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United Nations



*Strengthening agroclimatic
monitoring and information
systems to improve adaptation
to climate change and food
security in LAO People's
Democratic Republic
(GCP/LA0/021 /LDF)*

Atlas of agricultural livelihoods and climate risk

of the Lao People's Democratic Republic
2019–2020



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Map on the cover: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.

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Source of the map: all maps are produced by the Department of Agricultural Land Management, and the SAMIS project. The maps contain climatological data produced by the same entities. The province boundaries were produced by the National Geographic Department in 2013.

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»» Foreword by DALaM |

Agriculture is a climate-dependent sector, being highly sensitive to climatic changes and climate variability. As demonstrated by the recently published Atlas of Climatology and Agro-Climatology, climate change is strongly impacting the Lao People's Democratic Republic. The changing climate is threatening rural households' livelihoods depending on agricultural production.

Lao population is aware of the climate vagaries and perceives the emergency and risk for their future. During the last few years, with the support of the project Strengthening Agro-climatic Monitoring and Information Systems (SAMIS) to improve adaptation to climate change and food security in Lao People's Democratic Republic, the Department of Agricultural Land Management has developed several datasets to assess the impact of climate change and livelihood. However, while at the global interest in climate change in South East Asia is growing, at the local level the extent to which changes in climate and climate variability affect the agricultural population depends on the adaptive capacity of the rural population.

Several international entities and donors have been supporting the Government of Lao People's Democratic Republic over the last few years to intervene in high-level decision-making, policy, and planning of the climate change-affected rural population. The collaboration with the International Center for Tropical Agriculture (CIAT) through the project Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in Southeast Asia (De-Risk) has been instrumental to study the farmer's livelihood and climate vulnerabilities.

Agricultural land management is the process of managing the use and development of land resources for the agricultural sector. This Atlas of Agricultural Livelihoods and Climate Risk of Lao People's Democratic Republic 2019 – 2020, a first for the Lao People's Democratic Republic, is designed for decision-makers and planners use while managing the land. It should help donors, government entities, investors, and the general population to define priorities and devise targeted solutions for the different populations and livelihoods based on their vulnerability, the resources that they have available for adaptation, and their capacity to adapt to the external environment. In this framework, this atlas constitutes a one-stop platform for visualizing existing information in a relatively easy to use manner. The use of these data for decision making and planning will reinforce the application of 9th National Socioeconomic Development Plan (NSED) and support the achievement the United Nations' (UN's) Sustainable Development Goals (SDGs) by taking urgent action to combat climate change and its impacts.



Phd Nivong Sipaseuth
*Director General of the Department of Land Management
Ministry of Agriculture and Forestry*

»» Foreword by CIAT |

A science-driven approach to climate resilience in Lao People's Democratic Republic.

Globally, the impacts of climate change are threatening all aspects of people's livelihoods, making efforts to attain food security more challenging.

This timely work of the Alliance of Bioversity International and CIAT with the FAO project Strengthening Agro-Climatic Monitoring and Information Systems emphasizes the importance of livelihood characteristics and adaptive capacity in providing tailored solutions for climate change adaptation in Lao People's Democratic Republic.

By mapping livelihoods and different types of indicators of adaptive capacity, we have captured the critical issues for effective adaptation across the country. This was developed at a scale relevant to national planning while capturing spatial variability to ensure that proposed solutions are tailored to local needs and priorities.

This information enables users to effectively develop relevant adaptation packages, such as irrigation measures to improve water availability, the provision of improved seed varieties, delivery of climate information and advisory, access to credit and diversification of income sources. The development of proactive plans and programs can increase the absorptive and transformative capacities of people affected by climate change.

The Alliance hopes that the results of the analysis will enable sector-wide initiatives in designing and shaping policies and programs to climate-proof agricultural and rural investments and subsequently improve people's livelihoods and resilience.



Kees Swaans
*Senior Advisor - Climate Change and Development, Climate
Action CIAT*

» Acknowledgements |

This Atlas was made possible by two projects and collaborating teams. The science and knowledge, as well as part of the funding, was provided by the "Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in Southeast Asia" (De-Risk) project, implemented by CIAT and financed by the International Climate Initiative from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The baseline activities, logistical support and the partnership, as well as part of the funding, were provided by the Strengthening Agro-Climatic Monitoring and Information Systems (SAMIS) project, implemented by the Food and Agriculture Organization of the United Nations (FAO) and financed by the Global Environment Facility (GEF), which aims to improve adaptation to climate change and food security in the Lao People's Democratic Republic.

The main national agencies involved in carrying out the activities as part of this work included the Department of Agricultural Land Management (DALaM) and the National Agriculture and Forestry Research Institute (NAFRI) in collaboration with the Department of Meteorology and Hydrology (DMH). The methodology was developed by the International Center for Tropical Agriculture (CIAT).

The authors of this Atlas from CIAT, involved in both developing the scientific methodology and providing guidance on the preparation of the maps, included Dr Pablo Imbatch, De-Risk Project Coordinator at the time of the work being carried out; Dr Leo Kris Palao, Coordinator of the De-Risk project for the Lao People's Democratic Republic; and Dr Lao Luis Molina, Mr Trung Nguyen, Mr Angelica Barlis and Dr Thongkhoun Sysaphaithong, all Project Specialists at CIAT. The authors from DALaM who supported the entire process, including the running of the workshops, digitalization of the database and the mapping process, included Dr Saysongkharm Sayavong, Head of the Geographic and Information System (GIS) Unit and Head of Component 2 of SAMIS, and GIS Technicians include Mr Viengsun Savong, Ms. Sorlaty Sengxeu, Ms. Chinda Mounlamany and Ms. Phavanh Saylichanh.

The authors from NAFRI, who both developed the scientific methodology and participated in and ran the participatory workshops, were Dr Thavone Intavong, Director of Agricultural Research on Climate Change Center, Mrs Dalivanh Xamonty, Head of Climate Advisory Sector and Mrs Phone Aloun Chanthabouasone, Information Management and Dissemination Sector.

The authors from SAMIS and FAO, who supported the logistics and the development of the entire process, were Dr Monica Petri, Coordinator of the SAMIS project, and Mr Vandy Phothiylay, Training Manager. The SAMIS mapping specialist and consultants for Component 2 of SAMIS were Korlor Nyama and Chaiyang Chueva.

The authors wish to acknowledge the considerable support for DALaM's work provided by Dr Nivong Sipaseuth, Director General of the Department of Agricultural Land Use Management, Mr. Anolath Chanthavongsa, Deputy DG of DALaM, and Mr Phaythoune Philakone, Director of the Agricultural Land Use Planning Center. They would also like to recognize the important role played by the DMH by allowing the team to use its data, participating in workshops, and active facilitation of workshop activities spelling out the vision of the Ministry of Natural Resources and Environment (MONRE). The participants were Mr Viengxay Manivong, DOG, and National Project Director for SAMIS; and Mr. Saengduangdeuan Phouttanoxay, Deputy Division Director for the DMH and Head of Component 1 of the SAMIS project. Thanks to his active project leadership, Mr Viengxay Manivong in particular, provided SAMIS with the political capacity to lead this sort of innovative participatory mapping process which was a first for the Lao People's Democratic Republic.

» Abbreviations and acronyms

MAF	Ministry of Agriculture and Forestry
MONRE	Ministry of Natural Resources and Environment
FAO	Food and Agriculture Organization of the United Nations
DAFO	District Agriculture and Forestry Office
DALaM	Department of Agricultural Land Management
DMH	Department of Meteorology and Hydrology
NAFRI	National Agriculture and Forestry Research Institute
CIAT	International Center for Tropical Agriculture
SAMIS	Strengthening Agro-Climatic Monitoring and Information Systems
PAFO	Provincial Agriculture and Forestry Office

» Abstract |

This Atlas presents the first national dataset on livelihoods and the capacity to adapt to climate change in the Lao People's Democratic Republic. Maps on this Atlas help ascertain the livelihoods of farmers and how they are coping with climate risk, as well as identify farmers' needs for climate services at the national level. This method is state of the art and is probably one of the first examples of a national livelihood dataset being developed for a country at the Lao People's Democratic Republic's economic level.

The information is developed through a participatory method. First, it includes the collaborative development of a livelihood zone map. A livelihood zone is a geographical area where people share the same patterns of access to food and income (that is, they grow the same crops or keep the same types of livestock), and have the same access to markets. A livelihood zone can be defined as a mapping unit for which the adaptive capacity of those living and working in that zone is definite. Livelihood units are defined taking into consideration the type of production system in use (rainfed vs irrigated, perennial vs annual, subsistence vs market-oriented), land tenure schemes, farm size (small, medium or large), the natural environment (upland vs lowland), and access to markets. The second phase includes the definition of adaptive capacity, which is the capacity to assess changes in the environment, identify options, and plan and implement measures to reduce climate change's impact on one's livelihood. Adaptive capacity was mapped with a participatory method for each landscape based on three conditions: (a) the satisfaction of basic needs; (b) access to the resources needed for innovation; and (c) the capacity to translate innovation into action. To define these three conditions, the participants were asked to provide information on the natural, social, physical, financial, cultural and human resources, or capital, that characterized the livelihoods of the farmers in each landscape. The landscape characteristics mapped included attitudes towards livelihood-related change, economic activity, soil fertility, supporting infrastructure, food security issues, water security, institutional support and extension services, access to climate information through information and communication technologies (ICTs), market access vis-a-vis production orientation, use of and access to agricultural inputs, livelihood diversification, and dependency on agriculture, including the rearing of livestock and fish.

All the information mapped through this method is listed in this Atlas. This information helps identify areas where farmers are unable to satisfy their basic needs and thus may require extensive and long-term interventions to improve their adaptive capacity in combination with a few basic adaptation options to help them cope with climate and other types of shock. In addition, areas suitable for the rolling out of new or improved agricultural practices can also be identified based on whether or not farmers have the resources needed for innovation and are able to take action to mitigate the impact of climate risks. This shows how livelihood mapping and adaptive capacity data can be used to target the areas most in need of interventions, as well as determine which interventions are needed in each geographic area based on how they rate on the adaptive capacity indicators. Increasing the agricultural population's adaptive capacity requires coordinated investment in order to achieve socio-economic development outcomes aimed at strengthening the social, natural, financial, productive, cultural, political and human assets of rural livelihoods. Because some of the information analyses adaptation priorities at the landscape level, it also enables to identifying adaptation options tailored to local circumstances that use better agricultural technologies and encourage more widespread adoption of approaches. In addition, the method helps identify patterns across administrative boundaries and therefore provides an opportunity to coordinate and implement inter-administrative tailored adaptation measures efficiently. The capacity to point to weaknesses and opportunities also opens the door for collaboration between the public and private sectors.

Systematic data analysis used in this information ensures the effective use of the information. Each map described in this chapter represents one of the livelihood indicators. For each map and indicator, a methodology is provided, as well as the rationale behind its choice, its importance to the and explanation of the data included in the map. The maps' coloured areas, representing high to low levels of a given parameter, can be used to determine how well a province might be able to adapt to climate change, and rank the country's provinces accordingly. In addition, the data is freely available in the Land Resources Information System (LRMIS) at <https://lrims-dalam.net/> allowing for more experience users to also use and further analyse the information.

In summary, this Atlas provides leaders and development partners at all levels with the data needed to effectively plan climate change adaptation interventions. National teams are now able to independently use and access this information to help them manage agricultural production and promote the cultivation of high-quality produce.

» Introduction |

Because agriculture is the main livelihood in the Lao People's Democratic Republic, the Government prioritizes the agricultural sector by targeting many aspects such as food security, sustainable forest management, and green agriculture. The sector, employs approximately 76 percent of the total population. These days, however, the agriculture sector is facing uncertain conditions: climate change is affecting the livelihoods of villagers (particularly those in mountainous areas), food security, the frequency of natural disasters and the country's economic situation in general. Agriculture is a climate-dependent activity, being highly sensitive to climatic changes and climate variability. A changing climate represents a threat to thousands of rural households whose livelihoods depend on agricultural production. The extent to which changes in climate and climate variability affect the agricultural population depends on the adaptive capacity of the rural population. Adaptive capacity is the capacity to assess changes in the environment, identify options, and plan and implement measures to reduce the impact of climate change on their livelihoods. Increasing the adaptive capacity of the agricultural population requires coordinated investment in order to achieve socio-economic development outcomes designed to strengthen the social, natural, financial, productive, cultural, political and human assets of rural livelihoods (Flora *et al.*, 2015).

In an attempt to plan for and tackle these changing conditions, the Lao government proposed that the Lao office of the Food and Agriculture Organization of the United Nations (FAO) support this work to improve the country's 1) data collection and analysis systems at both the provincial and national levels, in order to support all food security-related activities; and 2) agro-climatic monitoring systems, data analysis, land resource information systems and appropriate land management, in order to support decision makers in the formulation of policy aimed at reducing climate change risks at the local level. In response to this proposal by the Lao government, FAO has developed the "Strengthening Agro-Climatic Monitoring and Information Systems to improve adaptation to climate change and food security in Lao People's Democratic Republic" project, otherwise known as the SAMIS project. Under the coordination of the Department of Agricultural Land Management (DALaM), one of the main targets of the project is the development of the Land Resources Information Management System (<https://lrims-dalam.net>) and online database containing both bio-physical and socio-economic data. This Atlas includes part of the socio-economic assessment contained in the LRIMS, known as the Socio-Economic and Vulnerability Assessment (SAVA). Decision makers and planners need methodologies to help them define priorities and devise targeted solutions for the most vulnerable populations and livelihoods based on the resources that they have available for adaptation (adaptive capacity) and expected impacts of climate change (Ford *et al.*, 2010). To define priorities for adaptation, livelihood zones were mapped using a participatory process involving agricultural and rural development front liners and experts in the country, in collaboration with DALaM and the National Agriculture and Forestry Research Institute (NAFRI). The map defines the following for

The Lao People's Democratic Republic's first national livelihood map

each zone: (1) crop type; (2) crop combinations; (3) the climate risks threatening agricultural livelihoods; and (4) several adaptive capacity indicators for use in climate change adaptation planning and vulnerability assessment. This also complements SAMIS's socioeconomic and vulnerability analysis (SAVA) by providing a detailed assessment of the adaptive capacity of each livelihood zone. The aim of mapping livelihood zones and assessing adaptive capacity was to identify priorities for national interventions and adaptation measures using landscape-level livelihood zones as the unit of analysis.

As part of this work, the SAMIS project has been cooperating with the International Center for Tropical Agriculture (CIAT). CIAT is involved in the "Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in Southeast Asia" project, which is financed by the International Climate Initiative of Germany's Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and led by the World Meteorological Organization.

CIAT has developed a methodology for identifying agricultural livelihoods and the climate change risks farmers are currently facing. This data is presented in this Atlas, as well as online as part of the LRIMS (<https://lrims-dalam.net>). The methodology also allows climate services within the Lao People's Democratic Republic to be prioritized. The dataset is state of the art, and is probably the first example of a publicly available livelihood dataset that uses participatory and expert methods being produced by a country in the Lao People's Democratic Republic's economic class.

Following this introduction, this Atlas is divided into two main parts. The first part explains the objectives, methodology and implementation approach for the national-level participatory method, as well as providing a summary and recommendations for the dataset's use. The second part describes the resulting maps and the methodology used to produce each of them.

At the time of writing this Atlas, the data are being used by SAMIS to develop an appropriate approach and encourage the government sector, policy makers and line agencies to support climate change risk management programmes, including climate information services, in the Lao People's Democratic Republic. Other development partners have already started using the Atlas to help them prioritize project interventions.



»» Objectives of determining agricultural livelihoods and climate risk |

- To ascertain the livelihoods of farmers and how they are coping with climate risk, as well as identifying farmers' needs for climate services at the national level. This method is state of the art and is probably one of the first examples of a national livelihood dataset being developed for a country at the Lao People's Democratic Republic's economic level.
- To bring together existing expert knowledge in order to support decision-making and transparent prioritization, opening the door for collaboration between government and non-government sectors.
- To make data available, despite there being a scarcity of economic resources available for data collection.
- To identify climate risks that threaten farmers' food security and livelihoods, and analyse adaptation priorities at the landscape level. Furthermore, to help identify adaptation options tailored to local circumstances that use better agricultural technologies and encourage more widespread adoption of approaches.
- To identify patterns across administrative boundaries, providing an opportunity to coordinate and implement inter-administrative tailored adaptation measures efficiently.
- To identify climate risks and their impact in order to support agricultural planning, thus increasing farmers' yields and climate resilience.

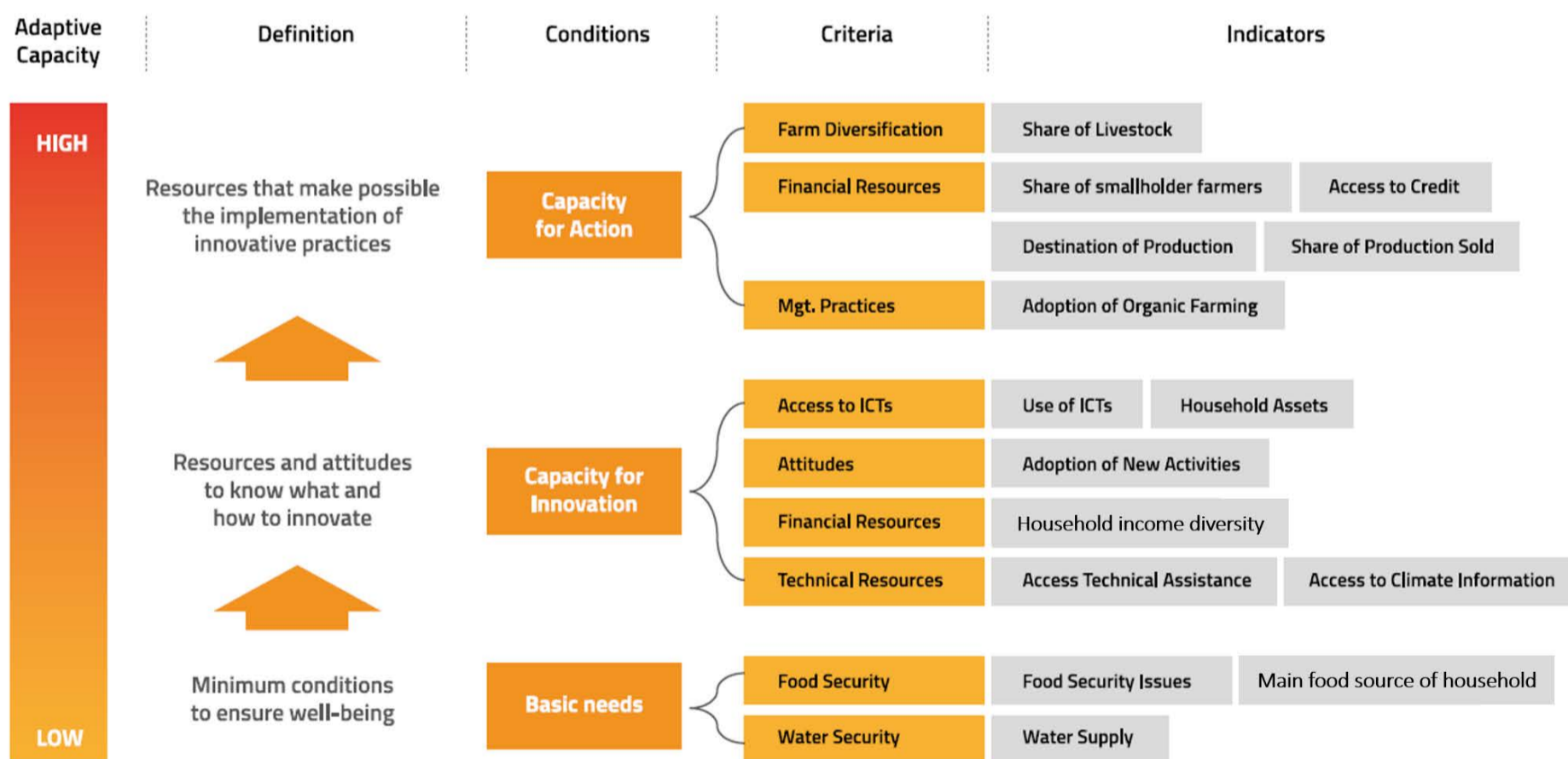
»» Target outputs |

- Collect information to generate the detailed geographical dataset on the Lao People's Democratic Republic's main agricultural production systems in different environmental conditions, including conditions in local areas such as access to production areas and markets and produce for either direct consumption or sale. These outputs are presented in this Atlas.
- Collect the data needed to provide climate services to farmers, such as crop calendars, production systems being used and climate risks. Some of these data have also been used in the Laos Climate Service for Agriculture (LaCSA) system: <https://www.lacsa.net/>.

»» What is this Atlas about? |

- **A livelihood zone** is a geographical area where people share the same patterns of access to food and income (that is, they grow the same crops or keep the same types of livestock), and have the same access to markets. A livelihood zone can be defined as a mapping unit. For each livelihood zone, a database record defines the adaptive capacity of those living and working in that zone. The database is publicly available and can be downloaded from the LRMIS.
- **Adaptive capacity** is the capacity to assess changes in the environment, identify options, and plan and implement measures to reduce climate change’s impact on one’s livelihood. Increasing the agricultural population’s adaptive capacity requires coordinate investment in order to achieve socio-economic development outcomes aimed at strengthening the social, natural, financial,

productive, cultural, political and human assets of rural livelihoods (Flora *et al.*, 2015). Following the approach of Bouroncle *et al.* (2017), adaptive capacity was mapped for each landscape based on three conditions: (a) the satisfaction of basic needs; (b) access to the resources needed for innovation; and (c) the capacity to translate innovation into action (Figure 1). These were assumed to follow a sequential order, such that farmers unable to satisfy their basic needs will have limited resources for innovation, and will therefore be less able to take action to adapt to climate change. To prepare the assessment, a comprehensive list of indicators was produced and related to the literature review and other studies conducted by CIAT on vulnerability mapping and analysis.



