awareness-raising, and improved access to climate and weather services.** This is consistent with the AF strategic objectives and result frameworks, in particular

- Outcome 1: Reduced exposure to climate-related hazards and threats;
- Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses;
- Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction process at local level

Component 2: Building resilience to climate change shocks and risks to agricultural production in Radovish valley through ***climate-proofing the irrigation system*** for resilient agricultural production and efficient and sustainable irrigation water management. This is consistent with the AF strategic objectives and result frameworks, in particular

- Outcome 1: Reduced exposure to climate-related hazard and threats;

- Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets;
- Outcome 7: Improved policies and regulation that promote and reinforce resilience measures.

Component 3: Empowering vulnerable communities to adapt to climate change and enhance their adaptation capacity through ***improved farm structure and climate-resilient agricultural practices***. This is consistent with the AF strategic objectives and result frameworks, in particular

- Outcome 1: Reduced exposure to climate-related hazards and threats;
- Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets;
- Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas;
- Outcome 8: Support the development and diffusion of innovative adaptation practices, tools and technologies.

Project / Programme Components and Financing:

Expected Outcomes	Expected Project Outputs and Activities	Budget ($US)
COMPONENT 1. Creating an enabling environment for climate adaptation in Radovish valley and regional and national levels through **generating evidence, building capacity, awareness-raising, and improved access to climate and weather services**		
1.1. Farmers empowered to make informed short-and long-term adaptation decisions based on the climate change projections and timely, accurate, and relevant climate information and advisory.	1.1.1. Three new automated agrometeorological stations installed and connected to the agro-meteorological network operated by the national HMS (Agrometeo.mk) to provide local weather forecast and seasonal forecast. 1.1.2. Soil sampling and mapping. Soil properties will inform identifying (i) best crop rotations for climate-resilient agriculture, (ii) measures needed to maintain soil health, and (iii) soil water properties for developing context-specific automated and/or semi-automated irrigation schedules. This will result in increased yield and water conservation. 1.1.3. Pilot model farms identified and equipped with Internet of Things (IoT) technologies and climate service app developed with notification Application Programme Interference (API) to disseminate information to other farmers and to mitigate impacts of extreme climate events, increase the efficiency of production through information on soil moisture and irrigation schedule, pest warnings, crop development and application of inputs. 1.1.4. Capacity of key stakeholders (HMS – agrometeorological services, NEA - advisory services and farmers' organisations) developed to collect and analyse data, provide advisories and establish effective dissemination mechanisms. 1.1.5. Awareness of climate change projections and risks and impacts on agriculture increased among women and men farmers and key local technical departments to facilitate climate adaptation efforts in Radovish region.	**350,000**
1.2. Climate change adaptation mainstreamed into local, regional and	1.2.1. Systematic review of existing adaptation practices in relevant sub-sectors (water management, agricultural practices, agro-investment, farm management and tenure, natural resource management, and agricultural technology and innovation), including	**100,000**

national adaptation plans and strategies.	their evaluation and impact assessment conducted. 1.2.2. Guidelines for policymakers prepared to mainstream climate change adaptation into the regional and national adaptation investment portfolio and adaptation plans and strategies.	
COMPONENT 2. Building resilience to climate change shocks and risks to agricultural production in Radovish valley through ***climate-proofing the irrigation system*** for resilient agricultural production and efficient and sustainable irrigation water management		
2.1. Existing irrigation system's capacity to mitigate climate change risks enhanced through technical improvements, leading to water conservation and water irrigation efficiency. 2.2. Climate-resilient agricultural livelihoods created through expansion of existing irrigation system facilitated through land consolidation. 2.3. Evidence generated to support developing national irrigation strategy and water management policy.	2.1.1. Replacement of the open right channel to a closed pressurized system to eliminate technical and losses from evapotranspiration; total length of 9 km to supply water to an area of 1,400 ha from the right side. The reduction in water losses will also increase available water for irrigation in the left channel to cover 600 ha and deliver water to approximately 300 ha to downstream users (Strumica RB). 2.1.2. Construction of energy-efficient (with frequency converter) pumping station accompanied with pumping pool to facilitate the introduction of water-saving on-farm technology (sprinkler and irrigation) and regulate water supply to the irrigation network, covering 1,400 ha of land. 2.2.1. Full replacement of old-type with new type hydrants to enable multiple user irrigation, eliminate water losses and increase efficiency on 2,000 ha of distribution network, 40 percent replacement of main manholes on the distribution lines and 40 percent replacement of the hydro-mechanical equipment, both to the right and left channel. 2.2.2 Protective structure built, including river crossing and closure of the section of existing canal that passes through the village Injevo. 2.3.1. Water monitoring system, involving in-situ and automated measurement devices (flow meters)	**5,500,000**
COMPONENT 3: Empowering vulnerable communities to adapt to climate change and enhance their adaptation capacity through ***improved farm structure and climate-resilient agricultural practices***		
3.1. Improved farm structure increases the efficiency of on-farm climate adaptation technologies and practices, motivates farmers to adopt, and enables landscape-level adaptation.	3.1.1. Feasibility studies conducted in seven selected villages to analyse current farm structures, land use, agricultural production, barriers for implementation of climate adaptive agricultural practices and the landowners' interest in participation in land consolidation including interest of owners not using their land in selling parcels and active farmers' interest in purchasing additional land. 3.1.2. Re-allotment Plans developed in areas where land consolidation is assessed feasible through direct negotiations and participation of the landowners/farmers following the procedures of the Law on consolidation of agricultural land and include detailed technical design of agricultural infrastructure, if any, for enhanced land productivity (service/access roads, shelter belts or other required interventions). 3.1.3. Registration in the Real Estate Cadastre of the new ownership rights following the approved Re-allotment Plans and construction of agricultural infrastructure with establishment of adaptive production	**1,550,000**

	practices enabled by land consolidation	
3.2. Radovish men and women farmers' and farmers at regional and national levels empowered to adopt climate-resilient agricultural practices for sustainable and environment-friendly production.	3.2.1. Mix of climate-resilient (i.e., climate-smart agriculture and organic farming) and context-specific agricultural practices, identified through systematic review and piloted and tested in consultation with technical experts and women and men farmers to identify no-regret adaptation options. 3.2.2. Climate-resilient crop diversification technology transferred and technical know-how disseminated through demonstrations, training and fact-finding farmer-to-farmer visits. 3.2.3. Evidence and lessons learned generated through climate-smart and organic production integrated into the e-platform for Agricultural Knowledge and Innovation Systems (AKIS) for scale-up at regional and national levels. 3.2.4. Evidence-based guidelines developed and, together with AKIS, integrated into the curriculum of the National Advisory Agency to support farmer-science-advisory services, knowledge sharing, and dissemination, informed by digital assistance, machine learning, and artificial intelligence (AI) 3.2.5. Training of trainers for Advisory Officers provided to enable the provision of up-to-date and expert gender-sensitive advisories on climate-resilient technologies, crop diversification, and information related to government programmes.	**910,000**
Project activities costs		**8,410,000**
Project Execution Cost (9.5 percent)		**798,950**
Total Project Cost		**9,208,950**
Implementing Entity Fee (8.5 percent)		**782,761**
Total Amount of Funding Requested[17]		**9,991,711**

Projected Calendar:

Milestones	Expected Dates
Start of Project/Programme Implementation	06-2022
Mid-term Review (if planned)	06-2025
Project/Programme Closing	06-2027
Terminal Evaluation	11-2027

[17] Transfer of the funds to executing partner shall be conducted through Operational Partners Implementation Modality (OPIM) approach. It should be noted that the identified Operational Partner or OP, results to be implemented by the OP and budgets to be transferred to the OP are non-binding and may change due to FAO internal partnership and agreement procedures which have not yet been concluded at the time of submission.

PART II. PROJECT JUSTIFICATION

A. Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience.

The Radovish valley is one of the most vulnerable regions in the country due to high exposure to climate risks, dependence on agriculture, and low capacity to adapt. The livelihoods that predominantly depend on agriculture for household food security and income are compromised due to projected increase in temperature, increased frequency and intensity of extreme events (droughts, hail, dry spells, heavy rains), and reduced rainfall. The current agricultural system is characterised as highly vulnerable to climate change impacts, and this vulnerability is compounded with further constraints due to inefficient farm structures such as (i) small farm and parcel sizes, excessive land fragmentation that constrains agricultural competitiveness and prevents opportunities for adaptation and implementation of cost-effective adaptive measures; (ii) limited access to climate and weather services, awareness about climate change impacts on agriculture, and knowledge of climate-resilient practices among farmers and advisory services, and (iii) an outdated irrigation system characterised by high water losses not able to meet timely demand for water for irrigation.

The combination of climate change risks and barriers to adaptation points to the need for on- and off-farm climate investments to ensure sustainable production and address climate change risks. The transformation to a climate-resilient agricultural system will be achieved through integrated, context-specific activities that will remove the barriers posed by the unique land structure pattern to adaptation, enable adaptation on-farm and off-farm, and increase effectiveness and cost-efficiency of adaptation interventions introduced through the project and directly by farmers. The interventions proposed will lead to:

- Improved farm structure created through the implementation of land consolidation increases the agricultural productivity and efficiency of on-farm climate adaptation technologies and practices, motivates farmers to adopt, enables landscape-level adaptation, and eventually increases resilience.
- Informed farmers who are able to make adaptation decisions based on the timely, accurate, and relevant climate information and weather services and advisories.
- Increased capacity of key stakeholders (agrometeorological officers, extension services and farmers' organisation) to collect and analyse data, and dissemination mechanisms established.
- Mainstreaming of climate change adaptation into municipal and regional plans and strategies and national policies through evidence generated.
- Enhanced capacity and conveyance efficiency of the irrigation system to mitigate climate change risks through climate-proofing and upgrading that promotes conservation and sustainable agricultural use of water.
- Climate-resilient agricultural livelihoods created through extension of existing irrigation system, facilitated through land consolidation.
- Farmers' communities empowered to adopt climate-resilient agricultural practices (organic farming, climate-smart agriculture) for sustainable, resource-efficient and environment-friendly agricultural production.
- Evidence generated to support national policy formulation for water allocation and water irrigation management.

The integrated implementation of land consolidation and climate-proofing of the irrigation system in the targeted areas where both interventions are feasible will contribute to spatial climate adaptation by dovetailing land consolidation objectives with climate risk mitigation and adaptation goals. The impact of the integrated water management and land consolidation initiatives in EU countries has shown that interventions jointly contribute to creating multifunctional climate-resilient rural areas (Stańczuk-Gałwiaczek et al., 2018[18]). Consolidation of land holdings was recognized as an essential step to any agricultural adaptation intervention as fragmented land makes it difficult to introduce any new productivity-enhancing intervention[19].

[18] Małgorzata Stańczuk-GałwiaczekKatarzyna Sobolewska-MikulskaHenk RitzemaJantsje M. van Loon-Steensma, Integration of water management and land consolidation in rural areas to adapt to climate change: Experiences from Poland and the Netherlands, https://doi.org/10.1016/j.landusepol.2018.06.005

[19] Adaptation Fund-WFP Building Resilient Food Security Systems to Benefit the Southern Egypt Region Phase I and II. available at: https://www.adaptation-

FAO is also recommending such multi-purpose land consolidation combining agricultural development with climate change actions[20]. Introducing land consolidation as an instrument of climate adaptation under the AF project will in the future guide similar interventions in other regions of North Macedonia and in the Western Balkan countries. Thus, land consolidation becomes an enabler of climate change adaptation, without which the farmers' efforts are excessively constrained by productivity and economic shortcomings.

The Components and activities proposed are fully aligned with the national priorities and validated through national and local Government meetings and community consultations (see Part II, Section H). In addition, in-country technical experts (i.e., irrigation, climate-resilient practices, climate and weather services) have validated all activities to assess initial feasibility and impact on present and future climate change risk. The proposed context-specific adaptation model will scale up good practices and lessons learned (e.g., the ongoing EU funded MAINLAND project supporting the implementation of the National Land Consolidation Programme implemented by FAO[21]), introduce innovations (Internet of Things, smart technology, land consolidation as an institutional instrument of adaptation), and leverage investments (national and from the EU Instrument for Pre-Accession Assistance for Rural Development IPARD 2021-2027) to support climate-smart irrigation technology and organic farming). The activities will be implemented at the farm level, and the impact at regional and national levels will be achieved through generating evidence and disseminating best practices, lessons learned, recommendations, and guidelines.

The climate change strategies of North-Macedonia are mostly focused on mitigation related activities, and supporting farmers in adaptation is considered crucial to secure the income of a large part of the rural population of the country and improve rural livelihood. The specific farm structure in the project area and the location of the project interventions must be further researched to exploit the potential and transfer the social innovation for scaling out. The project, therefore, introduces a rigorous review methodology (called systematic review) to provide unbiased and evidence-based best practices. As implemented and tested adaptation measures are in the infancy in the country, high-rigour methods can warrant the applicability of the recommendations. Evidence generated through systemic review and the AF project and guidelines for policy-makers will facilitate shifting and alignment of incentives to promote investment in climate-resilient development and mainstreaming climate change considerations into agricultural policies and programmes at local, regional, and national levels. Activities under each component are proposed that build capacity for climate adaptation of key stakeholders and transfer through e-platform, new technology, training, and information sharing targeting Advisory Services (i.e., Extension Officers), farmers, farmers organisations, and the Hydro-meteorological Service (HMS). Capacity-building activities will contribute to bringing transformative change beyond the project lifetime and targeted area. Specific components, outcomes, and activities are further elaborated in the text below.

Component 1: Creating an enabling environment for climate adaptation in Radovish valley and regional and national levels through generating evidence, building capacity, awareness-raising, and improved access to climate and weather services.

Component 1 aims to develop capacity for generating, analysing and disseminating climate and weather services, including seasonal forecasts, early warning (drought, dry spells), and weather forecasts to support farmers in making informed decisions and adopting context-specific, timely, climate-resilient practices. The installation of automated, in-situ agrometeorological weather stations will enable real-time information directly to farmers. The data from the newly installed automated weather stations will be aggregated into the national "Agrometeo" system and integrated into climate-smart apps for notification and data access through Application Programming Interface (API). The integration of local data with other global and regional data sets to support precision farming using Application Programme Interference (API) will serve as agricultural guidance that will mitigate the impact of extreme climate events (droughts, dry spells, heatwaves, pests) and increase efficiency and production through information on soil moisture and irrigation scheduling, pest warning, crop development, and application of inputs. This Component will be implemented in collaboration with the Hydro-meteorological Service (HMS) under the Ministry for Agriculture, Forestry and Water Economy (MAFWE), mandated to provide meteorological and climatological services and early

fund.org/projects-document-view/?URL=en/882201538084594437/4-Final-egypt.pdf pg. 28

[20] FAO Legal Guide on Land Consolidation, 2020: http://www.fao.org/documents/card/en/c/ca9520en/

[21] FAO MAINLAND website: http://www.fao.org/in-action/mainstreaming-national-land-consolidation-programme/en/

warning. Presently, the HMS develops 12-hour, 24-hour, 2-day, 3-day, and 5-day weather forecasts, and occasionally tailor-made weather forecasts for agriculture, and issues warnings for various hazards (e.g. fires, mudslides, hailstorms), disseminated through phone, radio, and television. Alerts and real-time data are also available through HMS's web page. However, rural areas are not well covered, and Radovish does not have a weather station. At present, there are informal and private agro-meteorological stations operating in the Southeast region. These stations provide information that is not part of the official state system because they do not fulfil the HMS and WMO standards, data is not validated, and the information they generate is not considered reliable. Moreover, there is no spatial modelling and downscaling and farmers cannot use the information because it is not site-specific for Radovish region. The in-situ agrometeorological weather monitoring will increase the inclusiveness of climate information systems and improve the national coverage of existing facilities.

Timely and accurate historical, point, and seasonal forecasts will help farmers plan, minimise costs, and make relevant decisions related to irrigation, timing of land works and delivery, pest control, harvesting, and fieldwork. This will maximise yield and profits for farmers. Demonstration model farms under Component 3.2. (i.e., climate-smart agriculture, organic agriculture and crop diversification) will be supported with remote sensing and in-situ equipment (e.g., soil moisture sensors, H sensors, automated valves for irrigation scheduling, drones with thermal and spectral cameras for pest and water monitoring) and equipped with Internet of Things (IoT) technologies to monitor farm-level dynamics and the impacts of climate-resilient practices and technologies. Demonstration farms will serve as learning and awareness-raising sites for Radovish women and men farmers and facilitate the scaling up of climate-smart practices. Demonstration sites will bring together farmers, advisors and scientists to disseminate best practices and lessons learned at regional and national levels. In addition, climate change awareness and understanding of risks will facilitate long-term planning at the farm level and the adoption of innovation introduced through Component 1 and Component 2. This effort is a continuation of FAO's ongoing work with the State Hydrometeorological service to provide advanced climate information systems and early warning for farmers. In addition, under this Component, awareness of climate change projections and risks will be increased, and technical and institutional capacity will be developed to mainstream climate change adaptation priorities into regional development plans and strategies. Under this Component, two Outputs are envisioned:

Output 1.1. Farmers are empowered to make informed short-and long-term adaptation decisions based on the climate change projections and timely, accurate, and relevant climate information and advisory. Under this Output, the following activities are planned:

1.1.1. Installing three automated weather stations for the Southeast region integrated into the national agrometeorological system.

