Concept Note

Developing agrometeorological information services for climate change resilient production of fruit and vegetables in Uzbekistan

Uzbekistan | UNEP

19 June 2019

GREEN CLIMATE FUND

Concept Note

Project/Programme Title:	Developing agrometeorological information services for climate change resilient production of fruit and vegetables in Uzbekistan
Country(ies):	Republic of Uzbekistan
National Designated Authority(ies) (NDA):	Center of Hydrometeorological Services under the Ministry of Emergency Situation of the Republic of Uzbekistan (Uzhydromet)
Accredited Entity(ies) (AE):	United Nations Environment Programme (UNEP)
Date of first submission/ version number:	*2019-04-15*
Date of current submission/ version number	*2019-05-20*

GREEN CLIMATE FUND

Notes

- The maximum number of pages should **not exceed 12 pages**, excluding annexes. Proposals exceeding the prescribed length will not be assessed within the indicative service standard time of 30 days.
- As per the Information Disclosure Policy, the concept note, and additional documents provided to the Secretariat can be disclosed unless marked by the Accredited Entity(ies) (or NDAs) as confidential.
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- NDA can also submit the concept note directly with or without an identified accredited entity at this stage. In this case, they can leave blank the section related to the accredited entity. The Secretariat will inform the accredited entity(ies) nominated by the NDA, if any.
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- Further information on GCF concept note preparation can be found on GCF website Funding Projects Fine Print.

A. Project/Programme Summary (max. 1 page)			
A.1. Project or programme	☒ Project ☐ Programme	**A.2. Public or private sector**	☒ Public sector ☐ Private sector
A.3. Is the CN submitted in response to an RFP?	Yes ☐ No ☒ If yes, specify the RFP: _____	**A.4. Confidentiality[1]**	☐ Confidential ☒ Not confidential
A.5. Indicate the result areas for the project/programme	Mitigation: Reduced emissions from: ☐ Energy access and power generation ☐ Low emission transport ☐ Buildings, cities and industries and appliances ☐ Forestry and land use Adaptation: Increased resilience of: ☒ Most vulnerable people and communities ☒ Health and well-being, and food and water security ☐ Infrastructure and built environment ☐ Ecosystem and ecosystem services		
A.6. Estimated mitigation impact (tCO2eq over lifespan)	N/A	**A.7. Estimated adaptation impact (number of direct beneficiaries and % of population)**	Beneficiaries / end users [2]: estimated 7.3 million dehkans[3] and farmers (45% of Uzbekistan's rural and 23% total population)
A.8. Indicative total project cost (GCF + co-finance)	Amount: USD 17.5 million	**A.9. Indicative GCF funding requested**	Amount: USD 14.5 million
A.10. Mark the type of financial instrument requested for the GCF funding	☒ Grant ☐ Reimbursable grant ☐ Guarantees ☐ Equity ☐ Subordinated loan ☐ Senior Loan ☐ Other: specify_____		
A.11. Estimated duration of project/ programme:	a) disbursement period: 2020-23 b) repayment period, if applicable: n/a	**A.12. Estimated project/ Programme lifespan**	15 to 30 years
A.13. Is funding from the Project Preparation Facility requested?[4]	Yes ☐ No ☒ Other support received ☐ If so, by who:	**A.14. ESS category[5]**	☐ A or I-1 ☐ B or I-2 ☒ C or I-3
A.15. Is the CN aligned with your accreditation standard?	Yes ☒ No ☐	**A.16. Has the CN been shared with the NDA?**	Yes ☒ No ☐
A.17. AMA signed (if submitted by AE)	Yes ☒ No ☐ If no, specify the status of AMA negotiations and expected date of signing:	**A.18. Is the CN included in the Entity Work Programme?**	Yes ☒ No ☐
A.19. Project/Programme rationale, objectives and approach of	Climate change is evident in all of Central Asia with Uzbekistan being no exception. Average annual temperature has been increasing since the 1950s by 0.27°C every 10		

[1] Concept notes (or sections of) not marked as confidential may be published in accordance with the Information Disclosure Policy (Decision B.12/35) and the Review of the Initial Proposal Approval Process (Decision B.17/18).
[2] Distinction here is made between project direct beneficiaries, who are Uzhydromet government staff receiving agrometeorological modernization support and training; and "indirect" beneficiaries, who are the end users of project-enhanced services receiving agrometeorological information as well as further support through agricultural extension services. In the specific context of this project it is the latter group that is believed to be a more appropriate measure of project impact.
[3] A "Dehkan" farm is an individual or family farm in Central Asia; in Uzbekistan, household plots were reclassified as "dehkan" farms in 1998 as per the Law of Dehkan Farms
[4] See here for access to project preparation support request template and guidelines
[5] Refer to the Fund's environmental and social safeguards (Decision B.07/02)

programme/project (max 100 words)	years[6]. Precipitation has gradually decreased throughout 1950 – 2013, with the strongest changes observed in the south of Uzbekistan. Heat waves have been registered in all parts of the country, with the highest growing numbers of affected days in the delta of the Amu Darya[7]. Throughout 2011 – 2016 droughts exacerbated by heat waves were registered every year. While fruit and vegetables provide livelihoods to Uzbekistan's rural population, support food security, and contribute significantly to national exports, their current and especially future production is increasingly threatened by aridity, scarcity of water and the frequency of extreme weather events. Without robust steps to increase productivity and climate resilience of horticultural practices, business-as-usual is expected to reduce yields in the sector by up to 60% by 2040. Better agrometeorological support for more climate-smart horticulture, thanks to improved planning of crops and land use and optimising practices and inputs through adaptive precision farming, will improve horticulture resilience to climate change and support the expansion of the sector in line with new Government policies seeking to transition farmers from traditional cotton production to higher-value and less-water intensive horticultural crops. The project will orientate Uzbekistan's agrometeorological information services towards its end users in the horticultural sector and address their needs by improving observation, forecasting and agricultural extension services for climate resilient production of fruit and vegetables. It will also introduce much greater knowledge about climate variability into horticultural planning and operations. Project activities will be implemented both centrally and at 57 horticulturally important rural districts. The AE will work with NDA Uzhydromet and the UNDP Country Office in Uzbekistan in implementing the project. By increasing the sustainability of horticultural production and income at farms and households, predominately located in impoverished communities, and the farmers' and dehkans' economic security, the project will strengthen the resilience of vulnerable people and communities in Uzbekistan. The project will also increase the resilience of well-being and food security of Uzbekistan rural communities and the population at large by helping meet demand for horticultural products and increase revenues from exporting them.

B. Project/Programme Information (max. 8 pages)

B.1. Context and baseline (max. 2 pages)

Climate vulnerabilities and impacts

Being part of Central Asia, climate change is evident in Uzbekistan, where average annual temperature has been increasing since the 1950s by 0.27°C every 10 years. In 2007 – 2016 the mean annual temperature (Fig. B.1.1) was 0.6 – 2°C higher than in 1961 – 1990[8]. Precipitation (Fig. B.1.2) has gradually decreased throughout 1950 – 2013, with the strongest changes observed in the south of Uzbekistan. Heat waves have been registered in all parts of the country, with the highest growing numbers of affected days in the delta of the Amu Darya [9]. Throughout 2011 – 2016 droughts exacerbated by heat waves were registered every year [10].

[6] Uzhydromet national official data
[7] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[8] Uzhydromet national official data
[9] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[10] FAO, IFAD, UNICEF, WFP and WHO. The state of food security and nutrition in the world 2018. Building climate resilience for food security and nutrition. FAO: Rome, 2018

Fig. B.1.1 Mean annual air temperature in Tashkent: 1887 – 2016 [11]

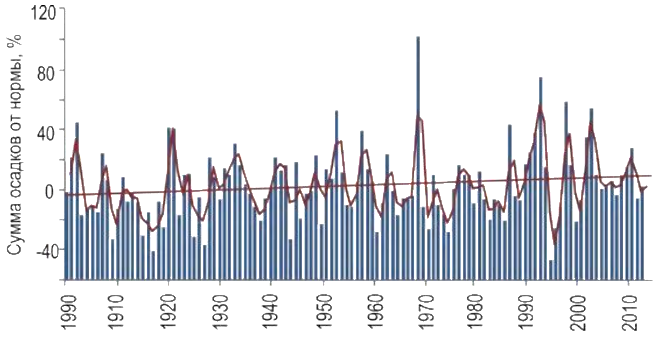

Fig. B.1.2 Change of precipitation (% of climatic norm) averaged over Uzbekistan weather stations with long time-series [12]

The impact of a changing climate on Uzbekistan's agriculture, including on the production of fruit and vegetables, is well documented [13,14,15,]. Specific impacts are manifested through short-term or long-lasting severe weather (frost, warm / cold winters, heat waves, persistent droughts) as well as through more fundamental shifts of seasons, phenology, productivity, and agroecological conditions. Reduced water availability and drought have underscored these risks, as has the presence of agricultural pests that may not have previously been found in Uzbekista. Considerable increase in the number of days per year with temperature above 35ºC, harmful to agricultural crops, has been observed during the last 70 years. Currently the number of such days per year is on average about 80 in the south, 60 in the north and more than 40 in the central and the piedmont areas (Fig. B.1.3). Compared to 1950s, the growing season currently starts earlier and ends later, its duration increasing by 3 days every 10 years (Fig. B.1.4). The sums of effective temperatures above 5ºC, 10ºC and 15ºC have been increasing too, respectively, by 68ºC, 53ºC and 38ºC every 10 years. As a result, in 1994 – 2013 the sums of effective temperatures above 5ºC and 15ºC have been 4-6% higher than in 1980 – 1999 (Fig. B.1.5).

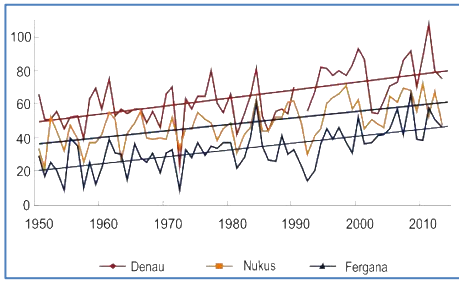

Fig. B.1.3 Change in the number of days with air temperature above 35ºC [16]

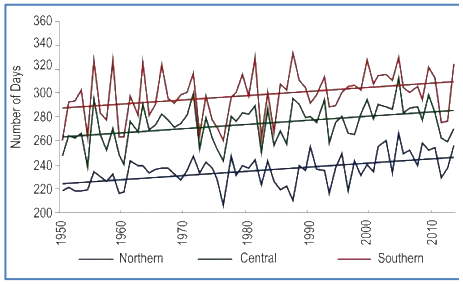

Fig. B.1.4 Change in the duration of the growing season [17]

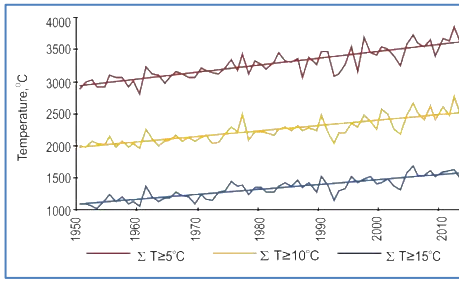

Fig. B.1.5 Change in the sums of effective temperatures in northern Uzbekistan [18]

During the last two decades, Uzbekistan has experienced several periods of drought, during which the affected areas lost 50% to 75% of agricultural harvest. During the 2000 – 2001 droughts the harvest of cotton dropped by 17%, cereals by 10%, and rice by 60%, with the total loss of USD 40 to 130 million according to different estimates [19]. According to polls among farmers, 94% of them have experienced drought-related damage [20]. Cold waves have caused significant damage too, in particular to horticulture. During the famous wave of November 1954, when the temperature dropped from 6ºC to -20ºC over two days, fruit trees died over most of the country. In recent years, 15 – 30% yield losses have resulted from night frost and early flowering of fruit trees followed by snowfall.