Author's own elaboration

Figure 1. Adaptive capacity assessment based on three conditions determining farmers’ level of capacity to adapt to climate change. The indicators shown here are non-exhaustive and provided only to demonstrate the approach.



» Implementation approach

- ▶ The core assessment phase involved a participatory process based on expert knowledge targeting the entire country, with livelihoods as the unit of analysis.

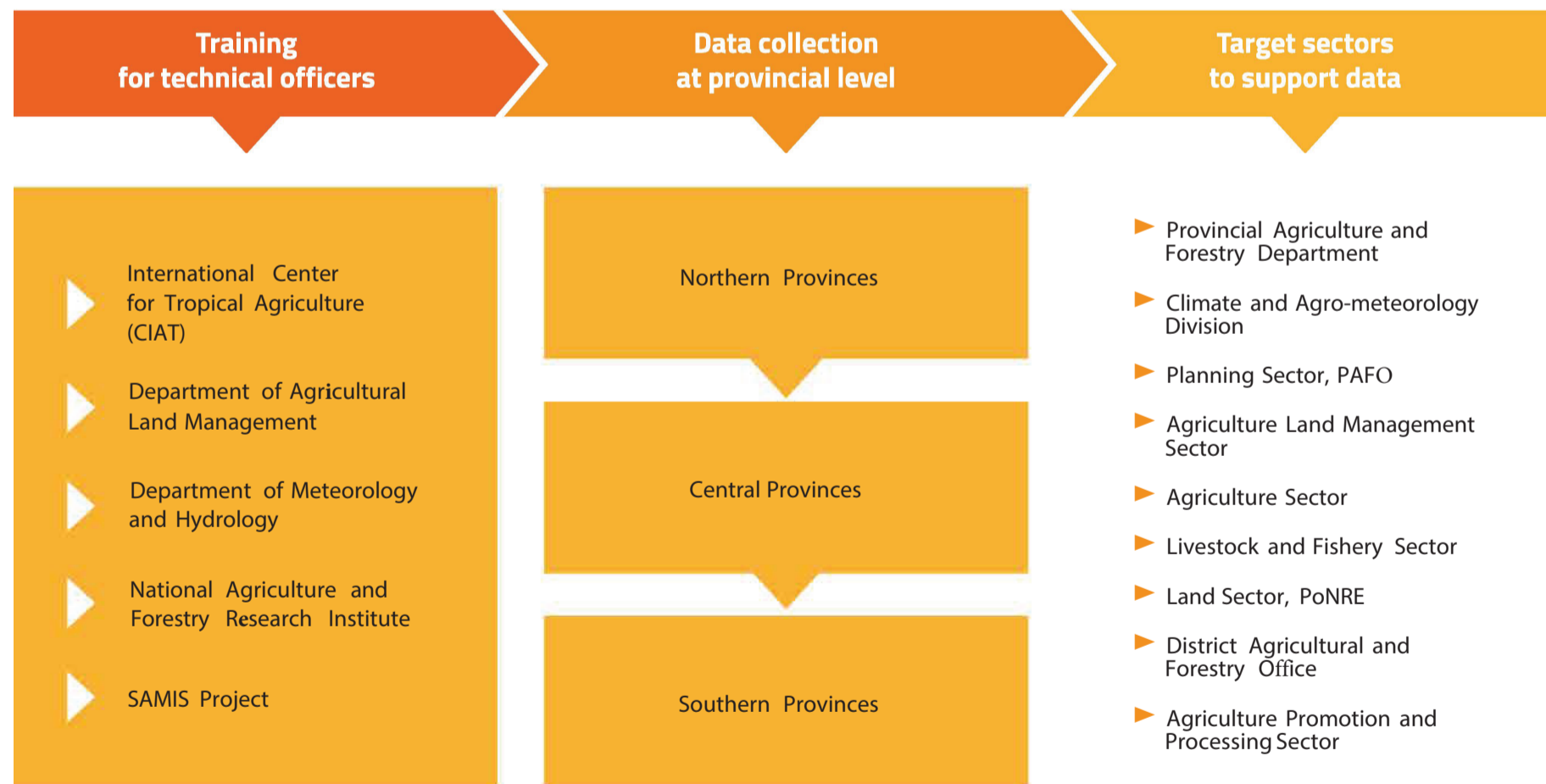
Planning and study phase

The planning and design of the methodology was carried out by CIAT before being discussed and agreed by the SAMIS project, NAFRI and DALaM. This included national-level data collection, the groupings of the provinces, target participants for workshops, the initial unit of analysis (spatial resolution), and the workshop programme. In addition, a list of indicators was produced and converted into a list of workshop phases designed to obtain the required expert information in map format and characterize agricultural livelihoods. The indicators were also later used to create a questionnaire to be made available at the workshops. CIAT also developed the capacity of central-level experts so that SAMIS, NAFRI and DALaM could help with the mapping of the units.

Responsibility for the workshops' logistics and planning was undertaken jointly by De-Risk and SAMIS.



CIAT experts meeting DALaM, NAFRI and SAMIS staff to train them and discuss the expected role of national staff in running the workshops.



Author's own elaboration

Figure 2. Flow chart of activities for the preparation of the target groups for data collection.

»» The consultation process |

Three two-day consultation meetings were held in Champasak Province (Figure 1), Xiangkhoang Province (Figure 2) and Oudomxay Province (Figure 3) for the southern, central and northern regions, respectively. These meetings were attended by 44 women out of a total of 212 participants, and their aim was to identify the main crops and agricultural production practices in the Lao People's Democratic Republic, create a map of agriculture livelihoods, determine and prioritize main crops, improve crop calendars, determine potential risks for the last ten years, identify risks affecting the main crop, and disseminate the information to support the network for climate change adaptation. The three groups covered the country's northern (Bokeo, Houaphan, Louangnamtha, Oudomxay, Phongsali and Xaignabouli), central (Bolikhamsai, Khammouan, Savannakhet, Vientiane Capital, Vientiane, Xaisomboun and Xiangkhoang) and southern (Attapu, Champasak, Salavan and Xekong) provinces. For the participatory data

During the workshops, participants were split into groups based on their province, with portions devoted to allowing the groups to interact in order to ensure the coordination of data across administrative boundaries. Participants were provided with maps and various drawings and workshop materials.

Landscape-level mapping of livelihood units

A participatory mapping approach was taken in which representatives from the District and Provincial Agriculture and Forestry Offices (PAFOs/DAFOs) were involved in defining the geographical boundaries of livelihood units. The unit of analysis for this process was agricultural livelihoods, defined as the resources required by farmers to support their means of living (e.g. natural resources, access to markets, social and community values, infrastructure). The teams received multiple paper maps of several dimensions and plastic



The logistics and management of all activities were undertaken by training expert Ms Pothiyalay.

expert gathering, the source of data collection for mapping was from the sectors under Agriculture and Forestry Offices of each province, National Agricultural and Forestry Research Institute, Natural Resource and Environment Department of each province, and projects related to the promotion of agriculture and forestry involved in activities at the local level.

In addition, the process involved around 20 experts from SAMIS, NAFRI, DALaM, the Department of Meteorology and Hydrology (DMH) and CIAT, who were involved both in carrying out the assessment and facilitating the teams. Journalists from the country's main media outlets attended all events.



The media recording the results of Khammuane province at the workshop in Phonsavan.

transparencies which they could draw on. They were left to determine appropriate livelihood units and refine their boundaries, taking into consideration production system type (rainfed vs irrigated, perennial vs annual, subsistence vs market-oriented), land tenure, farm size (small, medium, and large land holders), natural environment (upland vs lowland) and access to markets.

»» Livelihood assessment |

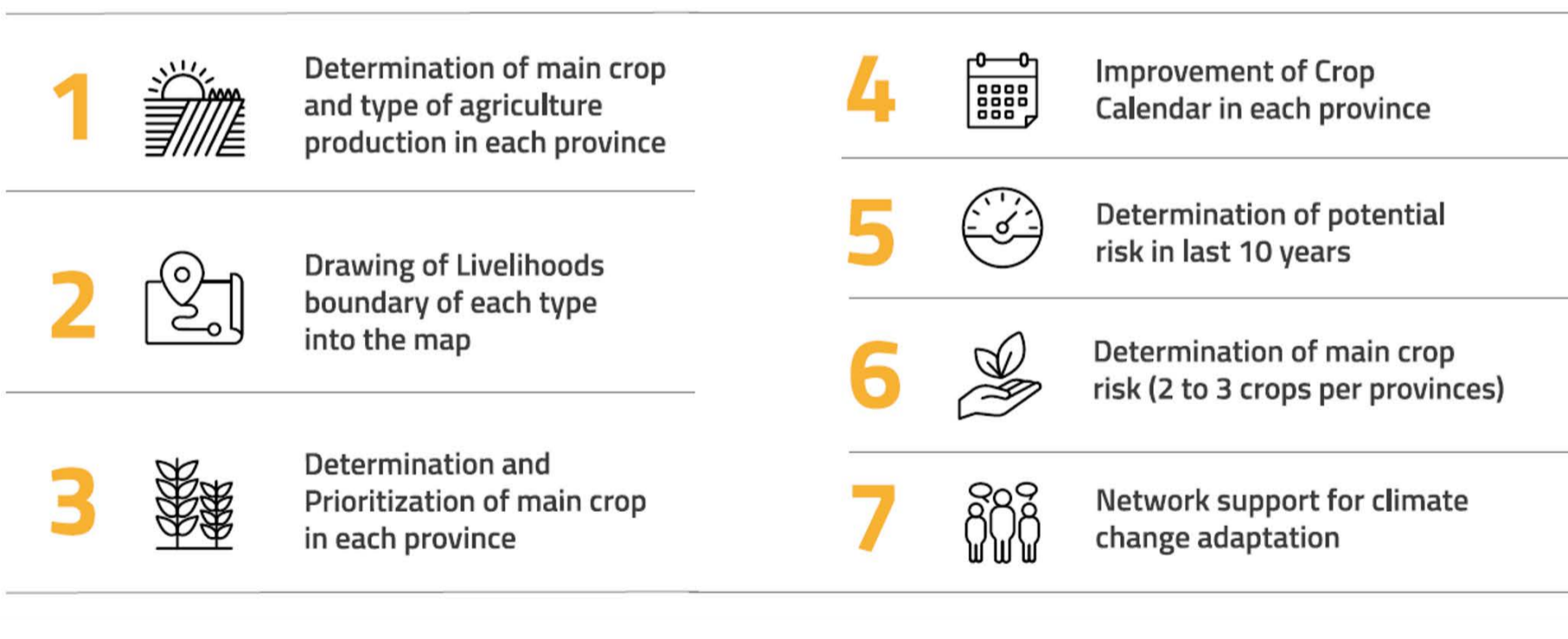
In addition to the mapping of livelihood units, the survey and data collection took place mainly by using the questionnaire developed by CIAT experts and supported by map materials based on expert knowledge. The qualitative method allowed respondents from provincial line agencies to support the information of their agencies and bring together experts from different sectors to exchange and share their perspectives critically and reasonably. The participants were then asked to provide information on the natural, social, physical, financial, cultural and human resources, or capital (Flora *et al.*, 2015), that characterized the livelihoods of the farmers in each landscape.

Following the approach of Bouroncle *et al.* (2017), each landscape's level of adaptive capacity depends on three conditions: (a) the satisfaction of basic needs; (b) the availability of resources permitting innovation; and (c) the capacity to translate innovation into action (Figure 1).

To characterize the livelihood units, the questionnaire gathered information on cropping patterns, crop calendars, crop stages, climate risk, and responses

during the workshops. Further interviews were conducted to collect detailed information on the indicators (see Figure 1) describing the characteristics of the landscape, attitudes towards livelihood-related change, economic activity, soil fertility, supporting infrastructure, food security issues, water security, institutional support and extension services, access to climate information through information and communication technologies (ICTs), market access vis-a-vis production orientation, use of and access to agricultural inputs, livelihood diversification, and dependency on agriculture, including the rearing of livestock and fish. These are the main indicators used to characterize the adaptive capacity of farmers. The indicators were grouped according to the three conditions for adaptation described above.

»» Flow chart of data requirement from target group |



Author's own elaboration

Figure 3. Data collected by each group of experts.

» Data analysis and mapping |

Data analysis and mapping was carried out by the SAM IS team and approved by CIAT, NAFRI and DALaM. The conversion of data from paper to electronic format ready for inclusion in the geographic information system (GIS) and database was mainly carried out by DALaM and SAMIS experts under the coordination of CIAT. Interpretation of the data and the drafting of this Atlas was mainly carried out by DALaM.



Figure 4. Chairperson and participants at the workshop for southern Laos.



Figure 5. Chairperson and participants at the workshop for central Laos.



Figure 6. Chairperson and participants at the workshop for northern Laos.

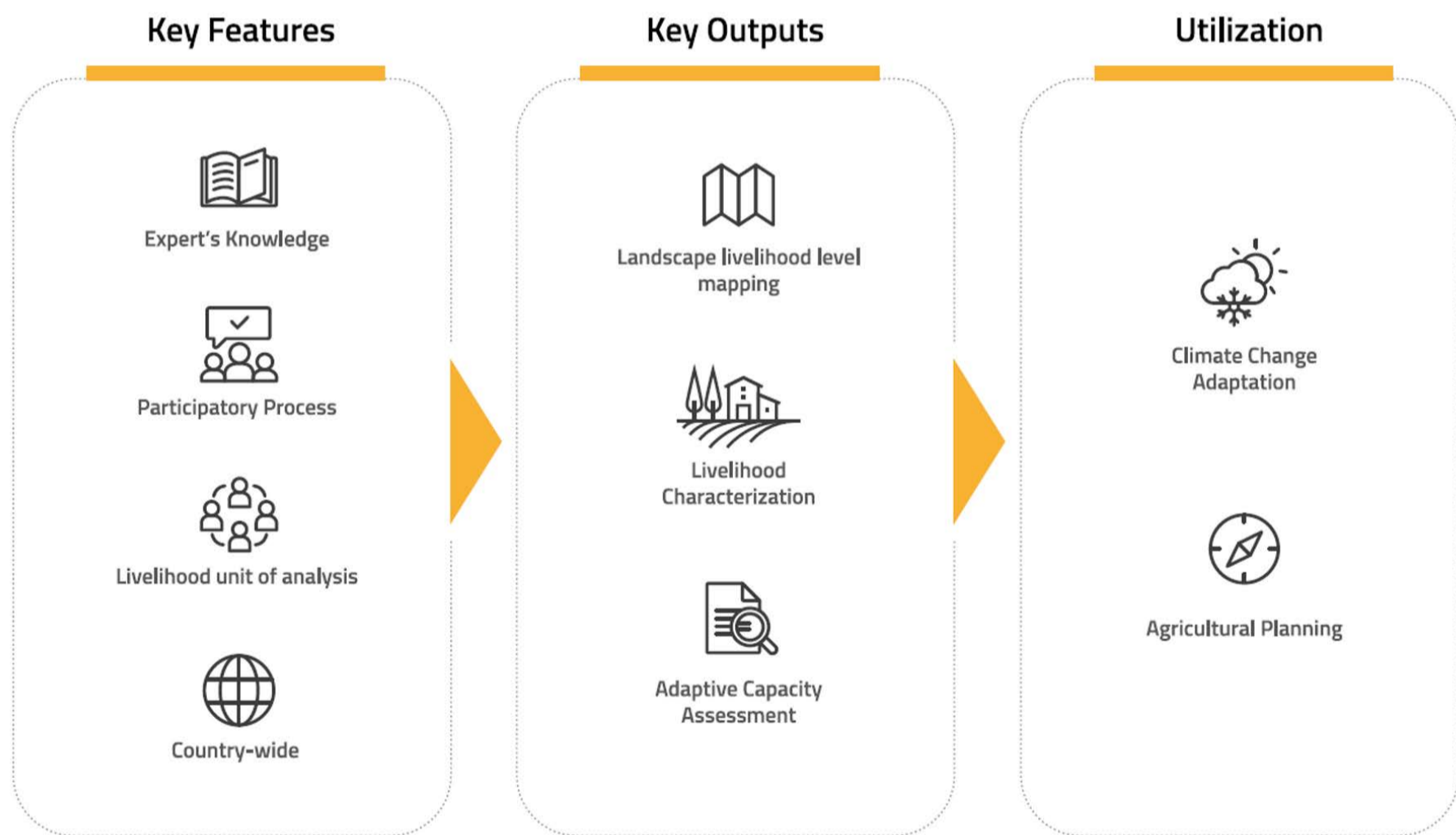


» Disclaimer |

This Atlas of agricultural livelihood and climate risk of the Lao People's Democratic Republic 2019 – 2020 is a new knowledge tool aimed at supporting decision-making in relation to the Lao government's socioeconomic development plan, particularly as this relates to agriculture and rural development, and achieving the targets of Agriculture Strategy 2030.

The maps in this Atlas showing the agricultural occupation of farmers, and how this affects their capacity for climate change adaptation, could serve as a reference for specialists, administrators and technicians when formulating development plans and policy by indicating the problems and potential of local farmers together with the enhancement of sustainable action in their areas.

The scale of the maps is 1:250 000, which may result in unclear images of areas that are difficult to define. These data do not allow villages or groups of villages to be considered individually. This map is suitable only for central-level planning, or the prioritization of interventions.



Author's own elaboration

Figure 7. Key features and outputs and intended uses of the livelihood maps.

»» Recommended use of the map and database |

Livelihood mapping was carried out at a national scale, capturing spatial variability within and extending beyond district-level administrative units. Taking landscapes as the unit of measurement when assessing adaptation priorities is key to identifying adaptation options tailored to local conditions which are more likely to be widely adopted. Furthermore, information on farmers' livelihoods and adaptive capacities can be used to identify patterns spanning administrative boundaries, providing an opportunity for greater efficiency in planning and the implementation of tailored adaptation measures. For each of the livelihood units, information is provided on the climate risks threatening farmers' food security and economic situation, as well as an assessment of the indicators relating to the three conditions for adaptation.

These three conditions can be used to help identify areas where farmers are unable to satisfy their basic needs, and thus may require extensive and long-term interventions to improve their adaptive capacity in combination with a few basic adaptation options to help them cope with climate and other types of shock. Areas suitable for the rolling out of new or improved agricultural practices can also be identified based on whether or not farmers have the resources needed for innovation and are able to take action to mitigate the impact of climate risks. This shows how livelihood mapping and adaptive capacity data can be used to target the areas most in need of interventions, as well as determine which interventions are needed in each geographic area based on how they rate on the adaptive capacity indicators. This also opens the door for collaboration between the public and private sectors.

»» Adaptive capacity patterns at the national level |

In most cases, levels of adaptive capacity could not be associated with one specific livelihood system. For example, rice-based livelihoods can be found at all levels of adaptive capacity, from very low to very high. Moreover, it might be expected that landscapes very distant from the main markets and infrastructure, or closer to the agricultural frontier, would have a predominantly lower adaptive capacity. While this is true of landscapes adjacent to and surrounded by extensive forests in the central, southern and northern most regions of the country, it does not apply systematically, since similar landscapes exist with high levels of adaptive capacity. Landscapes close to the border with Thailand were observed to have high adaptive capacity. Livelihood units that scored very low in terms of the satisfaction of basic needs tended to be located in the southern provinces of Laos. Upland rice and grassland areas accounted for the majority of agricultural land, with very low satisfaction of basic needs. Livestock-based livelihoods in the border areas of Savannakhet

and Khammouan also scored very low in terms of the satisfaction of basic needs, as did rainfed lowland rice paddies in Vientiane Province. Areas that scored high in terms of the conditions for adaptation were located in Bolikhamxai, portions of Savannakhet and Salavan, and some patches of Louangphabang, Oudomxay and Louangnamtha. Areas that scored very high in terms of their capacity to take action were found in Vientiane Capital and northern regions. High adaptive capacity is also associated with areas with a high capacity for innovation. Rice-based livelihoods (rainfed and irrigated) are predominant in these areas, alongside those based on the mixed cultivation of maize, vegetables and livestock. The analysis is based on the assumption that areas with very low levels of basic need satisfaction will also have a very low capacity for innovation and to take action.

»» Detailed maps of livelihood indicators |

This Atlas shows the geographic extent of livelihood and climate risk determination, and therefore illustrates the capacity to adapt to climate change of people working as farmers across the country.

The maps in this Atlas are the result of expert-based assessment which produced a range of data on farmers' capacity to adapt to climate change. Similarly, by describing agricultural production patterns based on actual and potential local conditions, this Atlas also reveals trends in people's ability to deal with climate change. The data are also available in the LRMIS online. Systematic data analysis is key to ensuring the effective use of the information described in this Atlas and allowing the data to be used as a reference for managers and experts at all levels in their decision-making.

Each map described in this chapter represents one of the livelihood indicators. For each map and indicator, a methodology is provided, as well as the rationale behind its choice, its importance to the Lao People's Democratic Republic and explanation of the data included in the map. The maps' coloured areas, representing high to low levels of a given parameter, can be used to determine how well a province might be able to adapt to climate change, and rank the country's provinces accordingly.

Methodology

The adaptive capacity index (ACI) was calculated as the normalized composite value of the three conditions for adaptation: (a) satisfaction of basic needs; (b) resources available for innovation; and (c) the capacity to translate innovations into action. The three conditions were assumed to follow a sequential order, such that farmers unable to satisfy their basic needs will have limited resources for innovation and will therefore be less able to take action to adapt to climate change. A comprehensive list of indicators was drawn up in order to evaluate each condition during the participatory workshops.



Representatives presenting the results of their discussion of livelihoods in each province.



Organic farmers group in Nonte village (Vientiane Capital) use shadow net to protect coriander at the time of planting.