1.1.2. Soil sampling and mapping. Soil properties will inform identifying (i) best crop rotations for climate-resilient agriculture, (ii) measures needed to maintain soil health, and (iii) soil water properties for developing context-specific automated and/or semi-automated irrigation schedules. This will result in increased yield and water conservation.

1.1.3. Pilot model farms identified and equipped with Internet of Things (IoT) technologies (soil, water needs and plant health sensors) and climate service app developed with notification Application Programme Interference (API) to disseminate information to other farmers and to mitigate impacts of extreme climate events, increase the efficiency of production through information on soil moisture and irrigation schedule, pest warnings, crop development and application of inputs.

1.1.4. Capacity of key stakeholders (HMS – agrometeorological services, NEA - advisory services and farmers' organisations) developed to collect and analyse data, provide advisories, and establish effective dissemination mechanisms. Based on accurate seasonal and weather forecasts, agro-meteorological information and advisory services will be delivered to farmers to enable them to plan for the agricultural season and introduce relevant and timely climate-smart practices that are essential for agricultural production.

1.1.5. Awareness of climate change projections and risks and impacts on agriculture increased among women and men farmers and key local technical departments to facilitate climate adaptation efforts in Radovish region.

Under Output 1.2, Institutional capacity building will lead to mainstreaming climate change adaptation into planning and decision-making instruments to identify adaptation priorities and advocate for resource allocation. This output will entail: (i) a review of available evidence related to climate adaptation, (ii) a review of lessons learned and best practices generated through the AF project (Component 1, 2 and 3), and (iii) identification of best practices, gaps in evidence, and research priorities related to adaptation in the agricultural sector. The Output will help balance between mitigation and adaptation activities, and eventually prepare farmers to mitigate climate change. It will build on scientific approaches that frame the recommendations in national and sub-national context. The Output will also serve as a basis for systematic scale-up of tested activities. Based on the review, the findings and recommendations will be disseminated to policymakers, farmers, the private sector, and other stakeholders. The following activities are planned:

1.2.1. Systematic review of existing adaptation practices in relevant categories (water management, agricultural practices, agro-investment, farm management and tenure, natural resource management, and agricultural technology and innovation), including lessons learned and best practices generated through the AF project.

1.2.2. Guidelines for policymakers prepared to mainstream climate change adaptation priorities in the local and regional investment portfolio and national policies, plans, and strategies.

Component 2: Building resilience to climate change shocks and risks to agricultural production in Radovish valley through climate-proofing the irrigation system for resilient agricultural production and efficient and sustainable irrigation water management

Both irrigation and rain-fed crops are expected to have higher water requirements due to increasing crop water demands, driven by higher temperatures and reduced soil moisture availability due to less precipitation, more runoff, and increased temperature. Climate-proofing of the irrigation infrastructure was identified as the key adaptation intervention to avoid adverse climate impacts (2nd NCCC 2008, World Bank 2013, 3rd NCCC 2014) on the rural population in Radovish valley, which is particularly sensitive due to heavy economic dependence[22] on agriculture. Without irrigation, climate change will reduce yields by 42 percent for maize, 45 percent for apples, 11 percent for vegetables, and 25 percent for grapes; with irrigation, yields can be maintained (e.g., maise) or increased, except for grapes (Table 5). Hence, climate-proofing Radovish valley irrigation system is critical to alleviating climate risks.

Table 5: Climate change impact on yield from 2040 to 2050 compared to current yield with irrigation and rainfed agriculture in the Mediterranean and continental agroecological zones (Source: World Bank, 2013[23])

% change

Irrigated/rainfed	*Crop*	*Mediterranean*	*Continental*	*Alpine*
Irrigated	Alfalfa	5	28	71
	Apples	9	13	15
	Grapes	−14	−23	N/A
	Maize	0	27	N/A
	Vegetables	11	10	N/A
	Wheat	16	30	100
Rainfed	Alfalfa	−10	2	42
	Apples	−45	−41	6
	Grapes	−25	−32	N/A
	Maize	−62	−54	N/A
	Pasture	−3	8	22
	Vegetables	−11	−9	N/A
	Wheat	6	25	99

Note: Results are average changes in crop yield, assuming no adaptation and no irrigation water constraints and no effect of carbon dioxide fertilization, under medium-impact scenario. Declines in yield are shown in shades of orange, with darkest representing biggest declines; increases are shaded green, with darkest representing the biggest increases. N/A = the crop is not grown in the AEZ specified.

Radovish valley has several irrigation systems that use different water sources, with the Mantovo irrigation system being the largest, designed to cover 4,214 ha. The irrigation scheme is part of the state-owned irrigation systems managed by the JSC “AD Vododstopanstvo,” subsidiary “Radovishko pole”. Located on

[22] The largest share of economy in the SE Region is in the “Agriculture, Forestry and Fisheries” sector. This sector contributed to 29percent of the regional economy (State Statistical Office (SSO), Gross value added, by Sector of activity, NKD Rev 2, by region, by year, 2015-2019)

[23] World Bank. 2013. Reducing the Vulnerability of the Former Yugoslav Republic of Macedonia’s Agricultural Systems to Climate Change

both sides of the Radovish river, it consists of a dam and reservoir (Mantovo, total storage 49.4 mil.m^3) of the river Kriva Lakavica, "Vrashnica" tunnel (length of 8.35 km; capacity 4.36 m^3 / s), main channel (right with a length of 11.7 km and the left main channel of 29.7 km), four pumping stations, and an irrigation network channels (approximately 200 km). As the Strumica RB is the poorest in water resources in the country and already experiencing shortages and unable to meet demand, the water for irrigation is transferred from the Mantovo reservoir. A joint technical FAO-Vodostopanstvo Radovishko Pole inspection of the irrigation system identified the following climate-proofing and upgrading needs[24]:

- Main channels. The right open channel is critically damaged (side damaged or at the bottom of the tunnel liner), being in a very poor condition with significant water losses. (Fig.8) The left channel is partially damaged at certain sections. Significant water losses at this side of the river derive from hydrants and hydromechanical equipment. A detailed technical analysis by marking sections of the channel (campaigns) with varying degrees of damage will be conducted in the next phase of preparing technical documentation.
- The left channel starts with a pipe with a diameter of DN1000 mm that passes through the Injevska riverbed. Due to increased incidents of heavy rains and erosion, the pipe emerged in the riverbed and is exposed, making it highly likely to be damaged and in risk of bursting. The bursting of the pipe would substantially increase the water loss and disconnect the access to water for irrigation on the area supplied by the left channel. Also it increases the accidental risk of flooding and destroying productive assets downstream. In addition, the left main canal is in need of a reinforced concrete slab where it passes through the village of Injevo in order to protect irrigation water from pollution and avoid harmful effects to human health but also to secure inhabitants from accidents. In other villages, the canal is covered and does not pose a danger.
- On both channels (right and left), due to technical shortfalls of obsolete hydrants, some of the water users are forced to make their own connections (install pipes) which are not properly executed and cause water losses.
- All four pumping stations are out of order. Two of them were never put in operation (Podaresh and Kalugerica), while Raklish and Vojislavtsi worked until 1998. During the transitional period, after the independence of the country, due to weak and improper maintenance, the pumps were completely destroyed and never repaired.
- The irrigation network works as a system under low pressure in the higher areas and higher pressure in the lower areas. The most common irrigation technique is surface irrigation with the exception of certain small areas where drip system is used. Despite the potential to save water through the distribution system, the achieved efficiency is undermined by the on-farm irrigation practices that greatly neglect localized, more water-saving irrigation methods (sprinkler or drip).

Figure 8: left to right: i) right main channel; ii) burst pipe on the right channel; iii) obsolete flooded hydrant (Source: FAO, 2021)

The irrigation network was planned to irrigate an area of 4,214 ha, but due to the above-mentioned problems, only 500-600 ha are currently irrigated. A large percentage of hydromechanical equipment is damaged (valves, air valves, hydrants, outlets, etc.). The 3rd NCCC (2014) assessed the status of the existing irrigation system in Strumica RB (including Radovish valley). The assessment concluded that the

[24] FAO (July 2021) Hydro System Mantovo Irrigation Scheme Radovishko Plole. Assessment and report prepared in as part of AF concept Note development.

system is characterised by: (i) poor technical conditions of its structure, facilities, and equipment and high water losses, (ii) low efficiency and lack of capacity to respond to changing crops demand for water-based on weather forecasts, and (iii) limited opportunities to promote water conservation, as there is no measuring device at the level of intakes or canals and (iv) large inequity amongst users, whereas infrastructure deterioration now crowds out a significant portion of farmers from irrigation. This was also evident through the on-site assessment. Irrigation system climate-proofing will be enhanced through synergies and integration with Components 1 and 3. For example: (i) introduction of climate-smart practices and technologies at farm and landscape levels will also support water conservation (e.g., no-till farming, agroforestry system, drought resistant and high value/low water use crops), hence reducing water demand, (ii) land consolidation will facilitate the irrigation development at scale also for the previously neglected farmers and improved farm management, and (iii) climate services and weather forecasts will enable timely irrigation systems response to the climate risks (e.g., dry spells) while raising awareness of climate change impacts on agriculture and water resources (also Recommendation 5 of the Enhanced NDC[25] 2021). The initial FAO-led field assessment and technical consultation with JSC Vodostopanstvo, subsidiary "Radovishko pole" identified the activities under this Component; however, the exact technical details of the intervention will be determined based on a feasibility study. Learning from past experiences and making the project more in line with sustainability requirements, the project will focus on controllable, but gravity-fed distribution where possible, thus decreasing the dependence on energy use and reducing the costs associated with enhanced access to water. As the supplied area is rather large, the replacement of distributaries is planned to deploy more efficient and regulated hydrants, equipped with flow regulators. This will ensure equal access to water and the monitoring of water use. The following activities are planned:

2.1.1 Replacement of the open right channel that is highly deteriorated to closed pressurized system to eliminate technical and losses from evapotranspiration; total length of 9 km to supply water to an area of 1,400 ha from the right side. The reduction in water losses will also increase available water for irrigation in the left channel to cover 600 ha and delivery of water for approximately 300 ha to downstream users (Strumica RB).

2.1.2. Construction of energy-efficient (with frequency converter) pumping station accompanied with pumping pool immediately after the diversion structure to facilitate the introduction of water-saving on-farm technology (sprinkler and irrigation) and regulate water supply to the irrigation network, covering 1,400 ha of land.

2.2.1. Full replacement of old-type to new type hydrants to enable multiple user irrigation, eliminate water losses and increase efficiency on 2,000 ha of distribution network, 40 percent replacement of main manholes on the distribution lines and 40 percent replacement of the hydro-mechanical equipment, both to the right and left channel.

2.2.2 Protective structure built, including river crossing and closure of the section of existing canal that passes through the village Injevo.

2.3.1 Water monitoring system, involving in-situ and automated measurement devices (flow meters)

The Ministry of Agriculture, Forestry and Water Economy plans to scale up the activities proposed under AF Component 2 to an additional 3,000 ha of closed and pressurized system in Radovish region and provide access to water supply for 2,300 ha in the Strumica region.

Component 3: Empowering vulnerable communities to adapt to climate change and enhance their adaptation capacity through improved farm structure and climate-resilient agricultural practices.

Under Component 3, two interlinked Outputs will simultaneously contribute to attaining the overall adaptation goal in Radovish valley. Output 3.1 will allow the establishment of a climate-resilient farm structure through land consolidation as an enabler and integrated instrument for adaptation while Output

[25] The Ministry of Environment and Physical Planning (MoEPP) revises and enhances the Macedonian Nationally Determined Contributions to Climate Change (NDC). The Macedonian Initial NDC had rather limited scope as it took into consideration the mitigation of potential only from Energy Supply, Buildings and Transport sectors. The enhanced NDC has more ambitious mitigation targets which are based on the mitigation potential both energy and nonenergy sectors, and are considered crosscutting areas: gender, various co-benefits; private sector engagement and Sustainable Development Goals (SDG) linkages

3.2. will test and demonstrate climate-resilient agricultural technologies and practices for scaling-up at local and national levels.

Fragmented and small agricultural land parcels (with an average size of 0.23 ha)[26] in private, state, and mixed ownership is strongly limiting the agricultural productivity, hampering efficiency of resource use and production volume in agriculture per unit and presents limitations and challenges for introducing on-and off-farm cost-effective adaptation investments. The inefficient farm structure with excessive land fragmentation is a barrier to establishing sustainable and efficient water use (National Irrigation and Drainage Strategy 2021-2031 NIDS[27]) because the land-water nexus is inextricably tied to the implementation of modern technologies for water conservation, and land fragmentation is hampering the revitalisation of and investment in new irrigation and drainage systems with additional costs. The new Agriculture and Rural Development Strategy 2021-2027, recognises land consolidation as a prerequisite condition for developing competitive primary agriculture. Radovish men and women farmers, especially young farmers and women farmers (Community Consultations, 2021), and the Radovish Municipality Climate Change Strategy 2016-2026, all recognise that an inefficient farm structure with land fragmentation and small farm sizes leads to low productivity and increase in workload and costs and limits investment opportunities. A comprehensive desk review was undertaken for the Radovish region to identify potentially feasible land consolidation areas in the Radovish valley as part of Concept Note (CN) development. Spatial and descriptive/attribute data for 20,851 parcels registered by the Agency for Real Estate Cadastre was analysed, covering in total 4,874 ha, divided into 7,074 property sheets. The analyses covered 11 areas (10 villages and town of Radovish), including Injevo, Jargulitsa, Kalugjeritsa, Oraovitsa, Podaresh, Pokrajchevo, Radovish, Raklish, Suldurtsi, Voislavtsi, and Zleovo, in Radovish valley, where the average parcel size is as small as 0.23 ha. The following data was analysed during the desk research: (i) ownership structure (private, state, mixed), (ii) land use (arable land and perennial crops), (iii) number of property sheets (landowners). Furthermore, with orthophoto and satellite images the fragmentation of agricultural plots was analysed and finding a large number of relatively small, spatially divided and irregularly shaped land parcels. Non-agricultural land (settlements, roads, channels, rivers, forests) was excluded from the analysis. In parallel, the assessment of auxiliary infrastructure such as access roads, shelter belts, etc. was carried out and will be elaborated in more detail during the preparation of the Land Consolidation Feasibility Studies. The preliminary analysis carried out in the Radovish region indicated that the following seven proposed areas (Figure 9) have the highest potential for land consolidation. The area was cross-checked against several established criteria for the feasibility of land consolidation such as type of terrain, agricultural land use (perennial versus annual crops), level of land fragmentation (number and size of parcels, number of owners, the share of state-owned land), and preliminary needs for development of auxiliary infrastructure. In the period 2014-2017, FAO funded and implemented the project, “Support to Formulation and Implementation of a National Land Consolidation Programme (TCP/MCD/3502)” in the Republic of North Macedonia. Under the land consolidation project, support was provided for: (i) testing land consolidation legislation and the process in two pilot areas, (ii) improving the new legal framework for land consolidation to make it effective and operational, (iii) aligning the legal framework with the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries, and Forests in the Context of National Food Security (VGGT), and (iv) provide training and capacity development for land consolidation. Based on the initial experiences, FAO is currently supporting the MAFWE in the implementation of the National Land Consolidation Programme through the implementation of 9 land consolidation projects under the EU funded MAINLAND project[28]. The existence of an already fully operational land consolidation instrument in North Macedonia provides an excellent opportunity to integrate climate change adaptation efforts with land consolidation and create additional synergies for the farmers in Radovish valley.

[26] FAO conducted initial land structure inventory in Radovish valley as part of the Adaptation Fund concept note development (Jun 2021)
[27] In process of being formulated. Draft consulted during the concept note development and project will be further aligned with priorities outlined in the final document
[28] http://www.fao.org/in-action/mainstreaming-national-land-consolidation-programme/en/

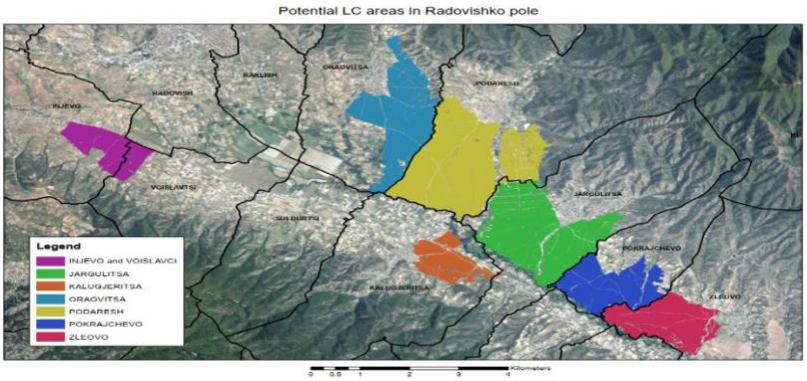

Figure 9: Areas proposed for the LC in Radovish valley

According to the field survey conducted as part of AF project community engagement (June 2021), around 54 percent of the farmers who participated in the survey expressed interest in land consolidation, while nearly 23 percent were not well informed and needed more information. In addition, 65 percent of young farmers who participated in the same survey expressed interest in land consolidation. Considering that awareness-raising on land consolidation was not conducted in the area prior to the survey, this is considered a significant interest on the farmers' side. In addition, women farmers, in particular, see land consolidation as important to increase productivity and reduce workload. The main phases of the land consolidation process explained below are based on the existing national legal framework, best international practices and the FAO Legal Guide on Land Consolidation[29].

