

Concept Note

Project/Programme Title: Scaling up climate-responsive planning and decision making for resilient agriculture and livelihoods in Lao PDR

Country(ies): Lao PDR

National Designated Authority(ies) (NDA): Ministry of Natural Resources and Environment

Accredited Entity(ies) (AE): Food and Agriculture Organization (FAO)

Date of first submission/
version number: [2021-11-24] [V.1]

Date of current submission/
version number: [2021-11-24] [V.1]



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.
- The relevant National Designated Authority (ies) will be informed by the Secretariat of the concept note upon receipt.
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- Accredited Entities and/or NDAs are encouraged to submit a Concept Note before making a request for project preparation support from the Project Preparation Facility (PPF).
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A. Project/Programme Summary (max. 1 page)			
A.1. Project or programme	<input checked="" type="checkbox"/> Project <input type="checkbox"/> Programme	A.2. Public or private sector	<input checked="" type="checkbox"/> Public sector <input type="checkbox"/> Private sector
A.3. Is the CN submitted in response to an RFP?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, specify the RFP: _____	A.4. Confidentiality¹	<input type="checkbox"/> Confidential <input checked="" type="checkbox"/> Not confidential
A.5. Indicate the result areas for the project/programme	<p><u>Mitigation</u>: Reduced emissions from:</p> <p><input type="checkbox"/> Energy access and power generation</p> <p><input type="checkbox"/> Low emission transport</p> <p><input type="checkbox"/> Buildings, cities and industries and appliances</p> <p><input type="checkbox"/> Forestry and land use</p> <p><u>Adaptation</u>: Increased resilience of:</p> <p><input checked="" type="checkbox"/> Most vulnerable people and communities</p> <p><input type="checkbox"/> Health and well-being, and food and water security</p> <p><input type="checkbox"/> Infrastructure and built environment</p> <p><input type="checkbox"/> Ecosystem and ecosystem services</p>		
A.6. Estimated mitigation impact (tCO₂eq over lifespan)		A.7. Estimated adaptation impact (number of direct beneficiaries and % of population)	2.33 million (100% of agricultural households and 31.9% of Lao PDR's total population)
A.8. Indicative total project cost (GCF + co-finance)	USD 32,000,000	A.9. Indicative GCF funding requested	USD 16,000,000
A.10. Mark the type of financial instrument requested for the GCF funding	<input checked="" type="checkbox"/> Grant <input type="checkbox"/> Reimbursable grant <input type="checkbox"/> Guarantees <input type="checkbox"/> Equity <input type="checkbox"/> Subordinated loan <input type="checkbox"/> Senior Loan <input type="checkbox"/> Other: specify _____		
A.11. Estimated duration of project/ programme:	5 years	A.12. Estimated project/ Programme lifespan	25 years
A.13. Is funding from the Project Preparation Facility requested?²	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Other support received <input type="checkbox"/> If so, by who: _____	A.14. ESS category³	<input type="checkbox"/> A or I-1 <input type="checkbox"/> B or I-2 <input checked="" type="checkbox"/> C or I-3
A.15. Is the CN aligned with your accreditation standard?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	A.16. Has the CN been shared with the NDA?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
A.17. AMA signed (if submitted by AE)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 <input checked="" type="checkbox"/> No <input type="checkbox"/>
A.19. Project/Programme rationale, objectives and approach of programme/project (max 100 words)	<p>The agriculture sector of Lao PDR is highly vulnerable to natural disasters (particularly droughts and floods), which are being exacerbated by climate change. The proposed project aims to enhance climate resilience in Lao PDR through increased use of agrometeorological and climate services in agriculture planning and decision making at all levels.</p> <p>The project will institutionalize the successful decision making tools developed and piloted by the Global Environment Facility's Least Developed Countries Fund (GEF-LDCF)-funded FAO-led project "Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security for farmers in Lao PDR"⁴. These tools, among</p>		

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 See [here](#) for access to project preparation support request template and guidelines

³ Refer to the Fund's environmental and social safeguards ([Decision B.07/02](#))

⁴ <http://www.fao.org/in-action/samis/en/>

	<p>others, are i) the Lao Climate Service for Agriculture (LaCSA)^{5 6}, which provides agrometeorological advisories and early warnings, and ii) the Land Resources Information Management System (LRIMS)⁷ that provides integrated climate, natural resources and agriculture data and analyses for strategic foresight and scenario-based planning.</p>
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⁵ <http://www.fao.org/3/ca3773en/ca3773en.pdf>

⁶ <http://www.fao.org/3/CA2927EN/ca2927en.pdf>

⁷ <http://www.fao.org/in-action/samis/crop-scenarios/en/>

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

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

Economic development, food security and agriculture in Lao PDR

1. Lao People's Democratic Republic (Lao PDR) is the only landlocked country in Southeast Asia. Some 80% of the country's area is composed of hills and mountains, and in 2019 its population was 7.17 million⁸. Lao PDR is currently classified as a Least Developed Country (LDC) by the United Nations Conference on Trade and Development (UNCTAD) but has achieved significant development gains in recent years.⁹ ¹⁰ During 2000-2019, the country experienced impressive average annual gross domestic product (GDP) growth of 7.0%¹¹ and annual per capita GDP growth of 5.4%¹². Poverty reduction has been equally impressive in the recent years, from 50.7% of the population in 1997 to just 10% in 2018 (using a \$1.90 a day indicator).¹³ The country's Human Development Index (HDI) value for 2019 is 0.613, up from 0.471 in 2000 and ranking 137th out of 189 countries and territories¹⁴.
2. Despite these impressive achievements, food insecurity and malnutrition are still widespread in Lao PDR, and largely associated with ethnicity, gender, and geography. An estimated 33.1% of children under five years of age were stunted in 2017¹⁵. Widespread inequalities and disparities exist, imposing challenges to the achievement of the Sustainable Development Goals (SDGs). Poverty remains high among minority ethnic groups and fell less quickly among poorly educated households. In 2019, a poverty rate of 34.6% was observed among people living in households headed by someone with no formal education¹⁶. While 75% of male members of agricultural households who are over 10 years old are able to read and write without difficulty, this rate is only 57% among female members. Moreover, major inequalities exist between female and male-headed agricultural households, with female-headed households often having smaller holdings by area, fewer plots of land, fewer income-generating livestock, lower levels of fishery and forest-related activities, and lower crop marketing rates. They also generally spend a larger proportion of cash income on food and have less access to safe drinking water sources than their male counterparts.
3. The growth of the agriculture sector has been lagging behind the rest of the economy, at around 3.7% per annum (ADB, 2018). Although declining in terms of contribution to the GDP (from 52% in 1997 to 15% in 2019)¹⁷, agriculture continues to play a pertinent role in Lao PDR' economy, employing 61% of labour force in 2019 (around 2.33 million people).¹⁸ Rural poverty has decreased faster in rural areas than in towns (by 7.6% points to 23.8%) during 2013-2019 thanks to growth in farm incomes and remittances among rural households¹⁹. However, about 50% of people employed in agriculture are still mainly or partly subsistence farmers with household income below US\$300 per year. Agriculture production is becoming increasingly commercialized with 33% of farmers today producing mainly for sale. This comes with emerging local businesses and farmer organizations and changing access to land (with increasing land lease, contract farming and foreign-investor plantations). At the same time, increasing use of chemical fertilizer raises concerns on its impacts on unique biodiversity and ecosystems of the country.

Climate variability and change

4. **Climate of Lao PDR.** Most of Lao PDR's territory falls within the Mekong River Basin. The climate of Lao PDR is divided into two distinct seasons: rainy season (or south-west monsoon) from May to mid-October, followed by a dry season from mid-October to April. The country's mean annual temperature is 23.4°C and mean annual rainfall is 1,733 mm year (1901-2020)²⁰. Annual rainfall typically varies between 1,500 and 3,000 mm. Lao PDR is divided into three different climatic zones:
 - The northern mountainous areas above 1,000 m have a mountain temperate and hilly sub-tropical climate. They are relatively dry, with annual rainfall typically between 1,500 and 2,000 mm.
 - The central mountainous areas range in altitude from 500 to 1,000 m (with some mountain peaks >2,000 m) and typically receive between 2,500 and 3,500 mm of precipitation annually. They have a tropical monsoonal climate with a higher temperature and higher average rainfall than elsewhere.
 - The tropical lowland plain and floodplains along the Mekong River and its main tributaries include the plains of Vientiane, Borikhamxay, Khammouane, Savannakhet, Champasack, Saravane, and Attapeu provinces. These areas have an average rainfall of 1,500 to 2,000 mm and are the areas most affected by drought and floods.
5. **Observed changes.** During 1901-2020, Lao PDR has experienced a significant increase in mean temperature across the country, with the temperature increase accelerated to a rate of 0.1-0.3°C per decade during the last 50 years (Figure

⁸ <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=LA>

⁹ <https://www.eastasiaforum.org/2020/01/01/laos-is-on-course-to-graduate-from-least-developed-country-status/>

¹⁰ <https://laopdr.un.org/32531-working-together-lao-pdrs-sustainable-ldc-graduation>

¹¹ <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=LA>

¹² <https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?locations=LA>

¹³ <https://data.worldbank.org/topic/poverty?locations=LA>

¹⁴ <https://countryeconomy.com/hdi/laos>

¹⁵ <https://data.unicef.org/topic/nutrition/malnutrition/>

¹⁶ http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/LAO.pdf

¹⁷ <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=LA>

¹⁸ <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=LA>

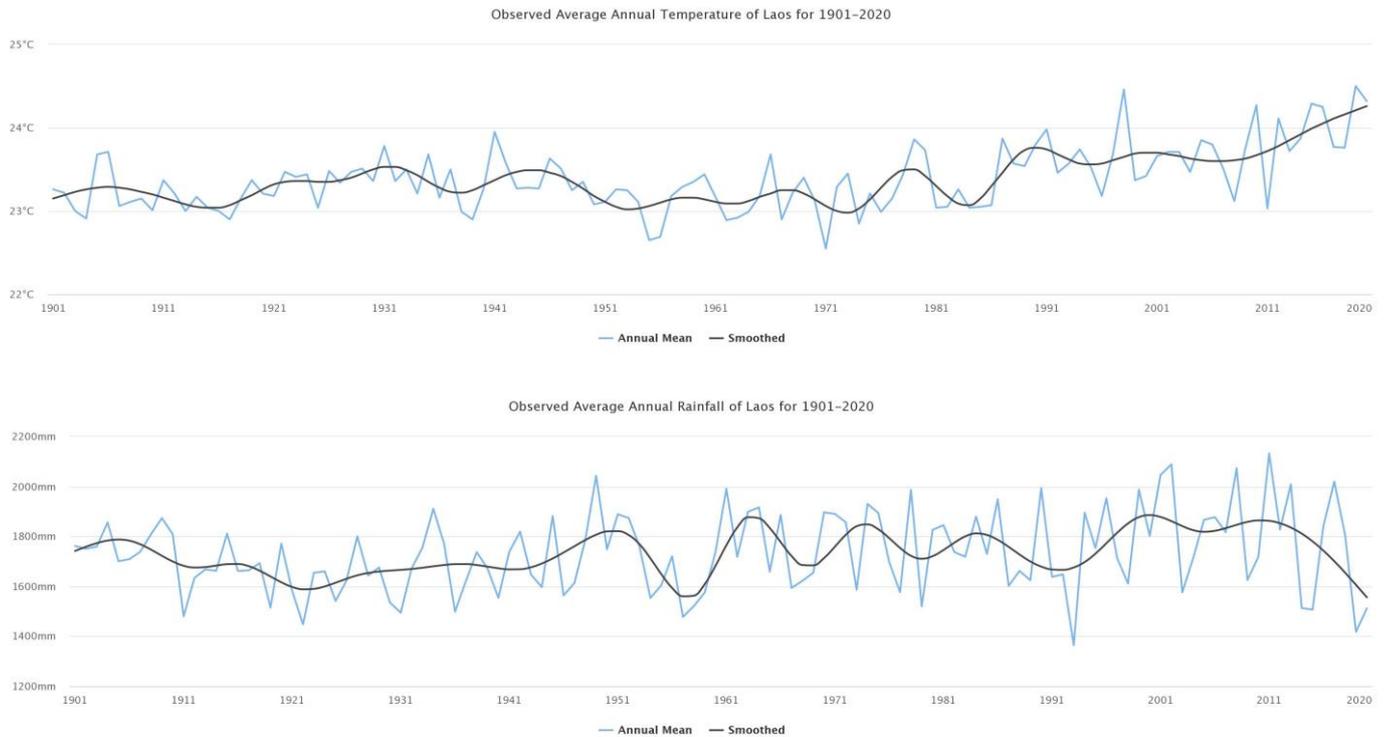
¹⁹ <https://data.worldbank.org/indicator/SL.TLF.TOTL.IN?locations=LA>

²⁰ <https://www.worldbank.org/en/country/laos/publication/laos-pdr-poverty-profile-and-poverty-assessment-2020#:~:text=Poverty%20in%20Lao%20PDR%20has,percent%20during%20the%20same%20period>

²⁰ <https://climateknowledgeportal.worldbank.org/country/laos/climate-data-historical>

1). There have not been any discernible trends in national-level rainfall over the 1901-2020 period (Figure 1). The soon-to-be-published Climatology and Agro climatology Atlas of Lao PDR²¹ ('FAO-MAF Atlas' hereafter) provides additional insight into climate change during 1990-2019:

- The northern region experienced higher temperature growth compared to the central and southern regions, and the increasing rates of minimum temperature are much higher than the ones of maximum temperature. Many northern areas are even showing more than 0.8 °C increase in minimum temperature for the 30-year period.
- Rainfall in northern and central regions has stayed the same or slightly decreased, while southern region shows increasing total rainfall with more than 30 mm increase in some areas.
- Monsoon onset dates have been delayed in 13 out of 18 provinces.



Decade	Average mean temperature (°C)	Temperature change per decade (°C)	Average mean rainfall (mm)	Rainfall change per decade (mm)
1901-10	23.21	-	1,776.36	-
1911-20	23.14	-0.07	1,655.77	-120.59
1921-30	23.37	0.23	1,616.07	-39.71
1931-40	23.34	-0.03	1,668.18	52.11
1941-50	23.42	0.08	1,743.47	75.29
1951-60	23.13	-0.28	1,670.82	-72.65
1961-70	23.15	0.01	1,783.32	112.50
1971-80	23.25	0.11	1,776.06	-7.26
1981-90	23.33	0.08	1,773.85	-2.21
1991-00	23.64	0.31	1,736.24	-37.61
2001-10	23.69	0.05	1,839.84	103.60
2011-20	23.96	0.28	1,758.14	-81.70

Figure 1. Annual mean temperature and rainfall in Lao PDR, 1901-2020.

Source: <https://climateknowledgeportal.worldbank.org/country/laos/climate-data-historical>

Exposure to natural disasters. Lao PDR is exposed to several climate extremes including heatwaves,²² floods, droughts tropical cyclones and landslides. It is ranked 69th out of 191 countries by the 2019 Inform Risk Index, including ranking 6th in exposure to flooding (riverine and flash).²³ During 1970-2010, Lao PDR experienced 33 natural hazards (mostly floods and droughts), affecting approximately 9 million people and causing damages over US\$ 400 million (CCWP, 2020). Average annual losses from disasters are around 1–2% of GDP, most of which is due to flooding.²⁴ The number of people affected by climate-related disasters has increased from an average of 60,000 per year during 1993-2002 to over 320,000 in 2003-2012.

²¹ FAO and MAF, forthcoming. Climatology and Agro climatology Atlas of the Lao People's Democratic Republic. Vientiane

²² Heatwave is defined as a period of three or more days where the daily temperature is above the long-term 95th percentile of daily mean temperature (World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR).

²³ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

²⁴ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

6. Flood hazard mapping that presents flood severity in terms of inundation depth and area with respect to 10-year, 25-year, 50-year and 100-year return periods has identified eight river basins and a number of districts at risk²⁵. Floods induced by tropical storms are frequent and severe: 20 extreme floods occurred between 1960 and 2012, affecting 3.5m people.²⁶ On average, the population annually affected by flooding is estimated at 48,000 people and the annual damages are \$159 million.²⁷ Furthermore, the costs of flood are increasing: the combined damage of floods induced by storm Son Tinh, storm Podul and tropical depression Kajiki in 2018 and 2019 is estimated at US\$535.5 million,²⁸ compared to US\$400 million caused by all natural hazards during 1970-2010 (discussed above).
7. The distribution of rainfall during the wet season is often erratic, leading to drought periods. At present, Lao PDR faces an annual median probability of severe meteorological drought of around 4%.²⁹ Drought can occur throughout the country, with southern and northern parts of the central region and southern parts of the northern region susceptible to drought during both dry and wet seasons (ADPC, 2012). A 2006 study conducted by the World Food Programme (WFP) found that about 46% of the rural population is vulnerable to drought (WFP, 2006). The extreme drought conditions in the northern and central regions in 2003 resulted in US\$ 16.5 million in damages. Apart from rainfall, drought exposure in Laos is impacted by hydropower development on the Mekong River, which significantly alters the hydrology of the region.³⁰
8. Lao PDR is also vulnerable to landslides due to combined slope and weather conditions, especially during the monsoon season. About 5.2% of the country is prone to very high landslide susceptibility, mainly in the southeast and central regions (ADPC, 2012). Landslides are particularly damaging to the transport network and the communities dependent on it.³¹ Epidemics, including pests and diseases, are another threat. Based on the pest and disease occurrence reports from the Plant Protection Center (PPC) under the Ministry of Agriculture (MAF), total rice area affected by insect pests and diseases during 2019-2021 was 9,300 ha and 250 ha, respectively. Outbreaks of fusarium wilt disease affected more than 8,000 ha of banana in 2019.
9. **Projected changes and future risks.** Projections by 23 General Climate Circulation Models under the recent Coupled Model Intercomparison Project 6 (CMIP6) Shared Socioeconomic Pathways (SSP) 585 scenario in Lao PDR – corresponding to the high emission scenario of the representative concentration pathway (RCP) 8.5 in CMIP5 show a 1-3°C temperature increase for 2040-2069 period and 2-6°C increase for 2070-2099 period (see Figure 2). The projections also indicate greater variation of yearly rainfall (1,933-4,204 mm/year for 2040-2069 period and 2,029-4,441 mm/year for 2070-2099 period, compared to 1,948 mm/year for 2000-2019).³² Overall, climate change is expected to: i) increase the frequency and intensity of extreme rainfall events,³³ with consequent increase in frequency and severity of floods; ii) increase temperatures and decrease rainfall during the dry season, leading to longer and severe droughts; iii) increase the incidence and range of pests and diseases, and iv) present new challenges related to water storage or transfer mechanisms due to rising temperatures.³⁴ More specifically:
 - The median probability of a heatwave (currently at around 3%) is projected to increase significantly under different emission pathways (see Figure 3). In addition, days of maximum temperature above 90% of historical distribution are projected to increase from 41 days per annum during 2000-2019 to 73-116 days for 2070-2099.³⁵ The general increase in temperatures suggests a transition to a chronically heat-stressed environment.³⁶
 - For droughts, projections suggest that the return periods of 12-month droughts could reduce.³⁷ The increasing trend of potential evapotranspiration and monsoon onset date and significant annual variation of rainfall will increase the occurrence of severe droughts in the near future.³⁸
 - For floods, CMIP6 SSP585 scenario projects greater daily rainfall intensity (up to 26-28 mm/day, compared to 9 mm/day for 2000-2019), which may increase the risk of flash or surface flooding and associated landslides.³² Another study using the CMIP5 RCP8.5 under the RCP8.5 emissions pathway found that climate change is expected to double the annual affected population to over 80,000 people and increase annual damages by \$295 million by the 2030s; if impacts of increasing urbanisation and economic development are taken into account, these figures are likely to be higher.³⁹

²⁵ UNDP, 2010, ACDP, 2012, National risk profile of Lao PDR

²⁶ Storm Xangsane in 2006 caused severe floods in central and southern Lao PDR, storm Ketsana in 2009 caused an estimated damage of US\$ 58 million, and a severe flood in 2011 caused by typhoons Haima and Nokten affected 12 provinces

²⁷ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR

²⁸ Floods induced by storm Son Tinh in 2018 hit 55 districts in 13 provinces and caused US\$371.5 million in economic losses, with agriculture and forestry bearing 57% of the total losses. Flooding due to storm Podul and tropical depression Kajiki in 2019 caused damages estimated at US\$164 million (https://laopdr.un.org/sites/default/files/2019-08/2018%20PDNA_English.pdf; <https://laos.opendevlopmentmekong.net/topics/disasters-and-emergency-response/>).

²⁹ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR

³⁰ DeRISK SE Asia: Climate Change in Lao PDR, <https://deriskseasia.org/cc.html>.

³¹ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR

³² DeRISK SE Asia: Climate Change in Lao PDR, <https://deriskseasia.org/cc.html>.