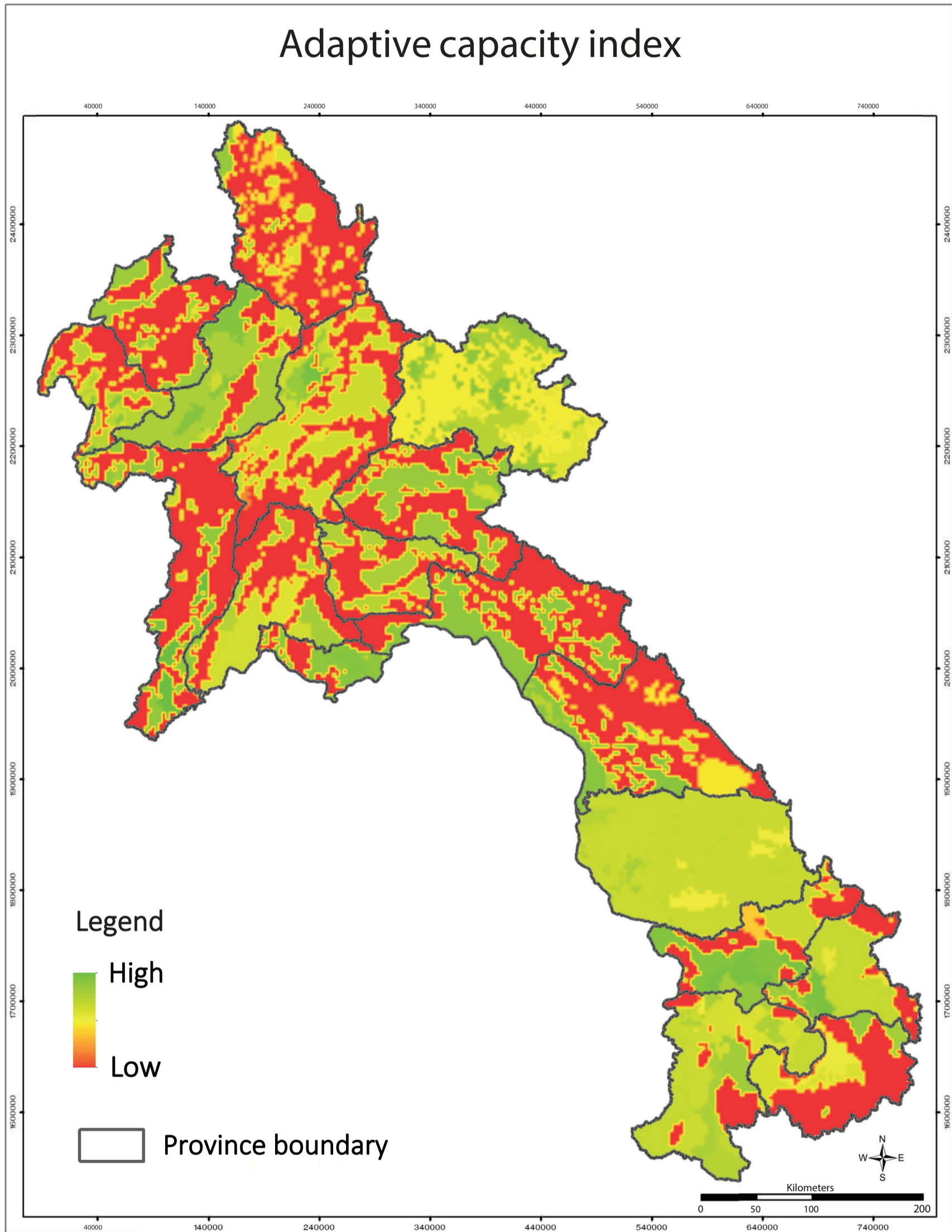
Assessment of the adaptive capacity index

The adaptive capacity index, representing agricultural producers and ecosystems' capacity to adapt to climate change, is a tool that can be used to support agricultural promotion and climate change adaptation policy and interventions at the local level in areas where there is a high risk of climate change in the future.

The map shows farmers' adaptive capacity index, with the red, yellow and green colours representing low, medium and high levels of adaptive capacity, respectively. The map reveals that there are two provinces in the Lao People's Democratic Republic with a medium-to-high adaptive capacity: Houaphan and Savannakhet. This is followed by five provinces - Champasak, Xekong, Salavan, Vientiane Capital and Oudomxay - with a low-to-medium level adaptive capacity. The remaining ten provinces are able to adapt only at the municipal or community level in areas with access to infrastructure which can be supplied in different sectors such as socioeconomics, technology, transportation, electricity, health care and sanitation, and with a central point of administration and management.



An adaptive local innovation used by organic farmers group in Nonte village (Vientiane Capital) include the use newspaper to wrap and protect the product against insects.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.



Methodology

The basic need satisfaction index was calculated as the normalized composite value of two criteria: food security and water security. Other indicators related to human capital were not included since they did not provide enough variability across livelihood zones. The data on food and water security were collected using participatory methods, with livelihood zones as the spatial unit of analysis. Agricultural experts from the DAFOs served as key informants by evaluating the indicators of adaptive capacity.



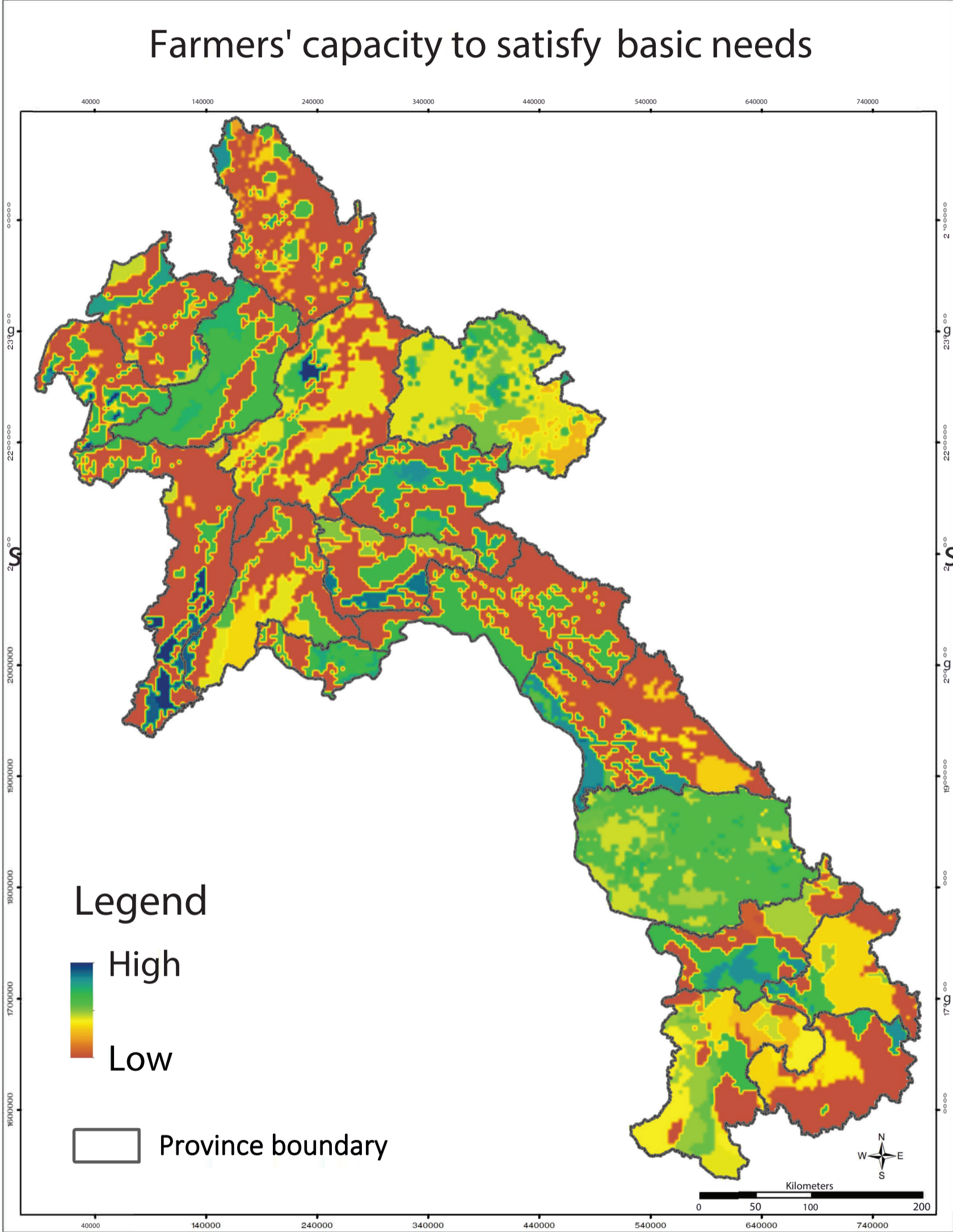
Phongsavan Province representatives showing the results of their discussion of farmers' capacity to satisfy their basic needs.

Assessment of farmers' capacity to satisfy basic needs

Satisfaction of basic needs is an important way of measuring poverty levels in developing countries, identifying households' resource usage and satisfaction of basic needs can provide an indication of hunger and long-term health issues due to poverty and thus an inability to purchase products for consumption. According to the map illustrating the basic need satisfaction data, of the 17 provinces and one capital city in the Lao People's Democratic Republic, there are seven provinces in which farmers' capacity to satisfy their basic needs has been classed as medium to high: Vientiane Capital, Oudomxay, Houaphan, Savannakhet, Champasak, Xekong and Salavan. In five provinces - Louangphabang, Vientiane, Bolikhamxai, Khammouan and Attapu - a medium level of capacity to satisfy basic needs was found. The residents of a further six provinces were able to satisfy their basic needs only in municipal areas and those with access to transport.



Women participating in a LaCSA capacity development workshop in Phouthone village, Vientiane Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.



Methodology

The capacity for innovation index was calculated as the normalized composite value of four criteria: access to ICTs, attitudes to innovation, financial resources, and technical assistance. These criteria represent the resources required for farmers to be able to start introducing innovation to their land use management. The data on ICT, attitudes and financial resources were collected using participatory methods, with the livelihood zones as the spatial unit of analysis. Agricultural experts from the DAFOs served as key informants by evaluating the indicators of adaptive capacity.



Bokeo Province representatives showing the results of their discussion of farmers' capacity for innovation.

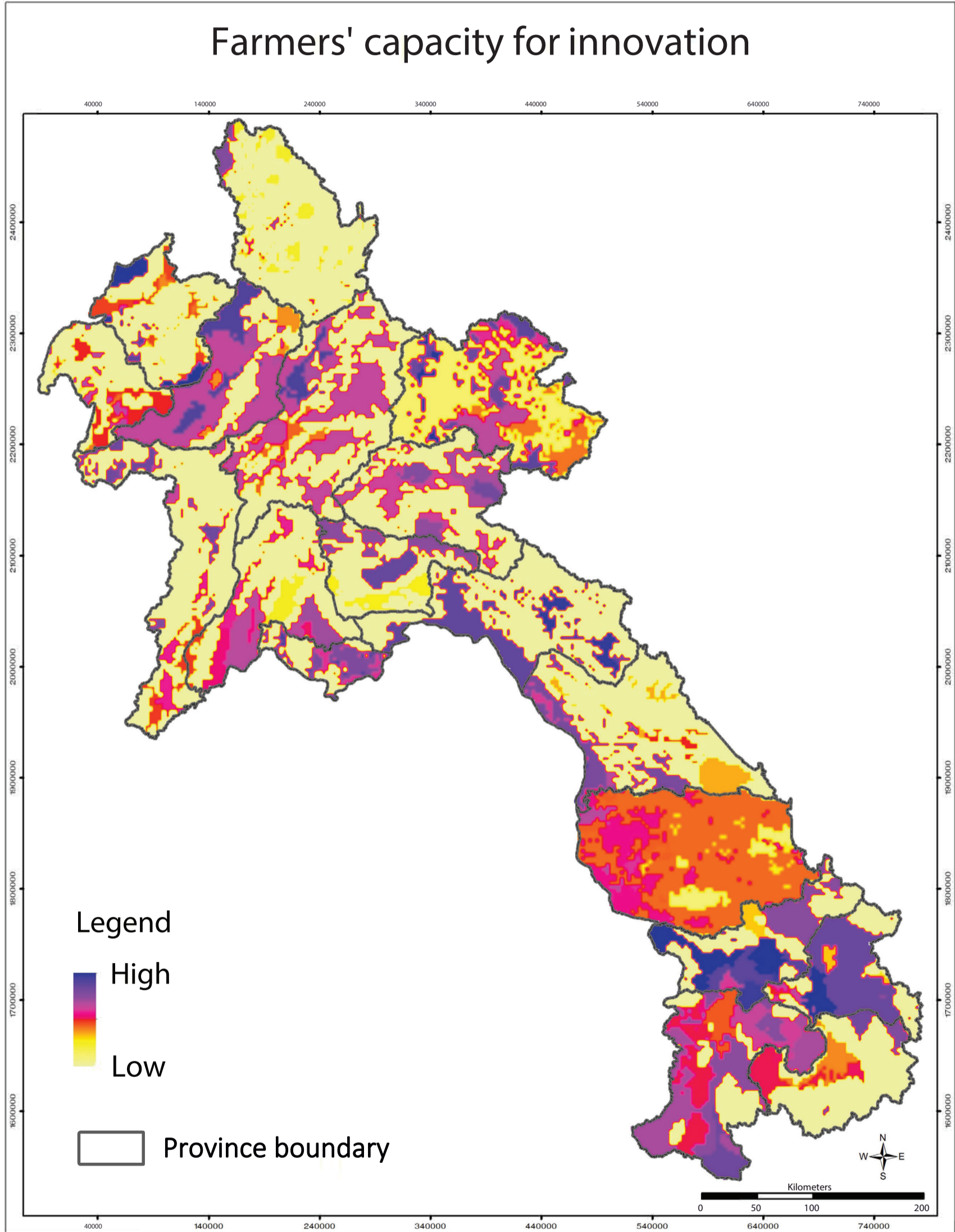
Assessment of farmers' capacity for innovation

The analysis and development of new knowledge for economic development of farmers are conducted in relation to farmers' capacity for innovation. This influences food security, youth employment and the development of networks, which are vital to the agricultural sector, particularly when it comes to access to finance. Networks also help bring together developers and investors and support cooperation, knowledge exchange and the innovation of new tools, leading to improved impact on activities on divert economic development. The map shows farmers' capacity for innovation based on tools used and climate change-related problem solving, with the dark blue, orange and light yellow colours representing high, medium and low levels of capacity for innovation, respectively.

Four provinces were found to have a high level of capacity: Champasak, Xekong, Salavan and Oudomxay. A medium level of capacity was found in a further five provinces: Vientiane Capital, Savannakhet, Houaphan, Louangphabang and Xiangkhoang. The remaining nine provinces had a good capacity of innovation only in urban areas of the plains located along the Mekong River and its tributaries.



Farmers in Phouthane village, Vientiane Province learning about the Laos Climate Service for Agriculture (LaCSA) demonstrating capacity for use of IT innovation.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

The capacity for action index was calculated as the normalized composite value of four criteria: agricultural diversification, financial resources, management practices and for supporting infrastructure. These criteria represent the resources needed for farmers to start translating innovation into action. The data on the four criteria was collected using participatory methods, with the livelihood zones as the spatial unit of analysis. Agricultural experts from the DAFOs served as key informants by evaluating the indicators of adaptive capacity.



Louangnamtha Province representatives showing the results of their discussion of farmers' capacity for action.

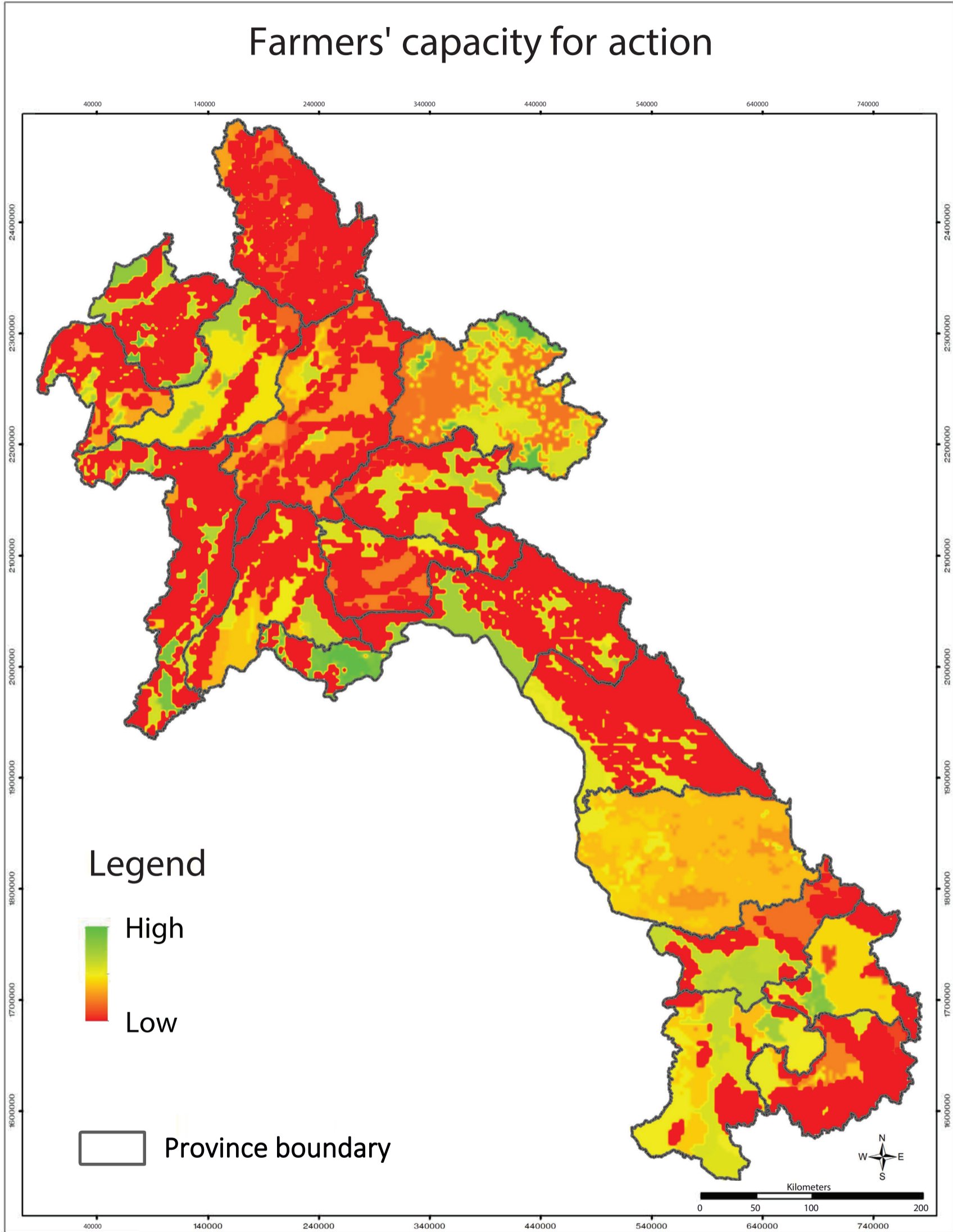
Assessment of farmers' capacity for action

The capacity to plan for and take appropriate action in response to the potential impacts of climate change on agricultural production relies not only on effective monitoring, but also on barrier analysis and the suitability of the initial idea for a solution.

The map of farmers' capacity for action reveals that there are two provinces in which farmers have a high level of capacity for action: Houaphan and Savannakhet. A medium level of capacity for action was found in five provinces: Vientiane Capital, Oudomxay, Champasak, and Xekong. The remaining 11 provinces are well adapted only at the municipal or community level in areas with access to infrastructure which can be applied to different sectors such as socio-economics, technology, transportation, electricity, health care and sanitation, and with a central point of administration and management.



Cassava field in Salavan Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of households that had access to and used climate information to support farm management, as well as the types of communication channels available to farmers. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. The number of communication channels served as a proxy for the type of communication channels available. A composite value was calculated by combining the proportion of farmers that used climate information and the types of communication channels available. Answers were aggregated for each livelihood zone by calculating the average value.



Oudomxay Province representatives showing the results of their discussion of farmers' capacity to access and use climate information.