3.1.1. Land consolidation feasibility studies conducted. The feasibility studies will detail the current land use, agricultural production, landowners interest in participation in land consolidation, including interest in voluntary sale, exchange and/or purchase of agricultural land. Furthermore, the report will reflect the farm-level barriers for implementation of climate adaptation practices and local needs for improvement of agricultural infrastructure, if any. Most importantly, the Feasibility Study Report will assess and confirm feasibility for implementation of land consolidation in the specific areas per potential land consolidation area.

3.1.2. Re-allotment Plans prepared. The feasibility study report will serve as a basis for preparation of a Land Re-allotment Plan in each area through a participatory approach and direct negotiations with the landowners/farmers. The outcome of the process will be a new farm structure where land fragmentation is significantly reduced and farms are enlarged on a voluntary basis improving the agricultural productivity and creating the basis for enhanced private investments in agriculture, e.g. planting an orchard or applying drip irrigation on consolidated land. The Reallotment Plan will be prepared by professional land consolidation planners based on the determined land value of all land parcels, landowner preferences and is subject to a series of public consultations and formal adoption by the Landowner's Assembly following the procedure stipulated in the national legislation and fully in line with VGGT.

3.1.3. Registration of new land ownership and implementation. Upon the adoption of the Re-allotment Plan by the Landowners Assembly, new ownership rights will be registered in the Real Estate Cadaster based on a Ministerial Decision, as well as the new parcel boundaries will be determined on the field. Construction of auxiliary agricultural infrastructure (service/access roads, shelter belts or other required interventions) in accordance with the national legislation will be carried out to enhance production conditions and amplify efficiency, increasing impacts of improved land structure. In addition, adaptive production practices will be enabled by land consolidation with a special focus on deficit irrigation, inter-cropping, land set-aside, water retention, and erosion control.

Output 3.2. Radovish men and women farmers' and farmers at regional and national levels empowered to adopt climate-resilient agricultural practices for sustainable and environment-friendly production.

Under this Component, climate-resilient agricultural practices will be piloted through a model farm approach. These model farms will serve as research and development sites for scaling up climate-smart agricultural technology and practices, diversify agricultural production, piloting technology for precision agriculture, generate knowledge, build capacity, and disseminate information.

[29] Ibid

Based on the climate change risks and adaptation priorities, the following practices will be demonstrated:

- Demonstration of subsurface fertigation for perennial and annual crops on 40-50 hectares (at least 50 households/demonstration farms). In addition to the real-time information on irrigation schedules to manage drought, fertigation will demonstrate the latest (affordable) technologies that conserve water, increase yields, and increase resilience to climate change. The crop response to the increased nutrient availability through fertilisation delivered at the right time and dosage for the specific crop will result in water and fertilizer savings and increased yield that is expected to motivate farmers to adopt. Irrigation and delivery of pesticides can also be introduced, and both practices (delivery of fertiliser and pesticides through irrigation) are expected to reduce environmental pollution.
- Demonstration of UV, hail, and frost protection using micro-sprinklers for orchards on 10 hectares (10 households) on farms with predominantly perennial crops.
- Demonstrating soil and water conservation technology to improve soil quality and soil water holding capacity, including cover crops/winter crops, mulching, composting, use of organic fertiliser (manure, compost, pruning residues), intercropping, crop rotations, irrigation scheduling based on soil moisture monitoring and others.
- Support to organic production as more energy-, nutrient-, and water-efficient than the conventional system and as an important adaptation strategy, especially for poor farmers with small agricultural parcels. Farmers interested in starting organic farming will be supported with trainings and advisory services and information on available subsidies provided through the Ministry of Agriculture, Forestry, and Water Economy (MAFWE) programmes.

Demonstration plots aimed at crop diversification will address farmers' willingness to diversify production and introduce high-value market-oriented crops. Crop diversification will aim to reduce areas under tobacco by providing interested farmers with inputs and advisory services to diversify production (traditionally, due to water shortage, farmers grow tobacco that contributes to soil erosion and acidification). This activity is aligned with the Strategy for tobacco production (2021-2027) that recommends diversification and the introduction of high-value crops in places where tobacco is grown. The survey conducted within the project, "Building the basis for the reform of the tobacco sector" (EUROPEAID/138538/IH/SER/MK) identified that 30 percent of tobacco producers are prepared to diversify their production. The choice of new crops will be determined based on climate change projections, market demand, and context-specific conditions (soil, water). The introduction of new crops will be accompanied by adaptation measures already tested in the country (e.g., crop rotation, Trichoderma[30]sp., water conservation measures such as mulching, integrated crop protection, and others). A small number of farmers, focusing on youth and women, are willing to introduce crops, technology, and varieties that are new to the region. The lead farmers will be selected as partners in the project, and their fields with new crops/varieties/technologies will be used for demonstration, learning, and scaling up to other farms. Lead farmers willing to diversify will be provided with input packages (seeds, fertilisers, plant protection materials) and advisories. An estimated 150 - 200 ha and 200-500 farmers will be targeted, with a 10 percent expected reduction of land under tobacco in 4 years.

The technology and practices introduced through the project are innovative and call for intensive capacity building. Therefore, agriculture knowledge information systems and capacity building will be incorporated and developed targeting national institutions (HMS and NEA) and farmers. To enable the transfer of information, the tools and piloted technologies will be disseminated through web platforms and mobile applications. In addition, knowledge based on locally validated models and lessons learned will be integrated with international best practices and disseminated through networks and software for wider knowledge exchange and capacity building. The knowledge platform for farmers will be developed based on end-users' real needs and ability to provide accurate and timely information. Networking of the farmers through the Agriculture Knowledge and Innovation System (AKIS) will be promoted as well as farmer-expert networks for learning and exchange. As part of the advisory services, a recognition system based on machine learning and artificial intelligence will be used for quick identification of pests, diseases, and crop symptoms (caused by biotic and abiotic factors) accompanied with timely advice for the solution of the

[30] Trichoderma a species of fungal organism helps farmers grow better crops and have higher income while protecting the soil environment. Trichoderma are found in soils in agricultural and natural environments worldwide and commercial products have been developed and piloted in North Macedonia

eventual problem. Farm accounting and based bookkeeping to support the introduction of adaptive technology and farm management will be introduced, targeting young and women farmers. This innovative knowledge transfer will be integrated into the curriculum of advisory system provided directly by extension officers, farm schools, and demonstration activities to reach all farmers, including those not familiar or comfortable with digital technology. This will enhance the sustainability of the project through the institutionalization of the developed knowledge. The Component will be implemented in collaboration with the regional officers of the National Extension Service. These capacity-building initiatives will be extended to other interested farmers in the region while network and software for knowledge exchange will have a country-wide reach.

The following activities will contribute to the outcomes under this Component:

3.2.1. A mix of climate-resilient (i.e. climate-smart agriculture) and context-specific agricultural practices, including organic farming, identified through systematic review, piloted in consultation with technical experts and women and men farmers to identify no-regret adaptation options.

3.2.2. Climate-resilient crop diversification technology transferred and technical know-how disseminated through demonstrations, training, and fact-finding farmer-to-farmer visits.

3.2.3. Evidence and lessons learned generated through climate-smart and organic production integrated into an e-platform for Agricultural Knowledge and Innovation Systems (AKIS) for scale-up at regional and national levels.

3.2.4. Evidence-based guidelines developed and together with AKIS, integrated into the curriculum of NEA to support farmer-science-advisory services, knowledge sharing and dissemination, informed by digital assistance, machine learning, and artificial intelligence (AI).

3.2.5. Training of trainers to NEA Officers provided to enable the provision of up-to-date and expert advisories on climate-resilient technologies, crop diversification, and information policies and programmes targeting women and men farmers.

B. Economic, social and environmental benefits of the project with particular reference to the most vulnerable communities and vulnerable groups within communities, including gender considerations.

The assessment of the socio-economic vulnerability[31] of the population in the Southeast region to climate change risks was conducted in ten municipalities based on the Social Vulnerability Index (SoVI). The SoVI, assessed the population characteristics (e.g., % of farmers, % with lower than average education, income per capita, % of social security users, % of single-parent household, % of unemployed, % of women engaged in seasonal work, member of a minority group[32]), that impact on social vulnerability (i.e., increases or reduces), and identified Radovish municipality as highly vulnerable to climate change with multiple socioeconomic disadvantages. The population has a low level of education and high unemployment (over 60 percent of the households have at least one unemployed member). In addition, a high proportion of the population receives social security benefits, and rural to urban migration is high. The vulnerability assessment points to limited resources and capacity to prepare and adapt to climate change risks (Kostadinova-Daskalovska, 2014). In addition, the national household poverty assessment revealed that 98 percent of the households experienced a food shortage, and agriculture is the main source of domestic supply of food and income[33], with 6 256 registered farmers. The project, considering context-specific vulnerabilities, will deliver numerous social-economic and environmental benefits for vulnerable farming communities, including women farmers and young farmers.

Land consolidation will also optimize the size of production and support the ownership of lands by rural women and adopt measures to protect their security of land tenure[34]. Specific economic, social and

[31]The Ministry of Environment and Physical Planning has produced three National Communications to the UN Framework Convention on Climate Change (UNFCCC), with UNDP's support, including a special assessment of the impact of climate change on the most socioeconomically vulnerable population in the South-East Planning Region

[32]Indicators and indices for socio-economic vulnerability of the population in relation to disaster risks and climate change. available at: http://www.unfccc.org.mk/content/Documents/VULNERABILITY/Jugoistocen%20part2%20MKD.pdf, pg. 26

[33] Ludwig Boltzmann Institute for Human Rights (2011): Study on Poverty and Social Exclusion in the Republic of Macedonia, pg. 67-89

[34] Smallholders and Family Farms in the Republic of North Macedonia, FAO (2019)

environmental benefits relevant for activities under each component and initial gender assessment and gender mainstreaming are presented in the text that follows.

Economic Benefits.

Component *1* will provide timely context-specific climate and weather information to farmers and advisory services that will enable farmers to identify the most suitable adaptation options for different crops. The modality for disseminating climate services and technology used will ensure that all farmers are reached with a focus on women farmers. The climate services will be accessible to an estimated ***6,256 (24,000 people) registered farmers in Radovish*** valley and soil sampling will cover the whole project area (estimated 2,000 ha). Both weather and soil data will inform decisions on agricultural practices, reduce costs, and contribute to increases in yield and income. This, together with other adaptation investments proposed under the project, is expected to double the income of early adopters from an estimated ***1,277 USD/year/ha to 2,560 USD/year/ha post-project*** (Cost-effectiveness analysis, FAO 2021).

Under Component 2, investments in climate-proofing irrigation will result in an increase in land under irrigation **from an estimated 500-600 ha currently irrigated to 2,000 ha under the climate resilient irrigation system**. Providing access to irrigation water or access to improved irrigation in the area would target estimated 6,400 **landowners** (Agency for Real estate Cadastre, 2021). Irrigation will increase yields even with climate change (Sutton et al., 2013) and increase farmers' incomes. The establishment of a pressurised type of irrigation will facilitate a shift in irrigation principle/technology from predominantly surface flooding to sprinklers and drip irrigation and result in increased effectiveness of water use in irrigation. While the increase in area under irrigation will increase the water for irrigation used through the irrigation system, the water use per ha is expected to reduce as yield increases. In addition, farmers will be prompted to shift away from the uncontrolled groundwater use that puts a pressure on the groundwater sources. Similar results are reported through evaluation studies of a land consolidation project in Turkey (FAO, 2015).

Under Component 3, Land consolidation will: (i) reduce costs of on-farm adaptation for farmers through an improved farm structure, (ii) increase the productivity of the farms that will motivate farmers for continuous adaptation, and (iii) enable and reduce the costs of farm and landscape level adaptation. Based on the currently on-going land consolidation projects (August 2021) in North Macedonia, a 20-30 percent reduction of costs for the use of mechanization[35] is reported due to parcel enlargement and better access to services. The land consolidation instrument[36] also aims to reduce the number of registered land parcels by at least 50 percent and at least double the size of land parcels, which is expected to increase the productivity of the land. A recent socio-economic impact assessment[37] of a land consolidation project in Turkey reported an increase in labour productivity of 24 percent and an increase in production value of 7.5 percent per year post land consolidation project. In addition, the same evaluation found that farmers were willing to make significant investments in farming after the land consolidation project. Due to the small size of family farms, farmers often have limited access to credit, and due to low volume of production, they invest in low-cost-risk-free assets, avoiding high-risk and high-tech innovation that can lead to capital growth (FAO, 2019[38]). As land consolidation was recognized as a precondition for productive farming by young farmers, it is expected that it will lead to increased access to financial support for the group. For example, 13.5 percent of the total number of agricultural holdings that applied for financial support in 2013[39] are managed/represented by young farmers aged between 18 and 40 years of age.

Climate-resilient demonstration sites, access to advisory and information, and capacity building opportunities will enable farmers to adopt new technologies. The Component will contribute to poverty reduction and food stability by the introduction of climate-resilient technology that will prevent yield reduction and provide financial stability for farmers that is currently compromised and varies from year to year. In addition, resilient agriculture will also result in the availability of seasonal work primarily performed by the poor and women. The project will also (i) establish an estimated 50 ha (50 households/farms) of demo sites

[35] Stojanovski E, Buzharovska D. 2020, Environmental Elaborate for construction of drainage channels, service/access roads in village Egri, Municipality of Bitola, 2020
[36] Mainstreaming of the National Land Consolidation Programme (MAINLAND), FAO Third Annual Progress Report 01.03.2019 - 29.02.2020
[37] FAO. (2015) Pilot evaluation: Land Consolidation in Konya Region, Cumra District, villages Inli and Dinlendik (2010-2012)
[38] FAO. (2019) Smallholders and Family Farms in the Republic of North Macedonia., Country Study Report
[39] EU Instrument for Pre-accession (IPA) Rural Development Programme 2014-2020, final version as adopted by the Commission Implementing Decision on 13.02.2015, No. C(2015) 760 final, pg. 31

with new technology, serving as learning and development sites for Radovish and the whole country, (ii) provide inputs and training for an estimated 400 farmers (150 ha) willing to introduce climate-resilient market-oriented crops, and (iii) equip 30 farmers with remote sensing equipment, including on-farm soil moisture monitoring, PH sensors, automated valves for irrigation scheduling, and other tools such as drones with thermal and spectral cameras, to serve as a demonstration and educational sites for stakeholders at local and national levels. With proper adaptation practices (e.g., delayed sowing and sprinkler irrigation) winter wheat yield can increase by 33 percent in 2025 and 43 percent in 2050 while the highest yield of maize can be expected using sprinkler irrigation (5 times, with the norm of 60 mm)[40]. For example, climate-smart adaption practices such as: (i) UV nets increase yield by 50 percent in comparison to uncovered trees, (ii) mulching provide better soil condition for the trees, resulting in 3,5 – 43 percent higher yields compared to orchard rows without mulch, and (iii) deeper planted apple trees have 20 - 33 percent better growth of the trunk and 28 percent increase in productivity, while sour cherries 10 percent increase in productivity[41].

Environmental Benefits.

The state of current irrigation poses environmental threats because of unsustainable management of water and soil resources, causing large quantities of nutrients to be lost in the field and increasing the erosion of the soils. In addition, a lack of monitoring water consumption impacts equity, adequacy, and efficiency in water distribution (FAO, 2019).

Under component 2 - rehabilitation and modernization of the irrigation system will lead to 35 percent reduction of water losses at the system level (60 percent reduction in right channel and 25 percent reduction from the right channel), or nearly 2,00 million m3/year irrigation water. In addition, the pressurized system will enable the introduction of water-saving techniques (drip and sprinkler irrigation) which will increase the irrigation efficiency from the currently 50 percent with furrow irrigation to 75-80 percent with sprinkler irrigation and up to 90 percent with drip irrigation. The closed versus open system has additional environmental benefits such as elimination of evapotranspiration, improved water quality (reduction of risk of water pollution and algae growth), elimination of erosion and sedimentation in open channels, elimination of risk of flooding due to improved water system regulation (flooding could occur during opening/closing of the open systems), etc.

Under *Component 3,* context-specific climate-smart practices (e.g., strip planting intercropping, mulching, composting, intercropping, crop rotation, etc.) and land consolidation (e.g., green belts, fallow land) simultaneously contribute to increased yield, climate adaptation and an increase in on-farm biodiversity. In addition, shelter belts will result in higher water infiltration, reduce wind speed (resulting in reduced evaporation), and reduce run-off, leading to less erosion. Crop diversification will lead to improved soil quality while organic farming to more efficient use of water due to better soil structure and protection of soil and ground water from pollution (40-60 percent less nitrogen) than conventional agriculture[42]. The fertilizer use efficiency is 20 percent higher in drip fertigation than drip irrigation[43].