³³ World Bank modelling projects an increase of up to 23% (under the highest emissions pathway) in the amount of rainfall accumulated during extreme rainfall events (World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR)

³⁴ <https://climateknowledgeportal.worldbank.org/country/laos>

³⁵ DeRISK SE Asia: Climate Change in Lao PDR, <https://deriskseasia.org/cc.html>

³⁶ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR

³⁷ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR

³⁸ FAO and MAF, 2021. Climatology and Agroclimatology Atlas of the Lao People's Democratic Republic. Vientiane

³⁹ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

- Projected increase in the amount of rainfall accumulated during extreme rainfall events (up to 23% under the highest emissions pathway) may increase the risk of flash or surface flooding and associated landslides.⁴⁰

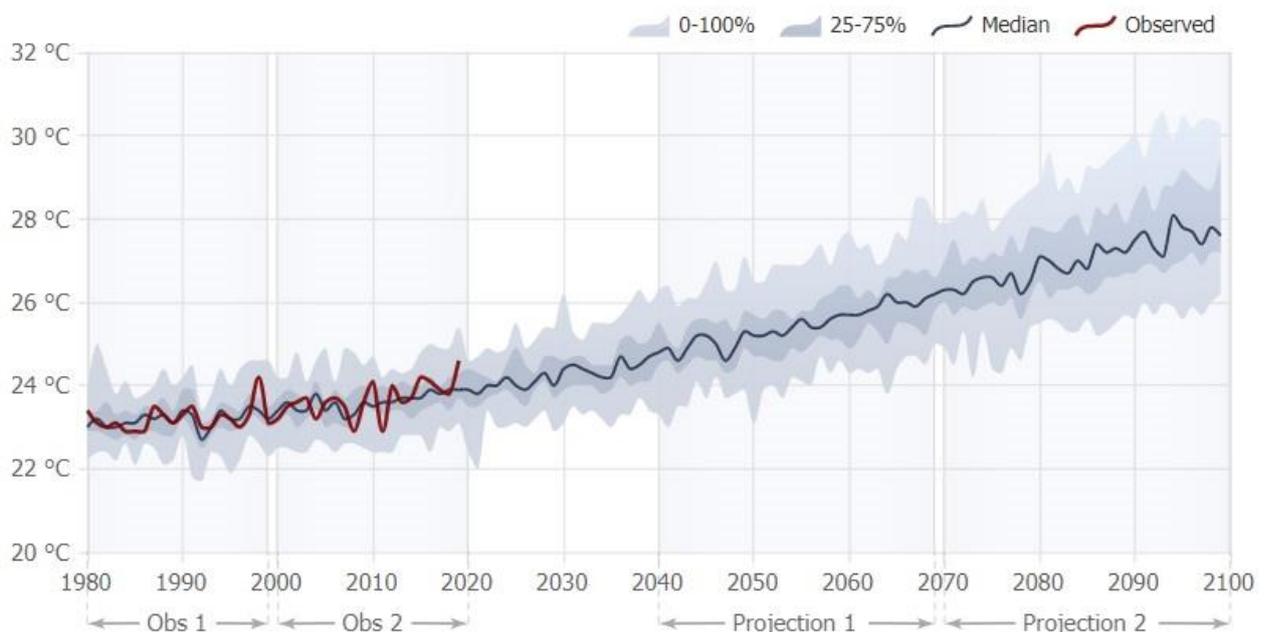


Figure 2. Annual mean temperature in Lao PDR using the SSP585 scenario, 1980-2100

Source: <https://deriskseasia.org/cc.html>

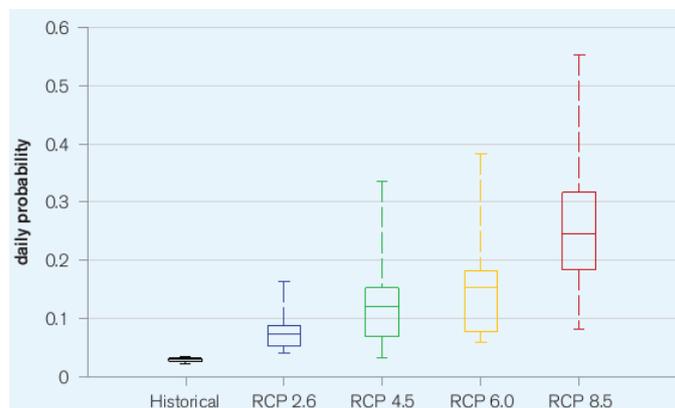


Figure 3. Projected change in the probability of observing a heat wave in Lao PDR for the period 2080–2099.

Source: World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

- GHG emissions.** Lao PDR is a relatively small contributor to climate change compared to its neighbours: in 2018, its total emissions were 38.63 mega-tonnes of carbon dioxide equivalent (MT CO₂eq), compared to 364.43 MT in Vietnam and 431.22 MT in Thailand. Energy is the largest source of emissions (47.6%), followed by agriculture (24.8%) and land use

⁴⁰ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

change and forestry (24.2%).⁴¹ While the country has been implementing mitigation measures to curb its emissions, climate change mitigation is outside the scope of this project (which focuses on climate resilience).

Vulnerability of agriculture

11. According to the Asian Development Bank (ADB), the agriculture, natural resources and rural development sector in Lao PDR is characterized by (i) geographically scattered production due to the country's topography and weak linkages to urban populations and regional markets, (ii) a heavily rice-based production system with limited diversification of component that is also constrained by limited access to irrigation in the dry season, and (iii) a heavy dependence of the population on the sector for employment and food.⁴²
12. Rice represents 60% of agricultural land, 50% of agricultural output and 80% of all farmers. Other major crops include maize, cassava, banana, citrus, watermelon and coffee; in addition, niche products such as garlic, cardamom and ginger are cultivated in geographic pockets with favourable cultivation and market conditions.⁴³ A large part of the 960,000 ha wet-season rice area is rain-fed and cultivated for subsistence, and limited irrigation coverage results in only 4% of the wet-season area being cultivated in dry season. Lack of road access (particularly in the north where the terrain is already difficult) hampers market integration and increases food insecurity by i) preventing remote households from accessing markets and ii) preventing surplus production in lowlands from being shipped to uplands⁴⁴. Livestock production accounts for 18% of agriculture GDP and includes water buffalo, pigs, cattle, and poultry. Commercial livestock production has developed around major towns and cities such as Vientiane, supplying meat, eggs, and milk to the urban population. Significant cross-border livestock trade is expanding with the China and Viet Nam, with further potential growth if reproductive and survival rates continue to improve. Commercial livestock production is growing with expanding cross-border trade with PRC, Viet Nam and Thailand.⁴⁵
13. The key impact of droughts on agriculture is crop stress and yield losses, as the majority of Lao agriculture is rain-dependent. This shock affects paddy rice harvest most severely, leading to food shortages.⁴⁶ As an example, the severe drought of 2015 (partly driven by a strong El Niño event) damaged tens of thousands of hectares of upland, rice, and fruit crops. While regular floods are beneficial as long as they come at the right time and are not too strong, extreme floods cause significant rice losses and paddy field damage. Households in flooded areas also experience loss of livestock due to drowning and flood-related diseases,⁴⁷ and floods exacerbate soil erosion from cultivation of maize and cassava on slopes. For example, extreme flooding in 2013 damaged 15,000 ha of rice crop, killed thousands of livestock and affected over 350,000 people.⁴⁸
14. Changes in climatic patterns have both seasonal and long-term impacts on agricultural livelihoods, particularly for those dependent on rain-fed crops. Shifts in the start of the monsoon season make it difficult for farmers to know when to plant crops from year to year, and may lead to a longer dry periods exacerbating drought. Similarly, changes in seasonality of rainfall increase flood risks and impact livelihoods in terms of food availability, access to health and education, and other income opportunities.
15. These impacts are expected to worsen with climate change due to projected further increase in frequency and severity of floods and droughts (as discussed above), which is likely to lead to crop failure and livestock losses. Furthermore, modelling of climate suitability of major crops in Lao PDR (paddy rice, maize, cassava and coffee) under SAMIS project (described below) shows that in many areas, these crops face the risk of becoming marginal or not suitable under the projected climate changes. Figure 4 illustrates the changes in climate suitability for rice and coffee cultivation over the 2010-2090 period under the RCP8.5 climate scenario.

⁴¹ https://www.climatewatchdata.org/ghg-emissions?end_year=2018®ions=LAO§ors=total-including-lucf&start_year=1990

⁴² <https://www.adb.org/sites/default/files/institutional-document/480141/lao-pdr-agriculture-assessment-strategy-road-map.pdf>

⁴³ Karan Sehgal, 31 March 2021.

⁴⁴ <http://reliefweb.int/sites/reliefweb.int/files/resources/Food%20and%20Nutrition%20Security%20Atlas%20of%20Lao%20PDR,%20Septem%20ber%202013.pdf>; https://ipad.fas.usda.gov/highlights/2011/12/Lao_PDR_13Dec2011/#:~:text=LAOS%3A%20Sustainability%20of%20Future%20Rice%20Production%20Growth%20and%20Food%20Security%20Uncertain&text=Despite%20the%20inherent%20shortage%20of,to%20significantly%20higher%20national%20production.

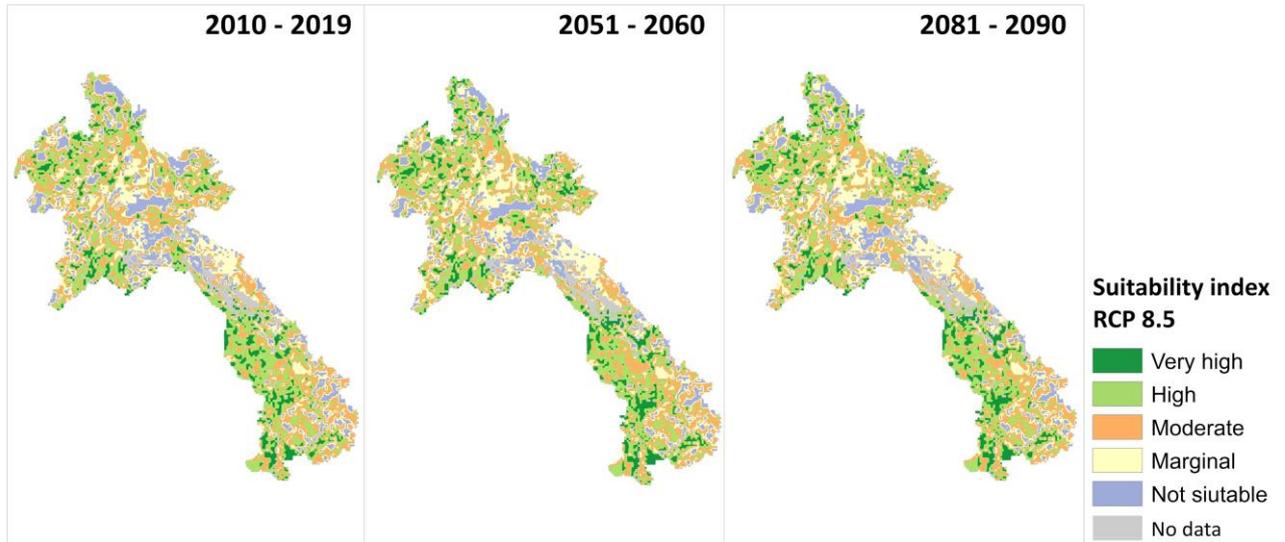
⁴⁵ Current livestock trade is significantly underreported with cross-border movement of livestock mostly avoiding international border gates. ADB (2018), 'Agriculture, natural resources, and rural development sector assessment, strategy, and road map - Lao People's Democratic Republic'.

⁴⁶ www.gripweb.org/gripweb/sites/default/files/Lao_RiskProfile_Part2.pdf

⁴⁷ <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp178397.pdf>

⁴⁸ World Bank and ADB (2021), Climate Risk Country Profile: Lao PDR.

Short variety Suitability of paddy rice



Suitability of Coffee (Robusta)

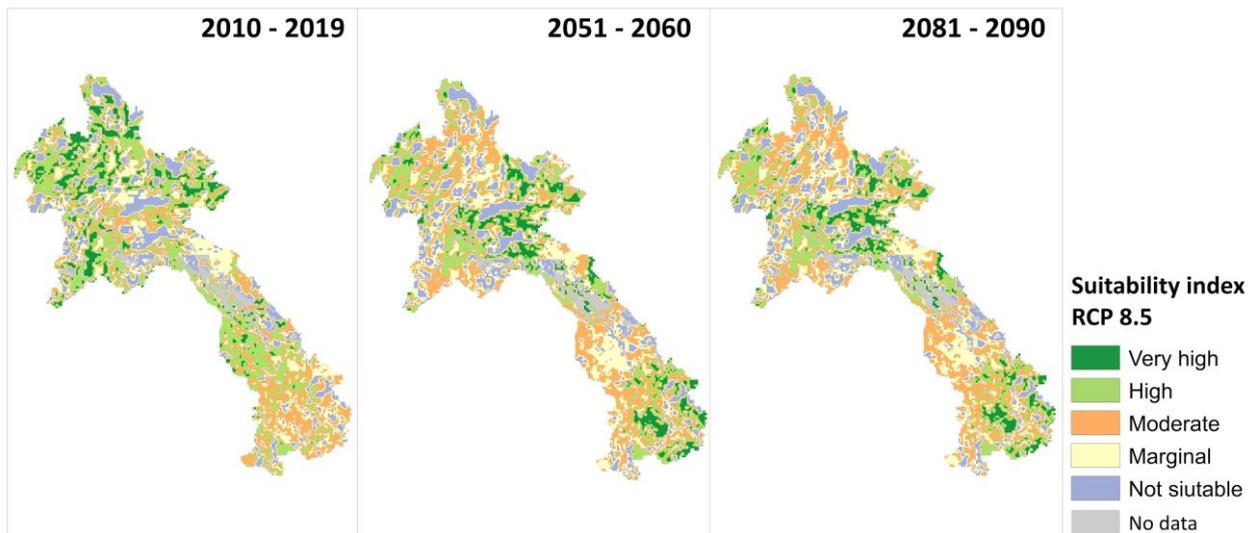


Figure 4 – Climate suitability of rice and coffee cultivation in Lao PDR, 2010-2090 (RCP8.5 climate scenario)
Source: DALAM and FAO SAMIS 2021

16. A recent study by Department of Agricultural Land Management (DALAM), National Agriculture and Forestry Research Institute (NAFRI), International Centre for Tropical Agriculture (CIAT) and FAO⁴⁹ suggests low adaptive capacity of agricultural livelihoods in Lao PDR. An adaptive capacity index was calculated by evaluating farmers’ performance against three defining conditions: i) capacity to satisfy their basic needs (food security and water security), ii) capacity for innovation (stemming from access to information and communication technologies, attitudes to innovation, financial resources, and technical assistance), and iii) capacity for action (stemming from access to agricultural diversification, financial resources, management practices and supporting infrastructure). Annex 1 displays the results of the study.

Impacts of COVID-19

17. Lao PDR has so far avoided a COVID-19 health crisis, but the pandemic-induced economic downturn has affected the country through multiple channels including commodity price, tourism, trade and investment, exchange rates and lower remittances. Lao PDR’s economic growth in 2020 was -0.5%,⁵⁰ with the pandemic impacts further aggravating the long-standing structural macroeconomic vulnerabilities of Lao PDR that stem from high fiscal deficit and public debt levels as well as low reserve buffers. A sharp drop in the performance of the travel, tourism and hospitality sectors (accounting for 11% of total employment and 22% of employment in urban areas) has caused widespread job losses, with unemployment

⁴⁹ FAO, CIAT, MAF and MONRE, 2021. Atlas of Agricultural Livelihood and Climate Risk of Lao PDR. FAO Laos, under publication, draft available [here](#).

⁵⁰ <https://www.adb.org/countries/lao-pdr/economy>

surging from 2% to 25%.⁵¹ About 214,000 additional people are projected to fall into poverty as a result of the pandemic. Hardest hit are vulnerable people, particularly the poor and those engaged in daily labour activities and the informal economy which constitutes 82.7% of the country workforce⁵². Early evidence suggests that COVID-19 has affected essential service delivery and disproportionately impacted women.⁵³ Since the outbreak, more than 200,000 migrant workers (mostly female) have returned⁵⁴, resulting in an estimated reduction of up to US\$125 million in remittances (0.7% of GDP); this has reduced recipient household income, particularly in rural areas.

18. Exports account for about one-third of Lao PDR's GDP (2016 data)⁵⁵. Following the outbreak of COVID-19, there was a substantial decrease in cash crop exports (from US\$109 in March 2020 to US\$42 million in April 2020). Plantations that produce cash crops are mostly run by Chinese companies employing contract farmers in the northern part of Lao PDR. Due to border closures, many fields are empty, with consequent decreased labour opportunities for Lao workers and the ability to trade with China⁵⁶.

National climate change strategies

19. Key Government of Lao PDR (GoL) documents related to climate in agriculture include the first Nationally Determined Contribution (NDC), Lao PDR National Adaptation Programme of Action (NAPA) and the 2019 Decree on Climate Change.⁵⁷ The NDC and NAPA⁵⁸ identify agriculture, forestry, water resources, and health as the most vulnerable and thus priority sectors for adaptation. Both documents highlight floods and droughts as primary climate hazards that have adverse impacts on agriculture, livelihoods and food security.
20. The GOL 9th National Strategy for Socio-Economic Development and Vision 2030 also gives priority to the agricultural sector as key for an innovative, green and sustainable economic growth of the country. The subsequent Agriculture Development Strategy 2025 and Vision to 2030, whose intended results are being validated using the SAMIS data, highlights the transition from subsistent to commercial production, developing clean, safe and sustainable agriculture and shifting to a resilient and productive agriculture economy, linked with rural development.
21. Climate change is also addressed in the national legislation, policies and plans related to disaster management. These include the 2020 Law on Disaster Management, the draft National Disaster Risk Reduction Strategy 2021-2030 and the 9th National Socio-Economic Development Plan (NSED) 2021-2025.⁵⁹

Barriers to climate-resilient agriculture (CRA) in Lao PDR

22. The review of relevant literature⁶⁰ has shown that low levels of productivity and lack of climate resilience among Lao farmers are largely due to lack of income-enhancing climate-resilient practices such as crop diversification (with predominance of rice, which is generally a low-return crop⁶¹), safe commodity storage and processing. The causes of this are numerous⁶² and include the lack of farmer access to high-quality agromet services. In the short term, agromet services improve agricultural productivity and climate resilience by informing farming practices (e.g., when to plant, harvest or apply fertilizer)⁶³ and giving farmers and agriculture officers time to prepare for imminent hazards such as droughts, floods and

⁵¹ <https://www.dfat.gov.au/sites/default/files/covid-response-plan-laos.pdf>

⁵² <https://www.wfp.org/publications/covid-19-rapid-assessment-food-security-and-agriculture-lao-pdr>

⁵³ <https://www.worldbank.org/en/country/lao/publication/covid-19-to-impact-lao-pdr-growth-debt-in-2020-new-world-bank-report>

⁵⁴ <https://reliefweb.int/report/lao-peoples-democratic-republic/lao-peoples-democratic-republic-returning-migrants-survey-2>

⁵⁵ <https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=LA>

⁵⁶ <https://www.wfp.org/publications/covid-19-rapid-assessment-food-security-and-agriculture-lao-pdr>

⁵⁷ <https://data.laos.opendevloppementmekong.net/dataset/decree-on-climate-change-lao-pdr-2019#:~:text=The%20decree%20determines%20the%20principles,properties%2C%20environment%2C%20biodiversity%2C%20and>

⁵⁸ <https://unfccc.int/resource/docs/napa/laos01.pdf>

⁵⁹ Goal 4, Priority 3 of NSED 2021-2025 is 'increasing disaster prevention, control and recovery'.

⁶⁰ ADB (2018), 'Agriculture, natural resources, and rural development sector assessment, strategy, and road map - Lao People's Democratic Republic'; World Bank (2018), 'Commercialization of Rice and Vegetables Value Chains in Lao PDR: Status and Prospects';

https://climateknowledgeportal.worldbank.org/sites/default/files/2018-10/wb_qfdr_climate_change_country_profile_for_LAO_0.pdf;

<https://climateknowledgeportal.worldbank.org/country/laos/impacts-agriculture>; <https://www.adaptation-undp.org/resources/assessments-and-background-documents/laos-pdr-national-adaptation-programme-action-napa>; Lao Government (2015), 'Decree on Endorsement and Declaration of the Agriculture Development Strategy to the year 2025 and Vision to the year 2030'.

⁶¹ A 2018 World Bank study in Khammouane and Vientiane provinces found that cultivation of non-glutinous rice delivered farm-gate net profit of \$108.74 per ha, compared to \$385.18 for lettuce and \$5,156 for coriander (World Bank. 2018. Commercialization of Rice and Vegetables Value Chains in Lao PDR: Status and Prospects)

⁶² The causes include poor transport infrastructure (which limits food trade); farmer's lack of knowledge of and access to energy- and water-saving technologies such as solar water pumps and drip irrigation; lack of access to high-quality inputs such as improved seeds, fertilizer and pesticide; poor fertilisation and pest management practices; lack of reliable water access, as HVCs require irrigation; lack of farmer knowledge on how to cultivate HVCs, due to inadequate extension services; lack of farmer connectivity to HVC value chains, due to lack of horizontal integration (farmer cooperatives and producer groups) and vertical integration (contracts with large-scale buyers); lack of farmer capital to switch to HVCs, due to high establishment costs and lack of access to finance; and HVCs not being adequately considered and encouraged in government land use planning. See Annex 7 'Project problem tree and links to project components' for further detail.