[11] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[12] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[13] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[14] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013
[15] Чуб В. Е. Изменение климата и его влияние на гидрометеорологические процессы, агроклиматические и водные ресурсы Республики Узбекистан. НИГМИ: Ташкент, 2007
[16] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[17] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[18] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[19] FAO. Drought characteristics and management in Asia and Turkey: FAO Waters Report 44. Rome, 2017
[20] Uzhydromet official data

Uzhydromet's systematic records of damage to fruit and vegetable plantations from extreme weather during the last decade registered multiple damage episodes during each year on the record (please see the Annex "Supplementary information: damage to Uzbekistan horticulture from extreme weather in 2005–2017"), The largest number of cases has been registered in the Tashkent, the Jizzakh and the Kashkadarya oblasts[21], which reflects regional variations in the overall vulnerability to climate change (Fig. B.1.6 – B.1.7) as well as the prevalence of horticulture in certain regions.

Notwithstanding the recurrent damage due to extreme events, thanks to strong economic stimuli driving the development horticulture, and to Uzbekistan's consistent policy to encourage it, including the expansion of production areas (see below), there has been no consistent correlation in the past 30 years between the growing horticultural output and yield on the one hand, and the above-described changing climatic conditions on the other. At the same time, the analyses of climate projections (below) shows that the future of Uzbekistan horticulture is seriously threatened by climate change.

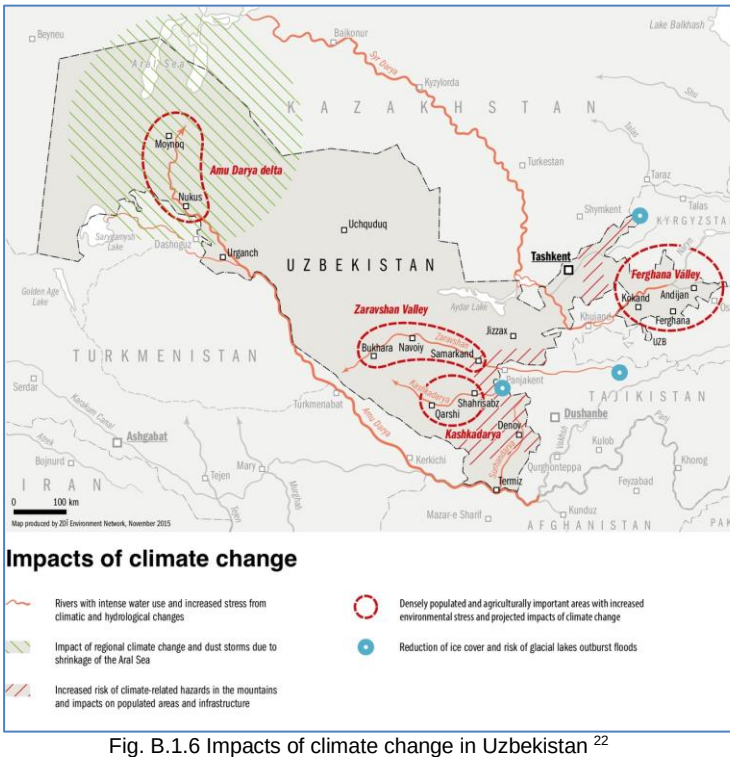

Fig. B.1.6 Impacts of climate change in Uzbekistan [22]

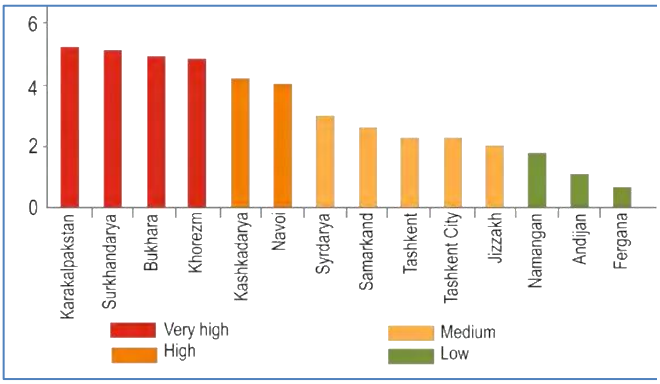

Fig. B.1.7 Vulnerability of Uzbekistan's regions to climate change[23]

Uzbekistan's climate projections with the range of global GHG emission scenarios roughly corresponding to Representative Concentration Pathways RCP2.6, RCP6 and RCP8.5 indicate that the growth of average air temperature will continue (Fig. B.1.8) and by 2030 may reach 1 – 1.4ºC. The frequency of heat and cold waves is also likely to increase. Under the soft scenario, the number of days with high temperature will grow by 2050 by the factor of 1.5 – 2 compared to the base period. The temperature variability is expected to increase too, which will affect the start, the end and the duration of the growing season as well as growing conditions, posing additional challenges to fruit and vegetable production in Uzbekistan.

[21] Oblasts are administrative regions; there are 13 different administrative regions in Uzbekistan: 12 oblasts and one autonomous republic
[22] Zoï Environment Network. Uzbekistan: climate facts and policy. Geneva, 2015
[23] Царев Б.К., Меркушкин А.С. Сравнительная оценка уязвимости вилоятов Узбекистана к климатическим изменениям. // Изменение климата, причины, последствия и меры реагирования. – Бюллетень No 10. – Ташкент, 2016. – с. 85-95. Based on the multidimensional analysis of regional-level socio-economic, demographic, water, land and agricultural statistics.

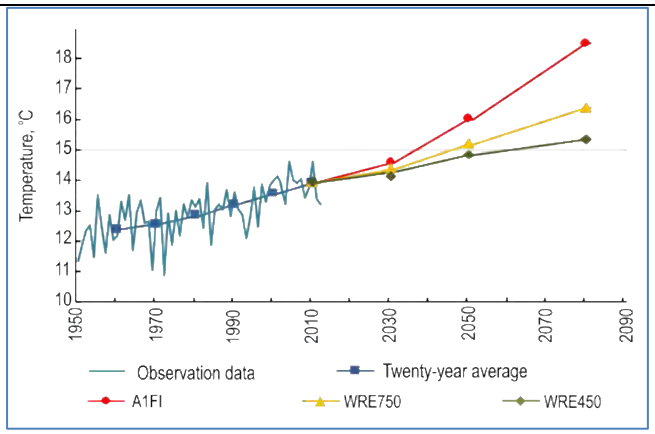

Fig. B.1.8 Projected increase of the annual air temperature [24]

Similarly, these scenarios point to lower precipitation to be expected in the future. Even the soft GHG emission scenario by 2050 may lead to a 17% increase in water deficit, while under the extreme scenario it can reach 30% [25]. Research by the World Bank confirms that, as a result of climate change, temperature will continue to grow. It however projects that precipitation on average is likely to increase, but will become more variable. However, climate change will worsen current competition over water resources because irrigation water demands will increase with higher temperature (Fig. B.1.9 – B.1.10)[26].

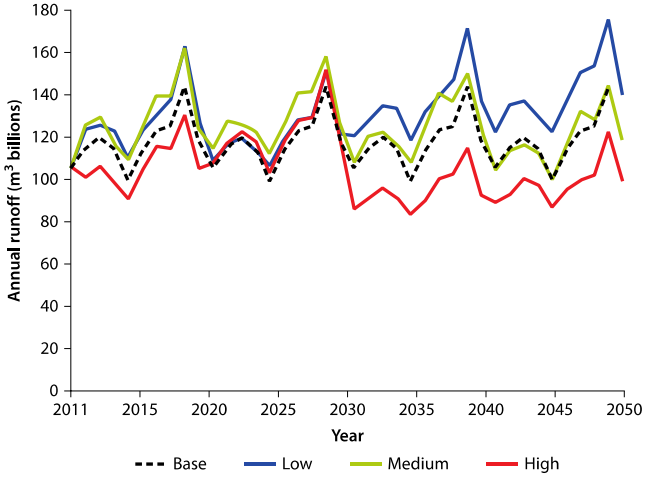

Fig. B.1.9 Projected 2011–50 annual runoff for all Uzbekistan basins [27]

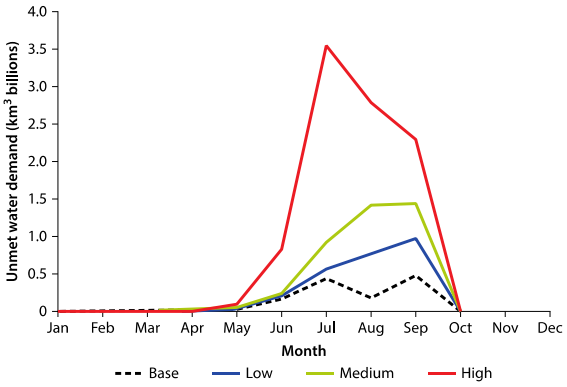

Fig. B.1.10 Projected 2040s mean monthly unmet irrigation-water demand over all river basins for different climate-change scenarios [28]

[24] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[25] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[26] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013
[27] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013
[28] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013

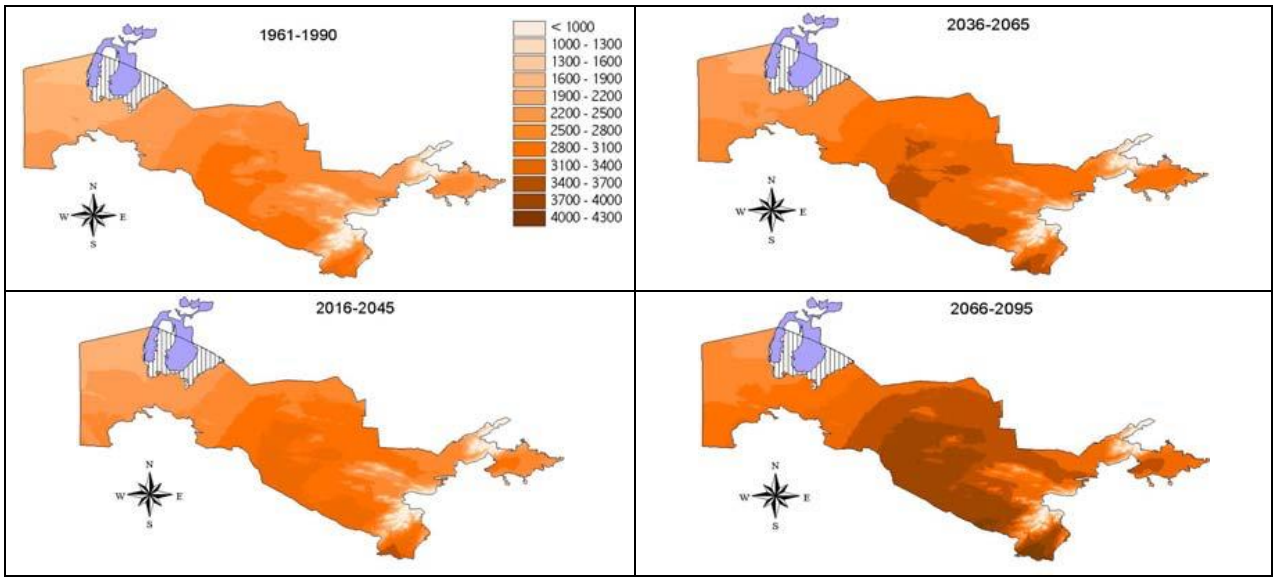

Figure B.1.11 Projected distribution of the sum of effective temperatures above 10°C [29]

The current spatial distribution of the availability of heat during the growing season will change too: with time, the Tashkent oblast can gradually reach the conditions of the Kashkadarya and later of the Surkhandarya oblasts, while conditions in mountainous areas will come close to those currently typical of Uzbekistan's plainland (Fig. B.1.11). By 2021 – 2040 the increase in the sum of effective temperatures is expected to exceed their natural variability by the factor of 1.5 – 2. Under the extreme GHG emission scenario, by 2050 the sum of effective temperatures above 5°C may increase there by 21%, and with 15°C baseline – by 34% compared to the base period [30].