Both Component 2 and 3 will result in water conservation, soil protection, reduced erosion with improvement in soil quality and protection of physical irrigation structures (elimination of sedimentation and pollution in the closed pressurized channel), improvement in irrigation water management, and reduced leaching. In respect to the drainage (Component 2), any negative impacts will be identified, including an increased opportunity for flooding, degrading water quality and leaching from farm fields, and mitigation strategies identified (e.g. control drainage by rehabilitation of outlet structures to control outflow).

Social Benefits.

A socioeconomic vulnerability assessment conducted in Strumica RB identified the most vulnerable groups to climate change risks as single mothers, fathers of minors, households below the poverty line, elderly smallholders (65+), and households with three or more children.

[40] MoEPP (2014),3rd NCCC, Vulnerability Assessment and adaptation to climate change, Sector Agriculture (2014)
[41] Rural Development Network, 2016. Final report, USAID project: “Adaptation to climate change in agriculture” (2012-2016)
[42] MoEPP (2014),3rd NCCC, Vulnerability Assessment and adaptation to climate change, Sector Agriculture (2014)
[43] Rural Development Network, 2016. Final report, USAID project: “Adaptation to climate change in agriculture” (2012-2016)

Under Component 1, climate and weather services and advisories will be delivered with special attention to modalities appropriate to reach the most vulnerable groups that will protect yields and reduce the negative impact on agricultural production. Under *Component 2,* land consolidation will provide an opportunity to secure land ownership for the most vulnerable groups and women and link them with irrigation systems through upgrading the existing system. This will enable more equitable access to water for Radovish farmers. Efficient irrigation will also reduce the burden for farmers, including workload, and ensure the stability of agricultural production that will facilitate farmers' investments in and adoption of climate-smart technology and contribute to positive household dynamics. Considering that efficient irrigation technologies will be implemented together with institutional, technical, and accounting measures that accurately track and economically reward reduced water users, this integrated approach is expected to result in water conservation with benefits for users downstream. *Component 3* will identify and target vulnerable agricultural households to be included as demonstration model farms under the project; targeting is aligned with Enhanced NDC (2021) Recommendation 7. Considering that one of the major problems in the agricultural sector is the ageing of the labour force, which undermines the agricultural sector's sustainability, young farmers (18-40 years) will also be targeted through the project. This will contribute to rural development and reduce pressure on urban centres.

The demonstration farms will serve for research and education purposes, as well as dissemination of the new technologies to the wider farmer community and other interested stakeholders at local and national levels.

Initial Gender Assessment (IGA)

An Initial Gender Assessment (IGA) was conducted through desktop review and focus group discussions with women farmers in 11 settlements in Radovish valley as part of community consultations. The desktop review centred around identifying gender dynamics, the role of women, cultural norms and values, the impact of climate change on women, women's control of assets, access to resources, and general barriers to empowerment and climate adaptation faced by women engaged in agriculture. The focus group discussions with women farmers were organized as part of community consolations and aimed to contextualise the desktop findings and better understand context-specific dynamics, barriers to adaptation, and preferred adaptation options. The following text presents the main findings and opportunities for gender mainstreaming into the AF project at the CN stage.

National Context. The Gender Gap Index 2021 (GGI)[44] places the Republic of North Macedonia in 74th (out of 156 countries) place globally and 13th place (out of 26) in Eastern and Central Asia countries with a score of 0.715 (i.e. 0.00=imparity; 1.00=parity) (GGI, 2021). The country scored high on education attainment (i.e. score of 0.977, and 99th place) and health and survival (score 1.034) sub-index (Fig.9.). When education attainment is compared to 2006 (i.e. 0.985), the 2021 score indicates a slight reverse in closing the gender gap. In addition, the national score hides differences between rural and urban education attainment. The country scores low on the political empowerment index, in 53rd place globally with a score of 0.267, and economic and opportunity ranks the country 97th, with a score of 0.647. The economic opportunities sub-index score of 2021 indicates deteriorating economic opportunities as compared to 2006, when the country scored 0.671 (GGI, 2021). Regarding economic opportunities, women constitute only 54.7 percent, compared to 77.2 percent of men in the labour force; only 10 percent of women earn more than $1,000 as compared to 18 percent of men, and 26 percent of women are found in senior official, legislator, and managerial jobs as opposed to 73.7 percent of men (GGI, 2021). Less-educated women, women from rural areas, and those engaged in agriculture are particularly vulnerable due to unequal labour market conditions (World Bank, 2018[45]).

Legal Context. North Macedonia has made significant efforts to advance gender equality by creating an enabling legislative framework, adopting policies, and establishing institutional mechanisms at the central and local levels. The Law on Equal Opportunities for Women and Men (2006) and subsequent amendments formalized the role of central and local government to incorporate gender aspects in strategic plans and budgets. The country adopted the first National Strategy for Equality and Non-discrimination (2012-2015)

[44] The Global Gender Gap Report 2021, available at https://www.weforum.org/reports/global-gender-gap-report-2021
[45] World Bank 2018. Labor Markets in FYR Macedonia: A Gender Lens

and the Strategy for Introducing Gender Responsive Budgeting in the Republic of Macedonia (2012-2017) that was followed by the Strategy for Gender Equality (2013-2020) and the National Strategy for Equality and Non-discrimination (2016-2020). However, women's representation and participation in decision-making remain limited. In addition, North Macedonia ratified the Convention on Elimination of all Forms of Discrimination Against Women (CEDAW) and the Optional Protocol in 1994 and is a signatory to the Beijing Declaration and Platform of Action (1995). In 2011, the country signed the Council of Europe's Convention on Preventing and Combating Violence against Women (the Istanbul Convention) (ratified in 2017) and developed the National Action Plan for the implementation of the Istanbul Convention (2018-2023). Nevertheless, gender-based violence remains one of the most significant manifestations of unequal gender relations and discrimination against women in North Macedonia. A recent survey (OSCE, 2018[46]) revealed that: (i) 45 percent of women surveyed experienced violence, (ii) violence against women is widely accepted as normal and underreported due to shame, financial reasons, lack of information and mistrust of services, fear, and lack of recognition of what counts as violence, especially in rural areas, (iii) rural women and minority groups need more support and targeted actions, (iv) women living in financially constrained families, prevalent in rural areas and the agricultural sector, are three to four times more likely to experience violence, and (iv) women from an ethnic minority are more likely to have encountered violence.

Regarding the agricultural sector, the new National Strategy on Agriculture and Rural Development 2021-2027 (NSARD) does not have a specific section on gender-transformative actions in agriculture. However, the strategy recognizes the disadvantaged status of women in rural areas and calls for promoting rural women's empowerment through (i) support to engage in economic activities through grants for processing activities, (ii) providing access to a fair market, and (iii) increasing land ownership of women. Under structural indicators, the strategy aims to increase rural women's employment from 122,830 in 2018 to 160,000 by 2027 and increase women's ownership of land 10.40 percent in 2016 to 25.4 percent by 2027 (an increase of 15 percent).

Women in Agriculture[47]**.** Women involved in agriculture face numerous barriers that prevent them from active engagement and contribute to gender inequalities. These include lack of ownership of assets and access to information, limited employment opportunities outside the home, limited decision-making role related to productive activities and management of agricultural holdings[48], and long working hours. In addition, women are not active members of agricultural associations and networks and do not actively participate in community-level decision-making (Nacka, 2019[49]; World Bank, 2020).

(i) Asset ownership. Patriarchal structures and traditional social norms are still present and reflected in the minimal share of women in the property ownership (land, family home) structure, especially evident in the rural areas. In terms of property inheritance, the dominant tradition is for men to inherit the entire property. This is especially the case in rural areas where agriculture is the dominant activity of the households. Women in rural areas do not consider traditional values and expectations as discriminating and believe that the tradition obliges the woman, even when offered a share of the property, not to accept it, in order to preserve family values and wealth.

(ii) Employment. Agriculture is an important but not necessarily a paid activity for women. Women are not registered in the agricultural labour force pool and constitute a major group of unpaid and informal workers, engaged mainly as unpaid family workers or seasonal agricultural workers (double the number compared to men). Even when paid, they only earn 33 percent of what men earn in the same sector. Young women in rural areas aged 20-24 years (59 percent) and 25 – 29 years (43 percent) have the highest unemployment rates. The root causes are (i) obligations traditionally posed on

[46] The abbreviated women's empowerment in agriculture index: an application in the Republic of North Macedonia, Journal of Agricultural, Food and Environmental Sciences, Vol 73 No 2 (2019) 70-78

[47] The section is together with primary data collected through focus group discussion informed by findings presented in the study Measuring Women's Empowerment in Agriculture with Survey-Based and Experimental Economics Method, The Faculty of Agricultural Sciences and Food - Skopje and the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), 2020. Available at http://www.fznh.ukim.edu.mk/images/stories/proekti/unwfznh/wp72020/policy_briev_fasf_un_women_en.pdf

[48] Down from 11 percent in 2013 to 10 percent in 2016; 90.3 percent of men make decisions on activities related to the land, whereas 50percent of female landowners are not actively making decision on activities related to the land; 48percent of women perceive that they are not eligible for credit by banks; and 62percentof women perceive themselves as not eligible for the rural development project implemented through the Government and benefit less often from them, negatively affecting their productivity and market access (World Bank, 2020)

[49] The abbreviated women's empowerment in agriculture index: an application in the Republic of North Macedonia, Journal of Agricultural, Food and Environmental Sciences, Vol 73 No 2 (2019) 70-78

women (to be spouses and mothers), (ii) traditional norm that the husband is the main source of income for the rural family, and (iii) unpaid domestic work women perform daily. Young women, due to their disadvantaged position, do not see future in agriculture and stay in rural areas only if they have another type of employment; young women constitute 70 percent of migrants in all regions (NARDS,

(iii) Rural Infrastructure. The rural population faces underdeveloped infrastructure and a limited supply of public services as compared to urban areas. Together with traditional values dominant in the rural areas, these factors put women in a disadvantageous position, primarily by limiting their movement, access to information and health services, and support and opportunities for personal development. For example, the limited offer of child care and transport impacts on opportunities women have to achieve their economic independence and empowerment and seek work outside the house.

(iv) Access to resources. The lack of initial capital and access to credits is a significant barrier to the development of sustainable businesses in rural areas in particular. While agricultural programs are open to all women submitting requests, men farmers continue to appear as more frequent institutional and financial support beneficiaries (e.g., 65 percent of women farmers never applied for institutional and financial support for their agricultural activities, while 67 percent of men farmers submitted a request). Limited agricultural education, extension, and training limits opportunities for women to gain new technological knowledge in their areas of production and voice their needs for support, including technology, policy, and financing (Risteska et al., 2012).

(v) Decision-making and participation. Women make a decision related to agricultural production and income when the decision is related to self-consumption at the household level. However, when decisions are made related to production for income and market, men have higher participation/voice. The degree of awareness of gender discrimination is relatively low in rural areas, hindering the realization of other activities related to gender equality, such as equal representation in politics and the economy and equal participation in society and at home (e.g., only 5 percent of women are active members in groups or associations). Women in rural areas are rarely consulted regarding public issues and they feel that they do not have the power to act, and they lack self-esteem.

(vi) Time and Workload. On average, women work 11.06 hours per day while men work 9.68 hours per day. Men have mainly paid work (on-farm work, off-farm work, product sales), whereas almost half of women's work is unpaid -41.7 percent of the total workload belongs to unpaid work (housework, cooking, producing food for household consumption, childcare, and elderly care). Women's tasks in farming tend to be manual-labour intensive and less supported by information and technology. The unpaid work of rural women is thought to be one of the main reasons for their economic dependence.

Climate Change Impact on Women in Radovish Valley and Priorities for Adaptation

Focus group discussions with women farmers collected data on gender dynamics, climate vulnerabilities, and women perspectives on priories for adaptation. Women report that during the agricultural season, they are engaged between 8-10 hours in agricultural activities per day and 3-5 hours in housework per day. Generally, women are responsible for housework (cleaning, cooking, washing) and taking care of children and the elderly and the participation of men in housework is negligible. Women are traditionally expected to stay at home and take care of children, the home, and the elderly, and there are no work opportunities for women due to the closure of the textile industry and the lack of childcare facilities and public transport. Because women do not have formal employment, women are less respected and face challenges accessing loans, as they do not have permanent and stable jobs with social and pension insurance. If they are formally employed, their salaries are low. With some exception, women also reported that they do not participate in governmental / non-governmental projects, nor they are involved in associations. Women are less represented in decision-making processes at the local level (and less informed about local policies),. In Radovich valley, only 7,648 women own land (23.93 percent) as compared to 24 318 men owners (76.07 percent) (Katastar, 2021). Considering that women lack the same access to inputs, resources, services and technology in agriculture as men, their sensitivity and vulnerability to climate change will increase. Lower incomes (and many have no personal incomes), low levels of education, and limited access to information and communications technology put women at greater risk. As a result of pre-existing conditions, rural women have little access to information and knowledge to improve their agricultural production and build on

their unique traditional knowledge (e.g., food processing, using natural resources in health treatment/healing, cooking). Frequent droughts will impact the availability of water for irrigation and consumption, which will directly impact women's labour, which is likely to increase as women traditionally take care of hygiene, home cooking, or irrigation for gardening. Extreme events (e.g., heat waves, droughts) can add to women's stress, as they see themselves as the primary caretakers of the children and elderly, who may need additional support and care in times of shock, and may further remove them from employment opportunities. To invest in climate-resilient technology, farmers will have to access credits and government subsidies. As women traditionally do not inherit property/agricultural land and have limited skills in managing finances (INDC Enhanced, 2021), this, in turn, will prevent them from accessing banking credits, loans, and funds to pursue adaptation options. Decreasing income from agricultural production and increasing inputs costs due to climate change risks could put rural women at increased stress or even at the risk of physical violence, considering that women in poor households are three times more likely to experience physical violence (OSCE, 2018). Climate change can significantly impact the availability of the seasonal agricultural work that women engage in and further reduce their employment and income-generating opportunities. Women who are entirely dependent on agriculture and have no other source of income reported that they will be impacted more, as they do not have other sources of livelihood. In addition, women reported that they are disproportionality impacted, as they do not traditionally work outside their homes and are not integrated in the labour market. Climate change is having a very adverse effect. It increases the unpredictability of production, worsens the quality of agricultural products, lowers incomes, and produces stress and anxiety to farmers. Women farmers in Radovish state the following priorities for adaptation to climate change risks:

"We need advice on how to introduce new crops, new sowing technology; if we have expert advice, we can be stronger and more competitive in the market."

"We need training on climate change, growing new crops, and organic production; accessing financial assistance from public calls and subsidies is especially important for them.

"We lack information and do not know how to apply for the financial support offered through Government programmes."

"For us, land consolidation and irrigation is the most important; it will reduce my workload, it will be easier to reach the land, and with irrigation, I can cultivate; if I have 2-3 larger irrigated plots, it will be easier to manage."

Source: Focus Group Discussions with Women Farmers in Radovish Valley (2021)

As agriculture is the main economic activity in the Radovish valley, the interventions proposed through the Adaptation Fund project have the potential to simultaneously reduce the gender gap while building the climate resilience of the agriculture system.

Project Gender Mainstreaming. Gender mainstreaming at the CN stage was facilitated through women's participation in the project design (i.e. desktop review and focus group discussion as part of community consultations) and guided the identification of specific strategies and activities to address gender inequality. Feasibility studies and gender analysis and assessment at the proposal development stage will identify other gender mainstreaming actions to be introduced through the AF project. Women's barriers to participation in the proposed adaptation activities (e.g., lack of childcare, financial constraints, lack of transport, digital gap) and women's inequalities will be addressed through budget allocation, activities specifically targeting women (e.g., training for farm budgeting/accounting targeting women), and modalities that enable women's equal access to project benefits (e.g. access to information and knowledge).

Under Component 1, climate services will be available in accessible formats and modalities most suitable for women and use non-technical language to allow female farmers to access information and remove ICT gender barriers.

Under Component 3, training for women in farm management, budgeting and accounting skills will be provided, and technical training on organic farming, information on governments subsidies, and support with applications for access credits and other government programmes. Agricultural extension services and information and awareness sessions will be tailored to women's specific needs and gaps to be more accessible. Village demonstration fields will consider women's barriers to participation and adoption of climate-resilient technologies (e.g. location of the demonstration sites, the timing of demonstration, type of climate-smart technology). Demonstration fields will allow women to view and discuss new techniques and

inputs in a way that is not confrontational and will contribute to family and community adoption of climate-resilient technology and practices. Based on the initial gender assessment, diversification and organic production are proposed as gender-responsive project component to ensure a decent income of their relatively smaller production areas and leverage the traditional production expertise of women. When selecting demo farms for adaptation of climate-smart technologies, women that are holders of agricultural holdings will be given priority. In alignment with the NSARD 2021, the project information platform will target women and facilitate: (i) the diversification of agricultural production for market targeting women (organic farming), (ii) improved access to a fair market (i.e., organic production), and (iii) reduction in the number of (and, when possible, the avoidance of) intermediaries (through direct sales, electronic sales, etc.).