⁶³ For example, a 1998 study on lettuce production in New York found a 10% productivity increase when farmers took into account weather forecasts to schedule irrigation (Wilks, D.S. and Wolfe, D.W. 1998. Optimal use and economic value of weather forecasts for lettuce irrigation in a humid climate. Agricultural and Forest Meteorology, 89, 115-130). In a more recent study in Kerala State, India, farmers who received agromet advisory services experienced a 19-34% growth in income compared to the control group (Dupdal et al. 2020. Perception and Economic Impact of Agromet Advisory Services: A Case Study of Thrissur AICRPAM Centre of Kerala State. Indian

pest infestations. In the long-term, crop suitability projections which incorporate impacts of climate change allow farmers and land-use planners to make better-informed decisions about crop and variety selection. Overall, the absence of high-quality agromet services increases the risk of crop losses due to lack of integration of weather and climate patterns in the decision-making of farmers and land-use planners, whilst also slowing down the transition to alternative, high-value crops (HVCs) such as fruits and vegetables.

23. The reasons behind the lack of farmer access to high-quality agromet services include:

- Insufficient infrastructure for weather monitoring and analysis. Only 80 weather stations are currently operating;⁶⁴ in comparison, the United Kingdom (whilst having the same area as Laos and being much less mountainous) has over 200 operating stations.⁶⁵ IT systems for development of flood and drought forecasts are also lacking.
- Limited awareness and dissemination of available data to better inform evidence-based planning and decision-making for policy makers and agricultural value chain (AVC) actors. The GOL has made progress in developing data for users at different levels to make more informed decisions about how to mitigate weather and climate risks to AVCs. However, gaps remain: work to date, while national in scope, has focused on specific crops and field level users and has been limited largely to sites where project support has facilitated information dissemination and farmer support activities. These gaps create challenges for timely decision making in response to extreme climate events and limited the possibilities for the full range of AVC actors to anticipate and respond to near and longer term climate risks. There is significant potential to expand the use and application of the knowledge and data being produced by the Ministry of Natural Resources and Environment (MONRE) to for wider range of users and purposes at the national scale through awareness raising and farmer support.
- Access to inter-sectoral data is challenging in the absence of clear institutional mandates, coordination and a culture to manage, share and communicate data for decision making. GoL, with donor funding, has strengthened weather monitoring and forecast systems through the Department of Meteorology and Hydrology (DMH) at MONRE. However, these systems do not integrate agriculture information and hence are insufficient for agriculture needs. While high-level inter-ministerial coordination on climate change exists, there is a lack of technical-level coordination to facilitate sharing and joint production of data and information required for effective climate change adaptation. Different information systems, including spatial information, are developed by donor projects but these are not integrated and not always accessible for planning.
- Limited capacity of the agriculture sector to provide farmers with the information and extension services required for adaptation actions in the transitioning agriculture system. Extension services are provided through provincial and district agriculture and forestry offices. The quality of services provided is hampered by staff, budgetary, and institutional limitations, with operational costs of the services highly dependent on external financing.⁶⁶ The provided agricultural information systems are nascent at best.

Baseline investments and remaining gaps

24. Several ongoing projects are seeking to improve the meteorological and hydrological sector functionality, harmonization and information system integration (a complete list is provided in Annex 3). Funded by a range of agencies such as the World Bank, Adaptation Fund, Korea Meteorological Institute, Climate Risk and Early Warning Systems (CREWS) and Lakang-Mekong Cooperation, these projects largely address the infrastructure and communication aspects required for the provision of general climate services and information management and data collection improvement at the national level. Provision of last mile services is not a key focus of these projects and none are targeting the specific infrastructure and information needs of the agricultural sector and AVCs. This project would build on these projects to provide infrastructure, capacity and services targeting a wide range of agricultural stakeholders and last mile users (farmers) of agrometeorological services, directly addressing barriers to climate adaptation in the agriculture sector. In particular, the complementarities with the WFP project 'Leveraging Forecast Based Early Action for Reduced Vulnerability in Lao PDR (FBEA) – currently under design for submission to GCF – are detailed in Annex 9.
25. A number of non-agromet projects seeking to improve productivity and climate resilience of Lao farmers are also planned or ongoing. Funded by a range of agencies including World Bank, ADB, United Nations Development Programme (UNDP), and International Fund for Agricultural Development (IFAD) and FAO, these projects and government-led initiatives largely address most of the above-mentioned causes of low productivity and climate resilience. However, these projects do not fully integrate a full range of agrometeorological services across their target value chains and their geographic targeting is uneven. More detail is provided in Annex 3. The impact of these projects and associated GOL initiatives will be expanded through collaboration with this project; such collaboration will be explored during proposal preparation.
26. With donor funding, GoL has improved the national hydro-meteorological network, and there are some pipeline projects to enhance the multi-hazard early warning systems (see Annex 3 for detail). Nevertheless, these investments do not focus on the agriculture sector's needs. The ongoing FAO **SAMIS project** (2017-2021, US\$5.5 million, funded by GEF-LDCF) seeks to address this gap. Specifically, the project aims to (i) strengthen agro-climatic monitoring, analysis, communication

Journal of Extension Education, vol. 56, No. 3, pp.10-16).

https://www.researchgate.net/publication/345050304_Perception_and_Economic_Impact_of_Agromet_Advisory_Services_A_Case_Study_of_Thrissur_AICRPAM_Centre_of_Kerala_State.

⁶⁴ Monica Petri, 4 November 2021 (personal communication).

⁶⁵ <https://www.metoffice.gov.uk/weather/learn-about/how-forecasts-are-made/observations/weather-stations>

⁶⁶ ADB (2018), 'Agriculture, natural resources, and rural development sector assessment, strategy, and road map - Lao People's Democratic Republic'.

and use of data and information for decision making in agriculture and food security; (ii) strengthen institutional and technical capacity for monitoring and analysis of agriculture production systems including food security vulnerability and development of Land Resources Information Management Systems (LRIMS) and agro-ecological zoning (AEZ); and (iii) promote knowledge management and dissemination of information and lessons learned for planning, monitoring and evaluation (M&E). The project has established the following agro-climate services for agriculture and food security in Lao PDR:

- **The Lao PDR Climate Service for Agriculture (LaCSA, www.lacsa.net)** has consolidated available data from all weather stations as well as agriculture data into a central database at DMH. It also develops agromet advisory bulletins comprising of forecasts and farming management recommendations and early warnings (short-term) in both English and Lao language. The services are available for decision makers at national and provincial levels and the public through DMH dissemination channels, as well as a dedicated app⁶⁷ in the following forms:
 - A seasonal bulletin for each of the 17 provinces, updated at the end of every month (see Figure 5);
 - A weekly bulletin for each district with weather forecast, CRA recommendations (for up to six crops, varied from one province to another) and pest and diseases risk advisories, with a total of 141 bulletins produced in English and Lao language every week automatically by the LaCSA system (see Figure 5).
 - The bulletins are also made accessible to farmers in the project target provinces through low-cost dissemination channels such as community loudspeakers, school posters (drawing on WFP's school feeding programme) and farmer groups. Farmer groups are a reliable source of information, particularly important for farmers who have limited access to broadcasted bulletins due to remoteness of their households.
 - LaCSA bulletins are proving effective in changing farmer practices: the project survey found that over 84% of interviewed farmers value the advisories regardless of dissemination channels, and over 85% of them have changed their farming practices as a result of access to the bulletins.⁶⁸ Agromet services have also allowed the government to proactively react to the predicted (or monitored) disasters, as well as allowing farmers to act on them by using their own measures (pesticide, drainage improvement, practicing water saving activities, etc.).

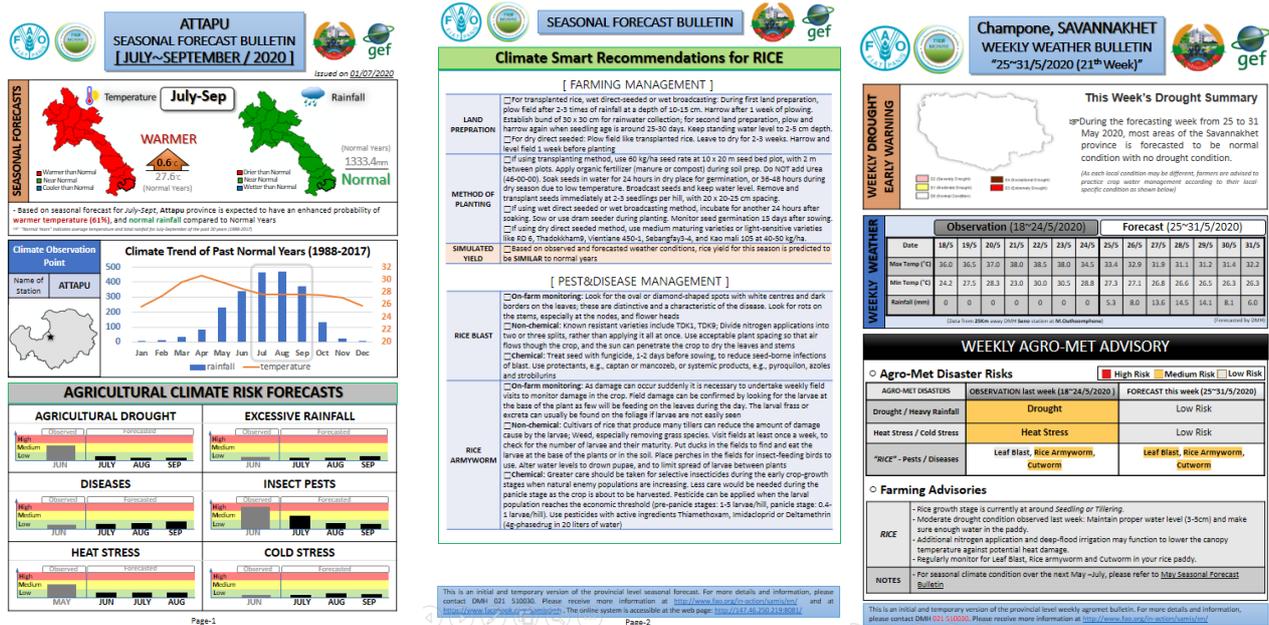


Figure 5 – Samples of seasonal and weekly LaCSA bulletins. Source: SAMIS.

- **The Land Resources Information Management System (LRIMS, <http://lrims-dalam.net/>)** produces long-term forecasts of crop distribution and productivity by under different climate scenarios (up to year 2090), thus informing future agriculture development pathways. Managed by DALAM, the system includes high-quality downscaled information such as 5 km resolution daily maps⁶⁹ for the last 30 years of rainfall, temperature and relative humidity. It has also gathered information on the exposure of the agricultural systems to climatic hazards and impacts of projected climate changes on food security. Initial training has been provided to GoL officials to plan and legislate the use of alternative foresight planning and alternative future narratives.

⁶⁷ The LaCSA app is freely available at https://play.google.com/store/apps/details?id=com.fao.lacsa_app and <https://apps.apple.com/sg/app/lacsa/id1573693442>. While the use of text messaging was originally considered, it has been tested by UNDP and is more expensive than using an app. The LaCSA app also collects near real-time information about crop cycles and pest and disease outbreaks from farmers (i.e. it is two-way), which is more difficult with text messaging. Preliminary discussions have been held with Lao Telecom and Unitel about providing nationwide free access to the LaCSA. The companies showed initial interest, and this possibility will be explored further during project design.

⁶⁸ Two reports that provide detail on farmers' stated benefits from the use of LaCSA are currently under publication. Quantification of farmer benefits from the use of LaCSA services (e.g. higher yields) is a complex process due to attribution issues and has not been done to date; it will be explored during proposal design, potentially with the use of case studies.

⁶⁹ The 5 km resolution was selected to match the weather station density of the climatological data (km² per DMH weather station) that was used to produce the dynamically downscaled information.

- MAF is producing weekly videos on SAMIS and discussing about use of data to plan investments that are green and sustainable. These videos are screened every Thursday in the Lao National Television. Further detail on SAMIS is provided in Annex 2.
27. SAMIS is a pilot project that seeks to identify whether LaCSA and LRIMS are technically viable and have sufficient demand from farmers and policy makers. Now that this has been established, the proposed project seeks to institutionalise the production and use of LaCSA and LRIMS information in decision-making. Lessons learned from SAMIS and other relevant projects point to the following gaps:
- Further infrastructure improvements are needed for high-quality agromet forecasts, advisories and early warnings. This includes installation, repair and upgrade of weather stations, strengthening the crop production monitoring system through annual satellite mapping using machine learning, and upgrading of the information technology (IT) system to develop harmonized flood and drought forecasts. As a LDC with a severely constrained public budget, Lao PDR has limited resources to invest in such infrastructure.
 - There is a need to expand dissemination of agromet services provided by LACSA beyond the four pilot provinces. Given the ongoing transition from subsistence to commercial agriculture, dissemination should target not only farmers but also contractors, farmer organisations, etc.
 - There is an urgent need to institutionalize and develop capacities for the use of agro-climate information and services in agriculture planning and extension. This includes training and development of policies and standard operating procedures (SOPs). For example, although LRIMS has been established, there is a lack of standardized system for using this information (which could inform policymakers).

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

Project expected results

28. The **goal** of the project is to increase climate resilience and food security of 2.33 million agricultural households in Lao PDR via increased adoption of climate-resilient practices and climate-responsive policies, plans and regulatory frameworks. The project rationale is as follows: **'IF** timely, accurate and actionable integrated climate information is available, **THEN** vulnerable farmers and other agricultural value chain actors in Lao PDR will be able to improve their climate resilience and food security **BECAUSE** policies, planning, investment decision-making and adoption of adaptive farming systems are informed by scientific evidence, agro-meteorological advisories and multi-hazard early warning'.
29. The project's **three interlinked expected outcomes** are:
- 1) Capacity to produce a range of agro-climate advisory products and foresight scenarios enhanced
 - 2) Systems to deploy agriculture advisories for a range of agri-value chain actors strengthened
 - 3) Capacity for anticipatory planning and policy for more resilient agri-food value chains over different geographic and temporal scales strengthened
30. Agro-met bulletins produced through LaCSA will be disseminated nation-wide, and central-level foresight planning will also benefit the nation as a whole. Admittedly, the project does not address other barriers to the uptake of climate-resilient practices (poor transport and irrigation infrastructure, lack of market access, etc.). To ensure that these barriers are already being addressed for targeted farmers and other AVC actors, the location-specific project activities (specifically, components 2.2 and 3.3) will seek to target villages already covered by other ongoing non-agromet projects described in Annex 3. This will also ensure that the project is addressing a concrete need and that the outcomes of these projects are further strengthened through the strategic use of GCF resources. Conversations with other donors on this collaboration have already begun⁷⁰ and will continue during project proposal design. If there are obstacles to such collaboration, the project will potentially focus on villages for which non-agromet barriers to climate resilience have already been addressed (e.g. villages which were involved in recently completed projects).
31. Smallholder farmers, most of whom are poor, are the main beneficiaries of the project. Off-farm AVC actors – including suppliers of inputs (seeds, fertilizer, pesticide, machinery), traders and commodity buyers – will also benefit directly (via targeted agromet services) and indirectly (via improved productivity of farmers). To ensure the needs of the private sector are met, private sector representatives will be consulted throughout project design and implementation, e.g. during design of new agromet advisories under component 1.2, and during design of agromet dissemination activities under component 2.1.
32. The project's theory of change and problem tree are provided in Annex 6 and 7, respectively, while its components and activities are described below.

Outcome 1: Capacity to produce a range of agro-climate advisory products and foresight scenarios enhanced

⁷⁰ In a meeting between ADB and FAO on 4 November 2021, an upcoming ADB 'Flood and Drought Management and Mitigation Project' was discussed. Scheduled to commence in 2023, the project will work with MAF's Department of Irrigation and MONRE's DMH, and will cover Vientiane Capital and Khammuane and Boulikomsai provinces. A preliminary agreement on collaboration with the proposed project was reached, including i) the use of LaCSA bulletins by targeted farmers, and ii) improving LaCSA modelling for irrigated areas (personal communication with Monica Petri, 7 November 2022).

Component 1.1 – Strengthen agro-climate monitoring and integrated information systems

This component will provide strategic investments to strengthen the monitoring network, and complete and sustain the data production system established by SAMIS. Up to 40 weather stations⁷¹ will be repaired and upgraded to include additional agrometeorological sensors to capture needed soil moisture and wind data. Up to 30 new weather stations with agrometeorological capabilities consistent with World Meteorological Organization (WMO) standards will be installed, with locations determined based on AEZ.⁷² To manage the expanded monitoring network and increase the analytical and advisory producing capacity of GOL (daily and seasonal weather forecasts, agro-met indices, expanded range of crops/commodities etc.), the calibration lab and IT systems in DMH and DALAM will be expanded and upgraded. Advanced training to support the operation and maintenance (O&M) of the observation network and data processing, analysis and reporting activities will be provided to DMH and DALAM staff.

1.1.1. Repair and upgrade key weather stations that are critical for strengthening the agrometeorological monitoring network.⁷³

1.1.2. Install 30 additional weather stations with agrometeorological capability and provide training for their operation and maintenance.

1.1.3. Upgrade IT systems in the GIS laboratory of the Climatology and Agro meteorology Division of DMH, and develop SOPs for their operations and maintenance.

1.1.4. Upgrade IT systems in the GIS laboratory of DALAM for the LRIMS, and develop SOPs for their operation and maintenance.⁷⁴

Component 1.2 – Expand the scope of the LaCSA system to additional agri-food value chains and off-farm activities

Under this component, the scope of the LaCSA system will be expanded to provide advisories for a wider range of agricultural commodities, beyond what those currently covered under the SAMIS project⁷⁵, as well as the livestock sector. The project will target commodities promoted under other ongoing projects including vegetables, tea, legumes and bamboo. The new information will be included in weekly and monthly agromet bulletins.

Separate weekly and monthly bulletins will be developed for off-farm AVC actors, including private seed companies, suppliers of inputs (seeds, fertilizer, pesticide and machinery), traders and commodity buyers. The bulletin will provide information for off-farm activities such as storage (e.g. humidity forecasts, and mitigating measures such as fan systems and dehumidifiers) and transportation (e.g. extreme rainfall advisory, and mitigating measures such as food storage technologies during transportation). The use of LaCSA advisories in MAF's breeding and variety selection programmes will also be explored.

Lastly, a feedback mechanism will be developed to collect and provide farmers and off-farm actors with up-to-date information on market prices and import and export requirements for commodities covered by LaCSA.

1.2.1. Incorporate agromet advisory information for vegetables, tea, legumes, bamboo and livestock into weekly and monthly LaCSA bulletins.

1.2.2. Develop agrometeorological advisory bulletins for input suppliers and traders.

1.2.3. Develop a feedback mechanism for dissemination of commodity prices and trade requirements.

Component 1.3 – Enhance tools and capacities to develop adaptation options for key agri-food value chains based on foresight and scenario modelling

This component will develop new data, information and tools required for foresight planning. This will include: a process for continued crop mapping at regular intervals with machine learning algorithms developed by SAMIS; a process to develop cropland cover map as DALAM/MAF monitoring tool for biannual and annual agricultural planning; and an improved soil map based on SAMIS training. Further information and tools will be developed to support the monitoring of the agricultural sector against NSEDP targets. Climate scenario modelling based on additional Intergovernmental Panel for Climate Change (IPCC) scenarios – to supplement three RCPs already covered under LRMIS – will be generated.

Through the foresight planning and scenario narrative exercise, MAF officials will be able to define additional information required for planning including a set of additional scenarios based on AEZ using the Python Package tool for AEZ (PyAEZ)

⁷¹ The final number of weather stations to be repaired and/or upgraded will depend on the number of malfunctioning stations at the time of proposal design (to be verified via a field mission). During project implementation, DMH will produce a list of automatic sensors which require replacement and contact a company which produced them to undertake the works.

⁷² With the support of the Korea Meteorological Administration, DMH has developed a master plan which identifies sites for installation of future weather stations nationwide. Sites were determined based on AEZs, with at least one weather station located within each AEZ and under a specific district authority. Topography of AEZs was also considered to ensure that variations in climate conditions are represented, thus providing more accurate agromet services to the farmers in those areas. During project preparation, DMH will conduct a detailed feasibility study and determine the exact location of the new stations and will conduct initial negotiations with local authorities to obtain the required land concessions.

⁷³ This activity will be completed in compliance with the GoL Law n. 36/NA on Meteorology and Hydrology (2017) and WMO standards.

⁷⁴ This activity will support DALAM integrate a range of databases into a comprehensive network of online GIS national databases to produce geospatial data for decision makers.

⁷⁵ SAMIS activities currently cover rice (upland, rain-fed and irrigated), cassava, maize, coffee (upland), banana, cabbage and pumpkin, as well as impact of heatwaves on livestock. For further detail, see <https://www.fao.org/3/cb5888en/cb5888en.pdf>.

software. Additional scenarios will include crops currently not covered under SAMIS that GoL might want to test in the field, crop management schemes, and livestock modelling. Studies of the agro-environmental impacts of planned agricultural development such as irrigation development or plantations schemes will be undertaken as part of alternative futures.

Lastly, university students will be trained to produce agromet advisories and incorporate climate change information in planning. National University of Lao PDR (NUOL) has a long standing curriculum on meteorology, but does not have sound training on climatology and use of climate and agro-climate. By targeting university students who are interested in working as District Office of Agriculture and Forestry (DAFO) and District Office of Natural Resources and Environment (DONRE) officials in rural areas or as agriculture advisors for the private sector, this activity seeks to improve sustainability of LaCSA and LRIMS activities. To this end, an interdisciplinary team consisting of government officials from DMH, DALAM and other departments will be created at the NUOL. This team will design and deliver courses on producing and using agromet advisories, foresight planning, RCP, climate scenario downscaling and climatological statistics. The courses will be incorporated into the curriculum of NUOL's Faculty of Agriculture and Faculty of Meteorology, and delivered by the members of the team. This activity will be co-financed by NUOL.