Table B.1.1 Number of days per year with air temperature above 39°C (adapted from Uzhydromet)[31]

Regions	1980 – 1999	2021 – 2040 projec-tion	2041-2060 projections*			2071-2090 projections*		
			Soft	*Mode-rate*	*Extreme*	*Soft*	*Mode-rate*	*Extreme*
Ferghana valley	3	5-7	9	12	17	14	20	34
Central piedmont	7	14-17	18	21	27	22	29	43
Lower Amudarya, Karakalpakstan	10	16-18	19	22	26	22	28	41
Khorezm oblast	10	19-21	22	25	29	25	32	45
Kashkadarya river valley	17	25-27	29	31	37	32	39	54
Surkhandarya river valley	25	33-25	35	39	45	40	49	62
Kyzylkum desert	29	36-38	39	42	46	42	50	64

* Soft scenario WRE 450, moderate scenario WRE 750, extreme scenario SRES A1FI.

Climate modelling further suggests the steady and significant increase in the number of days with air temperature above 39°C, which is the least favourable for plant development: up to 2 to 10 times by 2071 – 2090 compared to 1980 – 1999 (Table B.1.1), that is from 3 – 7 to 14 – 43 days in the Ferghana valley and the central piedmont areas; from 10 to 20 –

[29] Чуб В. Е. Изменение климата и его влияние на гидрометеорологические процессы, агроклиматические и водные ресурсы Республики Узбекистан. НИГМИ: Ташкент, 2007
[30] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016
[31] Centre of Hydrometeorological Service at the Cabinet of Ministers of the Republic of Uzbekistan. Third national communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent, 2016

45 days in the lower Amudarya, Karakaplakstan and the Khorezm oblast; from 17 to 32 – 54 days in the Kashkadarya valley; and from 25 – 29 to 40 – 64 days in the Kyzylkum desert and the Surkhandarya valley. Already by 2030 in many regions, especially in the south of Uzbekistan, climate conditions may reach critical level for the currently grown crops, which will experience thermal stress from extremely high temperatures exacerbated by the increasing moisture deficit.

One can also expect the gradual shifting, towards earlier parts of the spring and later parts of the autumn, of dates when average daily air temperature passes 5°C, 10°C and 15°C. However, within Uzbekistan's plainland up to 2041 – 2060, the length of the growing season may stay within the range of its current natural variability. Overall the soft scenario suggests that the current conditions will not change up to 2071 – 2090, however already under the moderate scenario by 2050s the change in the duration of the growing season will exceed its current variability.

Moisture deficit (the difference between evaporation / evapotranspiration and precipitation) is expected to increase throughout the country under all GHG emission scenarios, and a 11-14% increase is expected against the base period by 2021 – 2040. By 2041 – 2060, it is expected to stay within 17% according to the soft scenario, but may exceed 30% under the extreme scenario, pointing to the likely aridisation of climate. (These projections probably overestimate moisture deficit on irrigated lands.)[32]

Even without climate change, increases in non-agricultural demands for water will cause shortages in the next decades. With climate change, certain areas, particularly basins in the western part of the country, will face severe water shortages. In agriculture too the increasing moisture deficit will lead to increased demand for irrigation, while the actual shortage of water may cause water stress among crops and therefore decrease yield. Three climate change stressors will thus combine to yield an overall negative impact on crop yields throughout Uzbekistan: the direct effect of temperature and precipitation changes on crops; the increased irrigation demand required to maintain even reduced yields; and the decline in water supply associated with higher evaporation and lower rainfall.

Modelling by the World Bank[33] suggests that, under the medium-impact GHG emission scenario SRES B1, the direct effect of climate changes – not considering water availability – will be a reduction by 2050 in yields of irrigated crops, including cotton, wheat, apples, tomatoes, and potatoes, by about 1 – 13% across all agroecological zones of Uzbekistan. By 2050, climate change can also improve yields of some crops provided that sufficient irrigation water is available. However, water shortages could severely limit the availability of irrigation water: when their effects are taken into account, climate change has a much greater negative effect on almost all crops in almost all river basins, with yield reduction of 10 – 25% through 2050.

For fruit and vegetables included in the World Bank's study (apples, potatoes and tomatoes), even assuming no shortage of irrigation water, yields are forecast to decline about 1% – 9% under the medium scenario. Under the high-impact SRES A1B scenario[34] which forecasts higher temperature, lower precipitation and soil moisture in virtually all regions of Uzbekistan, yields could be reduced much more severely: to 15% across all agroecological zones (except for no change for tomatoes in the Southern highlands, but up to 24% for apples in the Eastern piedmont). If the availability of irrigation water is taken into account, yield losses expected under the high-impact scenario are even 2.5 – 4 times higher: up to 35 – 45% in most agroecological zones, and up to 56 – 64% in the Eastern piedmont (Table B.1.2) [35].

Table B.1.2 Ranges of projected yield decrease for selected horticultural crops through 2040s across three climate scenarios, including effects of reduced water availability (adapted from the World Bank) [36]

Crop	Eastern desert and steppe	Western desert and steppe	Southern highlands	Eastern piedmont	Southwestern piedmont
Apples	12 – 49%	22 – 39%	19 – 43%	0 – 63%	20 – 42%
Potatoes	10 – 41%	21 – 37%	20 – 38%	0 – 57%	19 – 37%
Tomatoes	8 – 45%	21 – 38%	18 – 29%	2 – 56%	14 – 40%

[32] Centre of Hydrometeorological Service 2016.
[33] Sutton et al. 2013.
[34] In fact, the high-impact global GHG emission scenario (SRES A1B) in the World Bank study (Sutton et al. 2013) is more moderate than the extreme scenario (SRES A1IF) used for projections in Uzbekistan's Third national communication to UNFCCC (Centre of Hydrometeorological Service 2016). Were A1IF to unfold, the negative impact on agricultural output might therefore exceed that projected under A1B. Other GHG emission scenarios used in the World Bank study are the low-impact SRES A2 and the medium-impact SRES B1.
[35] Sutton et al. 2013.
[36] Sutton et al. 2013

Key characteristics and dynamics of agriculture sector and horticulture sub-sector in Uzbekistan

Although agriculture's contribution to Uzbekistan's GDP declined from 30% in 2000 to about 17% percent, farm output has doubled in real terms and continues to grow steadily[37,38] Agriculture is an important sector of the economy of Uzbekistan, employing up to a fifth of the workforce and serving as a key source of income for half of the population. Uzbekistan is the second largest cotton exporter worldwide, where cotton has traditionally dominated the agricultural sector, occupying (together with wheat) more than 65% of cultivated land in the country.

Uzbekistan's horticultural sector, a source of both rural livelihoods and high-value exports, is expanding rapidly, fuelled by growing domestic demand and strong regional markets. Production of fresh fruit and vegetables has continually increased since the 1990s and in particular in recent years, and currently makes up 40% of the national agricultural exports, with half of this value falling on small and medium-size enterprises[39]. Most horticultural goods are destined for domestic markets. The majority of dehkan farmers are still predominantly consuming large proportions of their own production and bartering or selling any small surplus on nearby retail markets—products are sold in small lots in the administrative district centres nearest to the farm (Table B.1.3).

Table B.1.3 The use of selected horticultural crops[40]

	Consumed fresh locally	Processed locally	Exported
Deciduous and stone fruits *	69%	20%	11%
Vegetables *	81%	4.3%	3.4%
Grapes *	73%	23%	4%

Uzbek horticultural exports include cherries, apricots (dry and fresh), plums (fresh), grapes (fresh) and walnuts. Fruit and vegetables are exported to over 70 countries, and markets in China and Russia have large demand for some products (i.e. cherries, plums and grapes) that Uzbekistan strives to meet through expanded production. The Government is actively supporting this expansion, seeking to transition farmers from traditional cotton and wheat production to higher-value and less-water intensive horticultural crops[41] and encouraging almost 5 million households to use their plots to grow vegetables and fruits too. A series of strategic, legislative and regulatory documents[42] were recently adopted promoting support to the sector and establishing new institutions and responsibilities. These include for example:

- the Action Strategy in Five Priority Development Areas of the Republic of Uzbekistan for 2017 – 2021 which was adopted by Decree № 4947 of 7 February 2017 by the President of the Republic of Uzbekistan, defining the modernisation and intensive development of agriculture as an important element of economic development, and calling for optimised land-use by gradually replacing water-intensive cotton and cereals with, i.a., potatoes, vegetables, intensive gardens, vineyards and other higher-value crops – as well as for the overall adaptation of agriculture to global climate change. Under the new Action Strategy, new intensive orchards and vegetable plantations are to be created in particular on 445,000 hectares of arable land in 66 districts and 215,000 hectares of land released from cotton and grain cultivation in 2017 – 2020.

- the Decree № 3893 of 1 August 2018 by the President of the Republic of Uzbekistan "On supplementary measures to optimise the structure of cultivated land, increase the production of fruit, vegetables and other agricultural crops and their export in 2018" introduced 2018 area and outputs targets envisaging 817,000 tonnes

[37] Larson D. F., Khidirov D., Ramniceanu I. Uzbekistan: Strengthening the horticulture value chain. Background paper series – Uzbekistan vision 2030. World Bank: Washington DC, 2015
[38] World Bank. Project appraisal document on a proposed loan in the amount of US$150 million to the Republic of Uzbekistan for a horticulture development project. Report No: PAD774. Washington DC, May 15, 2014
[39] World Bank. China (and Russia) 2030 - Implications for agriculture in Central Asia. Phase 1 & 2 results. Report No: AUS0000211. Washington DC, June 8, 2018
[40] ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018
[41] A recent study estimates that about 4,426 m^3 of water is required to grow a ton of cotton in Uzbekistan; about 2,068 m^3 of water is required for wheat. Although comparable numbers are not available for Uzbekistan, a study of global water footprints using similar methodology suggests that horticultural products require substantially less than cotton, and in some cases less than wheat. For example, grapes require, on average, 2,400 m^3 of water per ton, while apples require about 820 m^3. New orchards in Uzbekistan generally employ modern drip irrigation technologies and therefore most likely less water than international average values would suggest (ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018)
[42] Examples: Decree № 3893 of 1 August 2018 by the President of the Republic of Uzbekistan "On supplementary measures to optimise the structure of cultivated land, increase the production of fruit, vegetables and other agricultural crops and their export in 2018"; Decree № 3978 of 17 October 2018 by the President of the Republic of Uzbekistan "On supplementary measures to raise the effectiveness of promoting fruit and vegetables on foreign markets".

of extra output to be produced in areas converted from cotton and wheat, and 266,000 tonnes of fruit, vegetables and other agricultural produces additionally available for export.