Under Component 3, within the framework of the land policy, and as identified in the Agriculture and Rural Development Strategy 2021-2027, improving the status of women through an increase in women ownership of land holding will be facilitated through the land consolidation activity introduced through the project. More specifically, through registration of the Re-allotment Plans in AREC, wives can be registered as co-owners for property acquired during marriage, which will allow more rural women to enjoy their ownership rights. Land consolidation will also increase productivity and income for households, improving the economic status of families and women. In addition, women land ownership will facilitate access to credits for women, leading to economic empowerment. The feasibility study will ensure female farmers are actively involved in information sessions, including voicing their concerns and needs, asking questions, and benefiting from structural land changes.

C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

The project's cost-effectiveness is assessed applying mixed methods, considering specific outputs, approaches, and activities, including cost-per beneficiary, loss avoided, and comparison with alternative options. Primary analysis as part of the CN development was conducted, and available studies were consulted to determine cost-effectiveness. Under *Component 1*, benefits of climate services and information were estimated based on the avoided loss method (Tesfaye et al. 2018). The climate awareness and weather services will reach an estimated 6,256 registered farmers in Radovish valley. A recent study (Teresa Armada Brás et al., 2021) showed that historical droughts and heatwaves reduced European cereal yields on average by 9 percent and 7.3 percent, respectively. Non-cereal yields declined by 3.8 percent and 3.1 percent during the same set of events. Cold waves led to cereal and non-cereal yield declines by 1.3 percent and 2.6 percent. The severity of heatwave and drought impacts on crop production roughly tripled over the last 50 years, from a reduction of 2.2 percent (1964–1990) to a reduction of 7.3 percent (1991–2015). As the drought events are expected to increase in frequency and intensity, the impact is also expected to increase. Hence, by providing climate and weather services and advisories, the project will support farmers in implementing appropriate adaptation measures to avoid losses. In addition, the Government of North Macedonia pays 3.5 million Euro annually to farmers for weather and climate-related extreme events compensation, and effective climate and weather services can reduce fiscal exposure from climate change risks. While the overall cost-effectiveness is evident, it is underestimated, considering that the method does not capture the use of climate information to improve production or net income.

As part of the CN development and to identify the most cost-effective intervention, under *Component 2*., three technical alternatives[50] were considered as options to rehabilitate and climate-proof Mantrovo irrigation system in Radovish valley. These options were analysed based on the irrigation water requirements, possible beneficiaries of the rehabilitated system, readiness of the beneficiaries to use improved water services, needs of different beneficiaries, capitalization on the existing infrastructure of the irrigation system, and expansion of the irrigation system to other beneficiaries not currently covered through the system. Each technical alternative was evaluated based on the water economy and cost of investment. The best technical alternative was determined based on the equal terms and unit price, and the final selection was based on the least cost method, a commonly used method to analyse hydro-technical infrastructure projects. The technical solution proposed under Component 2 (i.e. Alternative 3) is selected as the most optimal, with an investment cost of 2,350 Euro/ha. The solution offers a holistic approach to climate-proofing irrigation that will deliver adaptation benefits both short and long-term. The upgraded

[50] FAO and Radovishko pole irrigation experts conducted intently and analysis of cost-effectives of four technical solution as part of AF concept note development

irrigation system will enable access to irrigation for 1,400 ha of land currently not irrigated under the large irrigation scheme and 600 ha to improved irrigation, both critical to building resilience to climate change shocks.

The initial cost-effectiveness of adaptation options that integrate irrigation system climate-proofing (Component 2) and climate-resilient agricultural practices (Component 3) was estimated based on an assessment of the agricultural sector's vulnerability to climate change conducted to support the formulation of the 3rd NCCC. The assessment[51] generated evidence on (i) climate change risks and impact of adaptation options and (ii) economic benefits of different adaptation options. The adaptation options assessed considered different scenarios (SC) prevalent in the SER and correspond to the situation and proposed interventions under this project. The study assessed the cost-effectiveness of the business-as-usual scenario (no irrigation and traditional practices OR without project) and compared it with a scenario of irrigation and climate-resilient practices. The scenarios also considered different levels of investments in irrigation systems from no investment, partial investment, and full investment. The modelling scenarios and hypothesis analysed correspond to the Radovish valley context, as the study focused on the southeast region and correspond to the proposed activities under Component 2 and 3 of this AF project. The study results indicate that the cost-effectiveness of irrigation compared to business as usual is justified until 2025 when irrigation should be integrated with other climate-resilient practices and technologies (e.g., drought-tolerant seeds, changing planting depth and sowing dates, etc.). Hence, it can be concluded that the mix of adaptation interventions proposed in the CN is cost-effective both short and long-term.

Under *Component 3,* testing, demonstration and dissemination of climate-resilient technologies and practices will target farmers in Radovish and at regional and national levels. Adopting climate-resilient practices can avoid or minimise losses to agriculture. The urgency of adaptation in agriculture was confirmed by a recent study (Stojcheska et al., 2019) that looked at climate change impact on the return on investment of farming. The study used a Ricardian model to derive projected changes in the farm returns under different future climatic conditions, with five different precipitation and temperature change scenarios for the years 2025 and 2050. The simulation results show that the farm returns shrink as the scenarios aggravate and the time period gets longer (5.6 percent decrease at the 2025 lowest impact scenario, 23.1 percent decrease at the 2050 lowest impact scenario, 28.8 percent decrease in 2025 medium impact scenario, etc.), without adaptation.

The cost-effectiveness analysis conducted as part of the AF CN development compared BAU (i.e., without project) scenario and with project scenario. The analysis was conducted based on the cadastral crops grown in the project area divided by data on crops available through an official statistical database. The analysis "with the project" considered farmers' preferences, climatic conditions, and market demand. The analyses concluded that with the project, the farmers' net revenue would double from 1,277 USD/ha to 2,568 USD/ha due to access to improved irrigation and water, crop diversification, and adoption of climate-smart technologies. During the proposal development stage enhanced cost-benefit analysis will be performed.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national adaptation plan (NAP), national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

The Republic of North Macedonia has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 (Official Gazette of RM No. 61/07); it is a party to the UNFCCC as a non-Annex I country. As a candidate country for European Union (EU) membership, it is committed to adhering to the EU's climate and energy policy and assuming the obligations of the countries in Annex I. North Macedonia ratified the Kyoto Protocol to the UNFCCC in 2004 (Official Gazette of the Republic of Macedonia RM No. 49/04). The Ministry of Environment and Physical Planning (MOEPP) has been designated as the National Focal Point to the UNFCCC and as a Designated National Authority (DNA) for the implementation of the Kyoto Protocol. The country has developed three national communications and three biennial update reports. The project was screened for consistency with national climate change and sectoral priorities,

[51] Ministry of Environment and Physical Planning (2013) of Macedonia, Third National Communication to UNFCCC Sector: Agriculture (pg. 89-91)

strategies, and laws and is in full alignment. The alignment and consistency with the main instruments including, Law on Climate Action52, Long-term strategy on climate change, Third National Climate Change Communication to UNFCC (2014), Climate Change Strategy of Radovish Municipality 2015-2025, Strategy on Agriculture and Rural Development 2021-2027, Strategy on Irrigation 2021-2030 (draft), and Strategy on Land Consolidation is elaborated below.

The project goal contributes to Objective 1 of the ***Law on Climate Action (draft 2021)***, through promoting adaptation to the adverse effects of climate change. More specifically:

- ✓ through targeting Radovish municipality, the project directly contributes to **Article 5, Public interest** that calls for municipalities to align their policies with the Long-term strategy on Climate Action. Under ***Article 15, Adaptation to the climate change in plans and programs***, municipalities are obliged to include actions for adaptation in their plans and programmes that address climate vulnerabilities and climate change scenarios. Under *Component 1,* the project will contribute to these efforts by disseminating climate change information and supporting Radovish municipality to identify adaption priorities and mainstream climate change adaptation into their plans.
- ✓ In addition, the approach to project formulation is fully aligned ***with Article 7, Principle to govern climate action*** that calls for design and selection of activities that promote (i) rights of vulnerable groups, (ii) environmental and social safeguards, and (iii) equal opportunities for women and men.

All Components and Activities are fully aligned and in support of the Municipality of Radovish Climate Change Strategy 2015-2025. The project directly supports Objective 1, sustainable management of the irrigation water resources, and Objective 3, sustainable agriculture resilient to climate change. The activities are aligned with the proposed actions in the strategy, including rehabilitation of the irrigation system, switching to a climate-smart irrigation system, improved water management and conservation (Component 2), raising awareness of climate change impacts (Component 1), and promoting climate-resilient agricultural practices that can increase yields of key crops (Component 3).

All Components and Activities proposed, including climate-proofing of the irrigation system (Component 2), generating and disseminating knowledge for innovation, awareness-raising, and capacity building (Component 1 and 3) and introduction of climate-resilient agronomical practices (Component 3) are fully aligned with priorities identified in ***the Third National Climate Change Communication to UNFCC (2014)***. In addition, Components 2 and 3 are fully aligned with the priority adaptation measures in agriculture proposed (i.e., climate-smart practices, improvements and investments in the irrigation system, organic farming). Interventions proposed under Component 2 (i.e. irrigation) respond to the barriers to adaptation in Strumica RB and are also identified as key measures in the water resources sector.

The project also complements and contributes to the water, agriculture, climate change, and land consolidation national strategies and plans. The ***Long-term Strategy on Climate Action of the Republic of North Macedonia*** is the basic planning document for climate action in the Republic of North Macedonia (Final draft, May 2021). With regard to adaptation, the strategy focuses on addressing gaps in data availability, consistency and transparency, institutional capacity, and climate scenario development and analysis. The project is aligned with the priorities and approaches set in the Strategy aimed at increasing the resilience of the society, economy and ecosystems to the impacts of climate change. In addition, the project contributions to the Strategy are following:

- ✓ Objective 5 aims to build solid systems for the regular and periodic collection of data for the production and dissemination of scientific and technical knowledge. This will be supported through all Components of the project and data collected will support appropriate and timely response to the effects of climate change (Component 1), guide revision of national policies and priorities related to water use and management for irrigation (Component 2), and establish farmer-science-extension collaboration for creation and dissemination of knowledge (Component 3).

[52]Ministry of Environment and Physical Planning MoEPP. Law on Climate Action (draft Date: 08.12.2020)

- ✓ Objective 2 aims to increase the resilience of key socio-economic sectors and ecosystems to climate change impacts. This objective will be supported through all Components under the AF project with a focus on agriculture.
- ✓ The strategy calls for context-specific approaches to adaptation at the lowest level possible, which was also implemented in the AF proposal. Thus, the approach enables addressing context-specific vulnerability to the climate impact of the Radovish agricultural system,
- ✓ Objective 5 necessitate monitoring water for irrigation in rural contexts to ensure effective adaptation to climate change (Component 2; Outcome 2.2, 2.3., 2.4) and inform the formulation of policies for the management of water resources. In addition, Component 1, (Activity 1.2), and Component 3, (Activities 3.1., 3.2., and 3.3) will promote cooperation among key stakeholders in the agriculture sector for an enhanced science-policy link, consistent with the Strategy.
- ✓ Finally, the strategy recognizes that climate awareness remains limited, and this limits the overarching climate adaptation action. The Strategy sets measures for enhanced climate mainstreaming and awareness-raising, including measures to be implemented by the Government, relevant Ministries, Academia, and NGOs to strengthen the climate action capacity of national and local institutions (All Components and Outputs), raise climate awareness (Component 1; Output 1.1.), and facilitate active participation of affected communities in climate change decision-marking and equal participation of women and men (all Components and Outputs).

The **National Strategy on Agriculture and Rural Development 2021-2027 recognized that** that many regions (including Radovish) are exposed to both floods and droughts. Hence, the strategy proposes expansion and rehabilitation of existing irrigation systems and construction of new irrigation systems (Component 2; Outcome 2.1., 2.2.) as a priority need, especially in terms of expected adverse effects of climate change. Recognizing climate change threats to agriculture, the new IPARD program for the period 2021-2027 will provide an additionally higher percentage of public co-financing of investments aimed at mitigating and adapting to climate change that will also support scaling up climate-resilient practices promoted through the project and increase the effectiveness of the investment. The Strategy also aims to attract young farmers to start an agricultural activity through a favourable credit line and a package of benefits offered through several policies (e.g., direct payments, grants for investments, facilitated access to agricultural land and mandatory training and advisory support). In addition, the Strategy recognizes obstacles of land fragmentation and calls for land consolidation that would facilitate investment. Hence, the project is fully aligned with the priorities set in the Strategy and addresses key vulnerabilities of the agricultural sector. More specifically:

- ✓ The project goal is aligned with Strategic Goal 3 – application of environmental practices in production that lead to mitigation of the impacts of climate change and adaption. Specific goal (SG) 4 calls for contribution to climate change adaptation that the project aims towards.
- ✓ SG 5 encourages sustainable development and efficient management of natural resources, including water and soil this is aligned with Component 2 and Component 3 of the project.
- ✓ In addition, the project is aligned with Strategic Goal 3 – Ensuring sustainable Development of Rural areas and specifically SG 7 – by targeting young farmers to contribute to development in rural areas. The project will support the implementation of the strategy through awareness and information sharing targeting young farmers (Component 3; Outcome 3.1).
- ✓ Component 3; Outcome 3.2.3., Outcome 3.2.4., and Outcome 3.2.5., Outcome 3.2.6 will contribute to the goal of modernization of agriculture promoted through sharing knowledge, innovation, and development of digital technologies in agriculture with a focus on rural areas. Under the strategy, the goal is to be attained through integrated Agricultural Knowledge and Innovation System (hereinafter AKIS) to be established in the country that will promote cooperation between a group of stakeholders to make agriculture smarter, more efficient and sustainable. The activities under the project target Extension Officers, farmers, and scientists and will contribute these efforts through national curricula revisions for Extension Officers, Training for Extension Officers, farmer-science-policy makers collaboration, farmers access to information and farmer to farmer learning and collaboration.

- ✓ Component 1; Output 1.2 Climate Change Communication Strategy and Action Plan will increase climate change knowledge and awareness of Municipality of Radovish local authorities and technical departments (Extension Officers, Vodostopanstvo Radovishko pole) and farming communities of the impact on and vulnerability to a changing climate. At the municipality level, the activities will directly contribute to the outcomes under the (i) knowledge and awareness of the city or town's impact on and vulnerability to a changing climate, (ii) The capacity to develop and implement local climate-related strategies: including reducing the impact on, and vulnerability to, climate change at the local level, and (iii) proactive attitude to the mainstreaming of climate change considerations into the municipal process.

The approach to land consolidation (Component 3; Output 3.1.1., 3.1.2., 3.1.3., 3.1.4.) is fully aligned with and adheres to the National Law on Land Consolidation (2013) and the National Land Consolidation Strategy (2012-2020). In addition, land consolidation is also identified as a key instrument in establishing sustainable agricultural systems in the New Strategy on Agriculture and Rural Development 2021-2026 and in the draft National Irrigation Strategy 2021-2030. In addition, the Climate Change Strategy of Radovish Municipality 2015-2025 (pg. 60) identifies small plots and fragmented land as a barrier to implementing adaptation measures; hence, Component 3 (Activities 3.1.1 to 3.1.4.) will directly address barriers to adaptation as identified by the local Government.

E. Describe how the project/programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy (ESP)of the Adaptation Fund.

During the CN development stage, the project interventions were screened for compliance against laws and requirements and the 15 principles of the Environmental and Social policy of the Adaptation Fund. The project approach and activities meet the standards and the AF ESP principles, and these standards and principles will be further consulted when conducting the feasibility study and developing the project proposal. The project activities were also screened against the Decree that determines the projects for which an environmental impact assessment shall be carried out as per the Law on the Environment. The activities proposed under the project fall under activities listed in Annex II of the Decree, for which a screening procedure (not a full EIA) is required, as stipulated under Article 81 of the Law on the Environment. Annex II of the Decree identifies the following activities proposed through the project: agriculture, restructuring of rural land holdings, use of uncultivated land or semi-natural areas for intensive agricultural purposes, water management projects for agriculture, including irrigation and land drainage projects, and initial afforestation for the purposes of conversion to another type of land use. The table below lists the relevant rules, regulations, and standards and the ESP principles with which the project outputs are in compliance.