1.3.1. Improve crop, cropland and soil mapping.⁷⁶

1.3.2. Undertake climate scenario modelling based on additional IPCC scenarios based on existing methodologies⁷⁷.

1.3.3. Develop alternative futures for other key agri-food value chains, including livestock.

1.3.4. Improve capacity of future government officials and agriculture advisors to produce agromet services and foresight planning

Outcome 2: Systems to deploy agriculture advisories for a range of agri-value chain actors strengthened

To achieve this outcome, access to LaCSA and early warnings by farmers, agricultural input suppliers and extension officials will be scaled up across Lao PDR using proven cost-effective dissemination channels. The subsequent adoption of CRA technologies and practices and risk management strategies by farmers and off-farm actors will be facilitated via relevant training.

Component 2.1: Establish nation-wide dissemination of agro-meteorological advisories and early warnings targeted to a range of value chain actors

To date, data produced in the LaCSA component of the SAMIS project has been diffused at village level in small pilots, testing different diffusion means (farmer field schools, loud speakers, school posters, phone apps)⁷⁸. This component will expand LaCSA dissemination to achieve 100% village coverage in Lao PDR.⁷⁹

To this end, the last phase of the SAMIS project is working on data co-production protocols for crop calendars and pest and disease management, to be based on input from district offices and farmer. A similar process to expand the data collection to post-disaster information at the district level and incorporate this information into LaCSA will be developed. A guideline on linking agricultural advisories with early warnings and on the use of loudspeakers to disseminate LaCSA bulletins will be developed by the Department of Labour and Social Welfare within the Ministry of Labour and Social Welfare (MLSW). This guideline will be applicable to Disaster Management Committees at central, provincial, district and village levels.

Experience under SAMIS confirms that loudspeakers are the best delivery channel for agromet advisories and early warnings. Therefore, 1,000 additional loudspeakers will be purchased and installed to support villages in need. Village Disaster Management Committees of MLSW⁸⁰ will be trained – using the above-mentioned guideline and with involvement of MoNRE's Department of Climate Change (DCC) – to disseminate weekly and monthly LaCSA bulletins using loudspeaker systems. The project will also expand the dissemination of LaCSA information through magnetic school posters, with 8,500 posters distributed to 1,500 schools; this activity will draw on the WFP "School Feeding Programme", with WFP and the Ministry of Education to provide support to monitoring visits. Lastly, dissemination will be promoted via coaching of farmer groups. Improved access to LaCSA information will allow farmers to make more-informed farm management decisions (e.g. which varieties and crops are most suitable given the climate variability and weather patterns, and whether or not to invest in irrigation).

This component will also develop a mechanism to disseminate off-farm agromet bulletins developed under activity 1.2.3 to a full range of AVC actors such as suppliers of inputs, traders and commodity buyers. This activity will be piloted in selected districts; if deemed useful, a national-level rollout will follow, with a fee-paying system considered for long-term operational funding.

2.1.1. Develop protocols and guideline for incorporating disaster risk information into LaCSA and LRIMS.

⁷⁶ FAO and MAF, 2021. Atlas of Agricultural Land Cover. FAO Laos, under publication, draft available [here](#).

⁷⁷ FAO, MONRE and MAF. Atlas of Climate of Lao PDR. FAO Laos, under publication, draft available [here](#).

⁷⁸ CIAT and FAO, 2022. Adoption of climate services in Laos. A study on the use of the LaCSA tool. FAO Laos, under publication, draft available [here](#).

⁷⁹ While this target may seem ambitious, it has been examined in detail and agreed by the SAMIS team. According to MLSW and MAF, installation of loudspeaker systems in 100% of the villages is a realistic target.

⁸⁰ Village Disaster Management Committees (VDMCs) are assigned by the village head and lead disaster management activities at the village level. This includes implementing relevant regulations and plans, collecting data and providing emergency support during disasters. Equivalent Disaster Management Committees operate at district, provincial and central levels of government.

2.1.2. Scale up dissemination of LaCSA information to farmers and extension officials through community loudspeakers, school posters and farmer group coaching.

2.1.3. Develop a dissemination mechanism to distribute agro-met advisories to off-farm value chain actors.

Component 2.2: Promote application of agro-meteorological advisories and risk management actions across the agri-food value chain

This component will facilitate farmer and off-farm application of LaCSA advisories, targeting selected districts with expanded LaCSA advisories developed under component 1.2. Farmers will be reached via farmer groups: the project will work with MAF Department of Technical Extension and Agro-Processing (DTEAP) Training Center and NAFRI to develop training materials for farmer groups and train the trainers in Provincial Offices of Agriculture and Forestry (PAFOs) and DAFOs. These trainers will then facilitate farmers to form farmer groups (where these do not already exist), and will provide training on the use of agromet advisories for at least 2 seasons.⁸¹ The trainers will then monitor adoption and collect feedback from farmers. Off-farm actors in the targeted projects will be trained by PAFO and DAFO officials. A 'training of trainers' (ToT) training manual developed under SAMIS and based on pilot activities will be used.⁸² To ensure that non-agromet barriers to climate resilience are already being addressed for targeted farmers and other AVC actors, the activities will seek to target villages covered by other ongoing donor-funded projects or villages which were involved in recently completed projects.

2.2.1. Develop and deliver a ToT programme for application of LaCSA advisories to PAFOs and DAFOs in selected districts.

2.2.2. Facilitate farmer group training in uptake of LaCSA advisories.

2.2.3. Facilitate training in uptake of LaCSA advisories by off-farm actors.

Outcome 3: Capacity for anticipatory planning and policy for more resilient agri-food value chains over different geographic and temporal scales strengthened

Planning and policy-making in the agriculture sector will be improved via greater integration of agro-climate information. To this end, central-level government officials will be trained on strategic foresight and scenario-based planning using LRIMS. The use of LRIMS to define alternatives will be integrated into the national planning system. Lastly, the uptake of Participatory Forest and Agriculture Land Use Planning, Allocation and Management (FALUPAM)⁸³ – which entails participatory forest and land use planning at the village and village cluster level – will be increased to climate-proof land-use planning at the village level.

Component 3.1: Strengthen government capacity for climate-responsive planning at multiple time scales

This component will build the capacity of MONRE, MAF and MLSW officials on strategic foresight and scenario-based planning at multiple time scales using LRIMS. The SAMIS project has developed a step-by-step guidance to help GoL officials make more-informed decisions by using LRIMS scenarios to define alternatives; based on this guidance, a training programme will be developed by DALAM and NAFRI in collaboration with other entities.⁸⁴ Training modules will be aligned with responsibilities of each ministry, e.g. training of MLSW will focus on improving disaster forecasting and early warnings. Training will be delivered to MONRE, MAF and MLSW officials at central and provincial levels. ToT will also be provided to MAF and PAFO officials for subsequent training of DAFO officials and village leaders.

3.1.1. Develop and deliver a training programme on strategic foresight and scenario-based planning using LRIMS to MONRE, MAF and MLSW officials.

3.1.2. Deliver ToT on strategic foresight and scenario-based planning to MAF and PAFO officials.

Component 3.2: Incorporate climate-responsive planning into government policies, regulatory frameworks and reporting

As mentioned above, the SAMIS project has developed a step-by-step guidance to help GoL make more-informed decisions by using LRIMS scenarios to define alternatives. Activities 3.2.1 and 3.2.2 will integrate this decision-making process into the national planning system.

LRIMS scenarios can also be used to improve GoL's reporting to the United Nations Framework Convention on Climate Change (UNFCCC) under the Paris Agreement's Enhanced Transparency Framework (e.g. the Biennial Transparency Report). A protocol will be established to ensure that LRIMS-informed setting of adaptation priorities, targets, strategies and actions are reflected in GoL's reports to UNFCCC.

Lastly, SAMIS is using foresight scenario to develop a set of data and indicators that can be repeatedly produced or modelled to monitor the targets set by the national Agriculture Development Strategy. Based on SAMIS result, a new monitoring process will be formally established to measure the achievement of targets set under the national Agriculture Development Strategy related to enhanced climate resilience.

⁸¹ Different donors tend to use different training schemes for agriculture training, with FAO using farmers groups and farmer field schools. Exact recipients of the training (e.g. farmers or village technicians) can be modified during detailed design depending on DTEAP's preference.

⁸² FAO, 2021. Training manual - agrometeorology for agriculture extension officers. FAO Laos, under publication, draft available [here](#).

⁸³ FALUPAM has been implemented in Laos since 2011, and currently covers 250 villages in 10 provinces. For further detail, see <https://www.tabi.la/activities/land-use-planning/land-use-planing/>.

⁸⁴ This will include Department of Planning and Legal Affairs (DOPLA) and Faculty of Agriculture at NUOL, among others.

- 3.2.1. Develop MAF policies and protocols facilitating the use of LRMIS data and alternative futures scenarios in agriculture planning at multiple scales.
- 3.2.2. Pilot the use of provincial-level Agriculture Land Investment Plans during the design of provincial Socio-Economic Development Plans.
- 3.2.3. Establish a protocol for incorporating climate-responsive adaptation scenarios into UNFCCC reporting under the Paris Agreement.
- 3.2.4. Establish a climate-focused monitoring system for the national Agriculture Development Strategy.

Component 3.3: Expand the uptake of Participatory Forest and Agriculture Land use planning, allocation and Management (FALUPAM) to climate-proof land-use planning

Through SAMIS, DALAM has modified the FALUPAM tool to incorporate future climate scenarios in the land-use planning process.⁸⁵ SAMIS has tested and piloted the new tool in several villages. This component will support the uptake of FALUPAM at 300 villages, which will climate-proof land-use planning and prevent un-harmonized planning at the village level. Village selection will be undertaken in consultation with DALAM (a leading department for FALUPAM implementation) and MONRE's DCC, and will include a review of existing planning processes. ToT on the FALUPAM process will be provided to PAFO and DAFO officials, and the FALUPAM process will be facilitated. Links between FALUPAM and national- and provincial-level planning activities under component 3.2 will be established to ensure their complementarity.

- 3.3.1. Train PAFO and DAFO officials in the FALUPAM process.
- 3.3.2. Conduct FALUPAM in 300 villages.

Implementation arrangements

33. A simple schematic of the project's implementation arrangements is provided in Figure 6 below. FAO has been asked by GoL to be the project Accredited Entity (AE). FAO with its technical expertise will also be an Executing Entity.
34. From GoL, MONRE (with DMH as the lead department) will implement the project with support from MAF (DALAM and other relevant departments) and with targeted support from other national agencies such as MLSW as well as MONRE and MAF units at the provincial and district levels.
35. The SAMIS Project Steering Committee (PSC, chaired by MONRE with membership of MAF) and Project Management Unit (currently housed at the DMH) will be reviewed and expanded to enable effective implementation of the project.
36. The leading agencies at the national, provincial, district and village level will vary for each sub-component and activity; further detail is provided in Annex 8.

⁸⁵ FAO, University of Utrecht and CCAFS, 2022. Workbook on foresight planning at village level using decision support scenarios. FAO Laos, under publication, draft available [here](#).



Figure 6 – Project implementation arrangements

Risks and risk mitigation measures

37. Risk assessment has been conducted through the SAMIS project and no major grievances were recorded. Close cooperation among concerned ministries, FAO and other partners has been established through SAMIS. Agro-ecological CRA practices that have been applied in Lao PDR will be promoted. A full Environment and Social Risk analysis including gender and indigenous people will be performed for the full proposal. Below are initial risks identified and mitigation measures.

Risk	Risk level	Mitigation measures
GoL will not allocate sufficient budgets to ensure that production and dissemination of agromet advisories continue after project completion.	Medium	During the proposal stage, an O&M plan of the established agromet system (weather and agromet stations, IT systems and other equipment) will be developed together with concerned ministries and departments. The plan will include gradually decreasing human and financial resources to the project and increasing contributions by the GoL over the project lifetime, resulting in for full coverage by the GoL at the end of the project. An insurance scheme paid by GoL will be put in place to cover the risk of malfunctioning of the weather stations after their warranty periods.
Development of legal instruments for foresight planning and their imbedding into GoL's planning and regulatory frameworks (activity 3.2.1) will not receive the necessary cooperation and support from MAF.	Low	For MAF, the process of changing agricultural planning by incorporating the use of LRMIS data has already begun. This includes the use of foresight planning in crop strategic plans, development of a monitoring plan for agriculture targets under NSEDP, and development of a project monitoring information system for MAF projects. Close consultations with high-level MAF officials via the PSC will seek to ensure ongoing support.
Piloting the use of provincial-level Agriculture Land Investment Plans during the design of provincial Socio-Economic Development Plans (activity 3.2.2) will not receive the necessary cooperation and support from provincial authorities, specifically Provincial Office of Natural Resources and Environment (PONRE) and PAFO.	Medium	The benefits of the activity will be clearly communicated to relevant DONRE and DAFO officials by the project staff. The required instructions and guidance from MONRE and MAF to DONRE and DAFO will be obtained via the PSC. The Agriculture Land Investment Planning process is rooted in local planning methodologies and supported by various donors (e.g. GIZ and the Swiss Agency for Development and Cooperation).
Implementation of FALUPAM under component 3.3 will conflict with existing land-use planning arrangements in targeted villages.	Medium	Village selection will be undertaken in consultation with DALAM (a leading department for FALUPAM implementation) and DCC, and will include a review of existing planning processes. Links between FALUPAM and national- and provincial-level planning activities will be established to ensure their complementarity. DALAM

		has already tested the FALUPAM process in several provinces and is preparing a guidance booklet.
Major institutional changes in roles of key ministries (MONRE, MAF and MLSW) will disrupt project implementation.	Low	Changes in the roles of key ministries will be closely monitored by the Project Management Unit (PMU) throughout the project. PSC includes representatives of key ministries, and it is expected that any major institutional changes will be raised and addressed in PSC meetings. Because SAMIS has established strong institutional support from the key ministries, follow-on projects are likely to receive support even if institutional changes take place.
Proponents of ongoing and proposed projects that seek to improve climate resilience of farmers will object to dissemination of agromet services to their targeted beneficiaries (component 2.1 and 2.2) and implementation of FALUPAM in their targeted villages (component 3.3). This will mean that non-agromet barriers to uptake of CRA might not be addressed for beneficiaries of this project.	Medium	The exploration of potential collaboration with projects funded by other donors (ADB, World Bank, IFAD, and UNDP) has already begun via bilateral meetings and will be continued during proposal design. The key benefit of collaboration – addressing most (if not all) barriers to the uptake of CRA – will be explained to proponents of other projects as clearly as possible. If there are obstacles to such collaboration, the project will potentially focus on villages which were involved in recently completed projects, i.e. villages for whom non-agromet barriers to climate resilience have already been addressed. Future FAO projects will contain agromet activities.
Off-farm AVC actors are unwilling to participate in project-related training.	Medium	Off-farm actors will be identified, contacted and informed about the benefits of the training well in advance. Training format and timing will be arranged in a manner that suits actors' needs. If needed, participants will be provided with a per diem and/or a travel allowance.

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

Impact potential

- 38. Nation-wide coverage of agromet services and early warning systems to be established under the project is expected to impact all of the agricultural labour force (around 2.33 million people in 2019) and their dependents. These households are expected to experience greater climate resilience, higher agricultural productivity, consequent increases in income, and better preparedness for climate extremes. Farmers and off-farm AVC actors in selected districts⁸⁶ will also benefit from dissemination of off-farm agromet bulletins (activity 2.1.3), training on the application of LaCSA advisories (component 2.2) and rollout of FALUPAM land-use planning (component 3.3), thus improving their climate resilience even further.
- 39. More resilient and diversified agriculture production and increased household income are expected to increase vulnerable households' access to nutritious food, expenditures on water, sanitation, hygiene and health care, thus improving their food and nutrition security and well-being. This is critical given Lao PDR's high level of malnutrition.
- 40. The project will promote CRA practices that are agro-ecologically appropriate, resulting in reduced impact of agriculture on ecosystems (e.g. through improved soil, land and water management and IPM). By reduced impacts of floods, droughts and landslides as well as preventing pest and disease outbreaks, the project is expected to improve human health outcomes. In the medium- to long-term, greater uptake of climate-responsive land-use planning is expected to improve productivity of land and other natural resources such as water.

Paradigm shift

- 41. The project will transform the agriculture sector of Lao PDR toward climate resilience through evidence-based planning and decision making at all levels (from village to national). This will be done by achieving nation-wide access to agromet services that have proven effective in triggering adaptive practices by farmers and climate-resilient planning and policy making by government officials. While SAMIS has successfully piloted production and use of agromet data via LaCSA and LRIMS, the project will institutionalise this across the country (covering all villages, as well as a greater number of crops and types of users) and across sectors. At all stages of the AVC, the project will improve understanding and uptake of sustainable and climate resilient practices via better-informed decisions about crop variety selection, pest management and commodity transportation (among others). By incorporating long-term projections of impacts of climate change on crop suitability and exposure of agricultural systems to climatic hazards into planning, it will allow decision-makers to make better-informed policies about land use, with consequent benefits extending beyond the agriculture sector (e.g. via alternative productive use of land which will become unsuitable for agriculture in the future). The proposed training of government officials and university students in generation and use of agromet services and in foresight planning will help institutionalise these activities, thus significantly enhancing the sustainability of project outcomes.

Sustainable Development Benefits

- 42. The project will result in economic, social and environmental co-benefits aligned with the SDGs, in particular:
- 43. Economic co-benefits: Improved access to and use of agromet advice will contribute to increased agricultural productivity along each stage of the AVC in Lao PDR. Specifically, the use of improved agromet advice (e.g. for

⁸⁶ The exact number of these beneficiaries will be determined during proposal design.

additional crops and livestock) by a greater number of farmers will result in increased agricultural productivity (i.e. more farmers cultivating the right crops and in the correct way), leading to higher incomes. Expansion of agromet services to cover a wider range of crops will promote greater cultivation of climate-resilient HVCs (including fruits and vegetables), further increasing farmer incomes. The use of agromet services by off-farm AVC actors will result in their increased productivity (e.g. the use of correct storage and transportation techniques given the projected weather conditions, resulting in reduced commodity losses to spoilage), thus leading to higher incomes (SDG 8). To ensure that other barriers to uptake of CRA (e.g. the necessary road and water infrastructure, inputs and finance) are already being addressed for targeted farmers and other AVC actors – thus allowing for full achievement of potential economic co-benefits – the project will seek to collaborate with ongoing donor-funded projects (described in Annex 3). The conversations with such projects have commenced⁸⁷ and will continue during proposal design. If there are obstacles to such collaboration, the project will potentially focus on villages which were involved in recently completed projects, i.e. villages for whom non-agromet barriers to climate resilience have already been addressed.

44. Greater use of early warnings will reduce economic losses caused by natural disasters, including droughts and floods. The use of climate-responsive anticipatory planning by GoL will result in medium- and long-term productivity benefits, by ensuring that land use reflects anticipated changes in climate (e.g. not establishing rubber plantations on land where rubber cultivation will become impossible within a decade).
45. **Social co-benefits:** Increased crop diversification and agricultural productivity will reduce malnutrition among farmers, both directly (through increased availability of a wider range of food in the household) and indirectly (by increasing farmer income, thus allowing them to purchase a wider range of food) (SDG 2 and 3). Increased income for farmers and off-farm AVC actors will result in lower rates of poverty nation-wide (SDG 1). By reaching all villages, including those in remote areas, the project will contribute significantly to addressing regional social disparities in Lao PDR (SDG 10), as well as improving agriculture-related education (SDG 4). At the local level, trainings will include a minimum female participation rate of 30%, providing them with necessary know-how on CRA (SDG 5).
46. **Environmental co-benefits:** The use of improved agromet advice will result in higher rates of correct use of agricultural inputs such as water, fertilizer and pesticide, leading to water savings, reduced water and soil pollution (SDG 6), and reduced land degradation. The use of climate-responsive anticipatory planning by GoL should lead to more sustainable use of natural resources such as water, land and forest (e.g. by investing in water efficiency improvements in regions which are likely to suffer from water shortages in the future).

Needs of recipient

47. In 2018, Lao PDR ranked 22nd in the Global Climate Risk Index produced by German Watch for short-term (2018) and 76th for long-term (1999-2018)⁸⁸. It is ranked 79th in the 2021 INFORM risk index⁸⁹ that considers exposure, vulnerability and lack of coping capacity for flood, drought, cyclone as well as earthquake, epidemic and conflict. Although Lao PDR' overall risk is ranked as medium, lack of coping capacity is high (including weak institutional capacity).
48. Impacts of climate-related disasters immensely challenge sustainable development in Lao PDR, affecting food security and nutrition (particularly of the poor and most vulnerable populations). The national disaster risk profile of Lao PDR⁹⁰ identified correlation between disasters (occurrence, people affected, damage and loss) and poverty indicators. In the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) 2019 Asia-Pacific Disaster Report⁹¹ that analyses links between income inequality and disaster risks and inequalities of opportunities and disaster losses for selected countries in the region, Lao PDR is ranked high in both indexes. In the same report, UNESCAP estimates that without disasters, by 2030 Lao PDR would reduce extreme poverty by 71% from the 2016 baseline, compared to a 41% reduction with unmitigated disasters. Climate change will increase frequency and severity of climate-related hazards.
49. Despite the country's progress in economic growth and poverty reduction, Lao PDR is still an LDC with severely constrained public budgets.⁹² Consequently, it has limited resources to invest in climate change adaptation. Private investment in public goods such as agromet services is unlikely in the foreseeable future due to the limited potential of cost recovery. Introduction of high-quality nationwide agromet systems is therefore unfeasible without technical and financial donor support.