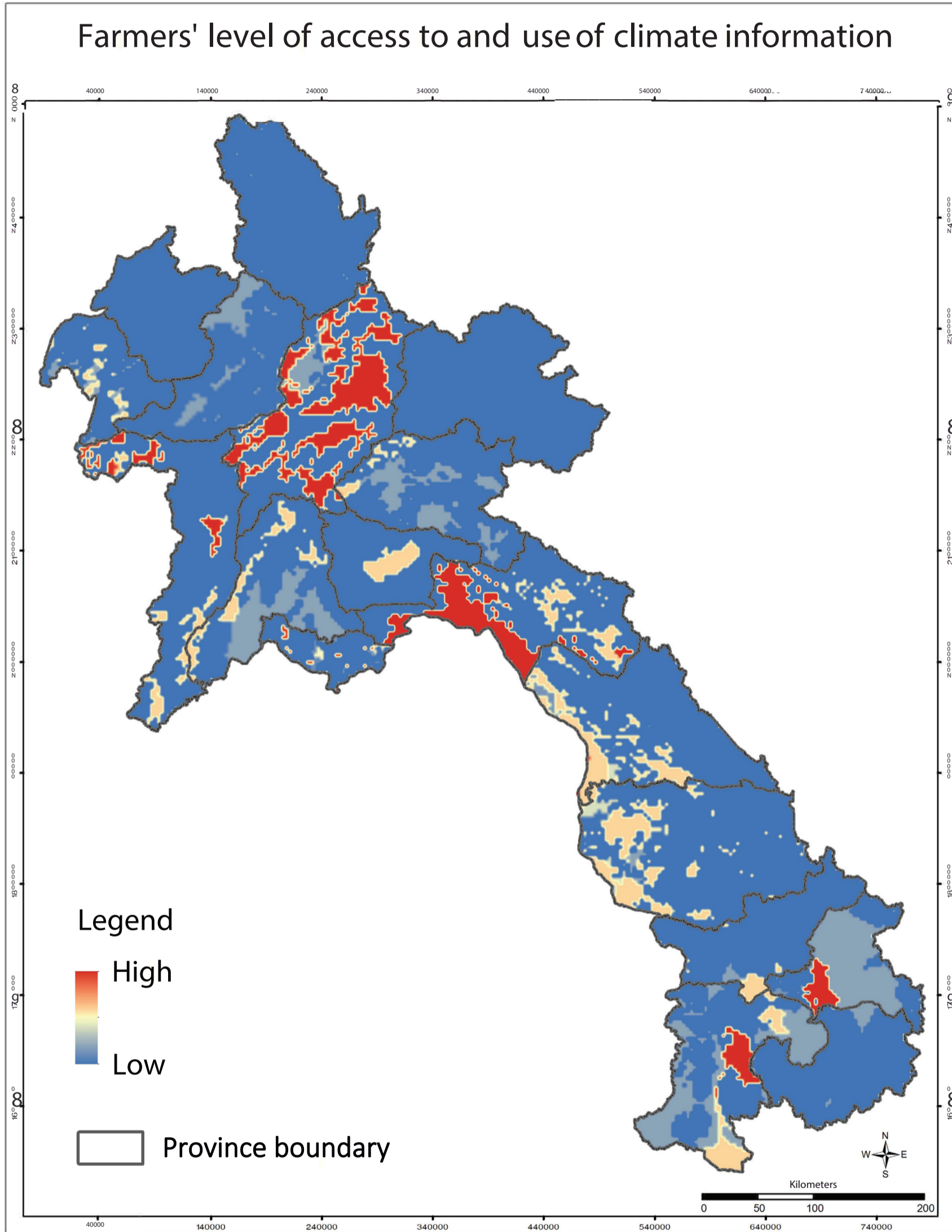
Accessing the LaCSA system in Viengxai District, Houaphan Province.

Assessment of farmers' level of access to and use of climate information

Climate change is the biggest challenge to food security, poverty reduction and the development of sustainable agriculture. Climate change adaptation is therefore an important part of reducing climate change-related risks affecting farmers. Climate information and data services are recommended as among the most important tools when it comes to adapting agricultural production in response to climate change, alongside accessible climate information support. Even when climate information is available and would help farmers to adapt, this is limited, however, by farmers' individual level of access to the system and lack of action taken by farmers. Two provinces - Oudomxay and Bolikhamxai - were found to have a high level of access to climate information services, and six provinces - Khammouan, Savannakhet, Champasak, Salavan and Xekong (Bolaven Plateau), and the Khop, Xaignabouli, Phiang, Boten and Kenthao districts of Xaignabouli Province - to have a medium level of access. The remaining ten provinces had a low level of access to climate information.



School pupils accessing climate information using LaCSA as part of the World Food Programme Santhong village, Salavan Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was calculated based on households' access to credit, and the type of credit available. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Based on these answers, a value was assigned for each criterion to provide a credit access score. A composite value was calculated using both criteria and aggregated for each livelihood zone by calculating the average value. The data was normalized to determine the livelihood zones where farmers have limited or ready access to credit to support agricultural activity.



Houaphan Province representatives showing the results of their discussion of farmers' access to credit.

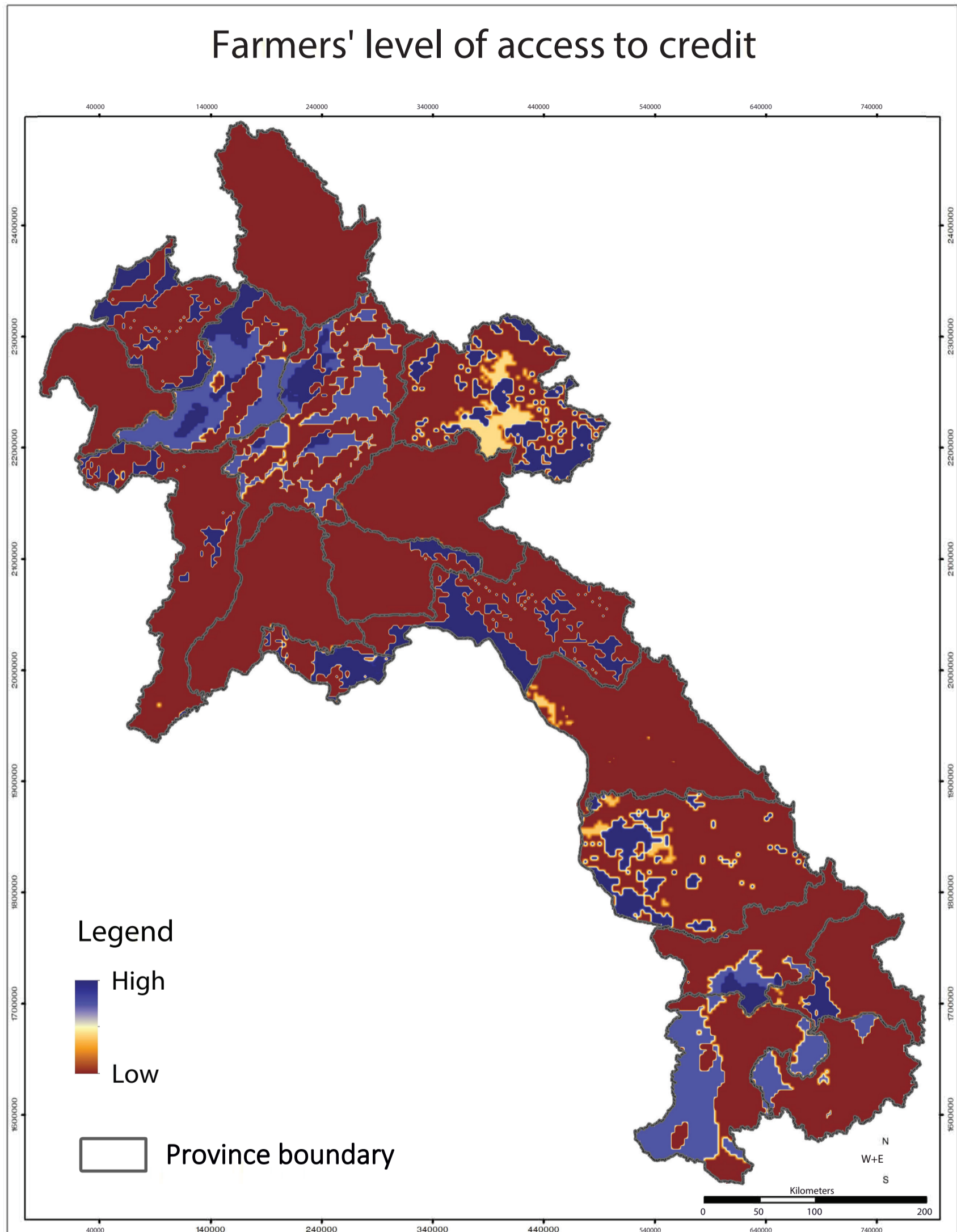
Assessment of farmers' level of access to credit

Farmers' level of access to credit is an important factor when it comes to improving agricultural production and reducing poverty. The release of credit can allow farmers to buy the necessary tools and increase their long-term capacity for investment in agriculture: there is a connection between the accessibility of credit and small- and medium-scale farmers' use of agricultural technology for cropping and livestock herding. For the most part, however, farmers are still unable to access agricultural credit.

The map shows farmers' access to credit, with the dark blue, yellow and dark brown colours representing high, medium and low levels of access, respectively. Five provinces in the Lao People's Democratic Republic - Vientiane Capital, Bolikhamxai, Oudomxay, Champasak, and Louangphabang - were found to have a medium-to-high level of access to credit. A medium level of access was found in six provinces: Houaphan, Savannakhet, Louangnamtha, Salavan, Xekong and Attapu. The remaining seven provinces had a low level of access to credit, with credit only accessible in certain districts, such as Xaignabouli and Khop (Xaignabouli Province), Hom (Xaisomboun Province) and Hinboun (Khammouan Province).



Farmer accessing bank services through an ATM.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

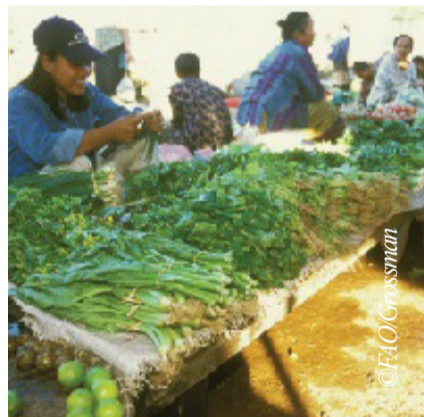
This indicator characterizes agricultural production as market-oriented, subsistence, or mixed. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Based on these answers, a value was assigned for each criterion in order to assess the type of agricultural production engaged in by farming households. The values were aggregated for each livelihood zone by calculating the average value. The data was normalized to determine the scale of production of the farming household.



Louangphabang Province representatives showing the results of their discussion of the level of market orientation of farmers' production.



Left: Processed agricultural products at Pakse market.



Right: Market scene in Savannakhet.

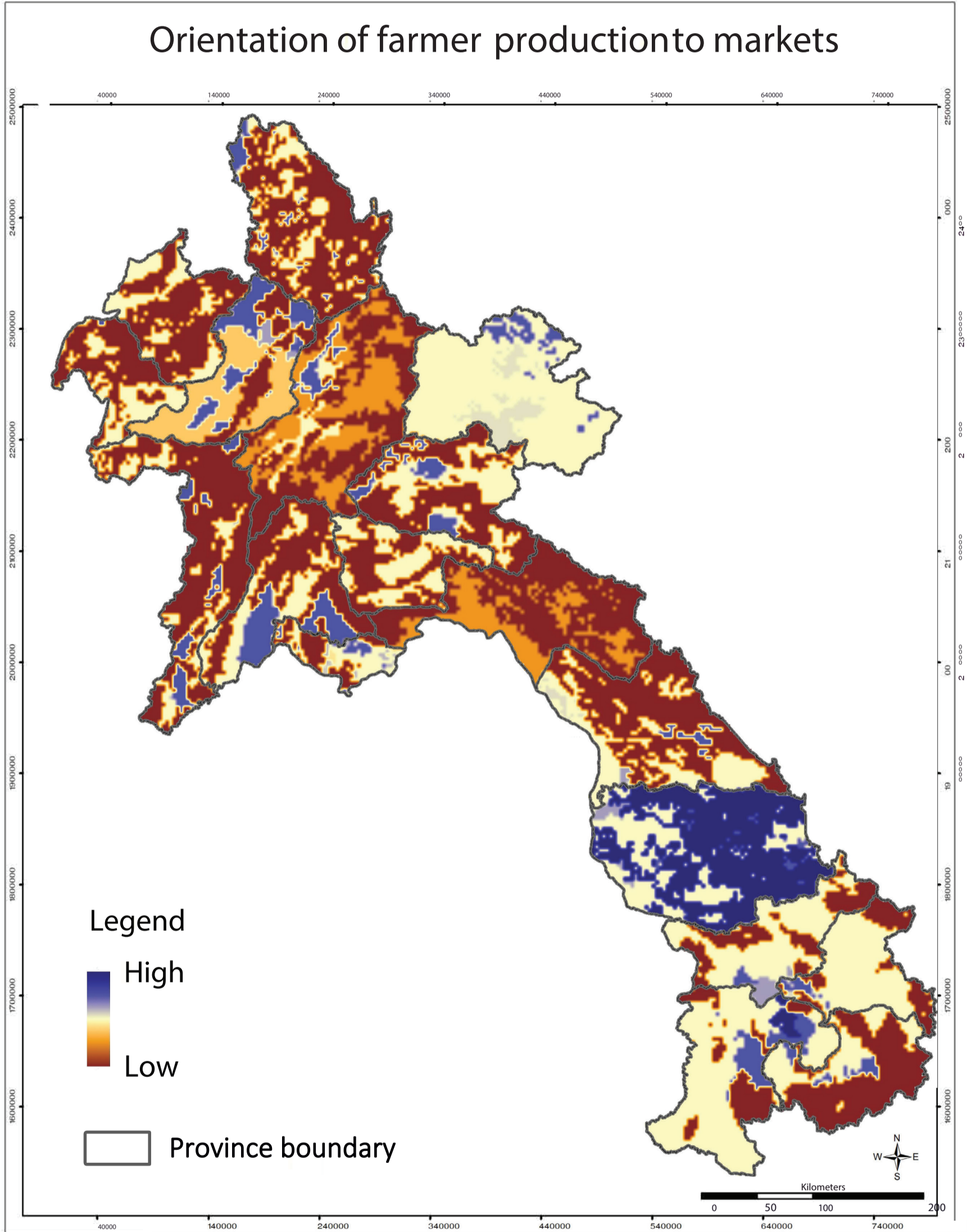
Assessment of the level of market orientation of agricultural production

Markets are a place to buy, sell and exchange villagers' and farmers' products, especially in developing countries. Markets create opportunities and sources of income, and reduce poverty and the risk of hunger. Moreover, accessible markets are essential to farmers, serving as a central point for agricultural production and maintaining relationships with the small-to-medium agricultural businesses that will produce the products ready for market. The ability and willingness to exchange produce and participate in markets is vital to bring local businesses and farming households as it increases crop diversification, production resilience and ultimately improves their living conditions.

The map reveals that there are two provinces in the Lao People's Democratic Republic with a medium-to-high adaptive capacity: Houaphan and Savannakhet. This is followed by five provinces - Champasak, Xekong, Salavan, Vientiane Capital and Oudomxay - with a low-to-medium level adaptive capacity. The remaining ten provinces are well able to adapt only at the municipal or community level in areas with access to infrastructure which can be supplied in different sectors such as socio-economics, technology, transportation, electricity, health care and sanitation, and with a central point of administration and management.



Pumpkins being sold by the roadside in Salavan Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of households owning equipment or machinery with an electric engine used to support agricultural production. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Responses were ranked and aggregated for each livelihood zone by calculating the average value. The data was normalized to determine the scale of the use of electricity-based machinery and equipment used in agricultural production.



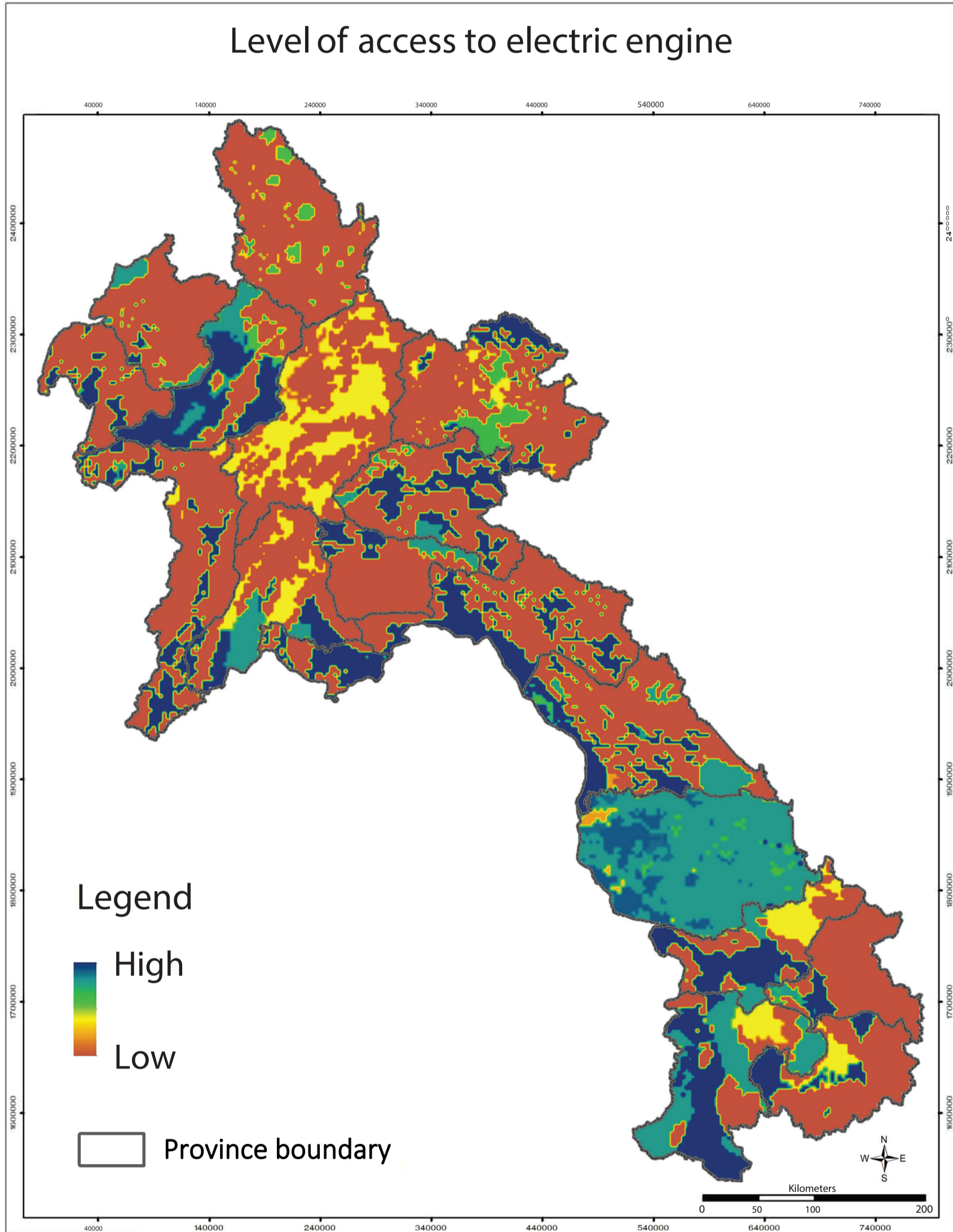
Xaignabouli Province representatives showing the results of their discussion of the level of access to an electric engine.

Assessment of the level of access to an electric engine

Will the increased use of modern technology in agriculture rely on a switch to clean energy? For the most part, however, oil-based energy is used in agricultural production due to the small area, limited capital and lower production capacity of primary production systems. The availability of electric-powered machinery is therefore not the problem, but rather the need to reduce the use of oil. However, it may not be judicious to expect farmers to make any rapid change to sustainable energy before new components that make use of renewable energy sources, such as solar; hydro- or wind power, become available. Analysis of the data has revealed that there are four provinces with a high level of access to electric engines: Vientiane Capital, Champasak, Oudomxay and Savannakhet. These are followed by nine provinces - Salavan, Khammouan, Bolikhamxai, Xiangkhoang, Vientiane, Xaignabouli, Bokeo and Louangphabang - with a medium level of access. The remaining five provinces - four parts of Louangnamtha, Phongsali, Attapu and Xekong - had medium-to-low access. In these provinces, higher levels of access were found in areas on the large, medium and small plains which had benefited from government schemes to develop and promote agricultural production.



Head irrigation with electric engine at Hardxayfong.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of households that used fertilizer to support agricultural production. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Responses were ranked and aggregated for each livelihood zone by calculating the average value. The data was normalized to determine the extent of fertilizer use in agricultural production.



Representatives from the Vientiane Capital DAFO discussing the number of farmers that use fertilizer.

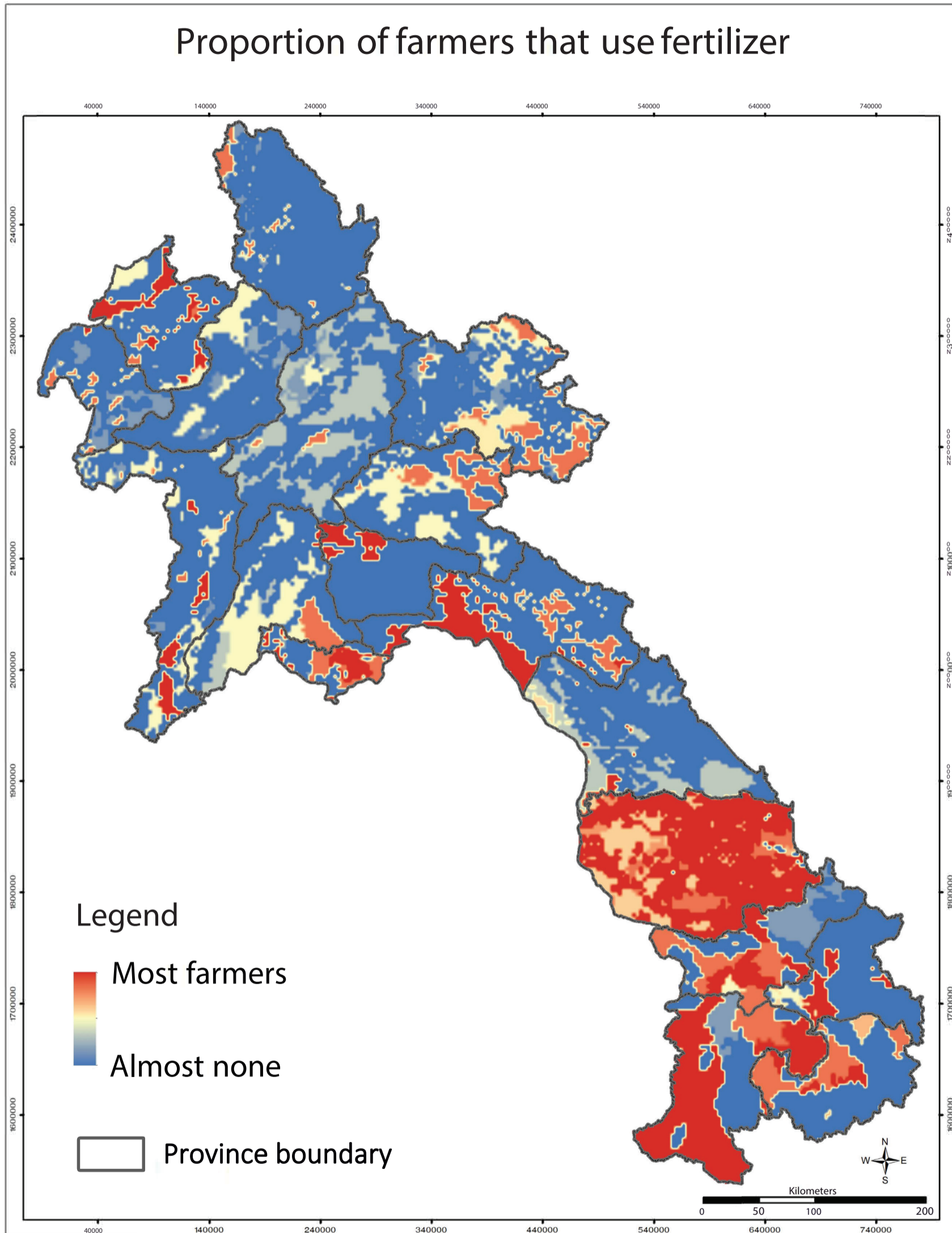
Assessment of the proportion of farmers that use fertilizer

In some areas, farmers are facing continuous increases in the cost of purchasing fertilizer. What is more, farmers are still reluctant and lack the budget to buy it during the production season. By using fertilizers, farmers can greatly increase their profits, as the amount actually produced is more likely to meet their expectations. However, in some areas where agricultural production is practised on a more industrial scale, increased fertilizer use may lead to soil depletion. In other areas, no fertilizer is used, mainly due to the fact that production levels are less intense and the areas of land owned by farmers are large and can be rotated, allowing them to remain fertile.