Interventions/ Sector	**Concrete Output (CO) and ESP principle (ESP)**	**Relevant Rules, Regulations, Standards and Procedures**
Generating Evidence, Knowledge, Awareness and (Component 1, 2 and 3)	*(CO 1.1.4. – ESP 1, 2, 3, 5,), (CO 1.1.5. - ESP 1, 2, 3, 5), (CO 1.2.1. – ESP 1, 2, 3, 5), CO 1.2.2. – ESP 1, 2, 3, 5), *CO 1.2.3. – ESP 1, 2, 3, 5), *(CO 2.5. – ESP 1, 2, 3, 5) * (CO 3.2.4 -– ESP 1, 2, 3, 5), (CO 3.2.5. – ESP 1, 2, 3, 5), (CO 3.2.6. – ESP 1, 2, 3, 5)	Law on the Scientific and Research Activities (2016); Law on System of Knowledge and Innovation in Agriculture
Irrigation (Component 2)	CO 2.1. – ESP 1, 2, 3, 5, 9, 10, 15), CO 2.2. - – ESP 1, 2, 3, 5, 9, 10, 15), (CO 2.3. – ESP 1, 2, 3, 5, 9, 10, 15), (CO 2.4. – ESP 1, 2, 3, 5, 9, 10, 11, 15)	*Law on Waters* (Official Gazette No. 51, 31.03.2015); *Law on Environment* (Official Gazette of R. Macedonia no. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13 and 187/13); *Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out* (Official Gazette of the Republic of Macedonia" No.74/2005); *Law on Water Economy* Official Gazette no. 51/2015
Climate-resilient agriculture and	(CO 3.2.1. – ESP 1, 2, 3, 5, 9, 10, 11, 12, 15), (CO 3.2.2. – ESP 1, 2, 3, 5, 9, 10, 12, 15), (CO 3.2.3. – ESP 1, 2, 3, 5, 9, 10, 12,	*Law on Agriculture and Rural Development* (Official Gazette 49/2010, 53/2011, 126/2012 and 2013); *Rulebook on the list of special minimum requirements for good agricultural practice*

innovations (Component 3.1)	15)	*and protection of the environment* (Official Gazette of the RM 43/2013, 178/2015); *Law of Innovation Activity of the Republic of North Macedonia*; *Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out* (Official Gazette of the Republic of Macedonia" No.74/2005);
Land Consolidation (Component 3.1)	(CO 3.1.1. – ESP 1, 2, 3, 5, 8, 9, 10, 11, 15), (CO 3.1.2. - ESP 1, 2, 3, 5, 8, 9, 10, 11, 15), (CO 3.1.3. - ESP 1, 2, 3, 5, 8, 9, 10, 11, 15), (CO 3.1.4. - ESP 1, 2, 3, 5, 8, 9, 10, 11, 15), (CO 3.1.4. - ESP 1, 2, 3, 5, 8, 9, 10, 11, 15)	*Land Consolidation Law 2013*; *Law on sale of state-owned agricultural land* (new draft law under public consideration, May 2021); *Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out* (Official Gazette of the Republic of Macedonia No.74/2005); *Law on Social Protection, the Law on Child Protection, and the Guaranteed Minimum Assistance program*

Together with the Government of North Macedonia, FAO works on introducing regulations on EIA for land consolidation projects and preparing the Law on Sale of State Land; these new developments will also inform screening for compliance in the proposal stage. FAO has established its Environmental and Social Safeguards that set out specific requirements for social and environmental issues. The nine safeguards are natural resource management; biodiversity, ecosystems and natural habitats, plant genetic resources for food and agriculture; animal – livestock and aquatic genetic resources for food and agriculture; pest and pesticide management; involuntary resettlement and displacement; decent work; gender equality; indigenous peoples and cultural heritage. The project will reflect on the defined Safeguards to ensure compliance with the organizational policy.

F. Describe if there is duplication of project / programme with other funding sources, if any.

Radovish valley was identified and prioritized based on its extreme vulnerability (2nd NCCC; 3rd NCCC) to climate change risks and limited capacity to adapt. Community consultations and meetings with the local government confirmed that the project is aligned with the priorities and that no projects implemented or planned in the Municipality would constitute a duplication of efforts. The project will scale up lessons learned and build on and contribute to ongoing regional and national initiatives and investments (e.g. Government subsidy programme for climate adaptation).

Projects/ Programme	Goals and Achievements	Complementary potential and non-duplication	Project Timeline
Mainstreaming of the National Land Consolidation Programme (MAINLAND) Implemented by: FAO	The goal is to assist smallholders and family farms to overcome the problems arising from excessive land fragmentation, small farm sizes and insufficient agricultural infrastructure to increase productivity, competitiveness and efficiency of farms, thus enhancing the potential of the agricultural sector in the Country.	*NO duplication; conducive environment created for land consolidation initiatives.* This project is scaling up of previous FAO support under the Technical Cooperation Program that piloted land consolidation (LC) in two villages in North Macedonia, which resulted in increased institutional in-country capacity for land consolidation and recommendations for amendment of legislation. The MAINLAND project is ongoing and resulted with eight selected locations in Egri, Logovardi, Optichari, Trn and Dabjani in Pelagonija, Sokolarci and Spanchevo in the Eastern region and Kozle in Skopje region. Radovish is not supported with LC activities through the previous and current project. The lessons learned and enabling environment created through the previous project and in-country capacity (FAO's and the Government institutions) and public awareness-raising will support the implementation of this component.	2017-2022
Agriculture Modernization Project Implemented by/Funded: World Bank	The goal is to improve competitiveness in targeted agricultural sub-sectors and strengthen agricultural public sector readiness for EU accession. This project has three components (i) enhancing farm-level competitiveness and fostering agricultural produce aggregation and integration of farmers to domestic and/or export markets through access to Training and Advisory Services and agriculture and Food Distribution Systems. The 2nd component will enhance public support services, including the capacity to design and deliver effective support to the agriculture sector through evidence-based policy-making; Instrument for Pre-Accession and Assistance for Rural Development (IPARD) Implementation Capacity; and (iii) Safe Disposal of Animal By-Products (ABPs). The 3rd component aims to support the Ministry of Agriculture, Forestry and Water Economy (MAFWE) in the efficient implementation of the project.	*No duplication at the project site; opportunities to leverage investments, and collaborate at the national level.* The project targets 15 municipalities, out of which 13 in the northern part of North Macedonia and only one in the southeast region targeting Strumica Municipality not targeted through the AF project. The project tackles important challenges in the agricultural sector (e.g., agricultural aggregation); however, the project's goal is not climate adaptation. Component 1, 2 and 3 aimed at generating evidence to inform policy formulation will align with any efforts under the World Bank project. Duplication of efforts at the national level, related to generating evidence, is not expected as the AF project is focusing on adaptation through integrated land consolidation -irrigation-climate resilient agriculture approach, while the World Bank project takes a different angle.	2020 - 2025
Small-scale, low-cost, environment-friendly irrigation schemes Implemented by: EPTISA	The project aimed to increase the agriculture sector's competitiveness, sustain farm incomes, and mitigate adverse effects of climate change in agriculture by promoting small-scale, low-cost, environment-friendly irrigation schemes. The project selected sites for investments, prepared feasibility studies and technical design for future investments, provided policy guidance on streamlining, strengthening and clarifying the roles of different stakeholders involved in irrigation water management, and developed a methodology for calculation of water tariff to achieve sustainability of community-based, small-scale irrigation systems.	*No duplication.* The project is implemented at 8 locations. One of the locations is in the South-east region (municipality of Bosilovo) not targeted by AF. Under AF project, any lessons learned and best practices related to a cost-effective, environmentally friendly irrigation scheme will be scaled up. Any available lessons learned and feasibility studies related to the technical design of small-scale irrigation systems will be reviewed for scaling-up under Component 2 and 3.	2017-2020

Green Climate Fund (GCF) Readiness project - NDA Strengthening and Country Programming support for North Macedonia Implemented by: FAO	The overall objective is to support the country in developing its capacities to engage with the GCF and setup the mechanisms to establish climate change adaptation and mitigation priorities. This will be achieved through strengthening the institutional capacities of the NDA/ NFP to fulfil its roles and responsibilities related to the Fund effectively and to start discussions with national stakeholders to engage them in the process and to start preparation of the Country program as well.	*No duplication,*	
Green Climate Fund (GCF[53]) Readiness Project - Country programming and strategic frameworks support for North Macedonia Implemented by: FAO	The Readiness Proposal intends to strengthen the capacities of key government institutions relevant for climate action, to become strong national partners that participate in the coordination mechanism and other decisionmaking bodies related to Sustainable Development and Climate Change, and particularly to make informed decision makers related to the GCF matters. As part of the readiness project a Country Work Programme for the GCF with concrete priorities along with different sectors and a detailed pipeline of project/programme ideas (from public and private stakeholders, on national and local levels, in the 9 priority sectors identified) will be finalized.	*No duplication.* AF project will support identifying priorities and project ideas in the agriculture sector that can be included in the Country Work Programme for the GCF under the readiness grant.	2019 - 2021
Support to Development of Agricultural Cooperatives Implemented by: CARE Germany	The project aims to provide (i)support to agricultural cooperatives in their transformation to sustainable farmers' cooperatives organized for economic purposes (sharing equipment and processing or marketing together) and (ii) contribute to improved competitiveness in the country, in line with the EU accession requirements.	*No duplication; opportunity to leverage efforts.* Agricultural cooperative with limited liability EKOPRODUKT Konche, Radovish that participated in CARE project and its members will be targeted through the project to contribute to the ongoing transformation of the agricultural system.	2017 – Feb 2021
GEF - The Fourth National Communication and the Third Biennial Update Report on Climate Change Implemented by: UNDP	The communication will identify the most relevant adaptation options and prepare the 4th NCCC.	*No duplication.* The project is fully aligned with the adaptation priorities identified in the Long-term strategy on climate change and adaptation priorities identified in the 2nd NCCC and 3rd NCCC. FAO is one of the stakeholders participating in the preparation of the document.	2018-2021
Restoring the Health of the Strumica River Basin Funding: Government of Switzerland Implemented by: UNDP	The project's aims to investigate transformational change in managing flood risk in the region, accelerating the shift from purely reactive responses to floods to integrated systems to manage hazards, vulnerabilities and exposure of communities and assets to prevent/mitigate losses and alleviate the impact of future floods. The project aimed to increase resilience to the flooding hazards, introduce integrated pollution prevention and control, identify feasible wastewater management approaches, pilot wastewater treatment systems in rural communities, reduce the use of agrochemicals and modified irrigation practices to reduce runoff, identify flood risk mitigation options, introduce flood early warning system, and strengthen regulatory integrated flood risk management.	*No duplication.* Under Component 1, the AF project focuses on mitigating risks of drought and other extreme events (hail, dry spells, frost) that is not the focus of the UNDP project. The UNDP project primarily focused on early warning and flood risks preparedness. Under Component 2 and Component 3, the AF project will scale up best practices developed through the UNDP's project on reducing the use of agrochemicals and modifying irrigation practices and work through any mechanisms and structures that were established at local and regional levels.	2015-Dec 2021

[53] GCF is funding two mitigations and 1 cross-cutting regional project, and two readiness projects in North Macedonia https://www.greenclimate.fund/countries/north-macedonia

G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

The AF project will provide an opportunity to test new technology and practices, demonstrate and collect evidence on the impact of innovations, and develop new products and services to guide scaling up no-regret adaptation options at the farm level, formulation of evidence-based adaptation policy, and programme formulation. The knowledge management (KM) and dissemination activities have been included under each Component. The capacity building activities will remove knowledge and information barriers to adaptation and target women and men farmers, Extension Officers, Vodostopanstvo staff, HMS staff, and local Municipal Authorities. Studies, lessons learned, and best practices generated in collaboration with farmers-scientist-extension-policy makers will enable the identification of the most relevant gaps in evidence and the generation and dissemination of evidence targeting different stakeholders. Considering that North Macedonia is in the process of formulating a NAP and mainstreaming adaptation into sectoral policies and programmes, the evidence generated through the AF project has the potential to support and inform this process with in-country findings. Software and applications developed will be used at the national level and can be calibrated with context-specific data relevant for different regions.

Expected Outcome	Stakeholders and learning objective	Knowledge product
1.1.3. Increase efficiency and production through integrated information on soil moisture and irrigation schedules, pest warnings, crop development, and application of inputs.	For: farmers, HMS staff, National Extension Agency (NEA) and farmers' organisations To: provide real-time information on weather risks, improve coverage of national climate information systems, update the existing methods	Climate service app developed with notification Application Programme Interference (API) Capacity-building on the use of the climate service app Software for integrating context-specific information and providing advisories
1.1.4. Capacity of key stakeholders developed to collect and analyse data, provide advisories, and establish effective dissemination mechanisms.	For: HMS staff, NEA and farmers' organisations) developed to collect and analyse data, provide advisories, and establish effective dissemination mechanisms. To: provide timely and accurate seasonal and weather forecasts and advisories	Manual for data collection and analysis Dissemination protocols developed
1.1.5. Awareness of climate change projections and risks and impacts on agriculture and seasonal forecasts facilitate climate adaptation efforts in Radovish.	For: women and men farmers, Radovish Municipality, farmers organizations, Vodostopansks, NEA officers To: identify long-term transformation adaptation priorities	Downscaled climate change projection and seasonal forecasts Community-level campaign (workshops, radio show) Report on men and women farmer-led climate change impacts and vulnerability analysis
1.2.1. Systematic review of existing adaptation practices in relevant sub-sectors including conducted.	For: policy-makers, educational institutions, farms To: stocktaking of available evidence, identify gaps and disseminated scientific evidence	Review report Position papers
1.2.2. Knowledge database constructed to provide a living repository of recommended best practices and address gaps in evidence.	For: policy-makers, educational institutions To: provide access to in-country evidence on adaptation in the agriculture sector	Database
1.2.3 Climate change adaptation mainstreamed into the regional and national adaptation investment portfolio and adaptation plans and strategies.	For: policymakers To: support evidence-based policy formulation and programe development	Guidelines for policymakers. Workshop reports Face-to-face farmer-policy-makers exchange

2.2.5. Water monitoring system, involving in-situ and automated measurement devices, installed (measuring discharge and water quantity).	For: policy-makers, farmers To: inform formulation policy and regulations for water use for irrigation at the national level	Reports on the water use
3.2.1. Radovish men and women farmers' and farmers at regional and national levels empowered to adopt climate-resilient agricultural practices for sustainable and environment-friendly production.	For: women and men farmer, extension officers To: scale out climate resilient technology and practices	On-site (i.e. demonstration farm) training for farmers and farmer associations Model farmer to exchange visits/study circles Model farmer to farmer instructions and visits Instructional YouTube videos for farmers Trainings implemented by Extension Officers for farmers Farmers innovation expositions. Local media– model farmer – extension officers
3.2.4. Evidence and lessons learned generated through climate-smart and organic production integrated into the e-platform for Agricultural Knowledge and Innovation Systems (AKIS) for scale-up at regional and national levels.	For: farmers, policy-makers, research institutes, extension officers To: on-going learning, exchange, and scaling-up climate adaptation innovations	Lessons learned and best practices. Established e-platform for Agricultural Knowledge and Innovations Systems (AKIS) Manuals for reporting data for pilot farms
3.2.5. Evidence-based guidelines developed and, together with AKIS, integrated into the curriculum of the National Advisory Agency.	For: National Extension Agency To: to support farmer-science-advisory services, knowledge sharing, and dissemination, informed by digital assistance, machine learning, and artificial intelligence (AI)	Revised Curriculum for the National Advisory/Extension Services. Manual on use of digital technology for advisory services
3.2.6. Provision of up-to-date and expert gender-sensitive advisories on climate-resilient technologies, crop diversification, and information related to government programmes.	For: Regional Extension Officers To: enable the provision of expert climate adaption advice to farmers	Training Manuals for Extension Officers. Monitoring and on-site technical protocols. Training and training manuals for women and men farmers (farm management and accounting)

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

Stakeholder consultation strategy was developed as part of AF CN development to (i) enable participation and community-led identification of climate risks, vulnerabilities, and adaptation options (ii) technically validate and elaborate on identified activities (iii) identify the most effective short-and long-term adaptation options, (iv) assess compliance with local and national adaptation and sectoral policies and priorities, and (v) identify opportunities for collaboration and avoiding duplication. Stakeholders involved in the pre-concept and CN design include: Radovish women and men farmers, Radovish Municipality, Ministry of Agriculture, Forestry and Water Economy (MAFWE), the Ministry of Environment and Physical Planning (MEPP), JSC Water Economy of the Republic of North Macedonia, Vodostopanstvo “Radovishko Pole”, and national technical experts within relevant Ministries and the Faculty of Agricultural Sciences and Food (see Annex 2). In addition, the CN was validated at the meeting held with the Climate Change Steering Committee members, the Minister of MAFWE, and the

Minister of MEPP (23 July 2021) and was revised based on the comments received. Following the CN validation, the endorsement letter was issued (Part IV). The text below reports on the outcomes of the stakeholder consultations.

Pre-concept note stage.

The CN development commenced with the initial meeting between FAO and North Macedonia Designated Authority for Adaptation Fund (i.e., Minister of Environment and Physical Planning) and MAFWE that identified gaps and priorities in adaption in the agriculture sector. Based on the initial discussions, FAO North Macedonia developed a concept idea with technical support from the FAO Regional and HQ Office. The initial concept idea was presented to the MAFWE and the AF Designated Authority and assessed as relevant; a support letter was issued by the MEPP indicating full support for the project and an invitation to proceed to the CN stage.

Concept-note stage.