⁸⁷ In a meeting between ADB and FAO on 4 November 2021, an upcoming ADB 'Flood and Drought Management and Mitigation Project' was discussed. Scheduled to commence in 2023, the project will work with MAF's Department of Irrigation and MONRE's DMH, and will cover Vientiane Capital and Khammuane and Boulikomsai provinces. A preliminary agreement on collaboration with the proposed project was reached, including i) the use of LaCSA bulletins by targeted farmers, and ii) improving LaCSA modelling for irrigated areas (personal communication with Monica Petri, 7 November 2022).

⁸⁸ https://www.germanwatch.org/sites/germanwatch.org/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_14.pdf

⁸⁹ <https://drmkc.jrc.ec.europa.eu/inform-index>

⁹⁰ <http://www.adpc.net/Igo/contents/Publications/publications-Details.asp?pid=275>

⁹¹ https://www.unescap.org/sites/default/d8files/knowledge-products/Asia-Pacific%20Disaster%20Report%202019_full%20version.pdf

⁹² Average budget deficit increased from about US\$ 50-60 million in early 2000 to US\$ 800-900 million in 2017-2018 (<https://countryeconomy.com/deficit/laos>). The World Bank estimates that COVID-19 impacts will increase the fiscal deficit in 2020 to between 7.5 and 8.8% of GDP, from 5.1% of GDP in 2019. Consequently, debt levels are expected to increase to 65-68% of GDP in 2020 (from 59% of GDP in 2019), which will generate higher debt service obligations (<https://www.worldbank.org/en/country/laos/publication/covid-19-to-impact-lao-pdr-growth-debt-in-2020-new-world-bank-report>). Lao PDR's external debt has grown from US\$ 7.4 billion in 2012 to \$17.2 billion in 2020 (<https://datatopics.worldbank.org/debt/ids/country/laos>).

Country ownership

50. The project is country-driven, as it has been designed at the request of the GoL to institutionalise the proven tools and practices developed under SAMIS. There is a high degree of country ownership for this project as MONRE and MAF are working with FAO on the SAMIS project and consequently recognize the benefits of climate services. The project is aligned with GoL national development priorities in climate change, agriculture and disaster risk management (DRM) sectors, by helping farmers transition from subsistence to market production, increasing food security and livelihoods, promoting adaptation to climate change, and improving DRM. Furthermore, the project aligns with GoL's COVID-19 cross-cutting response and recovery measures which emphasize adopting green and resilient investments and targeting vulnerable smallholders to improve their access to information, services and finance.
51. The NDA of Lao PDR has already reviewed this project concept note and included it in the list of top 5 priority projects in the GCF country programme's 1st financing cycle. After the review, the NDA sent a support letter to FAO as the project Accredited Entity (see Annex 5).

Efficiency and effectiveness

52. The project is highly cost-effective, combining a relatively low cost with the use of proven technologies (e.g. community loudspeakers) and implementation modalities that draw on other ongoing projects. By collaborating with ongoing projects which are addressing other, non-agromet barriers to CRA uptake, the likelihood of successful outcomes (i.e. greater resilience of farmers and other AVC actors) is substantially increased. The farmer training program on the application of agromet advisories (component 2.2) will adapt FAO's tested and documented CRA practices in different AEZs of Lao PDR including available materials in Lao language.

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

53. This project has been developed at the request of GoL. FAO has discussed the project concept with MONRE (the lead implementation agency) and MAF, and has obtained an initial approval from the GCF NDA of Lao PDR (see Annex 5). In addition, MLSW (responsible for the national early warning system) has agreed to participate in the project, acknowledging the links between climate change adaptation and DRM.
54. The SAMIS project carried out surveys of users of agromet advisories and early warnings; high levels of farmer satisfaction with these services provide a strong argument for their expansion nationwide. As part of the Vulnerability and Risk Analysis and other studies under SAMIS, FAO undertook consultations with farmers and other stakeholders that fed into the design of this project. Similarly, findings from consultations under other FAO projects in Lao PDR on agriculture, food security, natural resources management, disaster risk reduction and emergency response have also been utilized.
55. Annex 4 provides a list of government, donor and academia stakeholders. Consultations have commenced and will be completed during the full project proposal development. Active stakeholder engagement will also be undertaken throughout project implementation.

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
Component 1.1	14,000,000	3,000,000	Grant	11,000,000	TBC	TBC
Component 1.2	3,000,000	2,000,000	Grant	1,000,000	TBC	TBC
Component 1.3	5,500,000	3,500,000	Grant	2,000,000	TBC	TBC
Outcome 1 total:	22,500,000	8,500,000		14,000,000		
Component 2.1	3,500,000	3,000,000	Grant	500,000	TBC	TBC
Component 2.2	2,000,000	1,500,000	Grant	500,000	TBC	TBC
Outcome 2 total:	5,500,000	4,500,000		1,000,000		
Component 3.1	1,200,000	1,000,000	Grant	200,000	TBC	TBC
Component 3.2	1,400,000	1,000,000	Grant	400,000	TBC	TBC
Component 3.3	1,400,000	1,000,000	Grant	400,000	TBC	TBC

Outcome 3 total:	<u>4,000,000</u>	<u>3,000,000</u>		<u>1,000,000</u>		
Indicative total cost (USD)	32,000,000	16,000,000		16,000,000		

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

56. The GoL is seeking a GCF grant to institutionalise the successful tools and processes developed and piloted under SAMIS that will significantly improve climate resilience of agriculture-dependent households (who are also the most poor, vulnerable and food-insecure).
57. As discussed in section B.3, Lao PDR has limited resources to invest in climate change adaptation. Without GCF support, GoL would be unable to invest in actions to overcome the multiple institutional, technological and financial barriers to nation-wide adoption of agromet services. Financial support from the GCF will thus directly contribute to the country's current efforts towards improved climate resilience, while the project's value-chain approach keeps investment risk low. The activities included in the project would not be viable at a lower level of concessionality, as revenue-generating activities are not included in the project
58. Investments in climate services (encompassing hydromet and agromet services and early warnings) have proven successful in saving lives, protecting livelihoods and reducing economic losses due to climate-related disasters, as well as enabling long-term adaptation to climate change. The justification of GCF funding requested for this investment in Lao PDR is further supported by a recent study by the World Bank⁹³ indicating the need for hydromet systems modernization investment of between US\$ 1.5-2.0 billion worldwide. The study highlights that better weather, climate and hydrological observation and forecasting could lead up to USD 30 billion in improved global productivity that can be achieved with these services, and up USD 2.0 billion reduced global annual asset losses.

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

59. The project's institutional and capacity building measures address all conditions required for effective operations and sustainability of nation-wide agromet and early warning systems. These include: standardized data, information management and sharing, improved capacity across sectors for joint production and dissemination of climate services, and improved capacity to use climate information and services at all levels – by farmers for increased adoption of CRA and risk management practices, by planners for innovative foresight planning, by policy-makers for climate-responsive policies and regulations, as well as by the private sector for increased investment in CRA.
60. **Sustainability of Outcome 1: Capacity to produce a range of agro-climate advisory products and foresight scenarios enhanced.** During the funding proposal stage, an operations and maintenance (O&M) plan of the established agromet system (weather and agromet stations, IT systems and other equipment) will be developed together with concerned ministries and departments. The plan will include gradually decreasing human and financial resources to the project and increasing contributions by the GoL over the project lifetime, resulting in for full coverage by the GoL at the end of the project. An insurance scheme paid by GoL will be put in place to cover the risk of malfunctioning of the weather stations after their warranty periods. Lastly, training of government officials on O&M of installed equipment has been included under output 1.1.
61. **Sustainability of Outcome 2: Systems to deploy agriculture advisories for a range of agri-value chain actors strengthened.** A high level of ownership by all beneficiaries is expected, as new infrastructure, knowledge and skillsets will be utilized for decision making and planning that will significantly affect their work. Relevant government officials will be trained in dissemination and use of LaCSA bulletins, while farmers and off-farm actors will be trained in their use. Farmers' and off-farm actors' sustained use of the agromet advisories and early warning (and consequent adoption of CRA) will be stimulated by better yields, reduced damage and loss caused by disasters, and improved income. Their sustained demand will in turn stimulate the sustainability of the services provision and dissemination, i.e. the system is expected to become self-sustaining. Training of university students to produce and make use of agromet advisories under component 1.3 will further improve sustainability by improving capacity of future MAF and MONRE officials and private-sector agriculture advisors.
62. **Sustainability of Outcome 3: Capacity for anticipatory planning and policy for more resilient agri-food value chains over different geographic and temporal scales strengthened.** ToT on strategic foresight and scenario-based planning will be delivered to MAF and PAFO officials. The development of a policy and a decree on the use of alternative futures information and scenarios in agricultural planning (outputs 3.1 and 3.2) will further institutionalise this approach. Training of university students to incorporate climate change information in planning under component 1.3 will further improve long-term sustainability.

⁹³ <https://ifms.org/index.cfm/ifms/meetings/past-meetings/ifms-global-meeting-four/all-of-meeting-four-presentations/strengthening-hydromet-in-developing-countries-dr-makoto-suwa/>

63. **Replicability.** The CRA practices to be promoted under the project are designed to be highly replicable. The project will also set up an M&E system which will be result-based and emphasize learning. The information generated from the M&E system (including evidence of impacts) will feed into design of future projects to promote replication of best practices. Strengthening climate services for building climate resilience in agriculture is an important stream of work for FAO in Asia and the Pacific. The approaches, technologies and practices used by SAMIS and this proposed project have the potential for replication in other countries in the region.

D. Supporting documents submitted (OPTIONAL)

- Map indicating the location of the project/programme
- 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

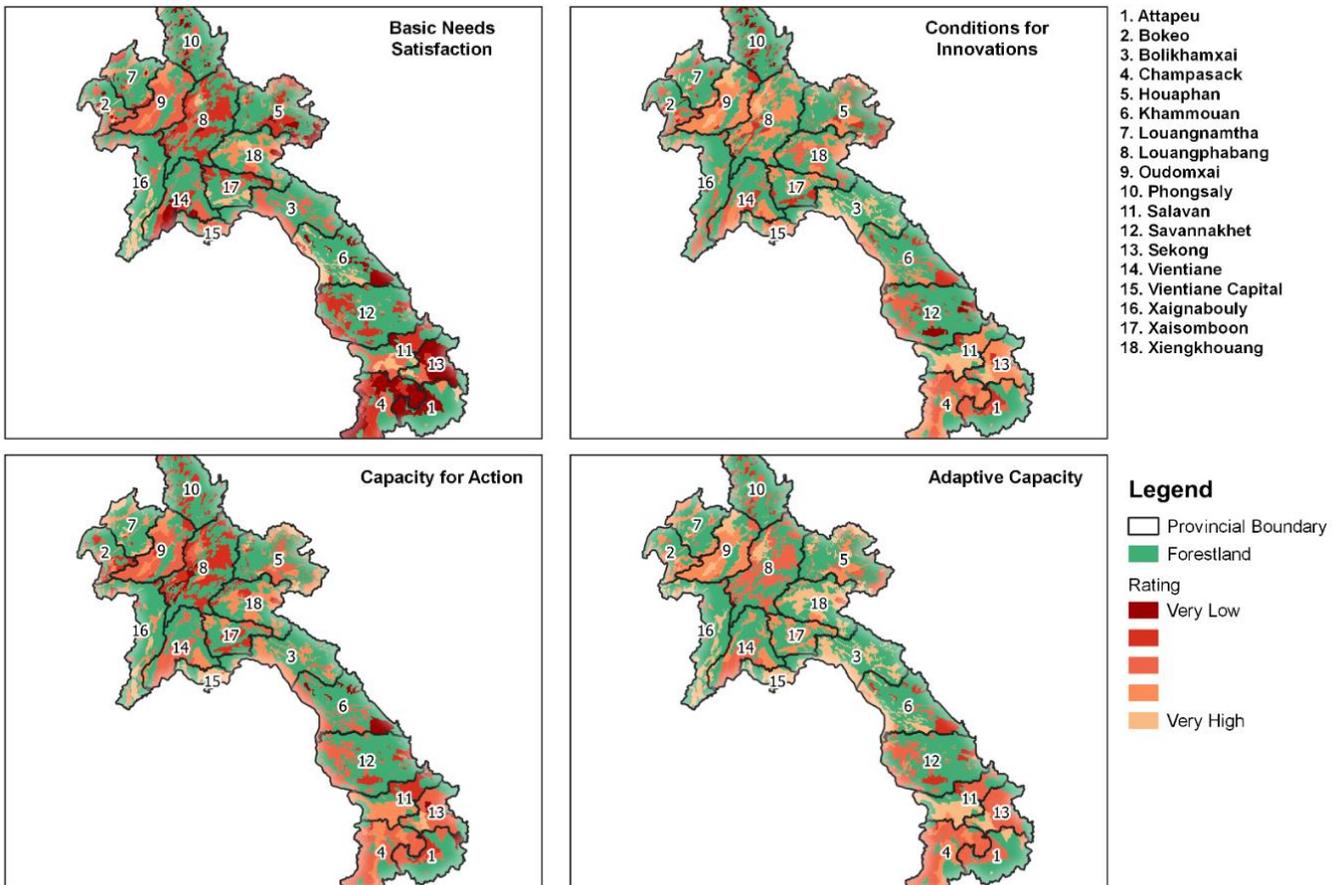
Self-awareness check boxes

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

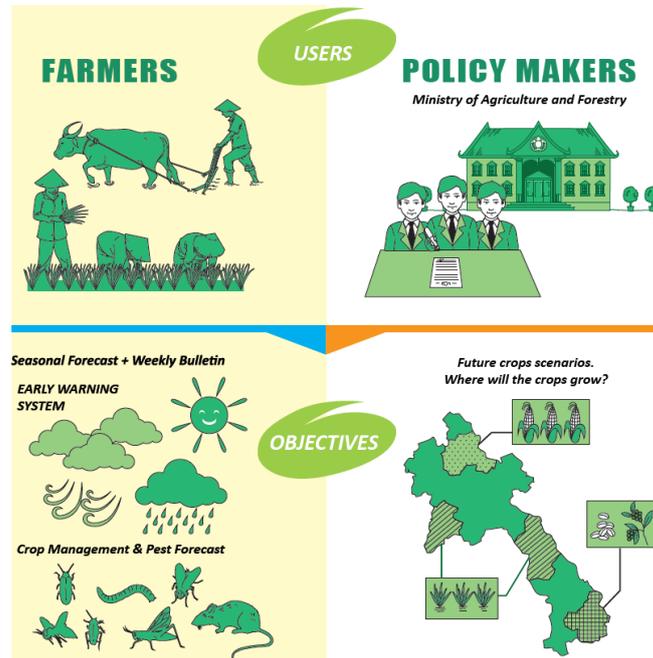
Are you aware that a funding proposal from an accredited entity without a signed AMA will be reviewed but not sent to the Board for consideration? Yes No

Annex 1: Adaptive capacity of agricultural livelihoods in Lao PDR



Source: LRIMS

Annex 2: Summary of FAO SAMIS project

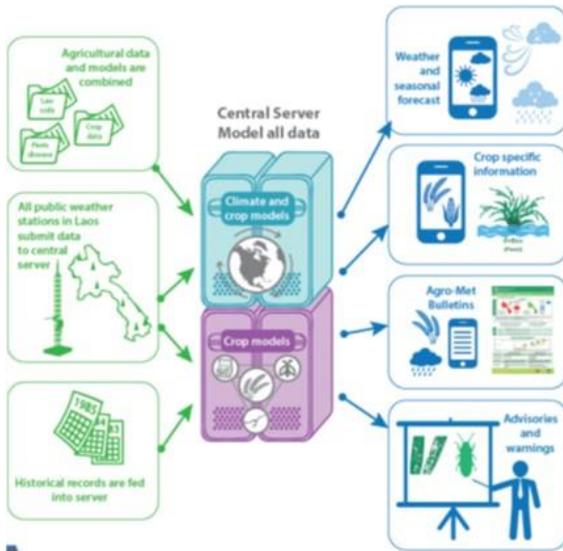


Component 1: Lao Climate Service for Agriculture (LaCSA)⁹⁴ (short-term)

LaCSA was established to support producers, service and input suppliers (e.g. seed producers, agricultural extension services) to take the best course of actions in anticipating climate conditions and hazards. The project has organized and institutionalized data collection from all weather stations in Lao PDR and merged them into a centralized database at DMH. Both recorded historical and newly collected data are used in weather and climate models to generate short- and medium-term weather and seasonal forecasts. Agronomic and agricultural data (e.g. soil, crop, and pest and disease data) are integrated to provide advisories and warnings for farmers and other stakeholders, such as advice for specific crops.

The system also provides management recommendations for the most widely grown crops (rice, cassava, maize, coffee, banana, cabbage), and informs farmers about pest and disease risks and best management options. Moreover, it provides crop-specific indices, such as estimated number of plants growing and maturation days (Growing Degree Days, or GDD), and crop yield forecasts with management recommendations. All information produced by the LaCSA is summarized in a user-friendly format and provided free of cost as weekly or monthly bulletins (see figure below).

⁹⁴ www.lacsa.net



Information generated by LaCSA currently includes:

- Historical climatic data for all stations in the entire country. This includes data from i) 38 manual stations that have been functioning for at least 20 years and that are updated daily for rainfall and temperature by telephone, and ii) 51 automatic stations that are uploaded every hour into LaCSA.⁹⁵ The bulk of the manual station observation is done by the Weather Forecast Division through the “AKAD Lao” app that has been developed by DMH.
- 3-hour forecast for temperature, rain, humidity, cloud cover and wind,
- Daily 7-day forecast for maximum and minimum temperature, rain, humidity and wind,
- Seasonal forecast (over 6 months) with monthly average data on temperature and rainfall,
- Seasonal forecast maps for the whole country with separate predictions for each province,
- Soil data produced by DALAM in map form;
- Crop calendar data for district and provinces produced by NAFRI and DALAM;
- Agricultural statistics from MAF used for validation purposes;
- The monthly pest and disease monitoring report produced at district level by the PPC on the 25th of every month;
- Agro-meteorological indices (‘agromet index’) for each weather station for a given planting date:
 - o GDD, which is a measure of heat accumulation over a period of time to predict plant and pest development rates,
 - o Rainfall amount and distribution,
 - o Drought intensity and length,
 - o Likelihood of insect pest outbreaks,
 - o Plant disease likelihood,
 - o Heat and cold stress likelihood,
 - o Water Stress Index and Evapotranspiration,
- In addition, a Combined Drought Index identifying agricultural drought is generated from Regional Hydrologic Extremes Assessment System (RHEAS) modelling framework using Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) rainfall, National Centers for Environmental Prediction (NCEP) temperature and wind, Soil Moisture Active Passive / Soil Moisture and Ocean Salinity (SMAP/SMOS) soil moisture, and North American Multi-Model Ensemble (NMME) seasonal forecast products;
- Crop recommendations produced by NAFRI, DALAM and CIAT.

This information is delivered via the following knowledge products:

- A seasonal bulletin for each province of the country, updated at the end of every month, for a total of 17 bulletins produced in English and Lao language every month,
- A weekly bulletin for each district with weather forecast, climate-smart agriculture recommendations and pest and diseases risk advisory, for a total of 141 bulletins produced in English and Lao language every week. Bulletins are produced automatically by the LaCSA system, completed with crop forecasts and recommendations, including crop phenology, yield estimates and different management scenarios.