The production of vegetables and fruits however still falls short of their maximum potential and of the national food security targets [43].

Also important to note is that land freed from cotton production is not always in a good condition, generally suffering from poor soil structure, lack of soil organic matter, low fertility (years of cotton / wheat cropping) and also soil salinity. Vegetables and fruit crops have need of higher quality soil that is well structured and offers deep rooting potential. Organic matter content should be high and fertility at a significantly higher level than that normally required for either cotton or wheat. Both fruits and vegetables are significantly less tolerant of soil salinity than cotton, and there will be both yield and quality loss if the quality of soils freed up from cotton is not improved and maintained. Soil salinity is also prone to increase in drought-affected areas. Coupled with the changing patterns of pests and diseases likely to follow the changing climate, this will require both higher and more precise inputs of agricultural chemicals into horticulture, backed up by denser, more intense, customised and regular monitoring of soli quality in order to help farmers optimise horticultural production.

Consequently, in order to optimise their land-use, agrotechnology and operations and in the end sustain their production and incomes, dehkans, farmers, larger businesses and other players in the horticultural value chain are becoming increasingly dependent on high-quality, tailored and timely climate and agrometeorological information and services.

Baseline agrometeorological information services and gaps

Uzbekistan's agrometeorological network has for a long time suffered from underfunding and lack of modernisation[44]. The core of the network of 60+ hydrometeorological stations with agrometeorological observation programmes and 30+ agrometeorological observation posts dates back to the Soviet time and can no longer provide modern services to the agricultural community. Furthermore, agrometeorological (and, at large, climate and hydrometeorological) services have been traditionally oriented towards state and regional authorities, with little experience and infrastructure to carry information down to agricultural end users and to integrate with it directly usable agronomic and agroecological advice. There is also little experience in the country of translating and using climate-change knowledge to support long-term agricultural planning at all levels: from the central government to small and individual farms. Therefore, while Uzbekistan strongly promotes expanding horticulture, it has so far invested little in improving the effectiveness and sustainability of its agrometeorological system.

This said, agrometeorological information and forecasts are regularly published in various formats (Table B.1.4), some of which are available on-line.

Table B.1.4 Selected agrometeorological information products

Type	Content
Periodical / ten-day agrometeorological bulletins	Meteorological and agrometeorological conditions
Seasonal agrometeorological information	Seasonal agrometeorological statistics and forecast Crop growth and development data Cultivation / agrotechnological data
Annual reviews of agrometeorological conditions	Reviews of conditions for cotton, cereals, fruit, grape, mulberry, grasslands
Annual forecast of agrometeorological conditions and yield	Analytical notes on expected heat supply, cotton yield
Ad-hoc briefings	Damage from extreme weather (frost, rain-showers etc.) Agrotechnological recommendations (e.g., dates for cotton sowing and defoliation)

There are certain limitations on the current capacities for, and practices of, the production and publication of analytical agrometeorological information:

[43] Compared to countries with similar climatic conditions, Uzbek productivity is still significantly lower and is yet to realise its full potential (ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018).
[44] Denisov N. and Grom L. Developing agrometeorological services for climate change resilient production of fruit and vegetables in Uzbekistan. Pre-feasibility study for a project proposal to the Green Climate Fund. UNEP: Geneva, 2018

- at the moment, agrometeorological forecasts are produced manually, with no use of modern automated analytical systems or software;
- pest and decease development forecasts are not produced at all;
- information and forecasts are not sufficiently localised, at best being provided at the regional / oblast levels;
- a large array of retroactive agrometeorological data which could be used to calibrate models, improve forecasting techniques and analyse longer-term trends are still stored on paper and are at risk at eventually being lost.

Agrometeorological observations also include taking soil samples for chemical analysis.

Noteworthy, the World Bank notices as the first limitation of Uzbekistan's capacity for adaptation in agriculture: "The ability to collect, generate, and provide meteorological data to farmers appears to be high, but the provision of those data to farmers for decision-making appears mixed. Uzhydromet appears to have good infrastructure and well-trained staff able to collect and provide agriculturally relevant meteorological data to farmers… however farmers noted that the agricultural extension service is not oriented toward ameliorating risks from climate, and could provide better integration with hydrometeorological data provision…" [45]

According to legislation and Uzbekistan's practice, agrometeorological publications, like other weather-related and hydrological information and forecasts, are routinely provided to the President's Administration, the Cabinet of Ministers, the Prosecutor-General's Office and central governmental agencies. These are also sent to regional administrations (Khokimiyats) and the regional branches of central authorities (e.g. regional agricultural departments). Both paper and electronic copies are distributed, the latter by electronic mail.

Agricultural producers including small-scale farmers are keen to use meteorological and agrometeorological information too, and do so to the possible extent. Yet the local reach of such information is at present very limited. As most information products from Uzhydromet are intended for higher management levels, quite often end users do not get the information contained in there at all, although some of it is available on-line or is made available in other ways by regional and district authorities. And even if they do, they do not necessarily have sufficient knowledge of how to effectively use it.

Small privately-owned weather stations for real-time monitoring of local meteorological conditions gradually become reality as well. Some are being set up through international technical assistance[46], others are a result of private investments[47]. At the moment there is no formal interaction between the owners and operators of such private installations on one side, and Uzhydromet on the other side. However, the fact that there exists tangible demand for such information and its analysis points to new economic opportunities for providers of weather and agrometeorological information and very targeted services – and to the need to strengthen coordination of data flows and, eventually, the exchange of data.

Root causes and barriers

Key challenges, including root causes and barriers, in providing high-quality, tailored and timely climate and agrometeorological support services to Uzbekistan's horticultural sector under the conditions of climate change therefore include:

- insufficient / outdated physical and institutional infrastructure of agrometeorological observations and services, unable to effectively support long-term and operational adaptation in horticulture;
- insufficient capacities of Uzhydromet to produce and communicate agrometeorological information relevant to the adaptation needs of dehkans, farmers and agricultural enterprises, as well as insufficient capacities of the end users to understand, accommodate and use the available agrometeorological information in their daily life;
- weak inter-sectoral linkages between hydrometeorology, agricultural policy and practices, resulting in limited cooperation e.g. to provide adaptation-management extension services to users and to integrate climate-change information into planning;
- the prevailing "supply" perspective among the providers of agrometeorological information and advice, not sufficiently oriented towards agricultural end users[48];
- insufficient expertise and the systematic lack of financial resources to address all the above challenges.

[45] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013
[46] "Business Forum for Uzbekistan" project of UNDP and the Chamber of Commerce of Uzbekistan http://www.uz.undp.org/content/uzbekistan/en/home/presscenter/articles/2017/10/27/meteorological-stations-installed-to-help-farmers-in-the-tashken.html
[47] For instance, private horticultural enterprise 'Leo Garden' https://www.facebook.com/pg/OOO-Leo-garden--578072395704831/posts/?ref=page_internal in the Tashkent oblast operates a set of small weather stations which generate data then processed and analysed in France to produce recommendations: Meeting with Mirzayev (Schröder) Research Institute of Gardening, Viticulture and Winemaking, September 2018.
[48] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013

Preferred solution, country ownership, and contribution to national needs and priorities

With timely external investment and expertise, not only will improved agrometeorological information services help rural communities sustain livelihoods and boost horticultural production under the conditions or rapid climate and economic changes, but they will also catalyse institutional and cultural changes across the board, affecting overall climate and hydrometeorological services to people and economic sectors of Uzbekistan.

As is recognised by the Government (Box B.1.1), the projected climate impacts will require changes to the current cropping and cultivation patterns and technologies in order to minimise risks and to get maximum benefits from the change and to avoid severe consequences for vulnerable groups of the population who are dependent on agriculture for their livelihoods. They are similarly needed to maintain food security and the economic potential of Uzbekistan's high-value horticulture. However, a detailed planning of adapting Uzbekistan's horticulture - and agriculture at large – is yet to commence, and improved agrometeorological information has its role to play to effectively guide and support it.

The project logic and suggested interventions are reflected in several recent strategic documents in the fields of both climate change and agriculture. Uzbekistan INDC (Box B.1.1.) points to adaptation needs in agriculture through the diversification of crop production patterns, the improvement of irrigated land and soil quality, and optimising water management, all of which would be impossible without both strategic (projected impacts on agriculture) and operational inputs (i.a. precision horticulture) from Uzbekistan agrometeorology.

Box B.1.1 Extract from Uzbekistan's Intended Nationally Determined Contribution to combatting global climate change

The global climate change is recognized as an unquestionable fact, and changes in the Earth climate system, observed from the 1950s, are unprecedented.... Uzbekistan is one of the most vulnerable countries to climate change. Without additional resource saving measures, the country may face deficiency of water resources, growth in land desertification and degradation, increase in occurrence of droughts and other dangerous phenomena, leading to instability of agricultural production and threatening to the country's food security.

…

Adaptation to climate change is the priority direction in Uzbekistan's activities aimed at decrease in vulnerability and ensuring the country's sustainability to climate change. Adaptation measures cover a wide scope of actions for protecting the communities from adverse impacts of climate change such as extreme droughts and dangerous hydrometeorological phenomena, associated with the global change in air temperature; increasing the sustainability of strategic infrastructure and ecosystems for conservation of agro- and biodiversity…

Adaptation of agriculture and water management sector

- *Improvement of climate resilience of agriculture through diversification of food crops production pattern…*
- *Improvement of irrigated lands affected by desertification, soil degradation and drought, increase in soil fertility of irrigated and rainfed lands;*
- *Further improvement of water management practice in irrigated agriculture…*

Adaptation of social sector to climate change

- *Raising of awareness and improvement of access to information about climate change for all groups of population;*
- *Development of early warning systems about dangerous hydrometeorological phenomena and climate risk management;*
- *Widening the participation of the public, scientific institutions, women and local communities in planning and management…*

Source: Intended Nationally Determined Contributions of the Republic of Uzbekistan, 2017

The draft agriculture modernisation strategy[49] currently under discussion (expected to be adopted by October 2019) contains numerous references to the so far inadequate attention to climate change in agricultural planning and the needs to address it. Strategic Area 6: Technology and Innovations includes prioritising investments into applied research programs to develop seeds and breeds suitable for different agri-ecological zones of the country aiming to raise yields, improve quality of outputs, and increase resilience to climate change. This requires strategic-level understanding of long-term future changes to agro-ecological zonation in Uzbekistan, to which horticulture will be particularly sensitive (see section B1 above). Strategic area 7: Sustainable Natural Resource Management promotes climate-smart practices in agriculture, including climate proofing of irrigation and drainage infrastructure. The strategy specifically acknowledges the

[49] Agriculture Modernization Strategy 2030, A long-term vision for Uzbekistan's agriculture and food industry. Draft Version. December 6, 2018

need for increased use of information from weather stations e.g. for modern irrigation scheduling, and suggests to employ the piloted extension services to strengthen capacity of farmers to adopt climate-smart farming practices (which would again require improved and more targeted agrometeorological support e.g. for optimising inputs and practices through precision farming).