The map reveals that farmers in Vientiane Capital, Savannakhet, Champasak, Salavan, and Bolikhamxai are the biggest users of fertilizer. Next came seven provinces - Attapu, Xiangkhoang, Houaphan, Vientiane, Xaignabouli, Louangnamtha, and Louangphabang - with moderate fertilizer use. The remaining six provinces have taken effective action on fertilizer usage especially the urban area, which is central of social economy, technology, transportation and electricity.



Distribution of white lime as amendant in the village of Kadarn.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

The number of food security issues experienced by farming households was used as a proxy for this indicator. Food security issues were defined as food crises caused by pests, diseases and extreme climate events, and the incidence of undernourishment in each livelihood zone. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Based on the answers, a value was assigned for each criterion in order to determine the level of food security. A composite value was calculated from all the criteria. The composite value was aggregated for each livelihood zone by calculating the average value. The data was normalized to determine the different levels of food security across the livelihood zones.



Vientiane Province representatives describing food security in farmers' households.

Assessment of the level of food security among farming households

Food security in farming households depends on the agricultural practices they employ, such as their choice of seeds and labour management, as well as consumer demand and to what extent they prioritize their own food supply.

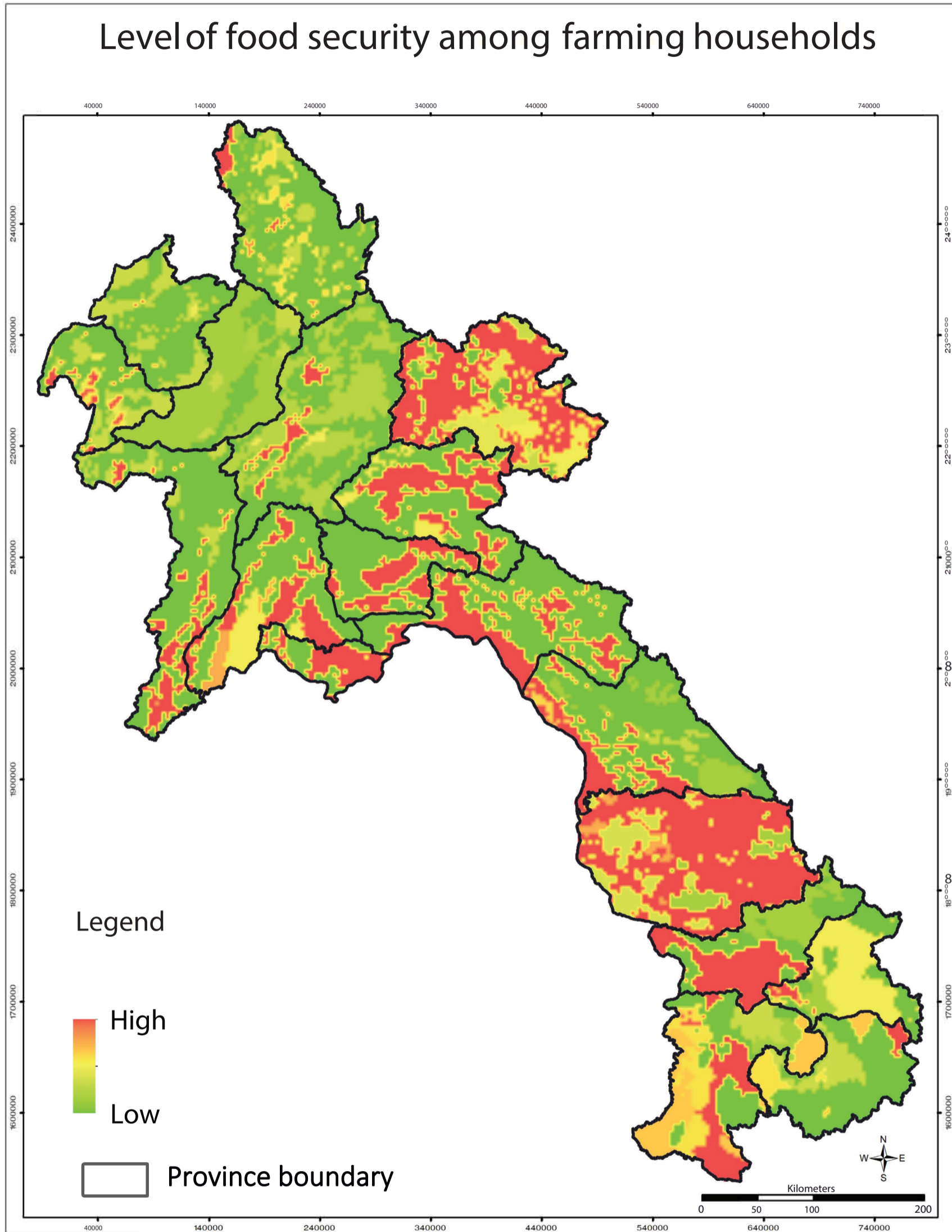
The map shows farmers' level of food security, with the red and green colours representing high and low household food security levels, respectively. According to the map, there are four provinces with high levels of food security: Savannakhet, Houaphan, Vientiane Capital and Champasak. A number of provinces extending over plains and plateaus, such as those of Xedon, Xebangfai, Bolikhamxai and Vientiane, were found to have medium levels of food security. In addition to which, certain provinces in northern and mountainous regions had low levels of food security.



Farmers selling on the street at a tourist spot in Thateng.



Oudamxay, La District: A basket of healthy and nutritious food items.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

The level of food source diversity among farming households in each livelihood zone was determined based on the number of farmers with orchards on a part of their land. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information on the presence of orchards among farming households. Answers from the participants were aggregated for each livelihood zone by calculating the total number of farmers that had orchards. Values were normalized in order to rank the livelihood zones in terms of the diversity of their food sources.



Xiangkhoang Province representatives discussing food source diversity among farming households.



Dietary diversity on a lunch table in a household in Ban Sinan, Phongsali Province.

Assessment of food source diversity among farming households

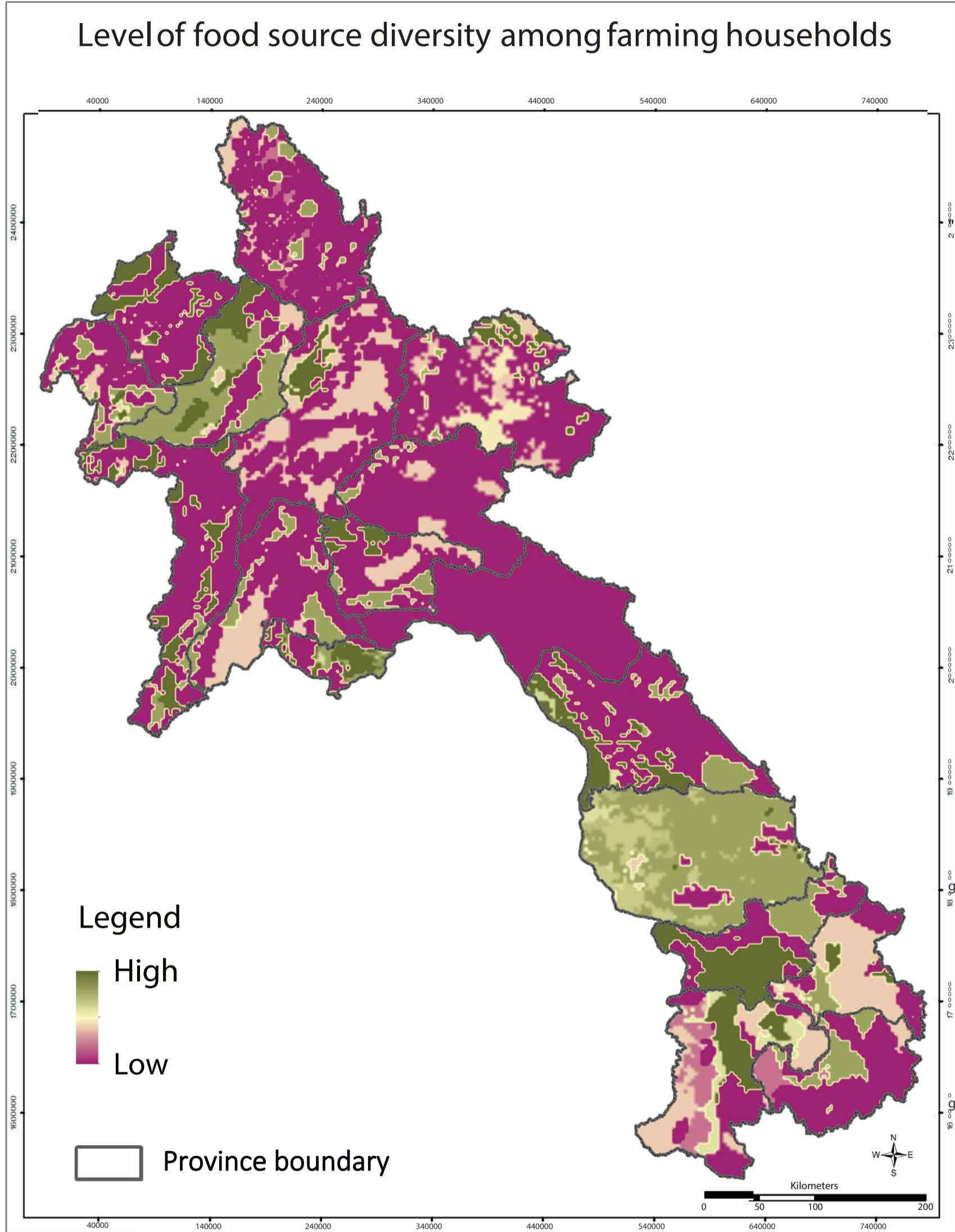
Household food security is an important measure of a good quality of life among farmers. Generally, household food source diversity comes from vegetables and animals. Farmers tend to be able to obtain sufficient nutrients, although this is not always the case for very poor families. Poverty reduction plays a crucial role in providing the food needed for a healthy life.

The magnitude of food shortage among farming families in the rural areas of developing countries restricts their socio-economic development, income and access to markets.

The map shows household food source diversity in the Lao People’s Democratic Republic, with the dark green and dark purple colours representing high and low levels food diversity, respectively. Three provinces -Vientiane Capital, Savannakhet and Oudomxay-were found to have a medium-to-high level of food source diversity, followed by Salavan, Xekong, Champasak, Attapu, Khammouan, Xaisomboun, Xiangkhoang, Houaphan, Vientiane, Xaignabouli, Louangnamtha, Bokeo, Phongsali, and Louangphabang provinces. Bolikhamxai is the province with the lowest level of household food diversity.



Local village khaotom meal at the Ban Bor Primary School in Xai District, Oudomxay.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.



Methodology

Households' ownership of material possessions such as televisions and cellphones, providing an indication of their economic status. Nine criteria were used to assess material possession. Agricultural experts from the DAFO served as key informants by collecting information on this indicator. A composite value was calculated from the nine criteria. Values were aggregated for each livelihood zone by calculating the average value. The values were then normalized to allow livelihood zones to be ranked in terms of their household assets.



Savannakhet Province representatives discussing the level of access to household assets.

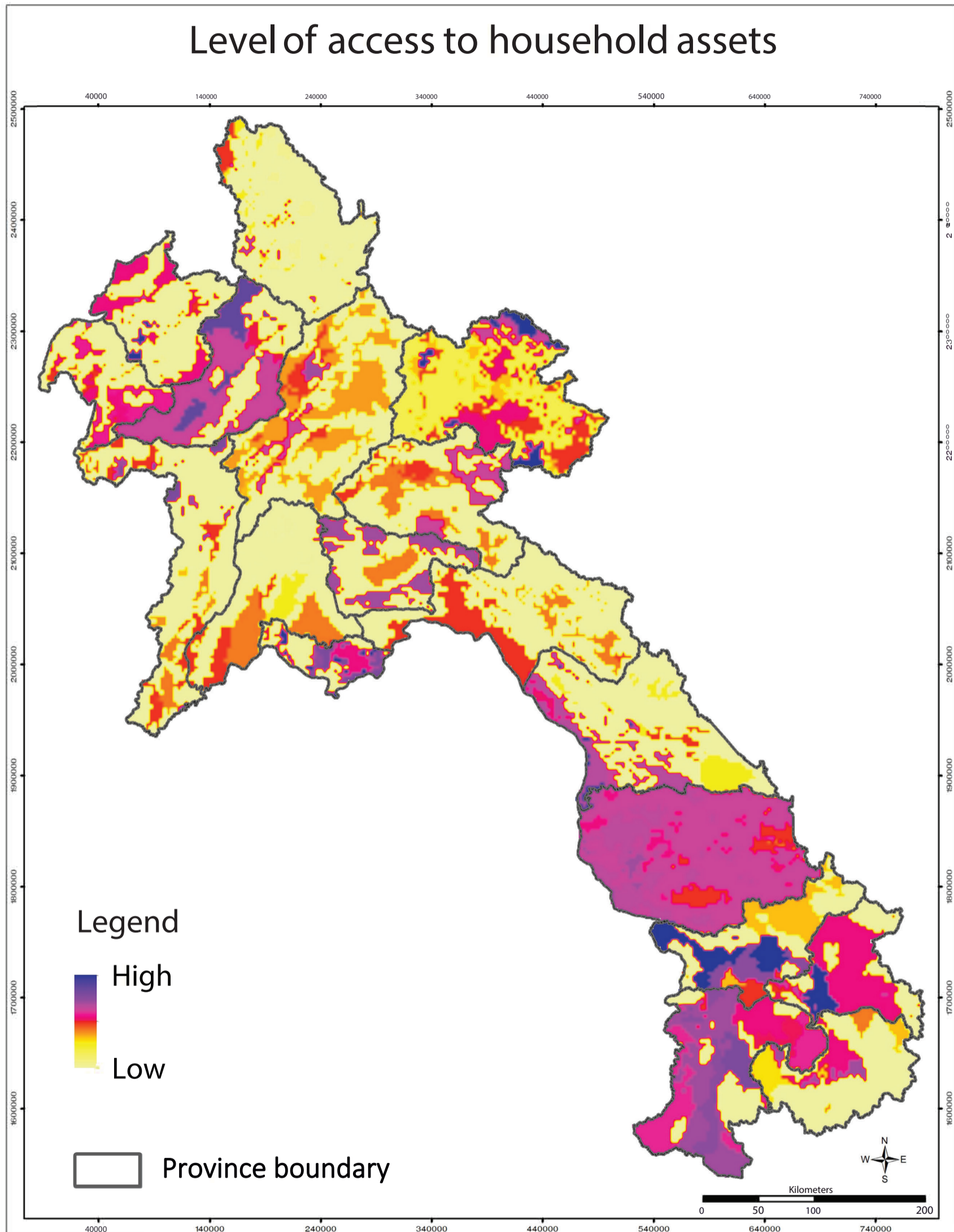
Assessment of the level of access to household assets

Agriculture is an important part of life for households in the rural areas of developing countries. Agricultural expansion depends on the use of certain key machinery. In terms of economic growth, access to agricultural assets (including land and animals) is potentially the most important factor, resulting in poverty reduction in rural areas. As a result of their lack of assets, landowners may find it difficult to generate sufficient income from agriculture when there is a requirement to use assets or land.

The map shows the level of access to household assets, from high to low, in each of the Lao People's Democratic Republic's 17 provinces and one municipality. It reveals that there is a medium-to-high level of access in Vientiane Capital, Savannakhet, Champasak, Salavan, Xekong, Oudomxay and Houaphan. Provinces found to have a lower level of access were those located in northern and central regions: Xiangkhoang, Xaisomboun, Louangphabang, Louangnamtha, Bokeo, Xaignabouli and Phongsali.



Household assets in Salavan Province, including their house and appliances, cattle, garden and poultry.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

The availability of water for domestic consumption was determined based on households' access to safe drinking water, and the availability of this access all year round. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Based on these answers, a value was assigned for each criterion in order to determine the availability of and access to safe drinking water. A composite value was calculated from both criteria. Composite values were aggregated for each livelihood zone by calculating the average value. The data was normalized to allow livelihood zones to be ranked in terms of farmers' continuous access to safe drinking water.



Bolikhambxai Province representatives discussing the uninterrupted availability of water for domestic use in the province.

Assessment of the level of uninterrupted availability of water for domestic use

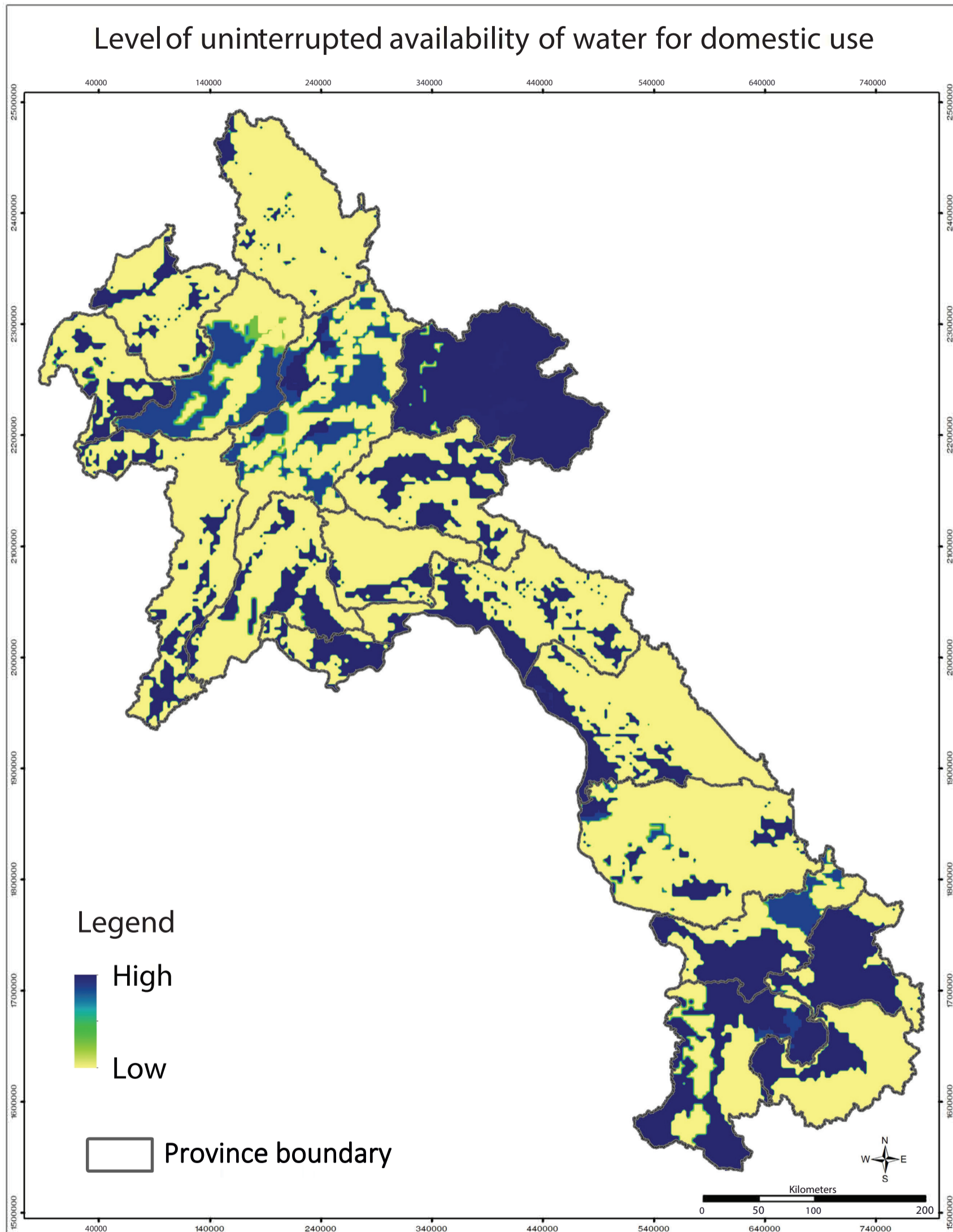
Although people's livelihoods have long relied on the use of water, the supply of water to villages, districts, provinces, and the country as a whole, continues to be a vital concern, especially in developing countries. Rural areas use water for sanitation, which is important to the way to supply clean. In addition, water is also used to support production. Short-term cropping in particular requires large amounts of water, although certain crops require less water. The cultivation of rice and vegetables are the agricultural activities which use the most water in rural areas.