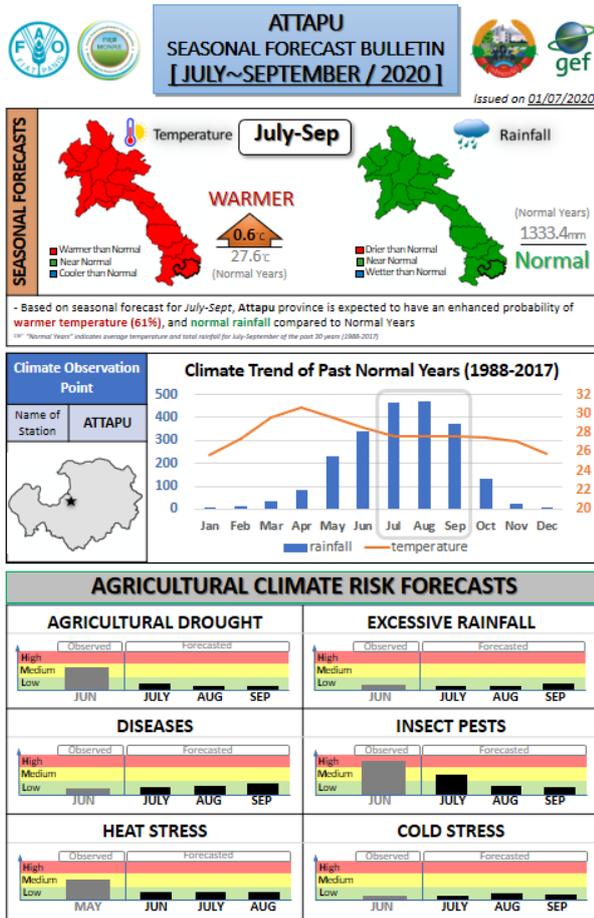
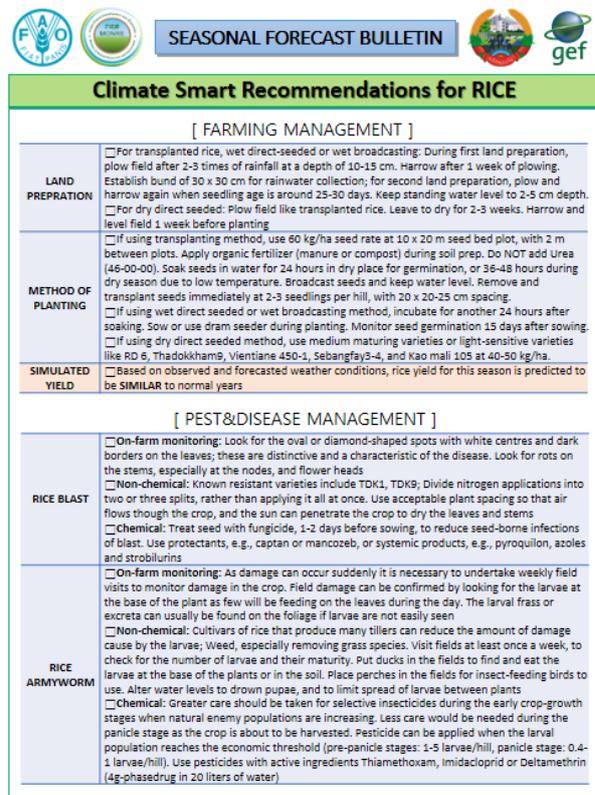
⁹⁵ The number of automatic stations is being increased to 71 by DMH with the use of a co-financing loan from the World Bank.

The data produced by LaCSA are also made available through a dedicated app that is under finalization and will be freely available for users in English and Lao language.



The monthly bulletin is produced by the Climatology and Agrometeorology Division of DMH. It references LaCSA data and is created with a dedicated offline software called MonthlyAgMetBulletin that produces the agromet indices. The monthly bulletin is produced at the provincial level and includes the following information:

- the three months forecast for temperature and rainfall;
- climate historical trends;
- agricultural climate risk forecast for drought, floods, pest, disease, heat and cold;
- climate smart recommendations for up to six crops (the list of crop varies with the province).

SEASONAL FORECAST BULLETIN [JULY~SEPTEMBER / 2020]

Climate Smart Recommendations for RICE

[FARMING MANAGEMENT]

Category	Recommendations
LAND PREPARATION	For transplanted rice, wet direct-seeded or wet broadcasting: During first land preparation, plow field after 2-3 times of rainfall at a depth of 10-15 cm. Harrow after 1 week of plowing. Establish bund of 30 x 30 cm for rainwater collection; for second land preparation, plow and harrow again when seedling age is around 25-30 days. Keep standing water level to 2-5 cm depth. For dry direct seeded: Plow field like transplanted rice. Leave to dry for 2-3 weeks. Harrow and level field 1 week before planting.
METHOD OF PLANTING	If using transplanting method, use 60 kg/ha seed rate at 10 x 20 m seed bed plot, with 2 m between plots. Apply organic fertilizer (manure or compost) during soil prep. Do NOT add Urea (46-00-00). Soak seeds in water for 24 hours in dry place for germination, or 36-48 hours during dry season due to low temperature. Broadcast seeds and keep water level. Remove and transplant seeds immediately at 2-3 seedlings per hill, with 20 x 20-25 cm spacing. If using wet direct seeded or wet broadcasting method, incubate for another 24 hours after soaking. Sow or use drum seeder during planting. Monitor seed germination 15 days after sowing. If using dry direct seeded method, use medium maturing varieties or light-sensitive varieties like RD 6, Thadokkham, Vientiane 450-1, Sebangfay3-4, and kao mall 105 at 40-50 kg/ha.
SIMULATED YIELD	Based on observed and forecasted weather conditions, rice yield for this season is predicted to be SIMILAR to normal years.

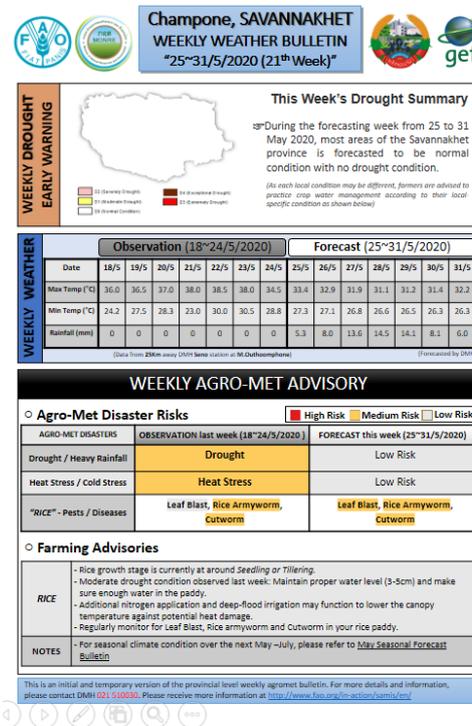
[PEST&DISEASE MANAGEMENT]

Rice Issue	Management Recommendations
RICE BLAST	On-farm monitoring: Look for the oval or diamond-shaped spots with white centres and dark borders on the leaves; these are distinctive and a characteristic of the disease. Look for rots on the stems, especially at the nodes, and flower heads. Non-chemical: Known resistant varieties include TDK1, TDK9; Divide nitrogen applications into two or three splits, rather than applying it all at once. Use acceptable plant spacing so that air flows through the crop, and the sun can penetrate the crop to dry the leaves and stems. Chemical: Treat seed with fungicide, 1-2 days before sowing, to reduce seed-borne infections of blast. Use protectants, e.g., captan or mancozeb, or systemic products, e.g., pyroquilon, azoles and strobilurins.
RICE ARMYWORM	On-farm monitoring: As damage can occur suddenly it is necessary to undertake weekly field visits to monitor damage in the crop. Field damage can be confirmed by looking for the larvae at the base of the plant as few will be feeding on the leaves during the day. The larval frass or excreta can usually be found on the foliage if larvae are not easily seen. Non-chemical: Cultivars of rice that produce many tillers can reduce the amount of damage cause by the larvae; Weed, especially removing grass species. Visit fields at least once a week, to check for the number of larvae and their maturity. Put ducks in the fields to find and eat the larvae at the base of the plants or in the soil. Place perches in the fields for insect-feeding birds to use. Alter water levels to drown pupae, and to limit spread of larvae between plants. Chemical: Greater care should be taken for selective insecticides during the early crop-growth stages when natural enemy populations are increasing. Less care would be needed during the panicle stage as the crop is about to be harvested. Pesticide can be applied when the larval population reaches the economic threshold (pre-panicle stages: 1-5 larvae/hill, panicle stage: 0.4-1 larvae/hill). Use pesticides with active ingredients Thiamethoxam, Imidacloprid or Deltamethrin (4g-phasedrug in 20 liters of water).

This is an initial and temporary version of the provincial level seasonal forecast. For more details and information, please contact DMH 021 510030. Please receive more information at <http://www.fao.org/in-action/sams/en/> and <https://www.facebook.com/moamdmh/>. The online system is accessible at the web page: <http://147.46.350.219:8081/>

The weekly bulletin is produced automatically by the LaCSA at district level (more than 140 districts) and include the following information:

- the drought summary map by district;
- weather forecast compared to observed data from the previous week;
- the agromet advisory forecast for drought, floods, pest, disease, heat and cold compared to the previous week;
- climate-smart recommendations for up to six crops (the list of crops varies with the district).



All bulletins are regularly made available in Facebook at the page SAMISDMH.

FAO developed national-level SOPs for this component, defining roles and responsibilities, to ensure a sustainable process and continuation of project. The data collection and project management are performed by different entities and it is coordinated overall by FAO Lao:

- Data from the 101 weather stations: ADB, World Bank, Japan International Cooperation Agency (JICA), and FAO
- Project management and implementation: MONRE in collaboration with MAF
- Data collection and provision: Climatology and Agrometeorology Division of DMH
- Weather Forecast: Weather Forecast Division of DMH
- Soil and agricultural data bases: NAFRI and DALAM
- Agricultural statistics: Agricultural Statistic Center of MAF
- Monthly pest and disease report: PPC of MAF
- Farming system and traditional knowledge input: CIAT Asia
- Akad Lao app maintenance: Weather Forecast Division of DMH
- Daily management and weekly and monthly bulletin preparation: Climatology and Agrometeorology Division of DMH.

Pilots activities for the awareness-raising of LaCSA

The SAMIS project has developed a considerable number of tests to pilot awareness raising activities on LaCSA, and these tests have been assessed through local level questionnaires with the help of CIAT.

The main tests have included:

- Dissemination of the bulletins through loudspeaker that has covered more than 30.000 people over two rainy seasons and has seen a satisfaction rate of 67% among interviewed farmers;
- Dissemination of information through school posters, organized with WFP and covering five schools with more than 5,000 beneficiaries;

- More than 84% (21139/10619)⁹⁶ of farmers valued the advisory regardless of the type of intervention (loudspeakers or farmer groups);
- Over 85% (21390/10746)* of farmers changed practices as a result of access to advisories from loudspeakers;
- Strategic planning related to selection of crop varieties, planting dates and water management were the main responses from farmers because of access to advisories. Tactical responses were also implemented for a relatively lower number of farmers;
- Areas for improving the advisories varied from lack of capacity to understand or use the information to lack of local tailoring or accuracy;
- About a third (32%) and half (44%) of farmer groups/speaker farmers could not describe areas for improvement of advisories and confirmed its usefulness;
- Farmer groups in 2 provinces comprising 31% of the interviewed farmers are also reliable sources of information according to farmers; Farmers that participate in farmer groups have less interest in advisories from loudspeakers;
- Limited broadcast reach due to the remoteness of household locations was the main limitation for farmers without access to farmer groups;
- Technical information, explanation of information and practices that needed to be adopted, is a type of support farmers receive from their support groups (primarily family members and relatives, neighbours and local agricultural technical staff);
- Over 75% of farmers received technical support;
- About half of the farmers received input materials;
- Less than 10% of the farmers received financial support;
- TV is the most preferred dissemination channel for farmers who don't access loudspeaker broadcasts;
- All farmers who did not access advisories indicated interest in accessing them;
- Farmers living or working in remote areas suggested improved frequency and timing of the advisory broadcasts;
- Farmer groups preferred improved timing of the broadcast and a comprehensive agro-advisory;
- About 30% of the farmers have access to internet (about half of farmer groups indicated access to internet);
- A quarter of farmers access SAMIS advisories from internet sources. Facebook and WhatsApp were the most accessed sources.

Component 2: Land Resources Information Management System (LRIMS)⁹⁷ (mid to long-term)

The second component of SAMIS project, called LRIMS, was established to produce future forecasts of crop distribution and productivity as well as socio-economical acceptability of farming and cropping systems that will results due to the impact of climate change (for example, in 50 years' time).

The objectives of this component are to improve monitoring and analysis of agricultural production systems by strengthening the national land resources information management systems and creating AEZ to support agricultural policies and climate change adaptation.

Collection of data produced by other partners

A national-level process to collect data from multiple government entities was completed at the beginning of the project. All government entities working with natural resources data were invited to a national level. Every government entity has signed a "data sharing agreement" in which the permissions of use of the data are detailed. Key data obtained by DALAM under this process include province and district boundaries, urban areas, roads, rivers, irrigated area and reservoirs, national biodiversity area, and forest protection and production areas.

Agronomical data for AEZ calculations

Also, Land Utilization Type has been collected in collaboration with DAFO and this include low/medium/high scenario data for crop management (inputs such as quantity of input used, capital intensity, labour intensity, farm power, market orientation, farm size and so on) and average output. In addition, NAFRI, has collected crop modelling parameters for six crops, as this is used for crop physiology inputs within the AEZ. Crop calendar by district and by provinces have been collected by DALAM and by CIAT/NAFRI respectively. Crop statistics from the modelling validation have been collected by the Statistic Office of MAF.

New data: soil and cropland maps

⁹⁶ * Estimated number of farmers (total/female) based on the total target population

⁹⁷ <http://lrims-dalam.net/>

The update of the existing national soil map, that will be based on the World Soil Classification Systems is been finalized by DALAM. So far, more than 140 soil profiles have been opened and the laboratory analysis is finalized. The soil classification and map preparation is ongoing.

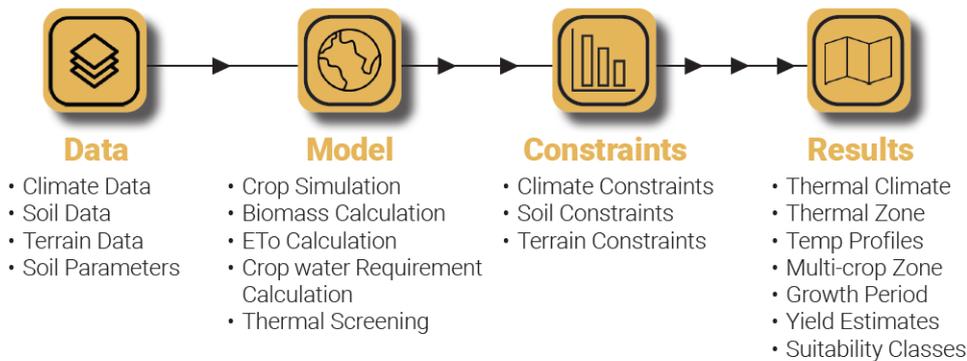
Cropland cover mapping has been finalised using machine learning. Filtered composition and mosaicking have been run using the SEPAL, a cloud computing based platform for autonomous land monitoring, using remotely-sensing data. The cropland cover map has been developed using the satellite imagery from ESA Sentinel 2A sensor and classified using the Land Cover Classification System (LCCS), the ISO Standard (ISO 1-19144) classification system developed by FAO and UNEP. The interpretation has been undertaken using machine learning random forest decision tree. The resulting map has 10 meters resolution and classify real crop areas for one specific crop year, can easily be replicated and the methodology has been published⁹⁸.

Climate downscaling and future scenarios

The complete process of downscaling is undertaken through cloud computing by DALAM with the support of the Asian Institute of Technology. Cloud computing resource specification include a total number of 12 high end computers utilized for the initial task of optimizing the model with physics parameterization. The total simulations for model parametrization only accounted for more than 5760 core hours of processing which produced about 500GB of raw model outputs. Dynamical downscaling of past and future climate data is based on the ‘Weather Research and Forecasting’ (WRF) model. The result of the entire process include climate maps for whole country at a resolution of 5km and output more than 50 weather parameters daily for the past 30 years and for the future 50 years under two scenarios. This task also provides the five major variables to be used in the AEZ. An Atlas of Climate of the country is being produced.

Preparation of the AEZ software

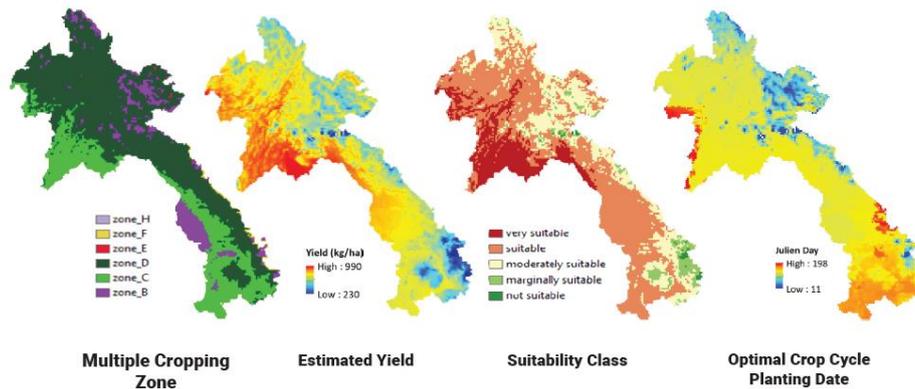
A Python Package tool for AEZ (PyAEZ) providing a standard framework for land resource inventory and appraisal adhering to the established FAO Land Evaluation Framework has been prepared by the Asian Institute of Technology and is available online⁹⁹. PyAEZ’s underlying algorithm uses numerous data inputs in simulated crop cycles to assess suitability and productivity of selected crops, and additionally estimates maximum yield under particular climate, soil, and terrain conditions. The logic and flow of interpolation in the PyAEZ software is available in the figure below.



The PyAEZ automatically allow for the preparation of suitability maps for present time (using data from the last 30 years) and for future scenarios.

⁹⁸ <http://www.fao.org/3/ca9960en/CA9960EN.pdf>

⁹⁹ <https://github.com/gicait/PyAEZ>



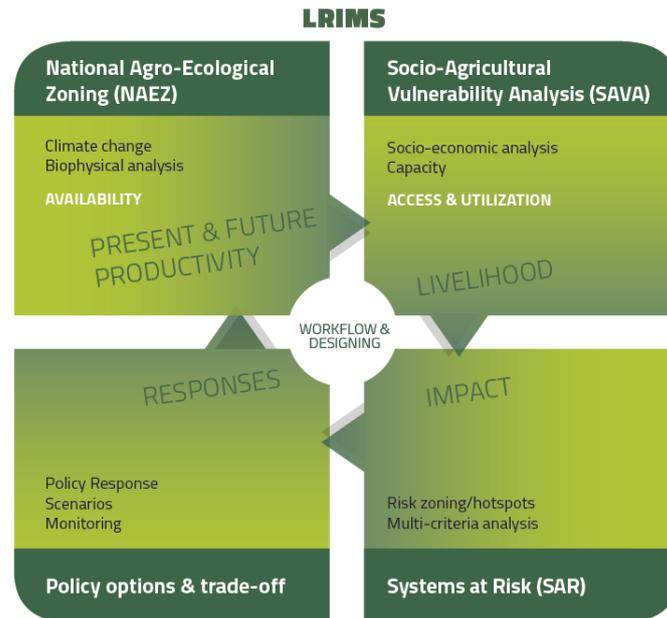
National-level vulnerability assessment (CIAT/NAFRI/DALAM)

A national level assessments of farmers' adaptive capacity to climate change and variability requires country wide coverage and often rely on statistics—socio-economic and environmental—that are expressed in terms of administrative units. Priorities and interventions set at national scale based on these national-level assessments may not be addressing the most immediate needs of the farmers, who also suffer the impacts of climate variability and extreme events. An approach overcoming these limits was therefore adopted aiming at assessing quantitatively the adaptive capacity farmers by identifying the local short-term needs of the agricultural population for the adoption of adaptation practices at local level without using administrative data only. The SAMIS participatory approach, developed with CIAT, defined the farmers' adaptive capacity as a combination of three conditions: (a) satisfaction of basic needs; (b) resources for innovation, and (c) capacity to translate innovation into action. These conditions, in turn, were defined in terms of the farmers' capacities and resources that constitute their means of living. The approach was carried out at a level of spatial disaggregation with units of analysis—livelihood zones—that captured the farmers' assets and capabilities. These livelihoods were defined as areas relatively homogeneous in terms of social and economic characteristics, which were defined, inter alia, by the dominant production systems, land tenure characteristics, biophysical gradients, agricultural practices, and socio-economic characteristics. The relevant indicators to define the livelihoods and for assessment of adaptive capacities were selected both from the literature and from previous experiences with this approach, and were validated with SAMIS, DALAM and NAFRI. An index was elaborated to measure quantitatively the adaptive capacity of the rural population. Further, using similar characteristics among rural livelihoods, the approach establishes a typology of livelihoods and helps identifying potential areas of investment to improve development conditions, and help increasing the overall adaptive capacity.

Land resources information management system

The project is currently producing a web enabled geo-spatial system aimed to support policy options design and land management planning. As per the figure below, the box NAEZ includes all the agro-ecological inputs and output data. The SAVA box includes the vulnerability assessment. The impacts and responses are elaborated

through the foresight planning and anticipatory governance. The system, which will be developed also in app form, is currently being tested and data are being uploaded¹⁰⁰.



The LRMIS component of the SAMIS project has produced and will produce a robust map and forecast database with the aim for it to be used by decision-makers in Lao PDR to include climate change data and models in the country's future regulations. The DALAM and NAFRI staff will be the leader supporting the planning phases and enabling policy makers to undertake future-proof development activities.

Foresight planning and anticipatory governance

The activity, developed by SAMIS, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the University of Utrecht, enables the GoL to use the previous listed data to develop long term planning and policies. It includes the design and holding of intensive professional development trainings providing a strategically focused, intensive introduction to up-to-date, research-informed pedagogic approaches in developing knowledge, skills and practices in foresight and anticipatory governance. DALAM developed the skills and vision to train and lead others in their institutions, cascading learning to colleagues to spread best practice and ultimately strengthen provision for timely and robust scenarios development and analysis for future proof agricultural planning. The system is piloted by SAMIS in the development of planning at multiple scales including one national level future plan and multiple tests of village level future plans which are describe below.

Development of national-level foresight planning and scenarios

The SAMIS project has developed a step-by-step process for incorporating long-term climate scenarios into government planning and policy-making. This approach, developed with CCAFS with the University of Utrecht and based on a methodology developed by the University of South Hampton, promotes climate-resilient outcomes by identifying systems at risk and facilitating a response. The approach is being finalized and will be used by GoL in the development of future plans and policies.