National Level Consolations. A meeting with MAFWE and JSC Water Economic experts was held to present the project, align with national priorities and strategies, technically validate the approach, and elaborate on the activities. The meeting confirmed the urgent need to repair and climate-proof irrigation systems to mitigate climate change risks considering the vulnerability of agriculture to climate change. MAFWE and JSC Water Economy representatives confirmed that the project activities correspond to the actual needs and priorities.

Local Radovish Authorities. FAO held a meeting with the Mayor of Radovish to discuss key adaptation priorities in the agriculture sector. During the meeting, the initial set of components and activities presented were screened for alignment with the Radovish Municipality Climate Change Strategy 2016-2025. The consultation meeting confirmed that the project will address key barriers to adaptation and will have a significant contribution to enhancing resilience to climate change.

The Municipality of Radovish offered full support with project implementation and communication with local stakeholders. Finally, the local authorities provided information on the women farmers associations to be targeted through the AF project and local climate change and strategic documents for alignment.

Local Technical Departments: The technical meetings and consultations with Vodostopantsvo “Radovishko pole” were held on a daily basis during the preparatory phase to further elaborate on and validate activities under each component. Two days of irrigation system field inspections were organized aimed at identifying system weaknesses to address climate change-induced risks to agriculture (Part II Section B). The technical field inspections identified numerous upgrading and climate-proofing needs. Follow-up discussions were held with MAFWE and Vodostopanstvo to analyze the system weaknesses and informed by Radovish farmers consultations, the decision was made to prioritize activities that will: (i) address climate change risks through improved access to water for irrigation for all farmers and eliminate water losses, (ii) introduce improvements that will enable the irrigation system to respond in a timely manner to climate-change-induced irrigation needs, and (iii) introduce improvements to the system that will facilitate and enable on-farm water conservation through the introduction of climate-smart irrigation technology (i.e., switch from furrow to sprinkler irrigation, timely irrigation, reduce uncontrolled and unmonitored groundwater consumption, increase the number of irrigation system users and reduce the number of unmonitored groundwater use for irrigation due to irrigation system inefficiency). The activities were validated through the consultation meetings with men and women farmers and through screening with the Radovish Municipality Climate Change Strategy 2016-2025; more in-depth assessments will be carried out during the proposal development stage and through a feasibility study.

Consultations with Women and Men Farmers. The FAO team conducted a week-long mission to targeted villages to conduct community consultations. Through stratified sampling, 142 women and men farmers from eleven villages targeted through the project participated in the consultations. In addition, fourteen focus group discussions were held (one in each village) and three separate meetings with women farmers and women associations (“Denica”; “Zenska Akcija”) to understand gender-specific

vulnerabilities and barriers to adaption (Figure 10). Turkish minority group members residing in the village of Kalugjeritsa were identified and participated in the consultations. Survey and focus group discussions collected data to understand farmers' perceptions of climate change risks and impacts on agriculture, understand farmers' barriers to adoption, and identify adaptation solutions proposed by the farmers.

Figure 10: Consultations with Turkish minority in Kalugjeritsa (left), and men and women farmers in Zleovo village (right).

The following data obtained through focus group discussions and the survey guided identification of adaptation components and activities:

- **Climate change and extreme events.** Radovish farmers have observed changes in weather and climate and noted more frequent early and late frosts, hailstorms, high temperatures, heavy rains, increases in average temperature, and more frequent droughts. These climate risks informed the selection of adaptation options.
- **Climate Change Impact on Agriculture.** Farmers reported that: (i) the workload increased, especially for women, as they spend more time irrigating the fields and treating the increased occurrence of pest infestation and diseases, (ii) yields reduced and the quality of crops reduced while costs of production increased due to increased need for labour, irrigation, and inputs costs, (iii) income from agriculture is not stable and varies from year to year (often farmers are forced to sell at a low price due to low quality of products), and, (iv) financial instability is causing stress and impacts on household dynamics. Farmers reported feeling insecure because the yield is reduced. Women and minorities are disproportionately impacted, especially women from the Turkish minority that entirely depends on agriculture.
- **Vulnerability and Barriers to Adoption**. Most farmers point to water shortages and lack of access for all to irrigation as the main barrier to climate change adaptation. This is due to outdated irrigation systems, fragmented land, lack of equality in water distribution, and long distances of land parcels from the irrigation channels. As the irrigation system cannot respond to climate-change-induced water needs and water availability is compromised due to losses, farmers are using groundwater on their farms for irrigation. In addition, a significant portion of land under the existing irrigation system is left as fallow as water losses (an estimated 50 percent of water is lost before it reaches agricultural plots) result in water shortages. Farmers also noted slow responses to repair the system, which can impact the agricultural season and crops. For example, in 2020, the irrigation system started supplying water late in the season (Aug-Sep).
- **The Turkish minority** group members identified access to irrigated land as the main problem that forces the minority to engage in seasonal work as hired labour and rent non-irrigated land, where rain-fed agriculture is highly vulnerable to climate change risks. Women from the Turkish minority reported (i) no opportunities to increase their knowledge through training and advisory services (agricultural practices, introduction of new crops) that can increase their household income, (ii) full dependence on agriculture and low levels of education (i.e., primary school) that, together with lack of public transport, limits their opportunities for employment in cities, and (iii) reduced and insecure

access to seasonal work due to climate change-induced yield loss and priorities for seasonal employment given to men, due to perceived stronger physical abilities for manual labour.

- **Young Farmers** (18-40 years) voiced a need for decent working conditions and income to motivate them to stay in the rural area. They consider small-scattered farms as not productive and profitable and stress the importance of irrigation and modern farm technologies as preconditions to make agriculture profitable and interesting for young farmers. Young farmers identified the following adaptation priorities: (i) advisory services for diversification and introduction of new profitable crops based on market demand, (i) access to irrigated land, and (iii) access to modern technology such as drip irrigation and IT on-farm technologies to reduce workload and safeguard production.

The adaptation priorities identified by farmers informed the final selection of components and activities, and the CN is fully aligned with barriers and adaptation priorities identified through community consolations. In addition, data collected through the focus group discussions with women farmers informed gender mainstreaming actions; see Part II Section C.

High-level validation workshop. Based on the above stakeholder consultations, the CN was drafted and presented to the Ministers of MEPP and MAFWE, and the Mayor of Radovish municipality (23 Jul 2021). High-level representatives agreed that the proposed project concept will address climate change risks to agricultural production, remove barriers to adaptation, and benefit thousands of farmers. Minister Nuredini, as Designated Authority of the Adaptation Fund in North Macedonia, expressed his full support for the Project CN, and ensured that the Ministries capacities will be allocated to support formulating the Full Project Proposal. Following final revisions of the CN, the endorsement letter was issued (see Part IV).

I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Climate-change-induced risks are most evident in the SE region of North Macedonia, and Radovish Municipality has been singled out as one of the most vulnerable (3rd NCCC) due to high exposure, limited adaptive capacity, and sensitivity to the impacts of agriculture-dependent livelihoods. The need for climate change adaptation has been recognised by women and men farmers and elaborated in the Radovish Municipality Climate Change Strategy 2016-2021. The barriers to adaptation for Radovish farmers include: limited access to resources and know-how to address water for irrigation problems, lack of accurate and timely weather and climate services, limited information and advisory services related to climate-smart agriculture, and fragmented land (making adaptation investments costly). The project will remove barriers to adaptation and is aligned with local, regional, and national adaptation and sectoral priorities. The funds requested from the AF are sufficient to attain adaptation objectives, and the proposed project activities can be executed without additional funding. The text below elaborates on the baseline situation and project-induced changes to address adaptation barriers and enhance climate resilience.

Component 1

Baseline scenario:

North Macedonia has made significant progress in generating climate change projections and analysing the agricultural sector's vulnerability. In addition, Radovish farmers have observed the changes in temperature, precipitation, and extreme events that impact agriculture. However, scientific evidence on ***climate change projections*** and impact on agriculture has not been disseminated to Radovish farmers, extension officers, and local technical departments. This lack of climate change awareness presents a barrier to short- and long-term prioritisation of adaptation investments at farm and municipality levels.

Radovish municipality does not have a weather station and depends on the Strumica station for weather and seasonal forecasts. Therefore, the accuracy of the service, due to changes in altitude, is not guaranteed (Climate Change Strategy 2016-2025, Municipality of Radovish). Farmers are not receiving timely and context-specific expert advisories that would support decision making around the timing of planting and harvest, fertiliser and pesticide and irrigation application, and protection from extreme events. As a result, yields are decreasing, the quality of production is low, and the workload and cost

of production are increasing. During the focus group discussions (Community Consolations, 2021), Radovish men and women farmers reported that high temperatures in the summer of 2020 caused spots on apples and reduced their quality; extreme heat and heavy rains destroyed and destroy pepper yield, and in 2019/20, prolonged droughts and high temperatures reduced grape yields by 25 percent-30 percent as timely and efficient irrigation was not possible to achieve. In addition, farmers reported the occurrence of frequent and new diseases and insects that destroy and reduce yield and expressed demand for expert advice to protect production. Finally, farmers do not have access to seasonal forecasts (i.e., climate variability) that would give an indication of probabilities for seasonal rainfall and temperature conditions or seasonal climate risks (dry spells, start of season, heavy rains). The lack of seasonal forecasts prevents planning for the upcoming season and making informed decisions as to the selection of crops and varieties, the intensity of input use (fertiliser, pesticides) and likely costs, labour demands, intensification and diversification of crops grown, seasonal water conservation strategy, and more.

With the project. The Internet of Things (IoT) technology will support precision farming by disseminating timely information (pests, soil moisture, crop development) to farmers. This will lead to an increase in crop yield and productivity and reduce consumption of agricultural inputs through timely decisions on irrigation, treatments, and fertiliser input, while also reducing workload. The project will install automated weather stations, on-farm sensors (temperature, humidity, moisture), and through automated data mining and software for data analysis, provide advisories for end users. As climate change impacts production, farmers need to predict problems before they occur and make informed decisions to avoid them. In addition, automation (Component 3.1) will demonstrate demand-based irrigation and feralization application to the advisories. Considering the impact of climate change on water availability and demand for irrigation, optimizing water use is particularly important. On-field sensors will help farmers conserve water and minimize the use of pesticides and fertilizer, contributing to more organic production. The real-time monitoring and prediction system will help farmers quickly respond to change in weather and pests, protect crops, and improve the quality of the crops.

The awareness of climate change projections and risks will motivate and empower key stakeholders (local government, technical departments, and farmers) to adapt and invest in climate change innovations, technologies, and practices and access opportunities through Government programmes. Capacity building for installed weather stations, provision of information, and advisories will enable farmers to make informed decisions, better manage risks, take advantage of favourable climate conditions, and adapt to climate change.

Component 2

Baseline scenario: Increases in temperature and dry spells and changes in the amount and timing of precipitation impact water availability and water demand. Floods and erosion cause damages to already dysfunctional irrigation systems. Heatwaves result in an increase in water consumption and accelerate evaporation, reducing the amount of surface water and groundwater. The damaged and non-functional parts of the irrigation system compromise access to water, limit water conservation opportunities and result in farmers abandoning production and leaving land fallow. Current water pressure in the irrigation system does not facilitate the switch to drip and sprinkler irrigation (Community Consultations 2021), thus resulting in significant water losses. The system is characterised by high vulnerability and high-water losses, low capacity to respond to changes in water demand as water use is not monitored, and unregulated flow during delivery (Vodostopanstvo Radovishko Pole and FAO Irrigation System Inspection, 2021). System inefficiency is evident in the low number of irrigated area (500-600 ha our to potential 3,200 ha), and farmers are switching to using groundwater for irrigation. The need for urgent modernisation and improvement of the irrigation system was also reported through focus group discussions with men and women farmers, and over 76 percent of farmers participating in the survey[54] as part of community consultations reported the need to modernise the irrigation system.

[54] As part of community consultations, in addition to focus group discussions, FAO administered questionnaire aimed at understanding profile of Radovish men and women farmers, key barriers to adaptation, and farmers adaptation priorities; 108 farmers, of which 35 percent women farmers, participated in the survey.

With project. Significant water conservation and a functional climate-proofed irrigation system will enable scaling up on-field conservation water technology (sprinkler and drip irrigation) due to increased water pressure and regulated flow. Off-farm system-level water losses through drainage and evaporation will be eliminated, and water conservation and land consolidation will enable expanding irrigation to the fields not currently under the irrigation system. The irrigation water use monitoring devices of the current system produce critical data to inform national policy development on the regulation of water used for irrigation to address climate change-induced risks to water resources and agricultural production. The irrigation system will be supported through technological improvements to respond to the climatic shock-induced crop demand for water and will be financially sustainable and able to cover operating and maintenance costs due to increased efficiency and quality that attracts new users. System-level and on-farm water conservation resulting from irrigation system climate-proofing will enable the distribution of water to users downstream (Strumica Municipality) who experience water shortages for irrigation and allow building climate resilience beyond the project's boundaries.

Component 3

Baseline. The fragmented and small size of agricultural plots limits the productivity of the land, limits opportunities for on-farm and landscape-level investments in adaptations, increases adaptation costs, and demotivates young farmers to farm. The precipitation variability and increase in temperature, and occurrence of dry spells create additional needs for water for irrigation. An increase in the incidence of pests and diseases calls for a timely response to minimise damage and loss of yield. Most of the farmers participating in community consultations indicated a lack of knowledge and expertise of climate-smart agricultural practices and technologies. In addition, focus group discussions with farmers revealed that older farmers do not have the relevant expertise needed to diversify production and introduce new market-orientated and climate-resilient crops. The investment in the irrigation system on- and off-farm and the introduction of climate-smart technologies and practices is compromised by small and fragmented agricultural plots that increase the costs of adaptation and limit the productivity of the land (Community Consultation, 2021). Women and men in Radovish have limited resources and the ability to implement adaptation measures to reduce climate change risks and limited know-how, and fragmented and small plots restrict opportunities for adaptation (Climate Change Strategy Radovish Municipality, 2016-2026).

With Project. Land consolidation will enable the creation of a climate-smart landscape through cost-effective and climate-resilient investments in the irrigation system and on-farm climate-smart technology. On-farm climate-smart agriculture will remove knowledge gaps related to technologies and practices pertaining to soil and nutrient management, soil and water conservation, irrigation technology, agroforestry system, crop diversification, and the use of digital technology. In addition, identification of alternative climate-smart and market demand-driven crops and dissemination of expert advisory services will build climate resilience through diversification. Agricultural advisors (i.e., Extension Officers) will be empowered through opportunities to upgrade their knowledge to enable them to provide relevant advisories based on the farmers' needs and climate adaptation needs. Advisors will have access to the latest knowledge that will be regularly upgraded through linkages with researchers and involvement in innovation development in Radovish. Farmer-to-farmer and farmer-science-extension officer learning platforms and events will facilitate learning and exchange for scaling-up best practices. The project's link with the newly established Agricultural Knowledge and Innovation System (AKIS) will both facilitate access to information and enable scaling best practices and lessons learned from the project site.

The three integrated components will enable the establishment of a climate-smart agriculture landscape in Radovish that is resilient to climate change shocks.

J. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

The conditions for continuous adaptation in Radovish beyond the project timeline will be possible through activities that build capacity, provide intrinsic motivation for change, and address economic, financial, social, and institutional sustainability implications. The initial approach to sustainability at the

CN stage will be further revised and the sustainability plan will be developed in collaboration with key stakeholders.

Policy and Institutions. North Macedonia has started to integrate climate change into national strategic planning documents and laws. However, though the adaptation is recognised in the Strategy for Sustainable Development, it is secondary to mitigation. The current climate change in-country efforts focus on meeting GHG mitigation goals, and the process to develop the National Adaptation Plan (NAP) has been initiated. The Radovish valley AF project has the potential to provide valuable lessons of local adaptation that can inform developing and aligning national-level adaptation priorities and approaches to adaptation (Component 3). This can also provide space and opportunity to continue adaptation efforts at the local level, hence increasing sustainability. The AF project can support the formulation of a national-level adaptation plan that will also support budget allocations for adaptation. This will ensure a stream of financing to continue enhancing the climate resilience of Radovish and other regions.

Under Component 1, the agrometeorological weather stations will be integrated in the national network operated by HMS as part of their regular work. After the termination of the project, agrometeorological data with recommendations for irrigation for the SE region/Radovish region will be provided by HMS; the system will be regularly calibrated with support from the Faculty of Agricultural Sciences and Food, Laboratory for Irrigation Sustainability. Under Component 2, the rehabilitated and modernized irrigation system is in state property. The management and operation of the state own irrigation systems (large irrigation schemes) is entitled to JSC Vodostopanstvo. Under Component 3 (climate-resilient technology and practices), the AKIS and personal assistants will be transferred to the National Extension Agency (NEA) that, through a number of local branches, operates in the whole country. Collaboration between NEA, Research and Higher Educational Institutions, and HMS will be strengthened through the project, which will facilitate upscaling of the AKIS and Virtual Assistants to a nationwide farmer audience for intensification of the smart agriculture approach in the country. The sustainability post-project will be supported by the priorities and measures already in place through the National Programmes for Agriculture and Rural Development. In addition, demonstration farms for irrigation scheduling, soil moisture monitoring, and pest warning models will be transferred to and monitored by the Faculty of Agricultural Sciences and Food, Laboratory for Irrigation post-project. The highly personalized data for specific field locations, soil properties on the farm, crop/variety used, and applied irrigation scheduling will serve for educational purposes and scientific research and for calibration of the HMS model for the provision of agrometeorological services nationwide.