In terms of water supply for agriculture in the Lao People's Democratic Republic, the main target is rice cultivation and vegetation plantation in the dry season, depending on the potential of the area and focal production area on plains such as the Vientiane, Bolikhambxai, Xebangfai, Xebanghing, Xedone, Champasak, and Attapu plains. On these plains, enough water is available to supply farms for two seasons. In addition to these, there are also other plains for which the government goes to great efforts to ensure the conditions in terms of water access for the cultivation of rice and short-term crops, including the Muang Phieng, Nam Tha, Phaohao, and Nguadeng plains.

The provinces with the highest water usage include Houaphan, Oudomxay, Vientiane Capital, Champasak, Salavan, Xekong, and Bokeo.



River-based cloth washing in Ban Nam Maa Yai, Gnot-Ou District, Phongsali Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of farmers using improved crop varieties in each livelihood zone. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. These answers were aggregated for each livelihood zone by calculating the average value. The values were then normalized to allow livelihood zones to be ranked according to the proportion of farmers using improved crop varieties.



Xaisomboun Province representatives discussing the proportion of farmers using improved crop varieties.



FAO Director-General Qu Dongyu visits the NAFRI Rice Research Centre in the village of Thadorkham, Xaithani District.

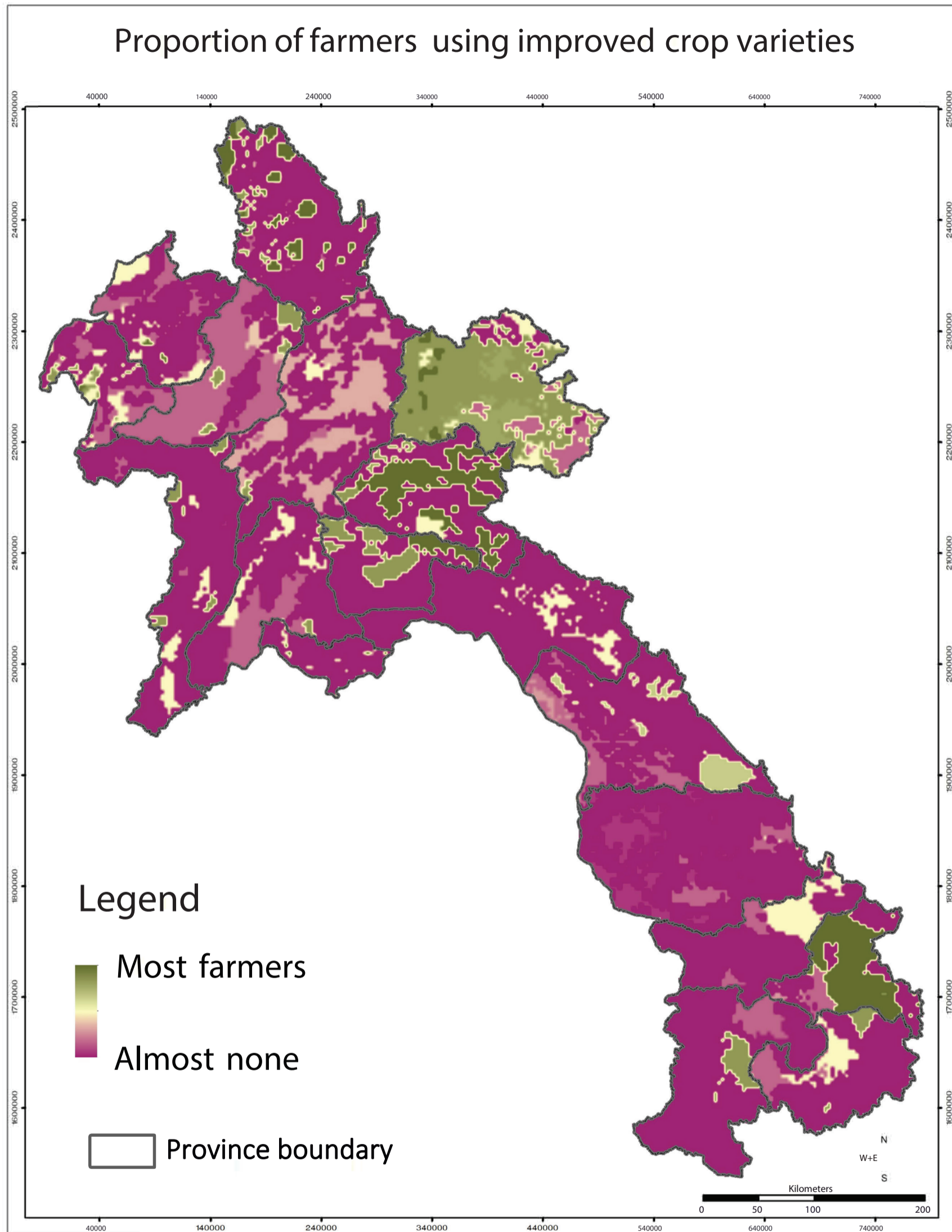
Assessment of the proportion of farmers using improved crop varieties

Most small-scale farmers in developing countries tend to use original crop varieties, which have a low level of productivity and are at risk from drought, heat waves, disease and other issues. Innovative crop varieties can result in higher productivity and higher quality and more stable production. Improved crop varieties exist for rice, maize, beans, chili, cassava, sugar cane and grass for pasture. These new crop varieties can ensure agriculture is resistant to climate change, disease, pests, insects, drought, heat waves, cold snaps, parasites, and other threats to crops. Crop varieties can be improved in terms of their size, quality, nutrition and other characteristics.

Of the 17 provinces and one municipality in the Lao People’s Democratic Republic, the highest numbers of farmers using improved crop varieties were found in Houaphan, Xiangkhoang, Xaisomboun, Xekong and Phongsali. A lower number of farmers using improved varieties was found in Champasak, Bokeo, Louangnamtha, Xaignabouli, Attapu, Khammouan, Bolikhamxai, Salavan and other provinces.



Testing rice crop variety in Naphok experimental farm of the NAFRI Rice Research Center, Vientiane Capital.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of farmers in each livelihood zone using improved seeds. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. These answers were aggregated for each livelihood zone by calculating the average value. The values were then normalized and used to rank livelihood zones in terms of the proportion of farmers using improved seeds.



Khammouan Province representatives discussing the number of farmers that use improved seeds.

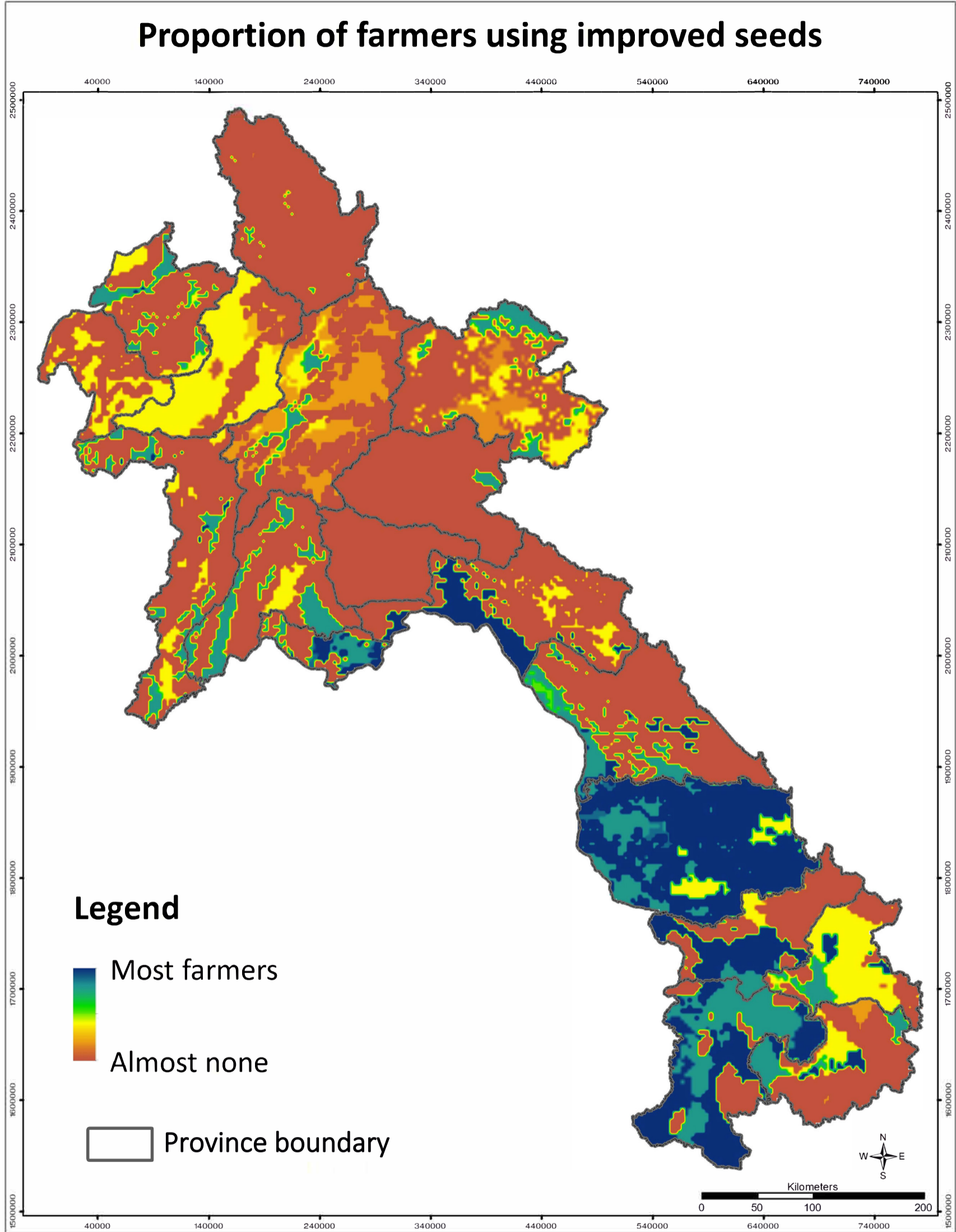
Assessment of the proportion of farmers using improved seeds

The use of improved seeds does not mean that all farmers will benefit equally in terms of increased agricultural production and reduced labour. The use of suitable amounts of fertilizer, farmers' experience with promotion, seed supply, marketing and soil quality will all have an impact on whether improved seeds result in higher income.

The use of improved seeds is now on the rise in the Lao People's Democratic Republic, and the benefits of using improved seeds are being communicated to farmers in order to increase productivity and efficiency and reduce risk. The map shows that improved seeds are used in the following provinces, presented in order of the proportion of farmers to use them, from most farmers to almost none: Savannakhet, Champasak, Xekong, Salavan, Attapu, Bolikhamxai, Khammouan, Vientiane Capital, Xaignabouli, Vientiane Province, Houaphan, Oudomxay, Bokeo and Louangnamtha. The provinces which do not use improved seeds are Xaisomboun, Xiangkhoang and Phongsali.



Testing rice crop variety in Naphok experimental farm of the NAFRI Rice Research Center, Vientiane Capital.



Methodology

Household income diversity was determined based on farming households' sources of income, and whether these were agricultural or non-agricultural. A survey was produced to determine households' level of income diversity. Answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Based on these answers, a value was assigned for each criterion (number of income sources and whether these were agricultural or non-agricultural). A composite value was calculated from the two criteria, and this was subsequently aggregated for each livelihood zone by calculating the average value. The data was normalized to estimate the level of income diversity among households in each livelihood zone.



Champasak Province representatives discussing household income diversity.

Assessment of household levels of income diversity

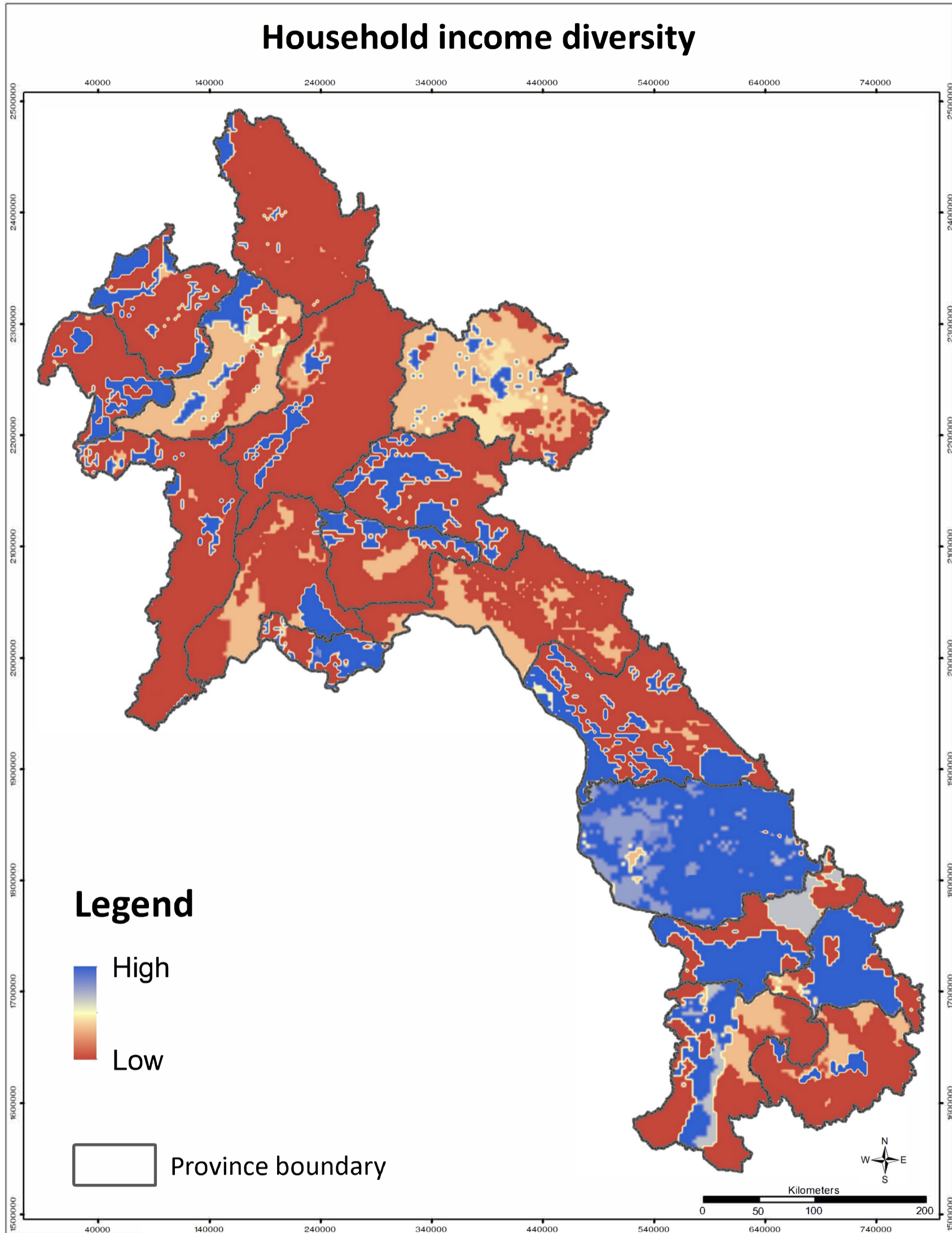
Household levels of income diversity in rural areas have been considered from status diversity to calculate the household income related to many factors, such as education, ethnicity, farmer's age, size of household, total income, income per person, access to credit, house location, access to markets, household assets and land area.

The maps shows the results of the data collected, with the dark blue, yellow and dark red colours representing provinces with high, medium and low levels of income diversity, respectively.

According to the map, households in Vientiane Capital, Savannakhet, Champasak, Salavan, Xekong, Khammouan and Xiangkhoang have a high level of income diversity. Moderate levels of income diversity were found in Louangnamtha, Bokeo, Oudomxay, Houaphan, Vientiane Province, Xaisomboun and Louangphabang. The provinces which households were found to have a low level of income diversity were Xaignabouli, Attapu, Phongsali and Bolikhamxai.



Throwing a net into a pond to catch fish at a combination rice, fish and poultry farm. The farm produces common carp and tilapia, as well as its own fry. It also has a small restaurant that adds value to the fish produced.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the number of farmers with access to different types of production infrastructure, such as water storage, crop storage, post-processing infrastructure, and assets for the transportation and distribution of agricultural products. A survey was designed to gather information on access to the different types of infrastructure at the district level. Answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. The number of assets accessible and available to farming households was used for the analysis. Values were aggregated for each livelihood zone by calculating the average value. The values were then normalized to allow livelihood zones to be ranked according to access to production infrastructure.



Xekong Province representatives discussing the level of access to production infrastructure.

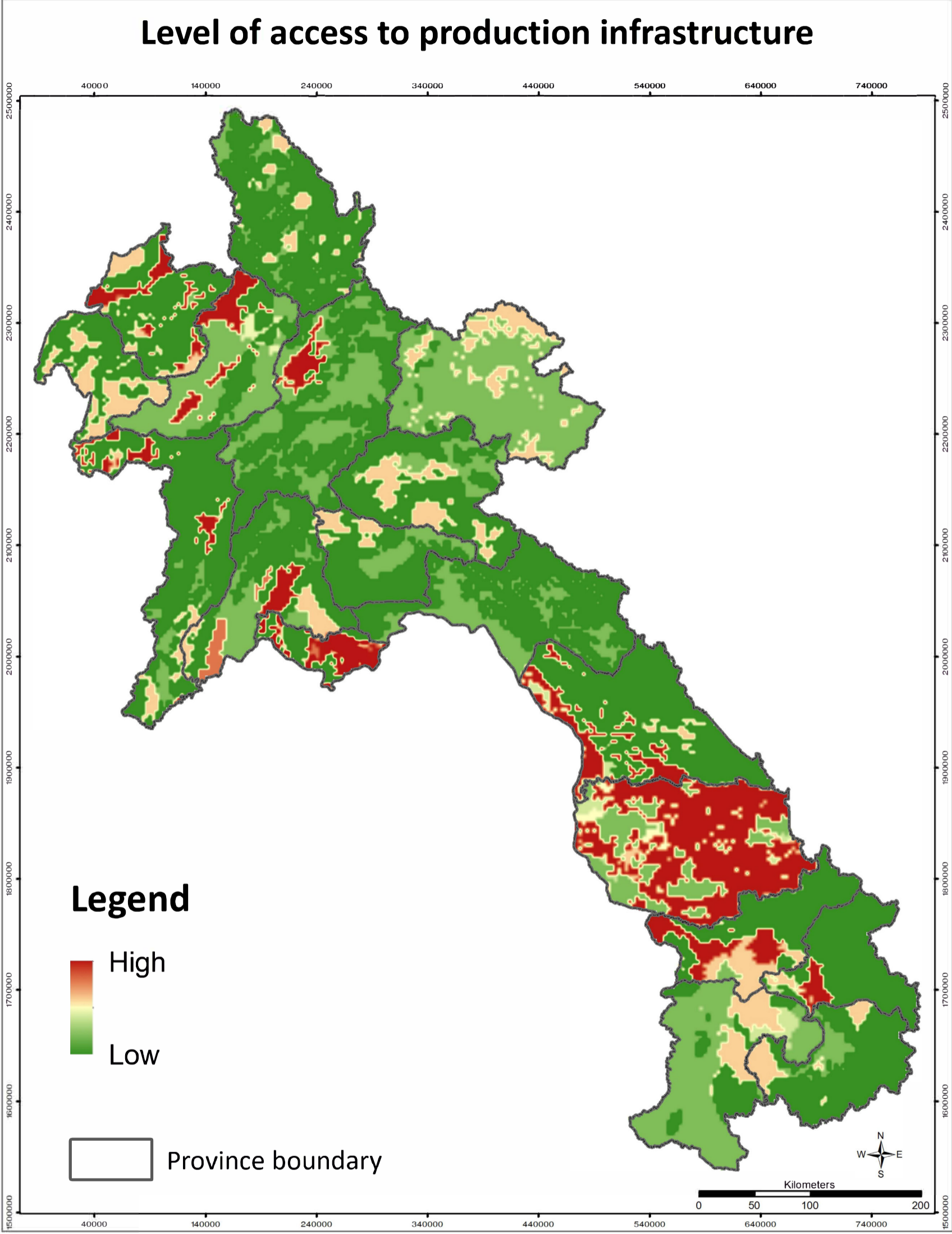


*Left: Agricultural infrastructure for drying cassava in Lao-Ngam, Salavan Province.
Right: Woman removing rice from a rice storehouse.*

Assessment of the level of access to production infrastructure

Infrastructure in rural areas is vital for both the agricultural and economic development of these areas, which are considered a basic prerequisite for improving farmers' quality of life. However, rural infrastructure development projects generally rely primarily on investment by farmers, while other infrastructure services are provided by the government. This means that, for example, rural projects to connect communities with markets are dependent on national infrastructure in the form of the road network. Seasonal changes in the accessibility of infrastructure can result in price fluctuations, increasing or decreasing depending on the accessibility of markets during the harvest season. Roads are poorly maintained and access difficult, particularly in the rainy season.

The map indicates that there are two provinces with a high level of access to production infrastructure: Savannakhet and Vientiane Capital. This is followed by Salavan, Khammouan, Vientiane, Oudomxay, Louangnamtha, Louangphabang, Xaignabouli and Xekong. The provinces with a medium-to-low level of access to production infrastructure are Champasak, Attapu, Houaphan, Xiangkhoang, Xaisomboun, Bokeo, Phongsali and Bolikhamxai.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of farmers using smartphones or computers with access to the internet. A survey was designed to gather this information. Answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. These answers were aggregated for each livelihood zone by calculating the average value. The values were then normalized to allow the livelihood zones to be ranked according to farmers' level of access to and use of the internet.