Many of the projects' conceptual ideas are also shared by Uzbekistan donors, cf the recent brief on the options for agricultural extension services [50] (further details are included in section B3 on the needs of the recipients).

In practice, most of the World Bank's climate-smart recommendations for Uzbekistan agriculture (Table B.1.5)[51] are directly relevant to the project objectives, and are be informed through improved agrometeorological information and services as indicated in the table below.

Table B.1.5 Recommended adaptation options for Uzbekistan's agriculture (adapted from the World Bank)

Category of adaptation	Adaptation measures and investments
A. Infrastructural	
Farm protection	Hail protection systems (nets) [a, b] Install plant protection belts [a] Lime dust on greenhouses to reduce heat [a] Vegetative barriers, snow fences, windbreaks [a] Move crops to greenhouses [a] Smoke curtains to address late spring and early fall frosts [a, b] Build or rehabilitate forest belts [a]
Water management	Enhance flood plain management (for example, wetland management) [a] Construct levees [a] Drainage systems Irrigation systems: new, rehabilitated, or modernized [a] Water harvesting and efficiency improvements [a]
B. Programmatic	
Extension and market development	Demonstration plots and/or knowledge sharing opportunities [a, b] Education and training of farmers via extension services [a, b] National research and technology transfer through extension programs [a, b] Private enterprises, as well as public or cooperative organizations for farm inputs [b] Strong linkages with local, national, and international markets for agricultural goods
Insurance and subsidies	Crop insurance [(b)] Subsidies and/or supplying modern equipment [(b)]
R&D	Locally relevant agricultural research in techniques and crop varieties [a,, b]
C. Farm management	
Crop yield management	Change fallow and mulching practices to retain moisture and organic matter [a, b] Change in cultivation techniques [a, b] Conservation tillage [a, b] Crop diversification [a] Crop rotation [a] Heat- and drought-resistant crops/varieties/hybrids [a] Increased input of agro-chemicals and/or organic matter to maintain yield [a, b] Manual weeding [b] More turning over of the soil [a] Strip cropping, contour bunding (or plowing) and farming [a] Switch to crops, varieties appropriate to temperature, precipitation [a] Optimize timing of operations (planting, inputs, irrigation, harvest) [b]
Land management	Mixed farming systems (crops, livestock, and trees) [a] Shift crops from areas that are vulnerable to drought [a] Switch from field to tree crops (agro-forestry) [a]
Pest and fire management	Develop sustainable integrated pesticide strategies [a, b] Fire management for forest and brush fires [a, b]

[50] Options for Agricultural Extension Services in Uzbekistan. Joint Donor Group Brief. March 11, 2019
[51] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013

	Integrated pest management [a, b] Introduce natural predators
Water management	Intercropping to maximize use of moisture [a, b] Optimize use of irrigation water (for example, at critical stages of crop growth, at night) [b] Use water-efficient crop varieties [a]
D. Indirect adaptation	
Market development	Physical infrastructure and logistics for storing, transporting, distributing farm outputs
Education	Increase general education level of farmers [a, b]
Water management	Improvements in water allocation laws and regulations Institute water charging or tradable permit schemes

a The project will contribute to strategic adaptation by providing information and advice about long-term climate changes and their implications for horticultural planning.

b The project will contribute to operational adaptation by providing timely agrometeorological information and advice for precision horticulture on the farm level.

As the National Adaptation Plan of Uzbekistan is in its early development, the project offers considerable opportunities for synergies as well as a possibilty to contribute to the agricultural part of NAP at the conceptual stage, thus considerably raising the GCF impact potential. (see also Section B3).

B.2. Project/Programme description (max. 3 pages)

On the overall level, the project is expected to help improve the resilience of climate-sensitive horticultural production in Uzbekistan and to strengthen the livelihoods of climate-affected rural communities. With the help of improved agrometeorological services, the targeted farms and households, agricultural businesses and authorities will be able to improve their land-use planning and the selection of crops, optimise their daily field operations such as the use of water and fertilisers, plant protection, pest and decease control, and other agrotechnological and protective measures.

The project is designed to address the entire agrometeorological information chain:

- starting from adopting a user-driven approach to climate information;
- to improving the analytical capacities and services of Uzhydromet as the key provider of climate and hydrometeorological information to be able to deliver to users more relevant, better-targeted and high-quality agrometeorological information and advice made accessible through many forms and media;
- to interventions in 57 rural districts of Uzbekistan integrating the modernization of agrometeorological observation networks with direct activities with regional and agricultural authorities, advisory services, farmers and dehkans to build a functional set-up for a continuous flow of agrometeorological information and advice for horticultural production;
- to ensuring long-term climate-change information to be available and integrated into strategic planning of agricultural / fruit and vegetable production.

Project components/outcomes and related outputs are described further below.

COMPONENT/OUTCOME I: User-driven and climate-responsive agrometeorological services in place and promoted by Uzbekistan's Centre of Hydrometeorological Services (Uzhydromet)

Output 1.1: Agrometeorological information user interface platform

- **Development of agrometeorological information user interface platform aimed at strengthening dialogue/interactions with end users of agrometeorological information in fruit- and vegetable-growing areas of Uzbekistan**. This platform will enable regular and increased understanding of the views, perspectives and needs of end users of agrometeorological information at district-level, as well as effective and regular collection of information demands/requests in fruit- and vegetable-growing areas. The user interface platform will regularly inform the establishment of functional mechanisms for a systematic dialogue with agrometeorological information users and regular collection and addressing of user feedback and demand.

Output 1.2: Long-term vision for agrometeorological information services for fruit and vegetable production in Uzbekistan

- **Development and adoption of a long-term vision for agrometeorological information services in support of fruit and vegetable production under anticipated climate change and evolving economic and market conditions**. The development of this new vision will be built upon the results of the in-depth assessment of the views, perspectives and needs of end users of agrometeorological information, take into account climate change scenarios and expected impacts on fruit and vegetable production, and market prospects for economic growth of the sector. The new long-term vision will divert from the prevailing paradigms by inverting the traditional supply-focussed approach to providing climate and hydrometeorological information in Uzbekistan by bringing long-term climate-change knowledge directly into Uzbekistan's strategic agricultural planning and by integrating modern principles of public access to information in the way that agrometeorological information is made available to end users.

Output 1.3: Legal, institutional and operational strengthening of agrometeorological information services in Uzbekistan

- **Development of the strategy plan and business model for the progressive introduction of legal, institutional and operational changes for modernising agrometeorological information services in Uzbekistan**. The strategy plan will comprise recommendations for action and a suggested schedule for their progressive implementation for addressing the insufficient / outdated physical and institutional infrastructure of Uzhydromet as the main provider of agrometeorological information services in Uzbekistan. It will also include recommendations to strengthen linkages between hydrometeorology and agricultural policies and practices, and inter-sectoral cooperation. Since Uzhydromet operates under only partially realistic assumption of cost-recovery from the market which is neither well developed, nor is capable to ensure the recovery of the costs of hydrometeorological and climate services, a new business model of cost-recovery will be proposed to support a more reliable foundation to the sustainability of agrometeorological information services for end users.

COMPONENT/OUTCOME II: Strengthened infrastructure for modernized collection of agrometeorological data in 57 fruit- and vegetable-growing districts of Uzbekistan

Output 2.1: Automated agrometeorological observations and data transfer and modernized soil-quality analytical laboratories

Automating agrometeorological observations and real-time data transfer at 39 locations in 12 administrative regions in Uzbekistan and modernising equipment for soil-quality analysis (salinity, humus content, agrochemicals) at 23 local, regional and central laboratories. The automating of agrometeorological observations and real-time data transfer will imply project interventions in 39 rural districts adjacent to the locations to be equipped with new automated equipment measuring weather parameters including air and soil temperature, precipitation, snow depth, solar radiation, humidity, wind speed, soil pH and other parameters; and by integrating the modernization of observation networks with building functional set-ups for a continuous flows of localised agrometeorological information and advice to support fruit and vegetable production in direct cooperation with regional and agricultural authorities, advisory services, farmers and dehkans. The specific rural areas chosen for field interventions where agrometeorological observations are to be modernised are rural districts within 50 – 60 kilometer distance of each of the 39 project locations. At further 18 sites which are to be covered by project activities observations will be or have already been automated through parallel activities of UNDP, FAO, USAID and China (Fig. B.2.1). The choice of locations to be covered by project activities has been guided by the district's importance for horticultural production, the vulnerability the latter to climate change (cf. Section B.1 above) together with the feasibility of automating observations at the respective hydrometeorological stations by making use of GCF and matching financial resources. Selecting and establishing agrometeorological stations is not expected to involve any land use issues such as buying and moving people in the selected locations, as the majority of the new stations to be installed will be replacing manual observation equipment at already existing sites where the National Hydrometeorological Service (Uzhydromet) collects data.

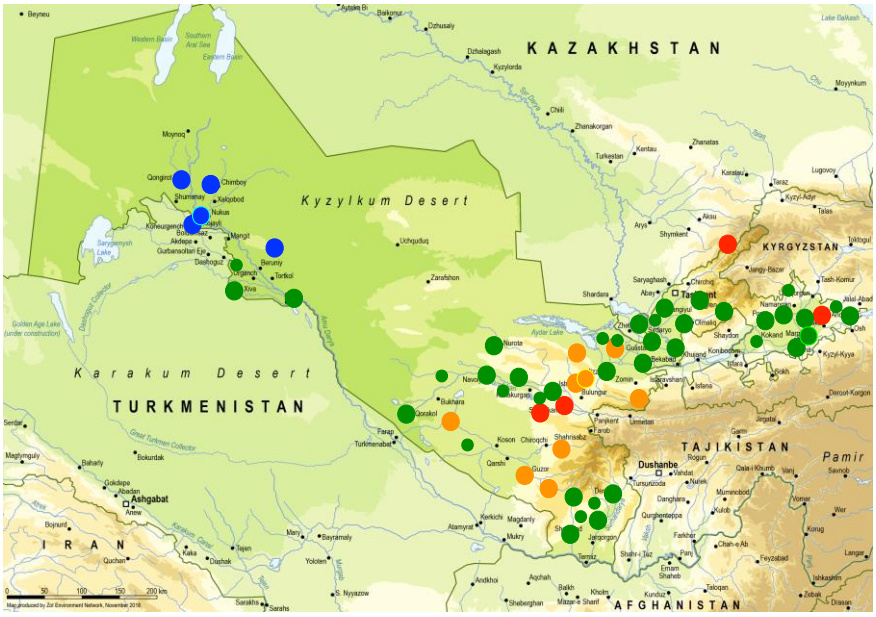

Figure B.2.1 Hydrometeorological stations and posts included in project design

Output 2.2: Agrometeorological observation network staff trained in operating and maintaining new equipment

- **Training the staff of the respective agrometeorological stations and analytical laboratories in operating and maintaining new automated and laboratory equipment.** A training programme will be rolled out for staff of the respective agrometeorological stations and analytical laboratories to improve the analytical capacities and services of Uzhydromet as the key providers of climate and hydrometeorological information, for it to be able to deliver more relevant, better-targeted and high-quality agrometeorological information and advice in many forms and through various media. Training will include capacity building activities in operating and maintaining new stations and laboratory equipment, which will be planned and delivered taking into account training needs as well as social, cultural, gender and age considerations.