Development of village-level foresight schemes

In 1993, MAF started to carry out pilots of a Land Use Planning and Land Allocation (LUP/LA) village-level process. Land use planning is actually the zoning of agricultural and forestry land for development and preservation, while participatory land use planning has the mandate to balance development and rural environment conservation needs, in order to lead to a sustainable landscape management. For this, MAF and MoNRE have launched The Agrobiodiversity Initiative (TABI) project financed by the Swiss Cooperation. DALAM participates in TABI by assessing the current soil land use and management in order to provide sustainable future management participatory recommendations using the FALUPAM method that has been used in approximately the 10% of the country villages. Data collection is implemented by using remote sensing techniques and surveys at the village scale to get accurate data on the existing agricultural situation and to plan future management to protect natural environment and improve the well-being of farmers.

Until SAMIS, the future management plan was based on policy plans, political leader ambition and villagers aspiration. With the intervention of SAMIS, the method has been slightly but significantly improved to enable the

¹⁰⁰ <http://54.254.146.134:3000/#/map>

village officials to access information about the potential suitability in the village' land in the future, and therefore enabling them to only focus on development that are climate resilient and reality-proof. In addition, the Department of Land of MONRE has developed a tool called Land Use Information System (LUIS) that is supposed to collect all village level plans but it is rarely used by donors. The LUIS system is available at: <http://139.5.159.140:14880/luis/>

Annex 3. Summary of recent and ongoing DRM, hydromet, agriculture and climate change initiatives in Lao PDR

Project title and duration	Financing	Location	Outcomes, outputs and activities
Disaster risk management sector			
Integrated Programme for Climate Resilience and Empowerment in Attapeu province (DRM component) (2020-2023)	Korean International Cooperation Agency (KOICA) \$756,395	National, Attapeu	<ul style="list-style-type: none"> - Strengthened provincial disaster risk assessment capacity - Improved capacity of local DMCs to prevent and mitigate the impacts of disasters - Enhanced disaster preparedness for effective response
Community Disaster Risk Reduction and Management Project Phase IV	Government of Luxembourg and Caritas Luxembourg, EUR 618,648	Xiengkhaoung, Houaphan	<ul style="list-style-type: none"> - Increased resilience of communities to disasters - Governance system are strengthened (public service, participation, ownership) - Adapted infrastructure are in place and other management to reduce direct impact from natural disaster
Urban Risk Management and Resilience - Integrated Resilience Building for Lao PDR's Sustainable Growth	UNDP, \$430,000	National	<ul style="list-style-type: none"> - Capacity of the National Disaster Management Office (NDMO), relevant national agencies, and UNDP country office strengthened to advance climate and disaster risk-informed urban resilience portfolio and gender for upscaling - Enhance capacity of government staff at local levels in regard to rapid assessments (national assessment forms, provision of digitized forms) - Support to additional disaster risk reduction-related emerging priorities and immediate needs in response to crisis (completion of the evacuation centre) - Establish partnership with Lao Women's Union for capacity building of women and persons with disability through livelihood empowerment projects e.g. cash transfers to the most vulnerable populations for cash-for-work for recovery - Lao Disaster Information Platform (LaoDi) updated and institutionalized at NDMO to support gender-responsive disaster preparedness, recovery and urban resilience
Hydromet sector			
Improvement of Equipment and Facilities for Meteorological and Hydrological Service (2013-2015)	Government of Japan/JICA, \$5.7m	National	Effective mitigation of the adverse effects of natural disasters through the improvement of the meteorological and hydrological forecasts/warnings of the DMH. Under this project, 18 automatic weather stations and 8 hydrological stations were installed in Vientiane Capital and 16 provinces.
Mekong Integrated Water Resources Management Project (original 2012-2018, additional finance 2018-2021)	World Bank; total credit for hydromet services component - \$5.2m	National	<p>The hydromet services component aims to improve hydrological and meteorological information collection and dissemination by constructing and upgrading hydromet stations with near-real time data transmission system. The project is expected to have 60 new/upgraded hydromet stations properly installed, operated, data used, and shared with other Lower Mekong Basin countries in 8 Mekong river tributaries in Lao PDR.</p> <p>The project also supported the construction of the National Early Warning Centre at DMH, the development of a central database at DMH for dissemination purposes and rehabilitation of provincial offices in the southern part of the Lao PDR.</p>
Building Resilience to High-Impact Hydro-meteorological Events through Strengthening MHEWSs in Small Island Developing States (SIDS) and South East Asia (running until March 2021)	Environment and Climate Change Canada, CAD 10m	National	Strengthening forecasting capabilities on a regional scale, and increased regional integrated forecasting, as well as the participating national meteorological and hydrological services' (NMHSs') capacities to access and use global and regional data, products and tools through several pilot programmes / projects. This is achieved through sponsoring WMO flagship activities in South East Asia such as the Severe Weather Forecasting Programme (a systematic approach for building capacity and for transferring knowledge and skills to operational weather forecasting teams across the NMHSs community) and the Southeast Asia Flash Flood Guidance System (that reduces the vulnerability of the region to flash floods).
Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in Southeast Asia (2018-2022)	International Climate Initiative (IKI), WMO, University of Queensland, CIAT, DeRisk SeA	National	Developing resilient climate risk management systems, best practices and insurance products that will shield smallholder farmers and businesses engaged across the AVC from the physical and financial disaster associated with climate change (coffee, sugar, rice, cassava, rubber, maize, associated crops and fruits, and grazing industries). Relevant governments (Cambodia, Lao PDR, Myanmar, Viet Nam) are assisted in developing national/regional adaptation and risk management strategies.
Lao PDR Southeast Asia Disaster Risk Management Project, component "Hydromet Modernization"	World Bank, \$10m	National	<ul style="list-style-type: none"> - Strengthening early warning systems and service delivery systems (US\$5 million) by: (a) developing and implementing a service delivery strategy; (b) strengthening EW services by developing localized and impact-based warning products, and enhancing the timely dissemination

Project title and duration	Financing	Location	Outcomes, outputs and activities
and Early Warning Systems" (2018 – 2023)			of warnings; (c) enhancing accessibility of hydromet information; (d) introducing a quality management system for service production and delivery; and (e) capacity building on service delivery, hydromet monitoring and forecasting, database management, and communications systems. - Modernizing the Observing, Forecasting, and Communications Systems (US\$4 million). Supporting the expansion of the hydromet network, and the forecasting and communications system in the country, including in the Luang Prabang, Oudomxay, and Phongsali Provinces - Project Management (US\$1 million).
Reinforcing the capacities of hydro-meteorological services and enhancing the early warning systems in Cambodia and Lao People's Democratic Republic (2021-2024)	WMO, World Bank, United Nations Office for Disaster Risk Reduction (UNDRR), Lao PDR and Cambodia, CREW, \$6,218,514	National	- Strengthen institutional capacities and enabling environment with improved NMHS delivery and structured interaction between relevant actors - Improve quality of forecasts and warnings with increased access and use of regional/national data products, tools and services; and improved risk information to guide early warning systems and climate and weather services - Strengthen NMHS's information and communication technology with improved IT capacity, - Strengthen disaster response capacity; and - Improve integration of gender and vulnerable groups across the early warning systems value chain
Enhancing Climate Resilience of Mekong River Communities through Strengthening Climate Services (2022-2025)	Adaptation Fund, approx. \$3.8m for Lao PDR; implemented by WMO	Regional - national DRM co-development system	- Operational EW capacities strengthened - Co-development and community use of DRM and long term plans - Regional integration
Modernization of Lao PDR's Meteorological and Hydrological System (2021-2024)	Korea Meteorological Institute, \$21m	National	Expansion of hydromet network, and renovation of meteorological equipment
Integrated Monitoring System of Water Resources and Heavy Rainfall for Safety Transportation in Lancang-Mekong Countries (2022-2023)	Lancang-Mekong Water Resources Cooperation Center \$0.5m	National Luang Prabang, Oudomxai	Improvement of the integrated extreme events monitoring system for the target provinces
Climate Risk and Early Warning Systems (CREWS) (2022-2025)	CREWS \$5.5m	Regional - national DRM co-development system	- Harmonization of warning criteria for hydromet hazards and DRM - ASEAN disaster responsive social-protection guidelines; - Improvement in existing service delivery - Community-based flood management, last-mile connectivity
Enhanced Severe Weather Response utilizing an Integrated Typhoon Monitoring and Forecasting Platform in Lao PDR (2021-2025)	Korea Meteorological Institute, \$3m	National	Improving typhoon monitoring and forecasting system, boosting meteorological satellite utilization
Agriculture sector			
Lao PDR Agriculture Competitiveness Project (2021-2027)	World Bank, \$29.3m	Vientiane, Bolykhamxay, Khammouane, Xayabury	Increase competitiveness of rice, maize and vegetable value chains by: - improving irrigation infrastructure - promoting adoption of good varieties and quality seeds - promoting good agricultural practices - improving extension service capacity of PAFOs and DAFOs.
Sustainable Rural Infrastructure and Watershed Management Sector Project (SRIWMSP) (2020-2027)	ADB, \$50m	Houaphan, Xiangkhouang, Louang Prabang, Xaignabouli	Increase profitability of the agriculture, natural resources and rural development sectors by: - increasing market-oriented agricultural production (with focus on HVCs including tea) - improving irrigation infrastructure and management - protecting catchments linked to subproject command areas - improving nutrition awareness and facilities
Partnerships for Irrigation and Smallholders Commercial Agriculture (2019-2025)	IFAD, \$13m	Houaphanh, Luang Prabang, Xaibury, Xiangkhouang	Provide irrigation management and market linkage support to irrigation systems rehabilitated under SRIWMSP, including: - training water user groups (WUGs) on O&M of new irrigation systems; - supporting farmer groups and WUGs to implement best agricultural practices in term of climate resilience, nutrition relevance and responsiveness to market demands; - establishing a Farmer Group Investment Facility to enable groups of farmers to develop minor infrastructure for agricultural production and market access; - establishing multi-stakeholder platforms (farmers, input suppliers, buyers and financial institutions) for promising agricultural commodities to enhance coordination within value chains; and

Project title and duration	Financing	Location	Outcomes, outputs and activities
			- improving nutritional practices.
Climate-Friendly Agribusiness Value Chains Sector Project (2018-2025)	ADB, \$40.5m	Khammouane, Saravan, Savannakhet, Vientiane Capital, Champasak, Sekong	Improve productivity of rice and vegetable value chains by: <ul style="list-style-type: none"> - rehabilitating small-scale irrigation infrastructure and rural roads; - enhancing crop research, and safety- and quality-testing infrastructure; - improving climate-friendly infrastructure for agribusiness enterprises; - promoting farm mechanization through smallholder financing via agricultural production groups
Strategic Support for Food Security and Nutrition Project – Global Agriculture and Food Security Program funds (2016-2022)	IFAD, \$38.8m	Oudomxay, Phongsali, Xiangkhouang, Houaphan	Reduce poverty and malnutrition in the poorest communities by: <ul style="list-style-type: none"> - strengthening the capacity of district officials and NAFRI to deliver climate-smart agriculture technologies and training; - implementing community-driven agriculture-based nutrition interventions; and - establishing market-driven partnerships targeting high-value, climate-resilient commodities.
Climate Smart Agriculture Alternatives for Upland Production Systems in Lao PDR (2021-2025)	FAO-LDCF, \$3.5m	Luang Prabang, Houaphan	Promote climate-smart agriculture in upland production systems by: <ul style="list-style-type: none"> - integrating AEZ climate modelling from SAMIS into provincial- and district-level land use planning; - training district extension officials in climate-smart agriculture practices, e.g. interpreting crop suitability assessments; - establishing value chain networks for 6 agricultural value chains (coffee, tea, small livestock, non-timber forest products, herbs and vegetables); and - developing and implementing investment action plans for improving climate resilience and profitability of these value chains.
Northern Rural Infrastructure Development Sector Project' (2010-2017 and 2017-2021)	ADB, \$50m	Luang Namtha, Bokeo, Phongsali, Oudomxai	Improve agricultural productivity by <ul style="list-style-type: none"> - rehabilitating and constructing irrigation systems and rural access roads; - training WUGs in maintenance of the installed infrastructure; - stabilising upstream watersheds; - establishing farmer producer groups to coordinate supplies of agricultural produce to markets and processors; - supporting contracts between farmers and processors with price incentives based on quality; and - securing land ownership certificates for WUG members. Targeted crops include rice, maize, cassava, tea and rubber.
Greater Mekong Subregion East–West Economic Corridor Agriculture Infrastructure Sector Project (2013-2022)	ADB, \$60m	Saravan, Savannakhet	Improve irrigation and rural road infrastructure in order to optimize agricultural output, promote crop diversification and increase production efficiency. Infrastructure upgrades are complemented by <ul style="list-style-type: none"> - training of WUGs in irrigation systems O&M; and - providing WUGs with advice on crops to be grown, agriculture techniques to be followed, and processing and market improvement opportunities to be pursued.
Climate change sector			
National Climate Change Strategy	\$80,000	National	To secure a future where the Lao PDR is capable of mitigating and adapting to changing climatic conditions in a way that promotes sustainable economic development, reduces poverty, protects public health and safety, enhances the quality of Lao PDR's natural environment, and advances the quality of life for all Lao people.
Nationally Determined Contribution (NDC)	\$450,000	National	To maximise the ambition of its mitigation contribution while considering the need for economic development, and capacity building to mitigate and adapt to changing climatic conditions.
Third National Communication on Climate Change	\$480,000	National	To strengthen the Government of the Lao PDR in the field of climate change: greenhouse gases inventory, build mechanism to facilitate in reducing the impact of climate change, and determine challenges, gaps and needs of support.
Building Climate resilience of Urban populations with ecosystem-based solution in Lao PDR (Urban EbS)	\$10,000,000	Vientiane capital, Bolikhamxay, Savannakhet, Champasack	<ul style="list-style-type: none"> - Technical and institutional capacity building to plan, design, implement and maintain integrated urban ecosystems-based adaptation (EBA) interventions for the reduction of climate change induced flooding; - Rehabilitation and protection of ecosystem in response to climate variability and change
Building Climate resilience of Urban system through ecosystem-based Adaptation in Asia-pacific Region (Urban EBA)	\$999,000	Phongsaly, Oudomxay	<ul style="list-style-type: none"> - Technical and institutional capacity of city management authorities to integrate urban EBA into development planning strengthened; - Demonstrating urban EBA interventions in pilot cities; - Disseminating knowledge and raising public awareness on urban EBA in pilot cities.
National Adaptation Planning (NAP)	\$3,552,969	National	<ul style="list-style-type: none"> - Enhanced access to information at regional, national and sub-national and local levels; - Strengthened institutional and technical capacities and human skills to identify, prioritise, implement, monitor and evaluate adaptation strategies and measures; - Strengthened institutional arrangements to lead, coordinate and support the integration of climate change adaptation into relevant policies, plans and associated programmes.
Accelerating Climate Action Through the	EUR 966,552	National	To contribute to the reduction of GHG emissions in cities/towns

Project title and duration	Financing	Location	Outcomes, outputs and activities
Promotion of Urban low Emission Development Strategies Phase II			
Strengthening Lao PDR's Institution Capacity to Comply with the Enhanced Transparency Framework under the Paris Agreement	\$1,210,000	National	Strengthen Lao PDR's national capacity to track progress against actions identified in its NDC for domestic and international reporting requirements under the Enhanced Transparency Framework of the Paris Agreement

Annex 4: List of Stakeholders

Agency	Role and responsibilities	Relevant part of the project	Consulted for this CN
MONRE			
DMH	Lead executing department and National Project Coordination Office. Provision of co-financing.	All	Y
Climate and Agro-Meteorology Division, DMH	Responsible for data sharing, LaCSA and production of bulletins.	All	Y
Weather Forecast Division, DMH	Nationally responsible for daily data collection from manual stations, weather forecasts, early warnings, collaboration with LaCSA.	Outcome 1	Y
Network Division, DMH	Responsible for installation of weather station and follow up of civil works. There is a letter of agreement (LoA) with SAMIS but it is not managed directly by the Division.	Outcome 1	Y
Department of Planning and Finance	PSC member and GEF Focal Point. Under LoA with SAMIS. Manages the co-financing of the project.	Project management	Y
Department of Climate Change	PSC member. Focal point for UNFCCC and preparation of NAPA and Second National Communication to the UNFCCC. Participate to the development of a drought index modelling within LaCSA. Under contract with SAMIS.	Outcomes 1 and 2	Y
Department of Inspection	PSC member. Revises SAMIS reports.	Project management	
Natural Resources and Environmental Statistic and Research Institute	Participate to activities related to foresight scenario	Outcome 3	Y
Land Planning and Development Department	Coordination and collaboration in use of LRIMS Responsible for MONRE data, including concessions and LUIS database (FALUPAM village level planning methodology)	Outcome 3	
MAF			
Department of Planning and Cooperation	Design of a sustainability strategy for LaCSA and LRIMS Participate to the development of a monitoring system of the Agricultural Development Strategy under SAMIS. Under LoA with SAMIS. Continue monitoring the Agricultural Development Strategy under the intended GCF.	Project management and Components 3.2	Y
Department of Policy and Legal Affairs	Participate to the development of a monitoring system of the Agricultural Development Strategy under SAMIS. Under LoA with SAMIS. Continue monitoring the Agricultural Development Strategy under the intended GCF	Components 3.2	

Agency	Role and responsibilities	Relevant part of the project	Consulted for this CN
Center for Statistics and Information	Informal member of the PSC. Collaboration with DMH on crop monitoring and yield forecasting. Improvement of crop monitoring products and services. Participate to the development of a monitoring system of the Agricultural Development Strategy under SAMIS	Components 1.2 and 1.3	
DALAM	Project lead for development of LRIMS and for preparation of land suitability maps. Under LoA with SAMIS.	Outcomes 1 and 3	Y
Plant Protection Division, Department of Agriculture	Contributing to the LaCSA database (data collection) and capacity development. Under LoA with SAMIS.	Outcomes 1 and 2	Y
National Agriculture and Forestry Research Institute (NAFRI)	Development of training materials for farmers on the use of LaCSA advisories, and for government officials on foresight planning. Developed the LaCSA decision making embedded in the IT system (farmer recommendation). Under LoA with SAMIS.	Outcomes 2 and 3	Y
Department of Agricultural Extension and Agro-Processing	Awareness-raising and dissemination activities (new partner)	Outcome 2	Y
Department of Livestock and Fishery	Improve LaCSA model in livestock	Component 1.2	Y
Other national entities			
Lao National Television	Broadcast the agro-meteorology information weekly	Component 1.2	N, but the broadcast is produced by and within DMH
Lao National Radio	Broadcast the agro-meteorology information weekly in five SAMIS provinces, will produce similar broadcast in all provinces and districts where it is available (around 20)	Component 1.2	N
MLSW, Department of Social Welfare	Disaster risk reduction using LaCSA and LRIMS. New partner.	Outcomes 1 and 3	Y
Lao Statistic Bureau	Meetings have been held to establish collaboration.	Outcome 1	
NUOL	Multiple consultants are part of the University. SAMIS staff have attended university events. Hold a curricula on meteorology that does not include climate scenario and long term planning.	All	N
Lao Farmers' Network	Multiple projects along the country	All	N
Telecommunication and mobile phone companies	Could give free access to the LaCSA app in selected areas. Both Lao Telecom and Unitel were consulted and shown an initial interest for the activity.	All	Y
International agencies			

Agency	Role and responsibilities	Relevant part of the project	Consulted for this CN
ADB	Implementing 4 related projects (see Annex 3); beneficiaries of these projects will receive training on the use of agromet advisories and FALUPAM rollout	Components 1.2, 2.2, 3.3	N
World Bank	Implementing 1 related project (see Annex 3); beneficiaries of these projects will receive training on the use of agromet advisories and FALUPAM rollout	Components 1.2, 2.2, 3.3	N
International Fund for Agricultural Development	Implementing 2 related projects (see Annex 3); beneficiaries of these projects will receive training on the use of agromet advisories and FALUPAM rollout	Components 1.2, 2.2, 3.3	N
World Meteorological Organization	Lead the De-Risk project that is co-financing SAMIS. Implementing various related and parallel projects (see point 24)	Components 1.2, 1.3, 2.2, 3.1, 3.2	Y, DMH office
Korea Meteorological Institute	Implementing various related and parallel projects (see point 24)	Components 1.2, 1.3	Y
Lakang-Mekong Water Resources Cooperation Center	Implementing various related and parallel projects (see point 24)	Components 1.2, 1.3	N
UN Office for Disaster Risk Reduction CREWS	Implementing various related and parallel projects (see point 24)	Components 1.2, 1.3, 2.2, 3.1, 3.2	Y, UNDRR Bangkok

Annex 5: NDA Clearance Letter



Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment
Department of Climate Change

Vientiane, 1st Oct 2020

To: Nasar HAYAT
Representative
Food and Agriculture Organization of the United Nations
Vientiane Capital, Lao PDR

Subject: Clearance Letter - Scaling-up local and national level decision making for climate resilience in the agricultural sector of Lao PDR.

Dear Sir,

We refer to the project Scaling-up local and national level decision making for climate resilience in the agricultural sector of Lao PDR as included in the concept note submitted by Food and Agriculture Organization of the United Nations (FAO) to us on 30th September 2020.

Please note that currently, national designated authorities and focal points are not required to provide a no-objection at the concept note stage. However, Green Climate Fund Board underscores the importance of early engagement by accredited entities with NDAs in the preparation and submission of concept notes and we are grateful to you for the submission of the above concept note to our office.