Champasak Province representatives discussing the level of internet access and use.



DMH representative consulting farmers in Lao-Ngam District using an internet-based questionnaire.

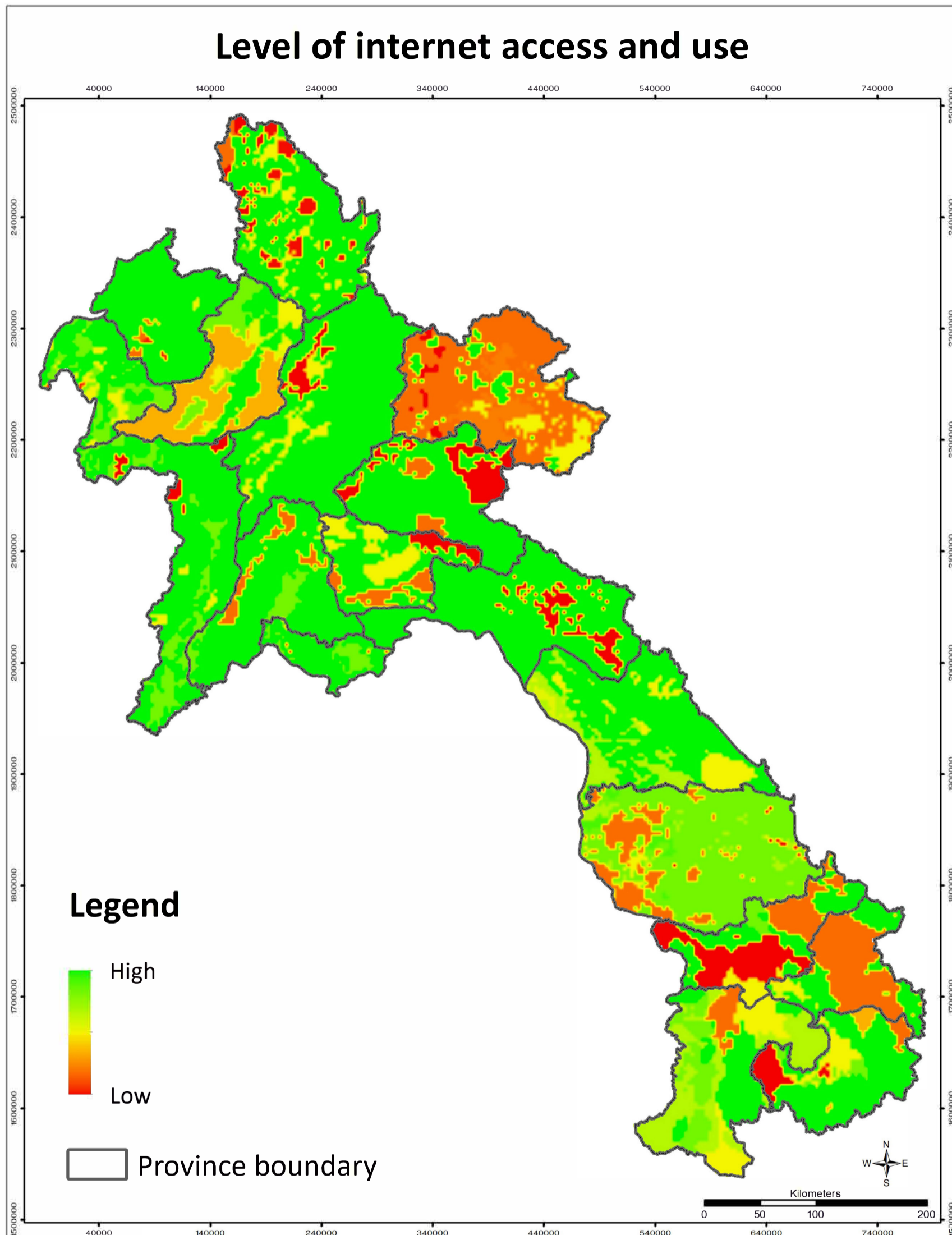
Assessment of the level of internet access and use

In the future, the internet may have a significant influence on the agricultural sector. Climate change information and services, for instance, can be accessed via the internet. Applications, mobile phones, computers and other internet-based communication tools are widely used by farmers to communicate with their social networks. Such tools also allow farmers to connect with their agricultural consultants, who are a useful source of information on climate change, agricultural techniques and pest and disease management, including during health emergencies. However, some farmers still lack knowledge of how to access and use the internet, or have access only to an unstable network.

The map shows the level of access to and use of the internet in each province. The provinces with high levels of internet access and use were Salavan, Xiangkhoang, Houaphan, and Xekong. Medium levels of internet access and use were found in Oudomxay, Savannakhet, Xaisomboun, Bolikhamxai, Attapu, Louangphabang, Phongsali, Vientiane Province, Bokeo, Louangnamtha and Khammouan. The provinces in which farmers have low levels of access to and use of the internet are Vientiane Capital and Xaignabouli.



LaCSA app being used in the village of Phonthone in Vientiane Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

To identify agricultural livelihoods in the Lao People's Democratic Republic, participatory mapping by representatives from the PAFOs/DAFOs was used. The mapping was carried out during a series of workshops that brought together participants from PAFOs and DAFOs from across the country. Agricultural livelihoods were defined based on the resources required by farmers to support their means of living (e.g. natural resources, access to markets, social and community values, infrastructure). During the exercise, participants were asked to divide the landscape into livelihood units, taking into consideration the type of production system in use (rainfed vs irrigated, perennial vs annual, subsistence vs market-oriented), land tenure schemes, farm size (small, medium or large), the natural environment (upland vs lowland), and access to markets.



Participants from each province listening w information on agricultural livelihoods in the Lao People's Democratic Republic.

Assessment of agricultural livelihoods in the Lao People's Democratic Republic

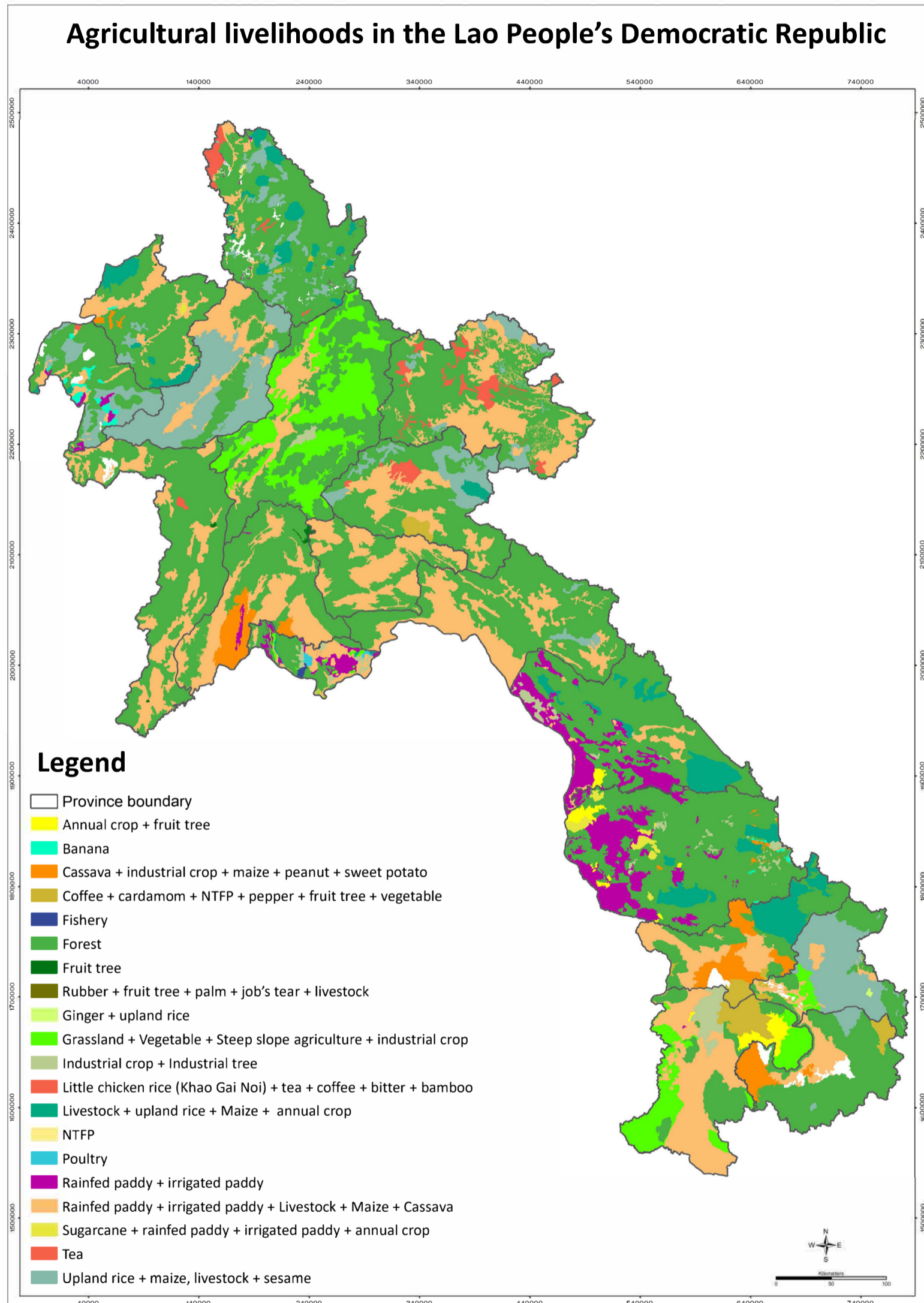
The Lao People's Democratic Republic is a developing nation in which most households rely on agriculture and livestock to support their needs. However, the number of agricultural jobs in rural areas is limited. The role of expansion to activities other than agriculture is totally different. In order to improve their living conditions, households are rapidly moving away from subsistence cultivation and towards market-oriented production and the cultivation of diverse crops such as maize, sugar cane, cassava, Job's tears, banana, ginger, beans, sweet potato, rice, and grass for pasture and livestock. In addition, fruit, rubber and industrial trees are important cash crops.



Edible insects are an important part of the Lao livelihood.

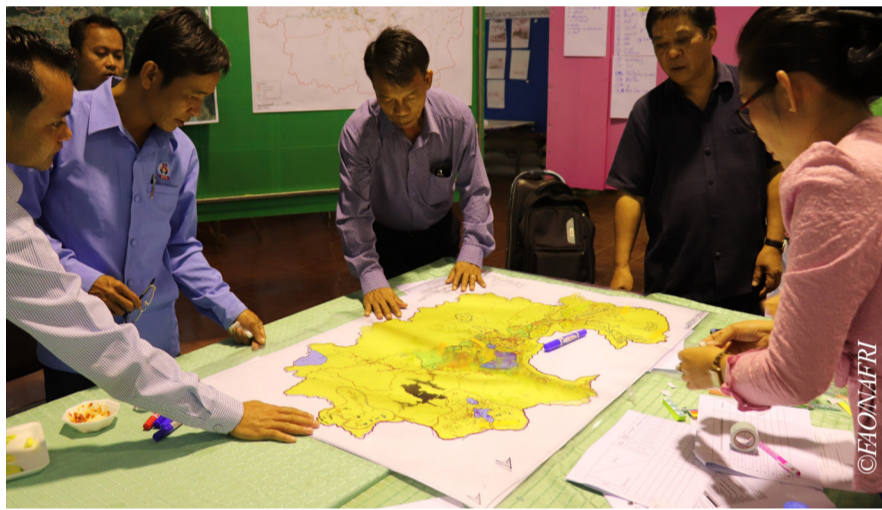


Farmers fishing along the road during a storm in Champone district .



Methodology

The level of adoption of various livestock and pasture management practices, including improved forage, feed concentrates and improved livestock breeds, was assessed using a survey. Agricultural experts from the DAFOs served as key informants by providing the number of livestock and pasture management practices adopted by farming households in each livelihood zone. These numbers were then normalized in order to rank livelihood zones according to farmers' level of adoption of these management practices.



Attapu Province representatives discussing the level of adoption of different livestock and pasture management practices.



Example of FAO project to increase the adoption of new livestock feeding practices.

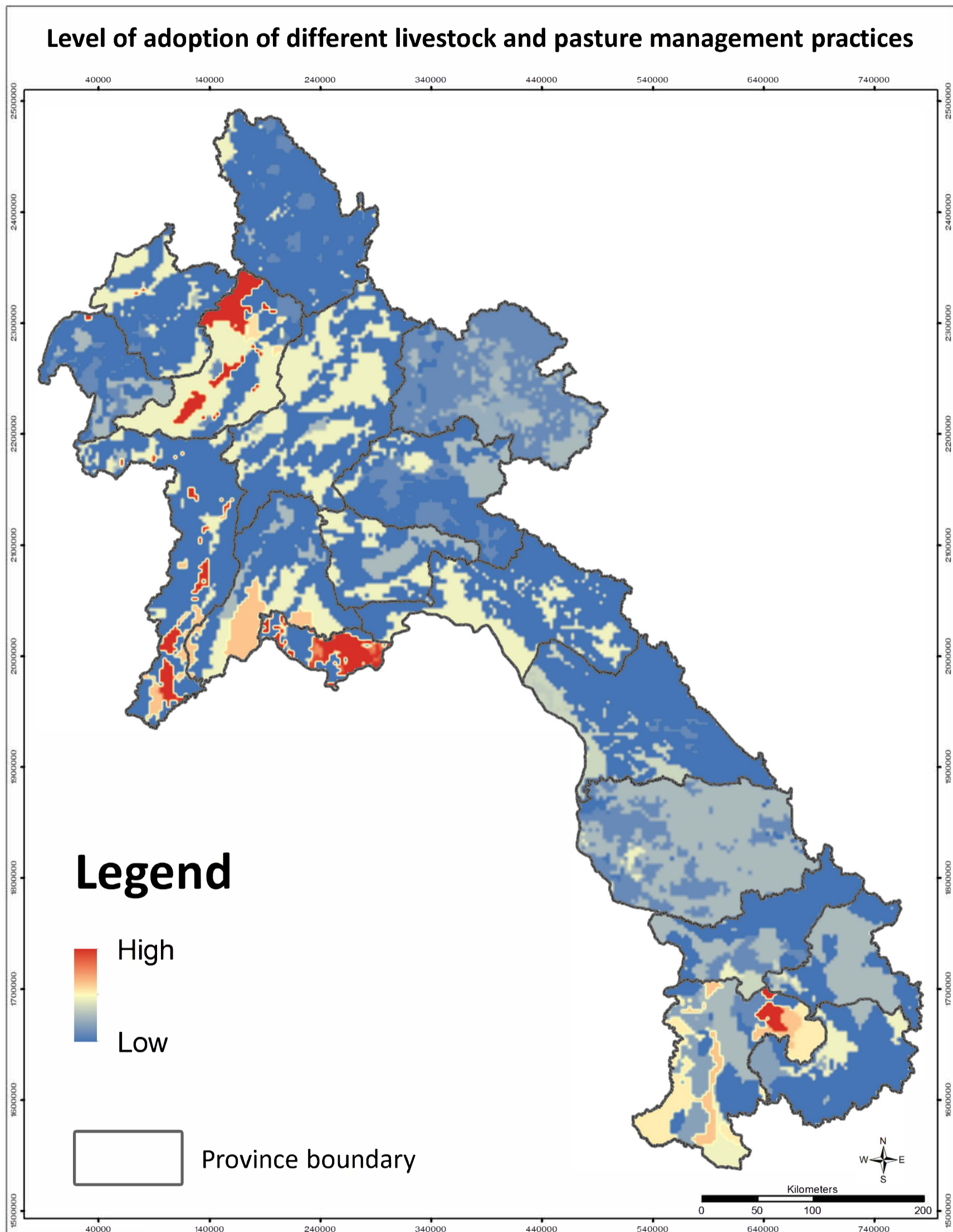
Assessment of the level of adoption of different livestock and pasture management practices

The raising of livestock makes a significant contribution to society, providing food, income, soil nutrients, employment and clothing. The process uses huge amounts of natural resources, such as land, natural grassland, meadows, springs and mines. The demand for meat in developing countries is continuously increasing as a result of growing populations, urbanization and higher incomes. If this demand is to be met in the future, sustainable approaches will be required that relieve the pressure on natural resources, such as reducing the amount of land needed to produce animal feed and avoiding deforestation. Effective management practices based on local conditions and the use of modern technology to improve agricultural production are therefore required.

The map shows that the process of adopting these various livestock and pasture management practices is now in its initial stages in the Lao People's Democratic Republic, and has been effectively implemented in Vientiane Capital, Oudomxay, Xaignabouli and Champasak, and to a lesser extent in Vientiane Province, Louangphabang, Louangnamtha, Bolikhamxai, Xaisomboun, Attapu and Xiangkhoang. In addition to which, certain provinces, such as Xekong, Salavan, Savvannakhet, Khammouan, Houaphan, Phongsali and Bokeo, are currently implementing these livestock and pasture management practices on a small scale.



Improving pasture in the village of Houayjay, La District, Oudomxay Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

The level of adoption of new livestock and fishery activities was assessed using a survey. Agricultural experts from the DAFOs served as key informants by evaluating the introduction of new techniques over the past ten years. The questionnaire completed by key informants (i.e. PAFO and DAFO during the workshop) included the development of a narrative text about whether or not informants would be in favour of adopting new techniques during extreme climate events. Data on these indicators were gathered for each livelihood zone. A composite value was calculated from the indicators. The data was normalized to determine in which livelihood zones farmers have low levels of adoption of new livestock and fishery activities these management practices, and in which zones high levels of adoption are found.



Champasak Province representatives discussing the level of adoption of new livestock and fishery activities.

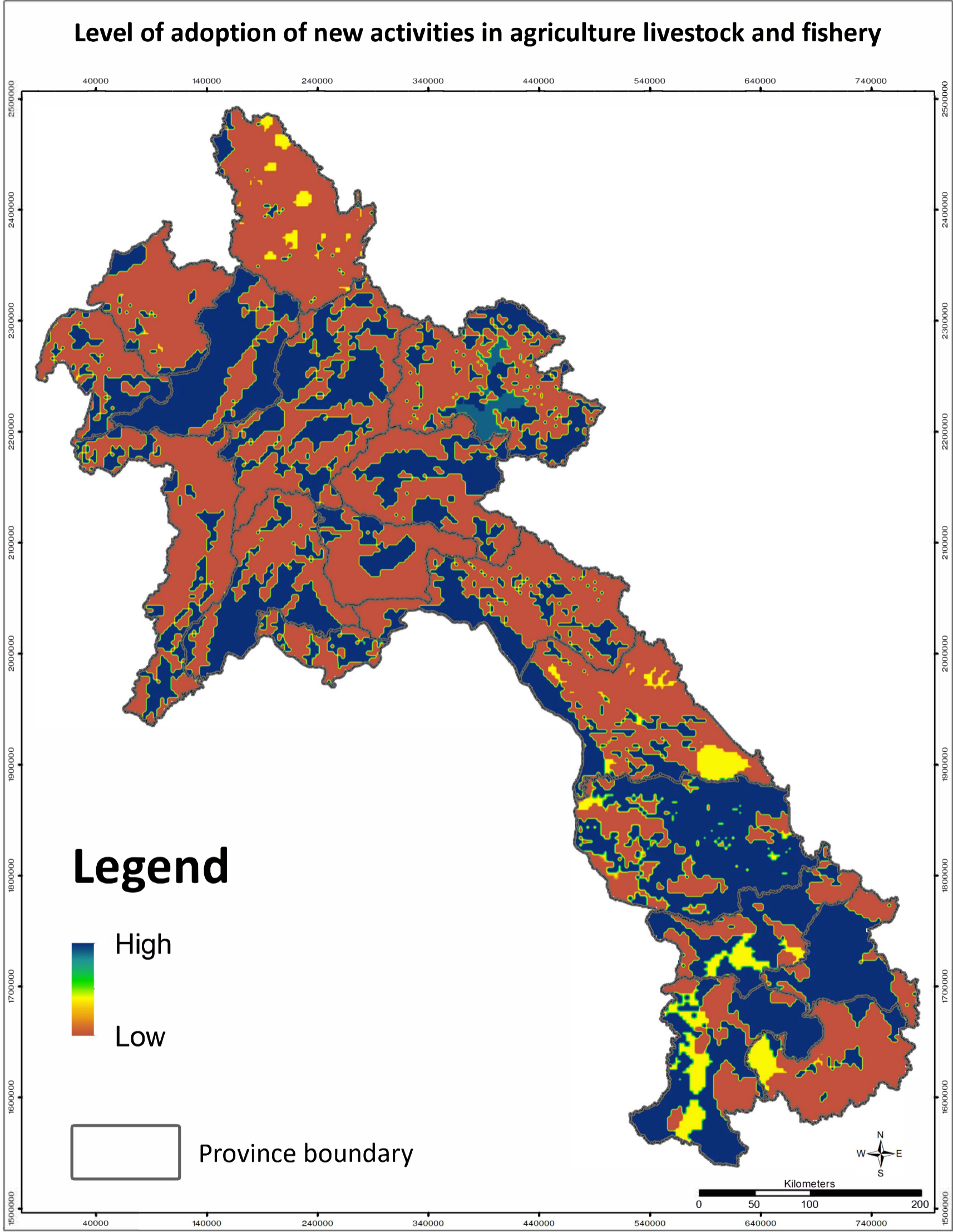
Assessment of the level of adoption of new activities or techniques with relation to agriculture livestock and fishery

The adoption of new agricultural techniques can be a method of dealing with the effects of climate change and its impact on the cultivation of animal feed and fish. Currently, the living conditions of small-scale farmers are threatened by climate change. The livestock integrated with cropping is a way of reducing the risk of climate change, resulting in increased production and fewer expenses for farmers, including investment in environmental protection.