Output 2.3: Innovative technologies for using and exchanging data piloted

- **Modalities for using and exchanging data with small / portable automatic weather stations** will be tested during the project with the aim to establish the potential of using data collected by external providers (for developing information and communication infrastructure and services of the agrometeorological network) as well as climate and agricultural research centres (for improving the analysis and delivery of climate-change information in support of horticultural planning at national and local levels through innovative and cost-effective methods).

COMPONENT/OUTCOME III: Improved processing, delivery and increased use of agrometeorological information by Uzhydromet and fruit and vegetables producers in Uzbekistan

Output 3.1: Upgraded and modernized IT capacities and expertise of Uzhydromet

- **IT capacities and expertise of Uzhydromet will be upgraded and modernized** for agrometeorological data processing and forecasting (including phenological, pest and plant disease forecasting adapted to local conditions).

Output 3.2: Modern communication channels for delivering agrometeorological information

- **Communication channels for delivering agrometeorological information will be modernized** through designing and operationalising new formats, including visualizations and the use of i.a. web-based, mobile

[52] https://www.thegef.org/project/integrated-natural-resources-management-drought-prone-and-salt-affected-agricultural
[53] https://www.adaptation-fund.org/project/developing-climate-resilience-of-farming-communities-in-the-drought-prone-parts-of-uzbekistan/

applications, media and social networks for improved delivery of and access to agrometeorological information for climate-resilient fruit and vegetable production.

Output 3.3: Improved capacity for agrotechnological, agroecological and agro-climatic issues

- **In-service / vocational training of the staff of the agrometeorological observational network** (taking into account training needs as well as cultural, gender and age considerations) will be carried out with the aim of improving their understanding on agrotechnological, agroecological and agro-climatic issues and their capacity to relate observed data with the needs of end-users as related to improving resilience of fruit and vegetable production to climate change.

Output 3.4: Capable extension services developed in target districts

- **Capability of extension services in target districts will be developed through (gender-sensitive) targeted training** in cooperation with local authorities, academia and the private sector to enable extension centres/facilities to foster improved access of agricultural end-users (fruit and vegetable producers) to agrotechnological advice based on effective agrometeorological information. By building their capacity, these extension centres/facilities will also be able to further train agricultural end-users (fruit and vegetable producers) in the understanding and use of that information for improving resilience of their production to climate change.

COMPONENT/OUTCOME IV: Climate-informed planning and forecasting of agricultural land-use, crop selection and agrotechnology for fruit and vegetable production in Uzbekistan

Output 4.1: Electronic archive of agrometeorological time-series

- **Agrometeorological information archives will be safeguarded electronically through the creation of an electronic archive** capable of supporting long-term analysis and forecasting / projections of changes in agroecological conditions. The archive will further enable the regular production and sharing of climate-change information and analyses for strategic horticultural planning.

Output 4.2: Customised Information about the anticipated impacts of long-term climate change on fruit and vegetables production regularly produced, updated and delivered to end-users

- **Regular production of customised and updated information on anticipated impacts of long-term climate change on fruit and vegetables production will be promoted and delivered to end-users**, taking into account social, cultural, gender and age considerations. Customised information will include scenarios, projections, overall and geographic impacts, etc., which will be delivered to agricultural stakeholders (from authorities to agronomists, farmers, retailers and exporters) through consultations, publications, media, and advisory/extension centres/facilities.

Table B.2.1 illustrates how the different project components (outcomes) respond to the various challenges identified as barriers in Section B.1.

Table B.2.1 Project outcomes addressing key challenges / root causes

Project outputs: improved… / Challenges / root causes	1. agrometeo-logical services	2. data collection & processing	3. information delivery & use	4. climate in strategic planning
Insufficient and outdated physical and institutional infrastructure	•	•	•	
Insufficient capacities to produce and communicate information relevant for farmers		•	•	•
Weak inter-sectoral linkages between hydrometeorology and agriculture			•	•
Lack of user orientation among the providers of agrometeorological information	•		•	•

Insufficient expertise and lack of financial resources for change	•	•	•	•

The scaling-up potential of the project is (1) geographical, expanding work and results from the 57 target districts to the entire territory of Uzbekistan; (2) sectoral, expanding the approach and results beyond agrometeorology to all hydrometeorology and climate services of Uzhydromet; and (3) sectoral with respect to agriculture, expanding improved agrometeorological information services beyond fruit and vegetables cultivation to all agricultural planning and production. The transformation / paradigm shift potential is described in section B3 below.

Project implementation entities and modalities

Being the leading global environmental agency with overall responsibility in the field of delivering environmental information for action, and having operational experience and regional presence in Central Asia, UNEP is well placed to lead the project. As per its GCF Entity Work Programme, the UN Environment Programme offers more than 20 years of experience working on climate change. It brings a comprehensive approach to climate change mitigation and adaptation that is grounded in both natural and economic science and is tied to the environmental and development concerns of countries. Based on its core science-based mandate, one of UN Environment's seven sub-programs is entirely dedicated to keeping the world environment under review. Through its Science Division, UN Environment has longstanding expertise in environmental and climate change information management and early warning. For example, with GEF and EC funding it is currently supporting over 50 countries in establishing or strengthening their environmental information management systems and using them for SDGs and MEA (amongst others) reporting. Through its global work on early warning and foresight, UN Environment enables stakeholders to respond to the latest emerging issues related to environment and climate change. Other examples include the CLIMWARN and Country Level Impacts of Climate Change (CLICC) projects managed within the Science Division, the Shared Environmental Information Systems (SEIS), environmental monitoring and environmental statistics project activities implemented in the Pan-European region (including Central Asia) by UN Environment Europe Office, and the strong convening power at regional and sub-regional level in Central Asia.

UN Environment convenes and facilitates regional environmental information networks and the world adaptation science program PROVIA. In the Pan-European region, UN Environment Europe Office actively supports the organization of the UNECE Working Group on Environmental Monitoring and Assessment and UNECE Joint Task Force on Environmental Indicators (JTF) that regularly convene environmental information experts and statistics from Eastern European Caucasus and Central Asia (EECCA) countries, including from Uzbekistan. UN Environment Europe Office, through its Sub-regional Office for Central Asia in Almaty, Kazakhstan, is also active in building capacity of environmental authorities and statistical offices in Central Asian countries in the promotion of Shared Environmental Information System (SEIS) principles of open access to environmental data. UN Environment Europe Office will assure overall strategic, managerial and substantive responsibility for project design, implementation and results, partnering with UNDP Uzbekistan Country Office and Uzhydromet as in-country executing partners for activities on the ground.

While keeping the overall strategic, managerial and substantive responsibility for project design, implementation and results, for activities on the ground it will enter into agreements with UNDP Uzbekistan country office and Uzhydromet as in-country executing partners, which will oversee and implement the project both centrally in Tashkent and in the 57 selected rural locations in accordance to well-established and tested project management guidelines and practices. As a co-Executing Entity, UNDP Uzbekistan Office, together with Uzhydromet, will be responsible for channelling GCF proceeds and the actual implementation of project activities.

Besides their own staff and capacities, the executing partners will also rely on cooperation and services of a broad range of both national and international external providers such as:

- IT and communication companies – for developing information and communication infrastructure and services of the agrometeorological network;
- climate and agricultural research centres – for improving the analysis and delivery of climate-change information in support of horticultural planning nationally and locally levels;
- agricultural research and training establishments for agroecological and agrotechnological training of Uzhydromet staff;
- local/ regional agricultural universities and colleges, agricultural consulting companies and organisations, oblast- and district-level agricultural authorities for building and delivering extensions services in rural areas.

Potential risks have been identified and are listed below along with mitigation strategies.

Risk	Category	Mitigation
Lack of capacity, engagement and cooperation among national institutions	Operational and Political	Uzhydromet will be a key executing entity in the project which is based on strong country demand. The project will ensure the full engagement of different ministries and other stakeholders in improving the delivery and use of agrometeorological services. The enhancement of interaction between producers and end-users of information is at the core of project design.
Geopolitical and intrastate tensions	Political	Through continuous monitoring, stakeholder engagement and the establishment of robust governance and coordination mechanisms, the project will mitigate the risk of tensions, including interstate and intrastate tensions related to water and land use, affecting project delivery.
Conflicting interests among stakeholders	Operational	Based on a stakeholder analysis and extensive stakeholder consultations, the project will mitigate potential conflicting interest among stakeholders amongst others through the establishment of an inclusive consultation and coordination mechanism for the development and the delivery of agrometeorological services.
Socio-economic risks	Operational	The project has been identified as low risk and will ensure that the socio-economic diversity, vulnerability and livelihood risks will be considered in all project activities.
Operation and maintenance of infrastructure and equipment	Operational	The project is based on a strategy and commitment for long-term operation and maintenance of equipment and observation infrastructure to ensure the sustainability of project results.

B.3. Expected project results aligned with the GCF investment criteria (max. 3 pages)

On the overall level, the project is expected to help improve the resilience of climate-sensitive horticultural production in Uzbekistan and to strengthen the livelihoods of climate-affected rural communities. With the help of improved agrometeorological services, the targeted farms and households, agricultural businesses and authorities will be able to improve their land-use planning and the selection of crops, optimise their daily field operations such as the use of water and fertilisers, plant protection, pest and decease control, and other agrotechnological and protective measures.

In economic terms the project will bring economic and social benefits such as lower costs of production, improved agrotechnological skills and practices, increased yield and quality of the output and reduced harvest losses, and, eventually higher sales revenues, in the end contributing to reduced poverty and a more climate-resilient, sustainable, efficient, diverse and competitive agricultural sector in Uzbekistan.

The project will contribute to improved resilience of climate-sensitive production of fruit and vegetables by improving the accessibility and use of high-quality, targeted, timely and understandable agrometeorological information and advice. In doing so it will address several challenges facing today Uzbekistan's agriculture and hydrometeorology which have been presented and discussed in the section B1.

Impact potential

The project contributes to the achievement of GCF strategic-level impacts through increased resilience and enhanced livelihoods of the most vulnerable people and communities in Uzbekistan's rural districts. While the project will also contribute to the achievement of the GCF indicator of the reduction in the number of people affected by climate-related disasters, it will primarily deliver climate change adaptation benefits through improving climate resilience, incomes and livelihoods of estimated 7.3 million horticultural farmers and dehkans[54] in all 13 provinces of Uzbekistan.