Under Component 3, land consolidation sustainability is attained through following the already operational land consolidation procedures established in the Law on consolidation of agricultural land and in line with the overall agricultural and rural development policy. The scope of land consolidation in North Macedonia is broader than just the re-parceling as also the needs for investment in agricultural infrastructure is assessed and such investments planned and implemented integrated with the land consolidation process. Land consolidation contributes to achieving several SDG targets including 1.4 on providing access to land and other natural resources, 2.3 on doubling productivity and income of small-scale food producers and 5.a on gender equality. The project is in full support of the national and local government plans and priorities and contributes to the implementation of the Radovish Municipality Climate Change Strategy 2016-2021. As such, the project is aligned with on-going and planned initiatives in the country and at the local level. This will provide the opportunities to support, link with, and leverage on-going and planned efforts introduced through the national and IPARD (2021-2027) funding (i.e., inputs needed to implement climate-smart practices at a subsidised price).

Social. The project will reduce farmers' risks to adopt climate-smart technology and practices by providing technical know-how, demonstrating and facilitating access to inputs, improved land structure, and irrigation. This will increase productivity and improve the economic status of Radovish farmers. These gains will continue motivating farmers to successfully engage their investments in climate adaptation technology and practices after the AF project. Furthermore, gender transformative actions through land ownership and targeting women with access to new technology and practices are expected to continue making positive changes in the lives of women farmers.

The technical capacity building through training and awareness-raising (HMS staff, Government structures, decision makers, farmers, extension officers) will ensure that capacity is strengthened to enable on-going self-sustaining delivery of adaptation at individual and institutional levels. Furthermore, community-driven sustainability was initiated in the project conceptualisation stage through community consultation and community-driven selection of adaptation activities. This on-going involvement of women and men farmers is expected to develop capacity and create space to initiate other farmer-led adaptation initiatives in the Radovish municipality post project.

The AF project will initiate the diffusion of benefits to the most vulnerable farmers and women farmers. The participation in the project and access to benefits provided through the AF is expected to empower vulnerable groups to seek support and access the benefits offered. In addition, as climate change risks and vulnerability over time become more apparent, the local farmers will be motivated to continue adaptation efforts. The project will deliver technical training to various stakeholders under each Component and simultaneously connect farmers, scientists, and extension officers as well as local and national structures. Creating learning and support groups using digital technology (Components 1 &3) will encourage learning and access to information for sustained technical capacity post project.

Financial. Under Component 1, the installation of automated weather stations is aligned with a national strategy to replace outdated installation and provide services that meet the standards of the National Hydrometeorological Services (NHS) and the World Meteorological Organization (WMO). Adhering to national and internationally recognised standards will facilitate the provision of timely and accurate weather and extreme events information. The stations will be integrated into the NHS and maintained and operated as part of a national network of weather stations; this will ensure that they function and provide services post project.

Under Component 2, an improved irrigation system will motivate farmers not currently linked to the system and using groundwater for irrigation to switch to using an improved irrigation system. In addition, the water-saving interventions and improvement in the irrigation structure enabled through land consolidation will provide access to irrigation to other parcels and downstream users This will lead to an increase in the number of water users and an increase in revenues, which will enable maintenance and functioning of the system post-project. In particular, the irrigation system in Radovish is operated by the subsidiary “Radovishko Pole” which, through the tariffs for irrigation services provided to farmers is able to operate and maintain the system. With improved access to irrigation and improved irrigation services, the number of water users will increase (at least 30 percent), which will generate more income and ensure better sustainability of irrigation services. The sustainability of the irrigation system will be further investigated and determined through a feasibility study.

Transparency will be promoted through the Radovish AF Steering Committees, comprising of local Government departments (agriculture, irrigation, weather services) and farmers, to monitor project progress and coordinate efforts. In the project design stage, in-depth analysis of the key institutions at the local level, their role, and the capacity needed to sustain project results will be conducted to ensure institutional contribution to sustainability. The sustainability will be further elaborated during the project design phase when key stakeholders and implementing partners will be involved in developing a sustainability strategy that will be periodically revised to address any changes in the operating environment.

K. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

The project Components and Activities have been screened against the 15 Environmental Social and Principles (ESP). The initial screening conducted during the CN stage established that the project promotes positive social and environmental benefits (see Part II, Section B) and is categorized as Category B with minimal, localized, and reversible environmental and social impacts. Category B is assigned due to the need for further assessment and feasibility studies at the proposal stage for land consolidation and irrigation activities. These studies will determine the exact project scope and activities based on which second round of screening for compliance will be taken. The risk findings during CN phase are preliminary and an environment and social risk assessment will be conducted at full proposal

stage. According to the Annex 2 Decree determining the projects for which an environmental impact assessment shall be carried out, the proposed interventions fall under Annex II activities (i.e., section 1 Agriculture, silviculture and aquaculture) for which screening procedure under Article 81 of the Law on Environmental shall be carried out and is not subject to environmental impact assessment before development can be given. Table 4 summarizes the outcome of the ESMP 15 principle risks screening at the CN stage.

Table 4: Screening against Environmental and Social Principals

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	✓ No risk. The project complies with the relevant legal framework in the country that is also aligned with EU laws, including laws on land consolidation, water management, and innovation and information sharing.	
Access and Equity		✓ Low risk. Community consultation meetings and stakeholder mapping identified a minority Turkish group with limited access to land under irrigation. Additional screening will take place and activities will be identified to (i) mitigate possible future inequalities due to impartial access to project benefits, (ii) feasibility study under land consolidation activity will identify, record and respect legitimate tenure right holders and their rights, whether formally recorded or not; to refrain from infringement of tenure rights of others, and to meet the duties associated with tenure rights.
Marginalized and Vulnerable Groups	✓ No risk. The marginalized and vulnerable groups (young women and women in general, families with 3 and more children, young farmers) were identified and participated in community consultation meetings. Needs, vulnerabilities, and barriers to the participation of the vulnerable groups informed targeting, selection of activities and implementing modalities under the project (see Part II, Sec. B)	
Human Rights	✓ No risk. The project and its activities do not risk violating any pillar of human rights.	
Gender Equality and Women's Empowerment	✓ No risk. Women were consulted during the project design stage, and gender mainstreaming actions identified based on needs, risks, vulnerabilities, and established cultural norms and values, see Part II, Section B for details.	
Core Labour Rights	✓ No risk. Projects risks to core labour rights were not identified.	
Indigenous Peoples	✓ No risk. There are no indigenous peoples in the targeted area.	
Involuntary Resettlement		✓ Low risk. Each phase of the land consolidation is regulated by the Law on Land Consolidation and fully in line with international instruments such as VGGT and following the fundamental principles of land consolidation (respect for and protection of legitimate tenure rights, the fundamental principle that participants should be at least as well of after the project compared with before, sustainability and environmental protection, consultation and participation, transparency, gender equality). Under the component 3 (land consolidation), the project will adhere to the national

		regulation and the above-mentioned land consolidation principles to eliminate the risk of economic displacement (i.e., loss of assets or access to assets to lead to loss of income).
Protection of Natural Habitats		✓ Low risk. The project is implemented in the agricultural area, and a detailed feasibly study of the land consolidation and irrigation component will identify possible areas around rivers and any woodlots in the area. Details will be provided in the proposal development stage.
Conservation of Biological Diversity		✓ Low risk. Feasibility study under land consolidation will also assess to what extend larger plots mean reduced biodiversity and will introduce wind belts to make the biodiversity intact and avoid soil erosion and identify other opportunities to contribute to preserving of and on-farm biological diversity. Organic farming and technologies and practices pertaining to climate-smart agriculture are expected to contribute to conservation and potentially increase biological divest.
Climate Change	✓ No risk. Proposed project activities are simultaneously contributing to the attainment of national GHG emission goals (increasing carbon stored in the soils, reduced emissions from transport due to land consolidation, reduces emission due to organic farming, smart technology resulting in reduced fertilizer and pesticide application, etc.).	
Pollution Prevention and Resource Efficiency	✓ No risk. The project will contribute to pollution prevention. Improved irrigation and climate-resilient practices on-farm are expected to prevent nutrient leaching and conserve water. Land consolidation will improve resource efficiency (e.g., reduce costs of adaptation technology, transport costs and reduce workload).	
Public Health	✓ No risk. The project is expected to contribute to improved public health through reduced leaching of nutrients due to improved irrigation system and drinking water contamination. Improved soil quality and organic farming is expected to improve the food security and nutritional value of the crops, contributing to public health.	
Physical and Cultural Heritage	✓ No risk. The project is implemented in agricultural zones of Radovish municipality; no risks to physical and cultural heritage were identified at the CN stage.	
Lands and Soil Conservation	✓ No risk. Project activities pose no risk. Land consolidation will enable afforestation of land of lower quality, leaving aside land and other measures to address erosion problems in the area (Land Consolidation Law 2013, Article 5) based on the feasibility study. Climate-resilient practices on-farm will promote land and soil conservation.	

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[55]

Mr. Naser Nuredini, Minister of Environment and Physical Planning	**Date: 27 July 2021**

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address.*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Maher Salman Implementing Entity Coordinator	
Date: *August 6, 2021*	Tel. and email: 0039 0657054718 Maher.Salman@fao.org
Project Contact Person: Maher.Salman@fao.org	
Tel. And Email: 0039 0657054718, Maher.Salman@fao.org	

[55] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities

Annex 1: NDA Endorsement Letter

Republic of North Macedonia
Ministry of Environment and Physical Planning

РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА - REPUBLIKA E MAQEDONISË SË VERIUT
МИНИСТЕРСТВО ЗА ЖИВОТНА СРЕДИНА И ПРОСТОРНО ПЛАНИРАЊЕ
MINISTRIA E MJEDISIT JETËSOR DHE PLANIFIKIMIT HAPËSINOR
Бр.-Nr. 02-3840/1
27-07-2021 20___ год.-viti
СКОПЈЕ - SHKUP

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: *Endorsement for the project "Building climate resilience of the agricultural system in Radovish region through improved irrigation, land and water management"*

In my capacity as designated authority for the Adaptation Fund in the Republic of North Macedonia, I confirm that the above single country project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in North Macedonia.

Accordingly, I am pleased to endorse the above project concept proposal with support from the Adaptation Fund. If approved, the project will be implemented by the Food and Agriculture Organization of the United Nations (FAO) and executed by the Ministry of Agriculture, Forestry and Water Economy.

Sincerely,

Mr. Naser Nuredini,
Minister of Environment and Physical Planning

1 | Ministry of environment and physical planning of the Republic of North Macedonia
Square "Presveta Bogorodica" No. 3, Skopje
Republic of North Macedonia
+389 2 3251 403
www.moepp.gov.mk

Annex 2: List of Stakeholders

1. Ministries, Local Government, and Local and National Technical Departments (March – July 2021)

Arjanit Hoxha	Minister of Agriculture, Forestry and Water Economy
Naser Nuredini	Minister of Environment and Physical planning
Dritan Ramadani,	MAFWE, Chief of Minister's cabinet
Arsim Fidani	MEPP, Special Advisor for Project Coordination
Teodora Grncharovska	MEPP, State Advisor on Climate Changes
Gerasim Konzulov	Municipality of Radovish, Mayor
Kirco Susinov	Municipality of Radovish, Head of urban planning department
Kiril Georgievski,	MAFWE, Head of Department for Consolidation of Agricultural Land, Exchange and Identification of Land Parcels
Lile Simonovska	MAFWE, Water Economy Administration
Bojan Durnev	MAFWE, Water Economy Administration
Riste Manev	JSC Water Economy of Republic of North Macedonia
Vlatko Nacev	JSC Water Economy of Republic of North Macedonia
Sanja Ristova	JSC Water Economy - subsidiary Radovishko pole
Iljo Filipov,	JSC Water Economy - subsidiary Radovishko pole
Lidija Loznalieva,	JSC Water Economy - subsidiary Radovishko pole
Vitan Kostadinovski,	JSC Water Economy - subsidiary Radovishko pole
Risto Tomov,	JSC Water Economy - subsidiary Radovishko pole

2. Radovish Farmers participating in consultation meetings (142 farmers) and survey (108 farmers) (Name, Surname, and Village) (June - July 2021)

Ljupco Milev, Jargulica; Kamche Atanasov, Jargulica; Gjorgji Atanasov, Jargulica; Zorancho Milev, Jargulica; Marjan Altiev, Jargulica; Ljupco Iliev, Jargulica; Stole Mitev, Pokrajchevo; Darko Temchev, Pokrajchevo; Mijalcho Kostadinov, Jargulica; Trajche Shopov, Pokrajchevo; Trajche Atanasov, Pokrajchevo; Kosta Stefanov, Pokrajchevo; Vancho Jovanov, Voislavci; Ristov Aco, Voislavci; Vance Temelkov, Voislavci; Riste Jovanov, Voislavci; Boris Trajanov, Voislavci; Tose Todorov, Voislavci; Trajan Jovanov, Voislavci; Trajche Ristov, Voislavci; Angel Iliev, Kalugjerica; Mitev Trajan, Kalugjerica; Dragan Pavlov, Kalugjerica; Nikola Jefremov, Kalugjerica; Stojanov Dimitar, Kalugjerica; Blazo Kitanov, Kalugjerica; Dragana Velkov, Kalugjerica; Trajanova Elica, Kalugjerica; Dance Stojanova, Kalugjerica; Vitan Kostadinovski, Oraovica; Zhivko Ristov, Oraovica; Risto Ristov, Oraovica; Vitan Stefanov, Oraovica; Spaso Eftimov,Oraovica; Bosniak Marjan, Oraovica; Mitko Atanasov, Oraovica; Lazarovska Betka, Oraovica; Kosta Gjorgjiev, Oraovica; Risto Iliev, Oraovica; Alipov Zokri, Kalugjerica; Sevdije Dzingova, Kalugjerica; Dalipov Ferdi, Kalugjerica; Daut Memishov, Kalugjerica; Nadije Memishova, Kalugjerica; Ipek Dzingova, Kalugjerica; Lide Miteva, Kalugjerica; Manev Blaze, Radovish; Gjosho Jankov, Surdulci; Rade Gjorgjiev, Surdulci; Nikola Kocev, Surdulci; Georgiev Dragi, Surdulci; Bistra Gjorgjieva, Zleovo; Renata Stoilova, Zleovo; Trajanka Gjorgjieva, Zleovo; Slave Stojanov, Zleovo; Dimche Stankov, Zleovo; Vasko Stojanov, Zleovo; Dimche Stankov,Zleovo; Aleksandar Gjorgjiev, Zleovo;Pancho Aleksov, Zleovo; Zorica Chacheva, Radovish; Gorica Ristova. other settlement; Liljana Karakasheva, Radovish; Nevenka Petrovska. other settlement; Gjorgji Karakashev, Radovish; Gjorgje Iliev, Radovish; Stojka Petrova, Radovish; Trajche Georgiev, Radovish; Dragan Mitev, Podaresh; Daniel Krstev, Podaresh; Milcho Ristov, Podaresh; Zhivko Gonev, Injevo; Eftimov Dimitar, Injevo; Vancho Stojanov, Injevo; Nikola Trajkov, Injevo John Stojanov, Injevo; Jonche Stojanov, Injevo; Mitko Trajkov, Injevo; Pepi Iliev, Injevo; Stojan Gonev, Injevo; Valentina Goneva, Injevo; Ivana Eftimova, Injevo; Jovanova Dubravka, Voislavci; Verka Ristova, Voislavci; Gligor Gjorgjiev, Surdulci; Vaska Gjorgjieva, Surdulci; Mare Trajkova , Surdulci; Ivan Vasilev, Injevo; Daniela Miteva, Injevo; Darko Ristov, Injevo; Stojka Goneva, Injevo; Zorka Eftimova, Injevo; Biljana Gjorgjieva, Injevo; Paca Kostadinova, Injevo; Vanco Kostadinov, Injevo; Marijana Miteva, Radovish; Sofija Postolova, Oraovica; Zuica Gazepova, Radovish; Ivanka Sokolova, Radovish; Marica Kacareva, Radovish; Vera Ristova, Radovish; Zivka Atanasova, Radovish; Natka Markova, Oraovica; Limonka Milenkova, Oraovica; Nadica Shukrieva, Radovish; Danica Stojanova, Zleovo; Sonja Ristova, Zleovo; without name1, Podaresh; without name2, Podaresh.

3. National High-level Meeting (23 July 2021)

Arjanit Hoxha	Minister of Agriculture, Forestry and Water Economy
Naser Nuredini	Minister of Environment and Physical planning
Dritan Ramadani,	MAFWE, Chief of Minister's cabinet
Arsim Fidani	MEPP, Special Advisor for Project Coordination
Teodora Grncharovska	MEPP, State Advisor on Climate Changes
Gerasim Konzulov	Municipality of Radovish, Mayor
Kirco Susinov	Municipality of Radovish, Civil Engineer