Pursuant to GCF decision B.17/09, paragraph (f), in my capacity as National Designated Authority for Lao PDR, I acknowledge reception of the above proposal and confirm that the concept note fits under national priorities and country ownership. In this context, the Government of Lao PDR encourages FAO to submit the Concept note to the GCF Secretariat and invite the Accredited Entity to share with the relevant line ministry and with NDA office any GCF secretariat's feedback related to this project.

During funding proposal development, the accredited entity is requested to undertake the necessary consultations and to provide further information on the conformity with:

- a) the country's national priorities, strategies and plans, and that consistency was pursued; and
- b) the relevant national (including international) laws and regulations, in accordance with the Fund's environmental and social safeguards.

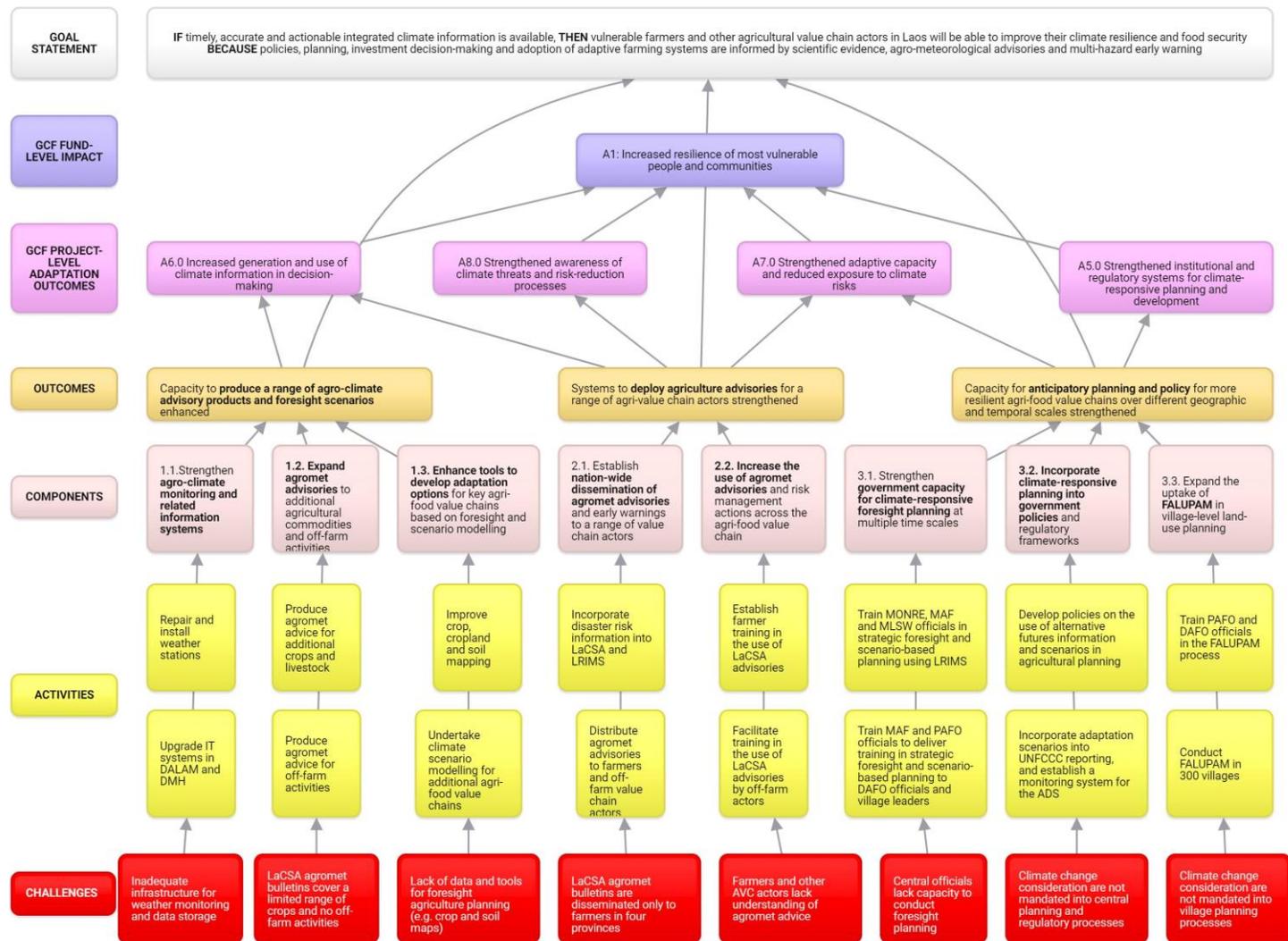
Based on the above, a technical committee will assess the funding proposal before the non-objection letter is issued.

Sincerely,

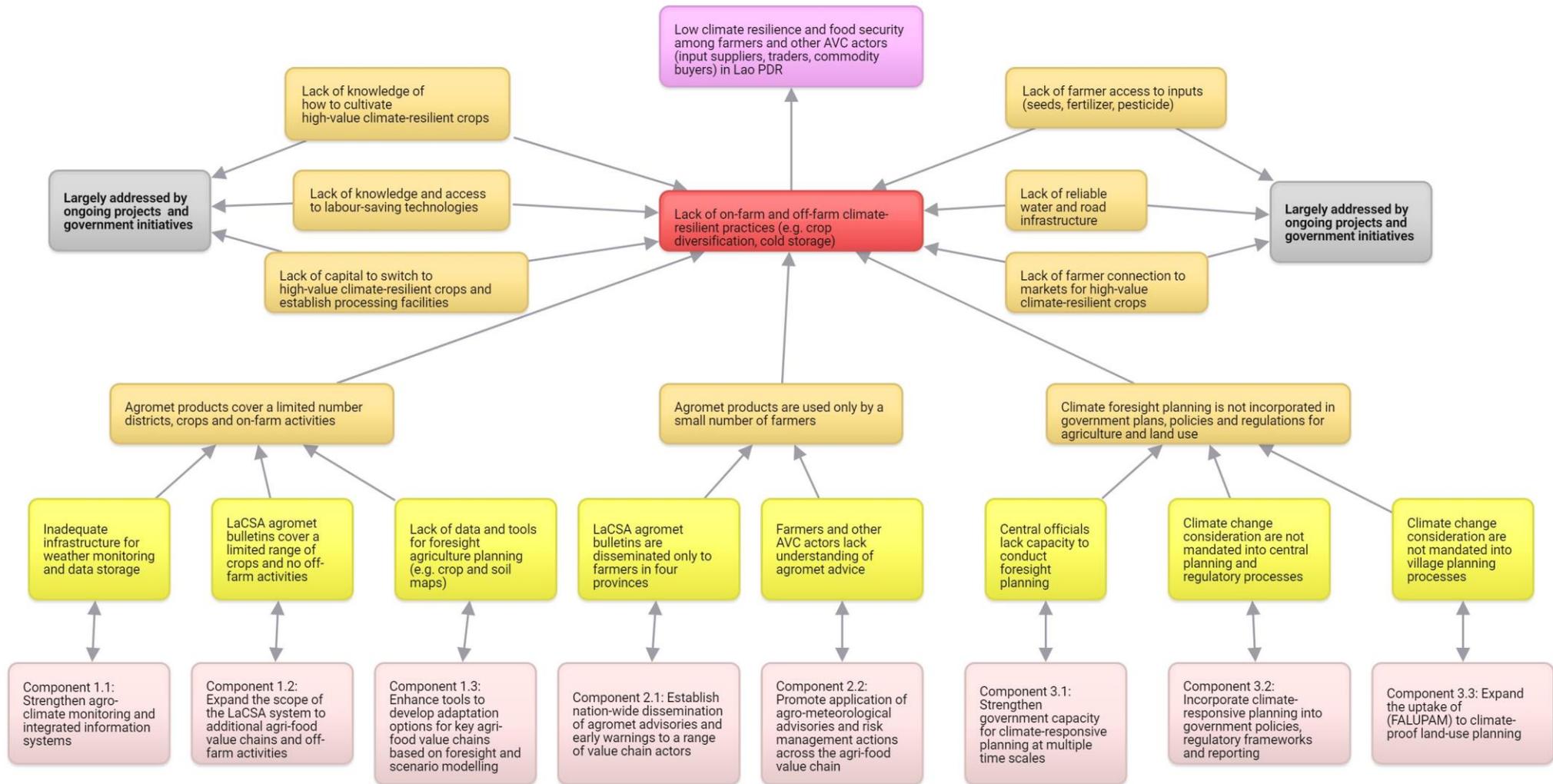


Syamphone Sengchandala
Director General,
Department of Climate Change,
Ministry of Natural Resources and Environment
National Designated Authority for Lao PDR

Annex 6: Project theory of change



Annex 7. Project problem tree and links to project components



Annex 8. Project implementation arrangements, by activity

Activity	Leading agency	Supporting agencies
<i>Outcome 1: Capacity to produce a range of agro-climate advisory products and foresight scenarios enhanced</i>		
Component 1.1 – Strengthen agro-climate monitoring and integrated information systems		
1.1.1. Repair and upgrade key weather stations that are critical for strengthening the agrometeorological monitoring network.	DMH	PONRE, DONRE,
1.1.2. Install 30 additional weather stations with agrometeorological capability and provide training for their operation and maintenance.	DMH	PONRE, DONRE
1.1.3. Upgrade IT systems in the GIS laboratory of the Climatology and Agrometeorology Division of DMH, and develop SOPs for their operations and maintenance.	DMH	
1.1.4. Upgrade IT systems in the GIS laboratory of DALAM for the LRIMS, and develop SOPs for their operation and maintenance	DALAM	
Component 1.2 – Expand the scope of the LaCSA system to additional agri-food value chains and off-farm activities		
1.2.1. Incorporate agromet advisory information for vegetables, tea, beans, legumes, bamboo and livestock into weekly and monthly LaCSA bulletins.	DMH	NAFRI
1.2.2. Develop agrometeorological advisory bulletins for input suppliers and traders.	MAF (department to be confirmed)	MOC (department to be confirmed), DONRE / Provincial Office for Industry and Commerce (PICO), PAFO / District Office of Industry and Commerce (DICO)
1.2.3. Develop a feedback mechanism for dissemination of commodity prices and trade requirements.	MAF (department to be confirmed)	MOC (department to be confirmed), DONRE / PICO, PAFO / DICO
Component 1.3 – Enhance tools and capacities to develop adaptation options for key agri-food value chains based on foresight and scenario modelling		
1.3.1. Improve crop, cropland and soil mapping.	DALAM	PALAM, DAFO
1.3.2. Undertake climate scenario modelling based on additional IPCC scenarios.	DALAM	DMH
1.3.3. Develop alternative futures for other key agri-food value chains, including livestock.	Multiple departments under MAF - DALAM, Department of Planning and Finance (DOPF), DOPLA, NAFRI, Department of Livestock and Fisheries	
1.3.4. Improve capacity of future government officials and agriculture advisors to produce agromet services and foresight planning	DTEAP and NUOL	DALAM and NAFRI
<i>Outcome 2: Systems to deploy agriculture advisories for a range of agri-value chain actors strengthened</i>		
Component 2.1: Establish nation-wide dissemination of agro-meteorological advisories and early warnings targeted to a range of value chain actors		
2.1.1. Develop protocols and guideline for incorporating disaster risk information into LaCSA and LRIMS.	MLSW	Protocol production – DALAM, DMH Guideline production – DMH, DALAM, PPC, NAFRI
2.1.2. Scale up dissemination of LaCSA information to farmers and extension officials through community	Loudspeakers – MLSW, with potential	Loudspeakers – Provincial Department of Labor and Social

Activity	Leading agency	Supporting agencies
loudspeakers, school posters and farmer group coaching.	collaboration with UNDP School posters – Ministry of Education and Sports, with collaboration with WFP Farmer group coaching (targeting ongoing projects) – MAF (with department varying based on the nature of the project)	Welfare at provincial level, District Disaster Management Committee and DAFO at district level, VDMC and village leadership at village level School posters – Province Office for Education and Sport, District Office of Education and Sport / DAFO, school authorities Farmer group coaching – PAFO, DAFO, farmer groups
2.1.3. Develop a dissemination mechanism to distribute agro-met advisories to off-farm value chain actors.	MAF (department to be confirmed)	MOC (department to be confirmed), PAFO / PICO, DAFO / DICO
Component 2.2: Promote application of agro-meteorological advisories and risk management actions across the agri-food value chain		
2.2.1. Develop and deliver a ToT programme for application of LaCSA advisories to PAFOs and DAFOs in selected districts.	DTEAP	NAFRI, DALAM, PPC
2.2.2. Facilitate farmer group training in uptake of LaCSA advisories.	MAF (with department varying based on the nature of the ongoing project to be targeted)	PAFO, DAFO, farmer groups, TV and radio (for message reinforcement)
2.2.3. Facilitate training in uptake of LaCSA advisories by off-farm actors.	MAF (department to be confirmed)	MOC (department to be confirmed), PAFO, PICO, TV, radio (for message reinforcement)
<i>Outcome 3: Capacity for anticipatory planning and policy for more resilient agri-food value chains over different geographic and temporal scales strengthened</i>		
Component 3.1: Strengthen government capacity for climate-responsive planning at multiple time scales		
3.1.1. Develop and deliver a training programme on strategic foresight and scenario-based planning using LRIMS to MONRE, MAF and MLSW officials.	MAF	MLSW, MONRE
3.1.2. Deliver ToT on strategic foresight and scenario-based planning to MAF and PAFO officials.	MAF	MLSW, MONRE, DALAM, PAFO, PALAM
Component 3.2: Incorporate climate-responsive planning into government policies, regulatory frameworks and reporting		
3.2.1. Develop MAF policies and protocols facilitating the use of LRMIS data and alternative futures scenarios in agriculture planning at multiple scales.	DOPLA	DOPF, DALAM, NAFRI
3.2.2. Pilot the use of provincial-level Agriculture Land Investment Plans during the design of provincial Socio-Economic Development Plans.	DOPLA	DOPF, DALAM, NAFRI, PALAM, DAFO, village leadership
3.2.3. Establish a protocol for incorporating climate-responsive adaptation scenarios into UNFCCC reporting under the Paris Agreement.	DCC	
3.2.4. Establish a climate-focused monitoring system for the national Agriculture Development Strategy.	DOPF	DOPLA, DALAM, NAFRI
Component 3.3: Expand the uptake of Participatory Forest and Agriculture Land use planning, allocation and Management (FALUPAM) to climate-proof land-use planning		
3.3.1. Train PAFO and DAFO officials in the FALUPAM process.	DALAM	PALAM, DAFO, village leadership
3.3.2. Conduct FALUPAM in 300 villages.	DALAM	PALAM, DAFO, village leadership



PROJECT / PROGRAMME CONCEPT NOTE Template V.2.2

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Annex 9: Complementarities between the proposed project and WFP’s proposed ‘Leveraging Forecast Based Early Action for Reduced Vulnerability in Lao PDR (FBEA)’ project

Focus Area	Complementarity	Activities	
		WFP	FAO
Data and information management	WFP and FAO aim to enhance capacities to produce, analyse and share data. FAO focuses on supporting capacities in agro-meteorology related products and services, while WFP looks to enhance capacities in impact-based forecasting through improved climate-related and socio-economic data management. Outcome 1 of the WFP proposal mentions building on existing national systems including LaCSA.	1.1.1 1.1.2 1.1.3 2.1.2	1.2.2 1.3.1 1.3.2
	The two GCF projects will rely upon a common tool to collect early-warning near-real-time data. The specifications, testing, and quality evaluation will be designed together in a common technical process.	1.1.1	2.1.1
	Impact-based forecast will be based on using LaCSA system. Any improvement in the seasonal forecast will also be uploaded for national fruition in the automatic LaCSA tool.		
Disaster risk management (DRM), early warning systems (EWS) and anticipatory action (AA)	Both proposals seek to improve early warning and disaster risk information. FAO seeks to focus on agro-met related products in EW and DRM, while WFP focus on development for application in AA & forecast-based financing.	1.3.1 1.3.2	2.2.1 3.1.1
	Common baseline training and shared training protocols. Initial common training needs assessment.		
Climate information and services	To facilitate local adaptation, both proposals aim to deliver last-mile climate services to vulnerable communities. The WFP proposal mentions building on the LaCSA system and its lessons in disseminating to the last mile. Common protocols will be established in case of use of common tools.	3.1.1.	2.2.1 2.2.2
	The FAO proposal mentions utilizing schools as a possible distribution mechanism for climate services, following a pilot between FAO and WFP. The FAO proposal will contain a budget to continue supporting the school meal process with posters and training. This will rely upon the continuation of WFP school poster programme. The plan for covering the schools will be developed at the inception of the project.		
	FAO project seeks to cover 100% of Lao PDR’s villages with agromet service deliver. The WFP project will provide additional EWS training that will go beyond the pure agromet services to cover broader EW and AA.		
	The WFP project will ensure the market price data collection app is disseminated as well.		1.2.3
Long-term community adaptation to climate change	Both proposals aim to support long-term community adaptation to climate change. The FAO proposal plans to climate-proof land use planning while WFP plans to support adaptation of community infrastructure and food systems. WFPs community interventions could benefit from improved land-use planning processes such as FALUPAM, which now includes vulnerability assessment and foresight planning.	3.3.1 3.3.2	3.3.1 3.3.2
Climate-resilient policies	The FAO project plans to train government officials in foresight planning and implement a new policy for climate-resilient investment planning. The WFP project plans to update DRM, EW and AA policies. AA could be inserted as a concept into land investment planning with the technical support and participation of WFP experts. For example, the law could mandate AA planning into large scale land investment, based on foresight scenario methods to be implemented with DAFOs. At the same time, WFP will ensure that the advancements obtained would feed the DRM and EW policy revision	1.3.1 1.3.2	3.1.1 3.1.2

Forecast based finance	FAO will produce an app for mass monitoring of market prices. The app will enable farmers to upload market prices in the system. WFP could rely on this app for planning investments and finance at local level	2.1.1 2.1.2	1.2.3
	Impact-based forecasts will be based on the LaCSA system. Any improvement in the seasonal forecast will also be uploaded for national fruition in the automatic LaCSA tool.	2.1.2	

Annex 10. List of acronyms

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
AEZ	Agro-Ecological Zoning
AVC	Agricultural value chain
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
CIAT	International Centre for Tropical Agriculture
CMIP	Coupled Model Intercomparison Project
CRA	Climate-resilient agriculture
CREWS	Climate Risk and Early Warning Systems
DAFO	District Office of Agriculture and Forestry
DALAM	Department of Agricultural Land Management (MAF)
DCC	Department of Climate Change (MONRE)
DICO	District Office of Industry and Commerce
DMH	Department of Meteorology and Hydrology (MONRE)
DONRE	District Office of Natural Resources and Environment
DOPF	Department of Planning and Finance (MAF)
DOPLA	Department of Planning and Legal Affairs (MAF)
DRM	Disaster risk management
DTEAP	Department of Technical Extension and Agro-Processing (MAF)
EBA	Ecosystems-based adaptation
FALUPAM	Participatory Forest and Agriculture Land use planning, allocation and Management
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GDD	Growing degree days
GDP	Gross domestic product
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GoL	Government of Lao PDR
HVC	High-value crops
IFAD	International Fund for Agricultural Development
IKI	International Climate Initiative
IPCC	Intergovernmental Panel on Climate Change
IT	Information technology
JICA	Japan International Cooperation Agency
KOICA	Korean International Cooperation Agency
LaCSA	Lao Climate Service for Agriculture
Lao PDR	Lao People's Democratic Republic
LaoDI	Lao Disaster Information Platform
LCCS	Land Cover Classification System
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LoA	Letter of agreement
LRIMS	Land Resources Information Management System
LUIS	Land Use Information System
LUP/LA	Land Use Planning and Land Allocation

M&E	monitoring and evaluation
MAF	Ministry of Agriculture
MLSW	Ministry of Labour and Social Welfare
MONRE	Ministry of Natural Resources and Environment
MT	mega-tonne
NAFRI	National Agriculture and Forestry Research Institute
NAPA	National Adaptation Programme of Action
NCEP	National Centers for Environmental Prediction
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NDMO	National Disaster Management Office
NMHS	National Meteorological and Hydrological Services
NMME	North American Multi-Model Ensemble
NSEDP	National Socio-Economic Development Plan
NUOL	National University of Lao PDR
O&M	Operation and maintenance
PAFO	Provincial Office of Agriculture and Forestry
PICO	Provincial Office for Industry and Commerce
PMU	Project Management Unit
PONRE	Provincial Office of Natural Resources and Environment
PPC	Plant Protection Centre (MAF)
PSC	Project Steering Committee
PyAEZ	Python Package tool for AEZ
RCP	Representative concentration pathway
RHEAS	Regional Hydrologic Extremes Assessment System
SAMIS	Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security for farmers in Lao PDR
SDG	Sustainable Development Goal
SMAP	Soil Moisture Active Passive
SMOS	Soil Moisture and Ocean Salinity
SOP	Standard operating procedure
SRIWMSP	Sustainable Rural Infrastructure and Watershed Management Sector Project
SSP	Shared Socioeconomic Pathways
TABI	The Agrobiodiversity Initiative
ToT	Training of trainers
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
VDMC	Village Disaster Management Committee
WFP	World Food Programme
WMO	World Meteorological Organization
WUG	Water user group