[54] In Uzbekistan, 8 million people employed at 4.7 million dekhan farms and at small farms work in the horticulture sector (ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018). In addition, estimated 0,8 to 1,4 million

Sustainable development

The project contributes to the overall sustainable development of Uzbekistan by improving the understanding of climate change and integrating this understanding into long-term planning and daily practices of agricultural production, and by helping strengthen the resilience and, eventually, the profitability of fruit and vegetable cultivation, thus improving the livelihoods of Uzbekistan's vulnerable rural population and contributing to sustaining and expanding Uzbekistan's economy as a whole.

- The project will help enhance income and alleviate poverty in rural communities, in particularly among the estimated 20 million members of dehkan families in the project area.
- The project will improve food security and quality of nutrition of 30 million Uzbekistan's population due to a stronger and more reliable supply of higher-quality vegetables and fruits.

Box B.3.1 Contribution of project results to attaining Sustainable Development Goals [55]

SDG 1 NO POVERTY

1.2 Reduce by half the proportion of people living in poverty
1.5 Build the resilience of and reduce the exposure and vulnerability of the poor to climate-related extreme events

SDG 2 ZERO HUNGER

2.1 Ensure access to safe, nutritious and sufficient food
2.3 Double the agricultural productivity and incomes of small-scale food producers, including family farmers
2.4 Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters
2.A Increase investment in rural infrastructure, agricultural research and extension services

SDG 8 DECENT WORK AND ECONOMIC GROWTH

8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including a focus on high-value added and labour-intensive sectors

SDG 13 CLIMATE ACTION

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters
13.2 Integrate climate change measures into national policies, strategies and planning

In the longer-term the project will tangibly contribute to the attainment of several Sustainable Development Goals (Box B.3.1).

Paradigm shift

As a catalyst of cultural change, the project will help shift several prevailing paradigms:

(1) The project will help invert the traditional supply-focussed approach to providing climate and hydrometeorological information in Uzbekistan by bringing end users to the fore of the design and implementation of agrometeorological services and by linking their delivery to users' needs – much in line with WMO's principles of the Global Framework for Climate Services (GFCS) and its support to the implementation of the respective National Frameworks for Climate Services;

farmers are employed at 28000 larger multi-purpose farms established by the President decree of 9.10.2017. The areas of project intervention cover about 80% of the country's rural population, hence in total 7 to 7.5 million people employed at dekhan households and various types of horticultural farms within these areas. The average estimate is 7.3 million people.

[55] https://sustainabledevelopment.un.org/; the formulations of SDGs and their tasks are simplified.

(2) In practical terms it will help redesign the obsolete business and institutional model of providing agrometeorological (and eventually, climate and hydrometeorological) information by linking it to the modern principles of public access to information as well as to the actual and prospective user demand and market potential, thus capitalising on business investment opportunities while protecting vulnerable groups unable to afford market-oriented services.

(3) For the first time, it will bring long-term climate-change knowledge directly into Uzbekistan's strategic agricultural planning through building robust capacities for continuously supplying relevant, understandable and actionable climate information to the various parts and players of the horticultural value chain;

Needs of the recipient and Country ownership

Uzhydromet as the key direct recipient of GCF support has been strongly engaged in project design (see details in section B4 below), hence its needs as well as financial vulnerability are fully taken into account. (Uzhydromet's annual budget of USD 2.5M does not allow for the badly needed modernisation of the observation network and the agrometeorological services).

The interests and needs of the end users, who are indirect beneficiaries of the project, including the estimated 6.5 million smallholder and individual farmers and dehkans engaged in horticulture (making up 40% of rural and 20% of the total population of Uzbekistan [56]) are at the very centre of project approach. The recent Uzbekistan donor group's brief on the options for agricultural extension services [57] notes the critical importance of improved and decentralised extension services in agricultural sectors dominated by smallholders who are "fragmented, unorganized, and much less commercial than larger farms", and affected by external factors outside of farmers' control, such as pests, diseases and drought. The group also recognised the need to turn public services towards their end users while "Uzbekistan still uses the supply-driven public extension service through state research institutes inherited from soviet era, which is not efficient at all in the current conditions". Finally, donors strongly recognise the need "to shift away from commodity [cotton] centered extension model to more participatory approaches for knowledge delivery and acquisition", which at the core of the design of this proposal.

In line with the principles laid out under the scope of the WMO Global Framework for Climate Services (GFCS)'s priority area on Agriculture and food security [58], [59], user needs are the key driver shaping project interventions and implementation.

The proposal is fully aligned with Uzbekistan's INDC (see Box B 1.1 above) as well as its policy decisions and documents concerning the development of modern climate-resilient agriculture and horticulture in particular. Additional information on meeting the needs of the recipient is provided in section C2 and on country ownership in section C3 below.

Efficiency and Effectiveness

The (cost-)efficiency of interventions will be ensured by building them upon Uzhydromet's existing infrastructure and capacities, gradually renovating, replacing and expanding them; and by relying on sustainable, cost-efficient and, where possible, locally-sourced technological solutions (e.g. providing bicycles rather than motor vehicles for surveying fields around agrometeorological stations).

The project will rely on the best available expertise within and outside of the UN system, as well as the worlds' best practices in the field of agrometeorology through the application of highly competitive procurement procedures and relying on collaboration with partners such as the WMO which strongly supports the project rationale and is willing to extend technical and operational support to its implementation.

This described above strong focus on user needs will ensure project effectiveness, as agrometeorological services will be designed and delivered so that users can receive exactly the information they need and can use, in the formats and

[56] According to the World Bank's World Development Indicators DataBank, in 2018 the share of female employment in Uzbekistan agriculture was 25%. According to ADB (ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018), women make up the majority of land users and workers of dehkan farms although are unlikely to play a key role in management or decision-making: out of a total of 160,752 registered farms in 2016, there were only 4,500 farms registered to women. A detailed gender analysis will be undertaken at the full project development stage.

[57] Options for Agricultural Extension Services in Uzbekistan. Joint Donor Group Brief. March 11, 2019

[58] http://www.wmo.int/gfcs/food_and_security

[59] http://www.wmo.int/gfcs/sites/default/files/Priority-Areas/Agriculture%20and%20food%20security/GFCS-AGRICULTURE-FOOD-SECURITY-EXEMPLAR-FINAL-14147_en.pdf

through channels they can access and understand. Consequently, project results will be directly linked to the actual production needs and outputs of fruit and vegetable growers and other players up the agricultural value chain.

The efficiency and effectiveness will be further increased by building on and complementing other existing or starting projects (Table B.3.1). Most of the organisations listed in the Table have already confirmed their interest in cooperation, the specific modalities of which will be discussed and agreed during the development of the full project framework.

Table B.3.1 Project synergies and opportunities through parallel financing

	Project	Timeframe	Matching activities / inputs of co-finding instruments
UNDP	Climate resilience of farming communities (Karakalpakstan)[60,61]	2014 – 2020	Automation of 5 agrometeorological stations.
	Adaptation and resilience of farming in the Fergana Valley[62]	2018 – 2020	Capacity building for climate information users.
FAO	Central Asian Initiative for Land Management II[63]	2018 – 2022	Automation of 9 agrometeorological stations in the Kashkadarya and the Jizak oblasts, training in drought monitoring, improving yield forecasting and agricultural production (Component 1, 2M)
World Bank	Horticulture Development Project[64]	2015 – 2023	Potential interest in use of climate knowledge and extension services (Component 1, total volume in 2018 – 2023 is 24.M).
	Climate adaptation and mitigation programme for the Aral Sea basin[65]	2015 – 2021	Regional climate knowledge services (12.5M), including upgrading monitoring networks and improving the use of climate information by end users.
	Central Asia Hydrometeorology Modernization Project[66]	2011 – 2021	Improving the management and provision of information by national hydrometeorological services (Component A, total volume USD 8.7M) .
ADB	Horticulture Value Chain Development Project[67]	2017 – 2021	Loans for horticultural production, storage improvement and processing. Potential interest in extension services.
USAID	Agricultural Value Chain[68,69]	2015 – 2020	Extension / advisory services in 33 districts / 12 provinces
OSCE	Support to development of farming and integration by promotion of web- technologies[70]	2019 - 2020	Web-portal providing information and consultancy support to agricultural producers

B.4. Engagement among the NDA, AE, and/or other relevant stakeholders in the country (max ½ page)

The idea of the project is an outcome of extensive stakeholder consultations carried out under the scope of the Green Climate Fund (GCF) Readiness Programme in Uzbekistan initiated in July 2016[71,72] and implemented by UNDP in partnership with UNEP and Uzhydromet. Following the endorsement of the project idea in June 2017 by the Readiness Programme's interagency task force (comprised of representatives of Uzbekistan's governmental agencies), Uzhydromet as the NDA requested UNEP's technical support for the further development of the project idea through an official letter dated 07 September 2018. The project idea was then further developed by UNEP with the strong engagement of UNDP and of Uzhydromet and its experts (who provided guidance, substantive support and expertise), taking into account additional stakeholders perspectives collected through further technical consultations.

[60] http://www.uz.undp.org/content/uzbekistan/en/home/operations/projects/environment_and_energy/developing-climate-resilience-of-farming-communities-in-the-drou.html
[61] https://www.adaptation-fund.org/project/developing-climate-resilience-of-farming-communities-in-the-drought-prone-parts-of-uzbekistan/
[62] Enhancing the adaptation and strengthening the resilience of farming to Climate Change Risks in Fergana Valley. Draft UNDP project proposal to Climate change window of RTFD, April 2018
[63] https://www.thegef.org/project/integrated-natural-resources-management-drought-prone-and-salt-affected-agricultural
[64] http://projects.worldbank.org/P133703?lang=en
[65] http://projects.worldbank.org/P151363?lang=en
[66] http://projects.worldbank.org/P120788?lang=en
[67] https://www.adb.org/projects/47305-002/main#project-overview
[68] https://uz.usembassy.gov/usaid-agricultural-value-chains-activity-launched-opening-ceremony-tashkent/
[69] https://www.dai.com/our-work/projects/uzbekistan-usaid-agricultural-value-chain-activity-uzbekistan-uzbekistan-avc
[70] OSCE Project Co-ordinator in Uzbekistan. Support to development of farming and integration by promotion of web- technologies. [OSCE project fiche.]
[71] http://www.gcfreadinessprogramme.org/uzbekistan-gcf-readiness-programme
[72] http://www.uz.undp.org/content/uzbekistan/en/home/operations/projects/environment_and_energy/Green_Climate_Fund_GCF_Readiness_Programme_in_Uzbekistan.html

In September 2018, an international fact-finding mission team comprised of UNEP, UNDP, international and local consultants, met a wide range of national and international stakeholders to collect additional information and perspectives and identify opportunities for synergies and leveraging project interventions. The main stakeholders consulted included:

- Ministry of Economy - Head of Agriculture and Water Resources Development Department
- Ministry of Agriculture - Deputy Head of International Cooperation Department and Deputy Head of the Department of Horticulture and Viticulture
- Chamber of Commerce and Industry - Head of Entrepreneurship and Business Department
- JSC Uzagroexport – General Director
- Representatives of agricultural science institutions (Mirzayev / Schröder Institute of Horticulture, Viticulture and Winemaking) and academia (Tashkent State Agrarian University)
- Agricultural producers
- Relevant international organisations (World Bank, FAO, USAID).

The project concept, presented and discussed in detail during the mission, received unanimous support from all key stakeholders. The concept was also discussed with WMO and the GFCS Secretariat in Geneva. Following the mission, the concept was further refined in close interaction with local experts and reviewed by Uzhydromet. All these organisations have committed resources to the development of a full funding proposal once the project concept is approved by the GCF, and to be part of project implementation under the leadership of UNEP once GCF resources become available.

Project design also makes use of farmer surveys undertaken by the World Bank[73] and UNDP[74].

C. Indicative Financing/Cost Information (max. 3 pages)

C.1. Financing by components (max ½ page)

Component	Indicative cost (USD)	GCF financing		Co-financing		
		Amount (USD)	Financial Instrument	Amount (USD)	Financial Instrument	Name of Institutions
Shaping agrometeorological services	600,000	300,000	Grant	300,000	Worktime Office Infrastructure	Uzhydromet* UNEP UNDP
Modernising the observation network	6,500,000	4,600,000	Grant	1,900,000	Infrastructure Operation Maintenance	Uzhydromet*
Improving data processing and user services	7,000,000	6,800,000	Grant	200,000	Worktime Office Infrastructure	Uzhydromet*
Introducing climate-informed planning	800,000	600,000	Grant	200,000	Worktime, Office, Infrastructure	Uzhydromet* UNEP
Project management and administration	2,600,000	2,200,000	Grant	400,000	Worktime Office	Uzhydromet* UNEP UNDP
Indicative total cost (USD)	**17,500,000**	**14,500,000**		**3,000,000**		

* In-kind

C.2. Justification of GCF funding request (max. 1 page)

The GCF grant is requested to provide the critical public good of climate information and agrometeorological services, including their dissemination and use, which will ultimately reduce the climate risks and enhance the resilience of up to 40% of the vulnerable rural population of Uzbekistan. The climate information and agrometeorological services that will be developed and rolled-out under this project will enable them to safeguard their lives, livelihoods and assets from climate-related hazards and risks. This is fully in line with The GCF board **Decision B.07/04 (b)** in reference to initial

[73] Sutton W. R., Srivastava J. P., Neumann J. E., Droogers P., Boehlert B. B. Reducing the vulnerability of Uzbekistan's agricultural systems to climate change. Impact assessment and adaptation options. World Bank: Washington DC, 2013
[74] UNDP. Baseline assessment of agriculture risks and problems related to climate change in the context of Namangan and Fergana provinces of Uzbekistan. Tashkent, 2016

results management framework of the Fund: section **(iii) Project/programme level outcomes for adaptation** calls for: *(5.0) Strengthened institutional and regulatory systems for climate-responsive planning and development; (6.0) Increased generation and use of climate information in decision-making; (7.0) Strengthened adaptive capacity and reduced exposure to climate risks; (8.0) Strengthened awareness of climate threats and risk-reduction processes.*

The proposed activities and outcomes are also fully in line with the priorities identified under the scope of the national UNDP/UNEP/Uzhydromet joint project "Green Climate Fund (GCF) Readiness Programme in Uzbekistan"[75] and, as discussed above in section B2, will directly contribute to two GFC result areas:

- Increased resilience of vulnerable people and communities to climate change by helping sustain horticultural production and income at farm / household level (and, correspondingly, improving the economic security of horticultural farmers and dehkans under climate change);
- Increased resilience of well-being and food security by reducing current and, in particularly, future gaps between the demand and the climate-affected supply for horticultural products, and improving the base for sustainable horticultural export under climate change.

Uzbekistan's agrometeorological network has for a long time suffered from underfunding and the lack of modernisation. The core of the network dates back to the Soviet time and can no longer provide modern services to the agricultural community. Currently Uzhydromet operates with a minimal budget of 17 – 20 million Uzbek so'ms per year (ca. 2.5 million USD at the current exchange rate), which is heavily biased towards personnel costs. Uzhydromet works under only partially realistic assumption of cost-recovery from the market which is neither well developed, nor is capable to ensure the recovery of the costs of hydrometeorological and climate services. Therefore, given the current economic situation and trends (GDP growth slowed to 4.9% in the first half of 2018 compared to 7% in the same period 2017 [76] and Government debt to GDP ratio was equivalent to 24.3% in 2017 up from 10.46% in 2016 [77]), it is not realistic to expect the required state financing that would allow for the needed structural changes and investments as proposed in this project.

Similarly, while the share of government investment in agriculture was 5.2% in 2011, by 2014 this had fallen to only 4.6%. The main factor in this change is primarily due to the recently changed priorities where the Government has concentrated investments mainly on other sectors such as industry, construction, housing and communal services and others. These changes reflect a growing maturity of the broader economy and the need for infrastructural support to maintain that growth, while agriculture is gradually being seen as more robust now that production is primarily in the private sector. It also possibly reflects an increasing understanding within Government that agricultural production is changing and that cotton is no longer the main driver of the sector[78].

Significant market shifts, such as the increasing ability and willingness of the export-oriented part of the fruit and vegetation growing sector to pay for customised agrometeorological information, can be expected in the medium to long term. Indeed, while the private business in Uzbekistan has generally been restrained towards large scale investment in agriculture which is viewed as unappealing because of the poor cash flow (seasonal income only) and the perceived low efficiency, all of which combine to deter interest of private businesses and external investors from getting involved in the sector, horticulture is viewed as an exception outside of this general sentiment for agriculture – with the result that there is significant private sector interest in being involved in all stages of the fruit and vegetable value chain: from production, through storage, processing and marketing[79]. However, the current system of agrometeorological services is unprepared to fully capitalise on such opportunities, as this would require structural changes some of which are yet to take place. Therefore, short term immediate financing from the private sector is also not realistic. In the case of Uzbekistan, GFC financing would have a catalytic effect, at the same time significantly improving the quality of agrometeorological information services and demonstrating their potential and, eventually, user and market value so that a more sustainable model can be built to protect the livelihoods of vulnerable farmers from predicted climate change risks.

Foreign investments in developing Uzbekistan's hydrometeorology as a whole have been so far small, only beginning to appear e.g. through World Bank's regional efforts, and are not yet sufficient to help change Uzhydromet's operating model. Aligning GCF funding with that of other international projects and initiatives focussing on both hydrometeorology and the agricultural sector, promise synergetic effects (see section B1).

Finally, the connection between hydrometeorological services and the economic (i.a. agricultural) output in the context of climate change is yet to be fully understood in Uzbekistan, and the project expects to contribute to such understanding.

[75] http://www.gcfreadinessprogramme.org/uzbekistan-gcf-readiness-programme
[76] World Bank: https://www.worldbank.org/en/country/uzbekistan/overview
[77] The State Committee of the Republic of Uzbekistan on Statistics (https://www.stat.uz/en/)
[78] ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018
[79] ADB. Horticulture Value Chain Development Project (Additional Financing): Report and Recommendation of the President. Supplementary Document 16: Detailed Sector Assessment: Agriculture, Natural Resources, and Rural Development. Manila, 2018

C.3. Sustainability and replicability of the project (exit strategy) (max. 1 page)

Uzhydromet has the mandate to maintain and develop the network of agrometeorological observations and to provide information about current and future agrometeorological conditions, including weather-related risks, to Uzbekistan's agricultural sector, authorities and organisations. With agricultural producers and Uzhydromet being an integral part of design, the project will establish strong long-term connections between the various users at all levels and Uzhydromet as the provider of agrometeorological services. These linkages will remain once the project is completed, and users will continue to interact with Uzhydromet in order to receive information they need. With mechanisms for user interaction and for monitoring project results and user satisfaction built through the project, external demand will give strong push to the continuity of services and project results.

In particular, Uzhydromet will will take ownership of the assets established by the project (e.g. the automated observation network), and fully ensure their operation and maintenance during and after the project implementation period with its own resources. The detailed operation and management plan will be elaborated during the development of the full project proposal.

The integration of climate services in key policies, strategies, plans and budgets supported by this project will provide a foundation for uptake of climate information in decision-making and facilitate sustainable service provision in the long term. In accordance with Uzbekistan's INDC, the recent decree № 3281 of September 2017 by the President of the Republic of Uzbekistan requests the optimised placement of agricultural crops, in particular intensive cucurbit plantations, gardens and vineyards, accounting for soil and climate conditions, the availability of water, regional specialisation, yields and other factors; thus confirming the need and demand for systematically integrating climate-change information in long-term agricultural planning.

The identification of funding modalities for climate information products including by integration in the national budget will contribute to sustainability. Similarly, climate information increasingly interests potential investors in agricultural business. This highlights the potential for bringing climate knowledge into business planning, and may in turn bring new economic opportunities to Uzbekistan's agrometeorological network and services, thus ensuring its long term sustainability and replicability.

In summary, in line with national policies, the project will provide a long-term vision for agrometeorological services in Uzbekistan, including user interaction and feedback mechanisms as well as legal and business model changes at Uzhydromet to create a sustainable and replicable service to protect the vulnerable through their enhanced ability to adapt to climate change. The project will result in automated stations installed at multiple locations and soil analysis equipment modernized at 23 laboratories, as well as delivering the facilities for data collection, exchange and knowledge management, thereby complementing and upgrading the basic existing infrastructure. This will be supported by the provision of extension services for horticultural end users and capacity building and training of some 150-200 Uzhydromet staff. Through these capacity development activities, awareness raising and a dedicated knowledge management component, their capacity will be enhanced and the sustainability of results facilitated. The holistic approach to climate services is tailored to the circumstances of Uzbekistan and therefore more likely to lead to sustainability rather than a focus on the provision of technical infrastructure alone.

Uzhydromet is committed to fully integrate project results into its daily operations. The project will not only help modernise the agrometeorological network and service capacities, but will also assist Uzhydromet in making legal and operational changes necessary to make the transformation sustainable. Among other elements, it will help adopt a new business model of cost-recovery that will provide a more reliable foundation to the sustainability of Uzhydromet and its services.

Sustainability and replicability of the project will be facilitated and supported through partnerships as presented in section B3 Efficiency and Effectiveness, and its alignment with key frameworks and strategies.

D. Supporting documents submitted (OPTIONAL)

- ☐ Map indicating the location of the project/programme (included in section B.2 – not submitted separately)
- ☒ Diagram of the theory of change
- ☐ Economic and financial model with key assumptions and potential stressed scenarios
- ☐ Pre-feasibility study
- ☐ Evaluation report of previous project
- ☒ Results of environmental and social risk screening
- ☒ Supplementary information: damage to Uzbekistan horticulture from extreme weather in 2005–2017

Self-awareness check boxes
Are you aware that the full Funding Proposal and Annexes will require these documents? Yes ☒ No ☐ • Feasibility Study • Environmental and social impact assessment or environmental and social management framework • Stakeholder consultations at national and project level implementation including with indigenous people if relevant • Gender assessment and action plan • Operations and maintenance plan if relevant • Loan or grant operation manual as appropriate • Co-financing commitment letters
Are you aware that a funding proposal from an accredited entity without a signed AMA will be reviewed but not sent to the Board for consideration? Yes ☒ No ☐