The map shows the level of adoption of new livestock and fishery activities in the Lao People's Democratic Republic's agricultural sector. The following is a list of the country's provinces presented in order of level of adoption, from high to low: Savannakhet, Xekong, Oudomxay, Vientiane Province, Louangphabang, Xiangkhoang, Vientiane Capital, Houaphan, Champasak, Salavan, Bolikhamxai, Khammouan, Xaignabouli, Bokeo, Xaisomboun, Louangnamtha, Phongsali and Attapu.



Innovative machine for processing silk being presented at a NAFRI fair.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>



Methodology

This indicator was estimated based on the proportion of farmers adopting organic farming as part of their livelihood. Agricultural experts from the DAFOs served as key informants by collecting information on this indicator. Answers from the participants were aggregated for each livelihood zone by calculating the average value. The values were then normalized to allow the livelihood zones to be ranked in terms of farmers' level of adoption of organic farming.



Salavan Province representatives discussing the level of adoption of organic farming.

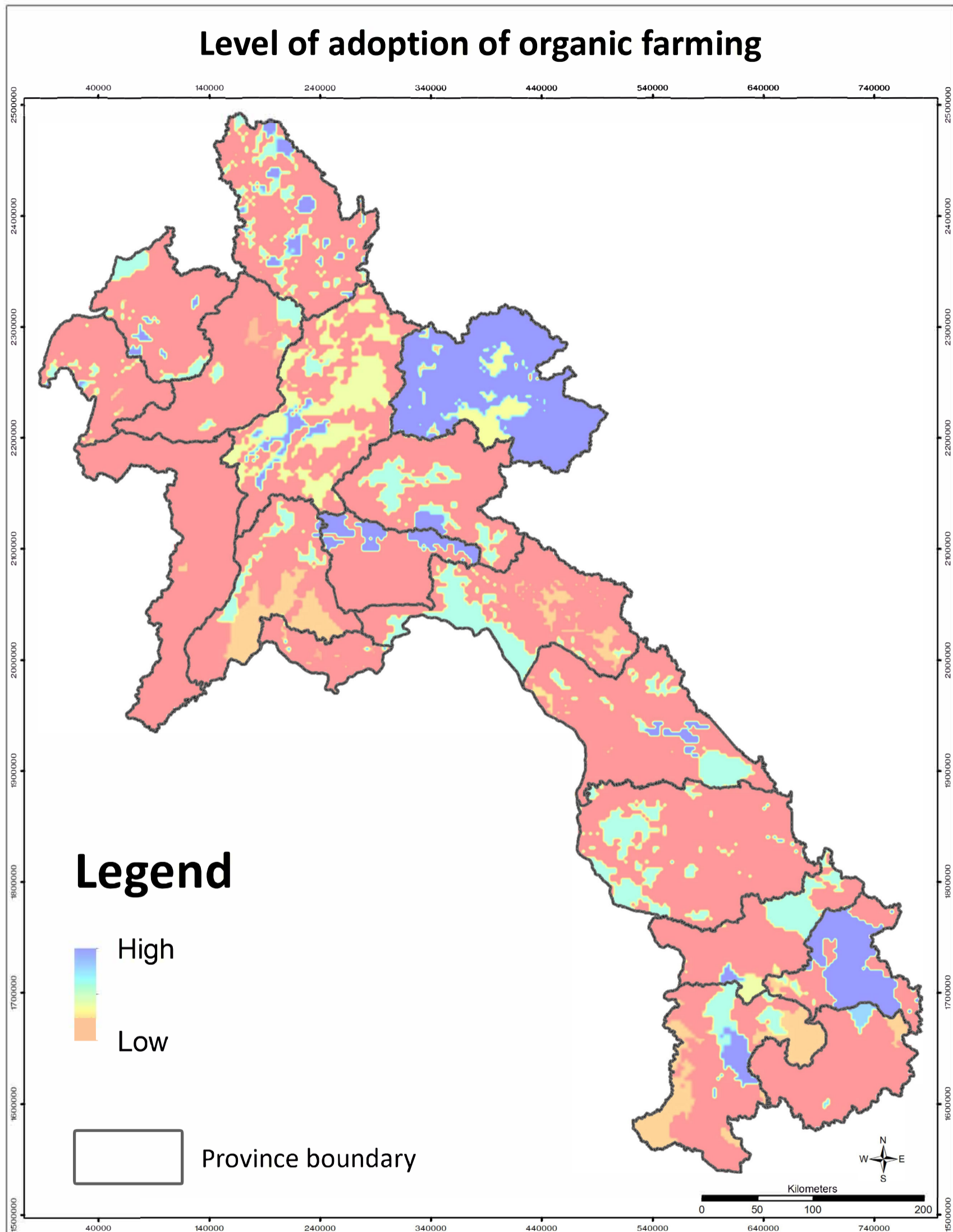
Assessment of the level of adoption of organic farming

The adoption of organic farming by households is dependent on them receiving the relevant technical information, as well as government support, development projects and other investment. While farmers' level of technical understanding of organic farming is still low, organic production is popular, and some farmers are therefore adapting in order to meet this demand, although some time is needed in order to complete this process.

The map shows that Houaphan, Xekong, Xaisomboun, Xiangkhoang, Champasak, Phongsali, Savannakhet, and Louangphabang have a high level of adoption of organic farming practices, while Vientiane Province, Bolikhamxai, Khammouan, Salavan, Louangnamtha, Bokeo, Oudomxay, Vientiane Capital, Attapu and Xaignabouli have a low level of adoption.



Irrigation in organic farm in Vientiane Capital.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

Information on the zones in which farmers' livelihoods include the cultivation of rice was extracted from the agricultural livelihood zones database. The livelihood zones were mapped during a series of participatory workshops which took place across the country, involving key agricultural experts from the PAFOs and DAFOs. For more detail on this process, please see the map of agricultural livelihoods.



Representatives from the country's central regions helped map out paddy rice and other livelihood zones in the Lao People's Democratic Republic.

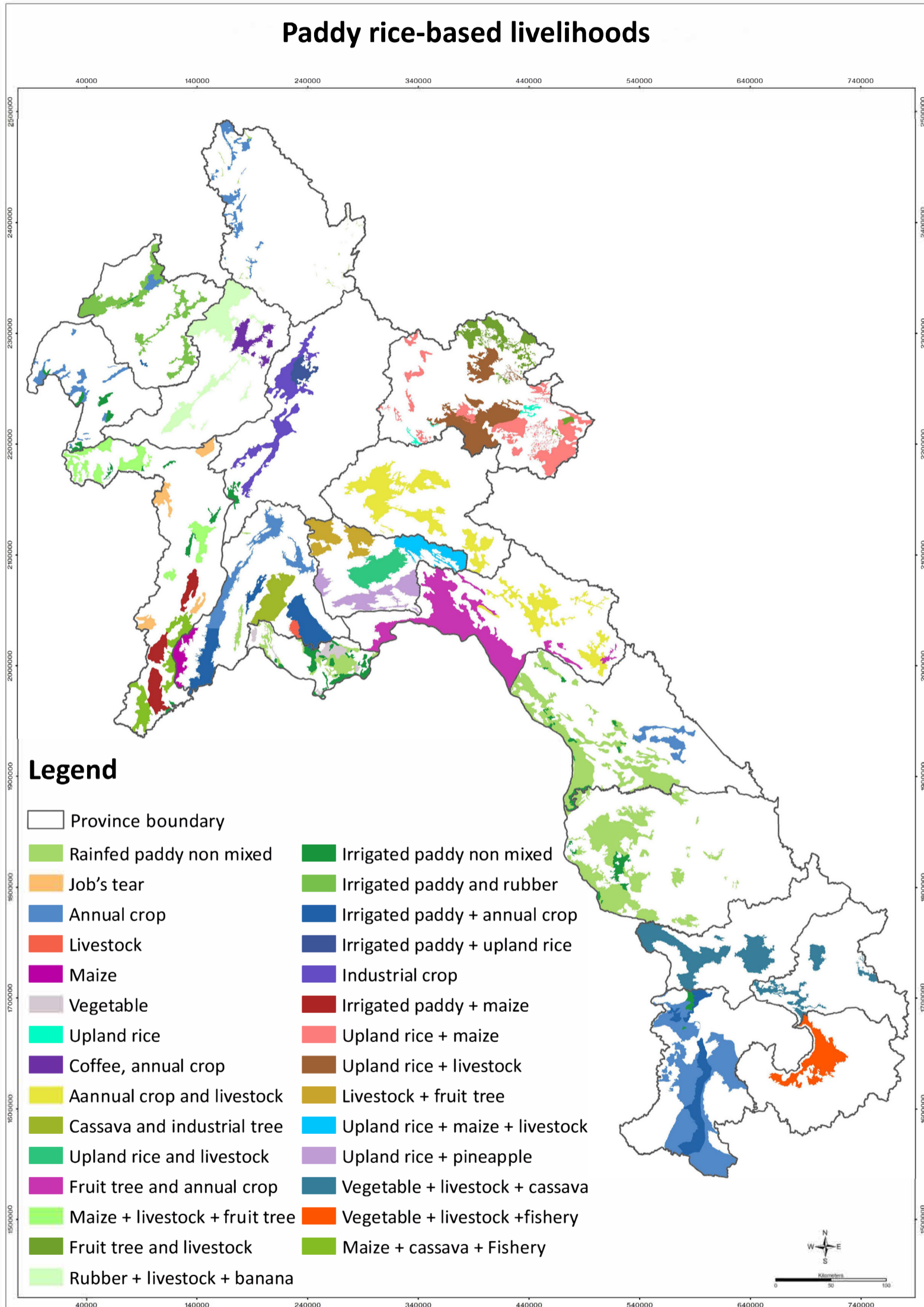
Paddy rice-based livelihoods in the Lao People's Democratic Republic

Rice is the main staple food in the Lao People's Democratic Republic. Rice covers 80 percent of the total area of land given over to agricultural crops. Rice production in the wet and dry seasons is dependent on proper irrigation to avoid issues caused by inappropriate and unpredicted climate, flooding, drought and pest outbreaks. Nevertheless, farmers in Laos still rely on rice production as their main area of activity. Small-scale farmers in rural areas tend to grow local sticky rice varieties, which are widely cultivated. Most of the cropland devoted to rice is distributed across the country's large, medium and small plains, as well as along major tributaries of rivers. In addition to rice cultivation, farmers tend to also be involved in other agricultural activities. The geographic location, and suitable socioeconomic conditions and population growth within the country, have meant that farmers can diversify into other areas compatible with rice growing, such as the cultivation of vegetables, short-term crops, livestock, industrial crops, coffee, tea, fruit, industrial trees and fish.

Farmers in Houaphan and Xaignabouli grow more rice than in other northern provinces, and also cultivate more other products than in the other provinces. In the central provinces, the most rice growing occurs in Vientiane Province. In the south, it is Champasak which has the most rice farmers.



Ducks in a rice field, Xekong Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>

Methodology

This livelihood indicator was estimated based on the proportion of agricultural produce being sold by farmers to gain income. A survey was designed to collect information on the proportion of agricultural produce being sold within each livelihood zone. Agricultural experts from the DAFOs served as key informants by gathering information on this indicator. Answers from the participants were aggregated for each livelihood zone by calculating the average value. The values were then normalized to identify livelihood zones in which agricultural produce contributed significantly to the farming household's income.

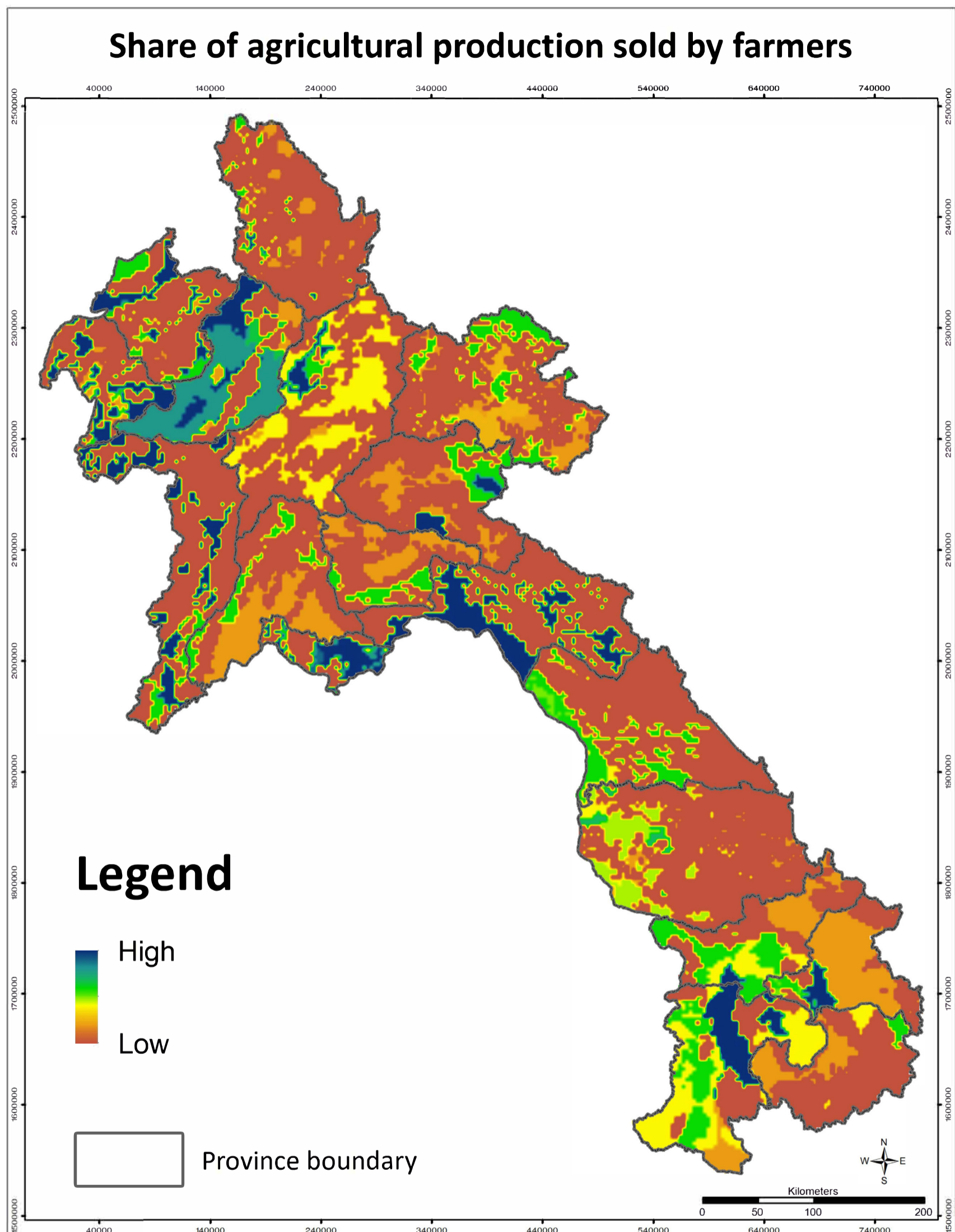


Organic farm in Vientiane Capital.

Assessment of the share of agricultural production sold by farmers

The livelihoods of small-scale farmers and their families are dependent on the cultivation of crops, livestock and fish. In rural areas, the agricultural produce is mainly intended for direct consumption. And some farmers are therefore adapting in order to meet this demand, although some time is needed in order to complete this process.

After selling some of their produce, farmers in rural areas use the remainder to exchange with other products or keep for their own consumption and save for animal feed. Produce is mainly sold to merchants from other villages, as well as to merchants within their own village. According to the map, of the 17 provinces and one municipality in the Lao People's Democratic Republic, Vientiane Capital, Bolikhamxai, Oudomxay, Xaignabouli, Bokeo, Champasak and Louangnamtha came top in terms of the proportion of agricultural produce sold. In Salavan, Khammouan, Xekong, Houaphan, Louangphabang, Savannakhet, Xiangkhoang, Xaisomboun, Attapu and Phongsali, meanwhile, farmers sold a lower proportion of their produce at market. Sales are handled more through intermediaries.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of farmers who own livestock. A survey was designed to collect information on the proportion of farmers that own livestock as part of their livelihood. Agricultural experts from the DAFOs served as key informants by assessing this indicator. The answers from the participants were aggregated for each livelihood zone by calculating the average value. The data was normalized in order to determine which livelihood zones had high levels of livestock ownership and which had low levels.



Salavan Province representatives discussing livestock ownership levels among farmers.

Assessment of level of livestock ownership among farmers

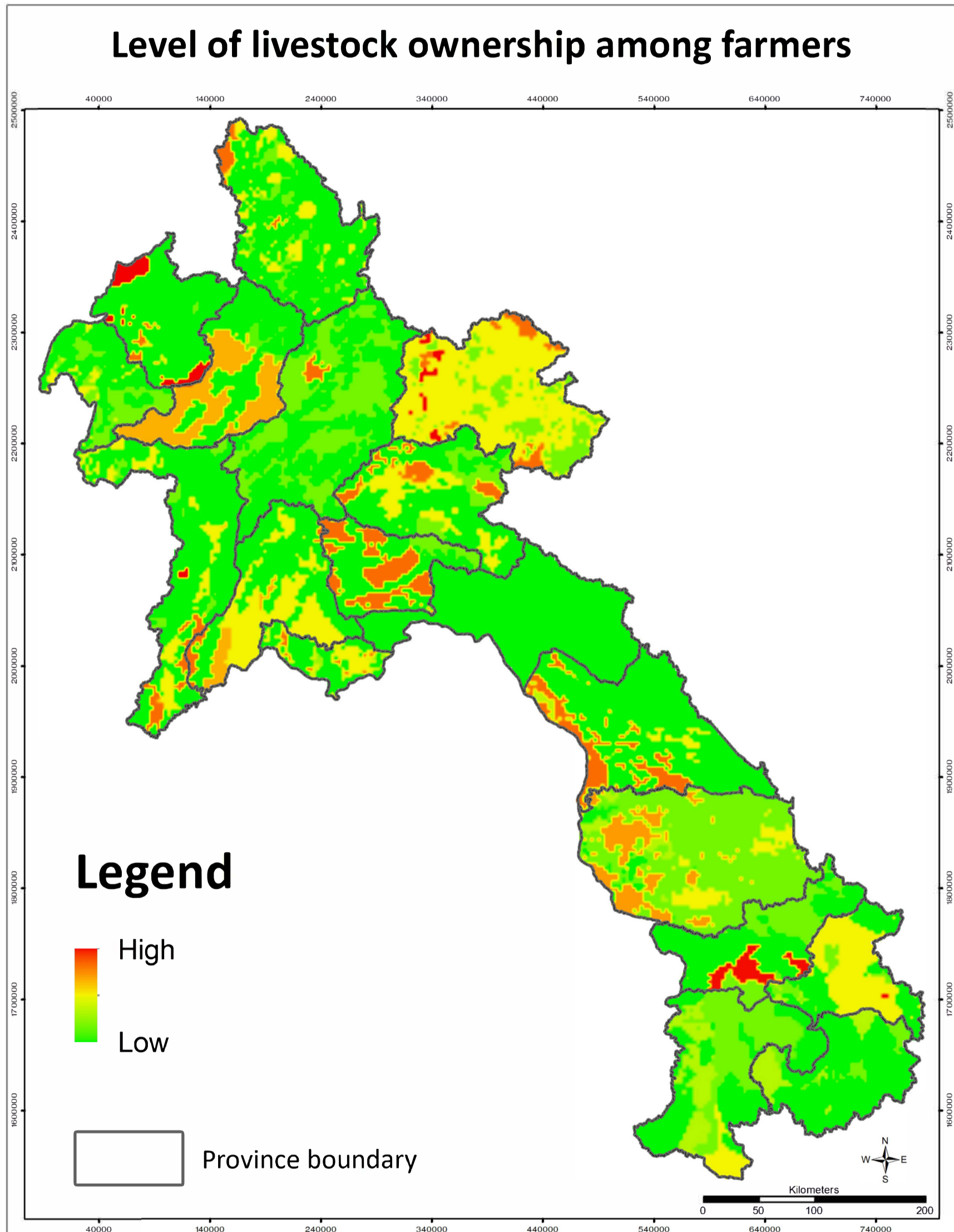
The rearing of livestock is an important part of the agricultural sector in the Lao People’s Democratic Republic. Most of the country’s livestock is owned by small businesses, in addition to which livestock are also kept by livestock farms and individual households.

In modern agriculture, the type of livestock raised depends on the topographic area in which the farm is located. The range of livestock species available in the country is expanding, with this including cows, buffalo, goats, horses and poultry. Other important factors that must be considered in order to ensure high-quality produce and market requirements are met include feed management, monitoring, health care, species selection, and breeding.

The map shows that Louangnamtha and Xekong have high levels of livestock ownership on farms. Xaisomboun, Khammouan, Savannakhet, Houaphan, Vientiane Province, Xiangkhoang, Xaignabouli, Phongsali, Xekong, Champasak and Bokeo have moderate levels, while farmers in Oudomxay and Bolikhamxai have low livestock ownership levels.



Livestock on a farm near Lao-Ngan, Salavan Province.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator provides information on the proportion of farmers in each livelihood zone who are smallholders. A survey was designed to determine the proportion of smallholder farmers, and agricultural experts from the DAFOs served as key informants by assessing this indicator. The answers from the participants were aggregated for each livelihood zone by calculating the average value. The data was normalized in order to rank the livelihood zones in terms of the proportion of smallholder farmers.



Vientiane Capital representatives discussing the proportion of smallholder farmers.

Assessment of the proportion of smallholder farmers

Agricultural expansion, loss of natural areas to make way for plantations, the contribution of farmers (and smallholder farmers in particular) to the national economy, the accessibility of markets, and stable production and job growth are all issues that will pose challenges in the future. In the choices farming households make, through farmers' demand for technical information, and by sharing their experience with one another, smallholder farmers help improve production techniques and product quality, as well as contributing to socio-economic development, particularly at the local level.

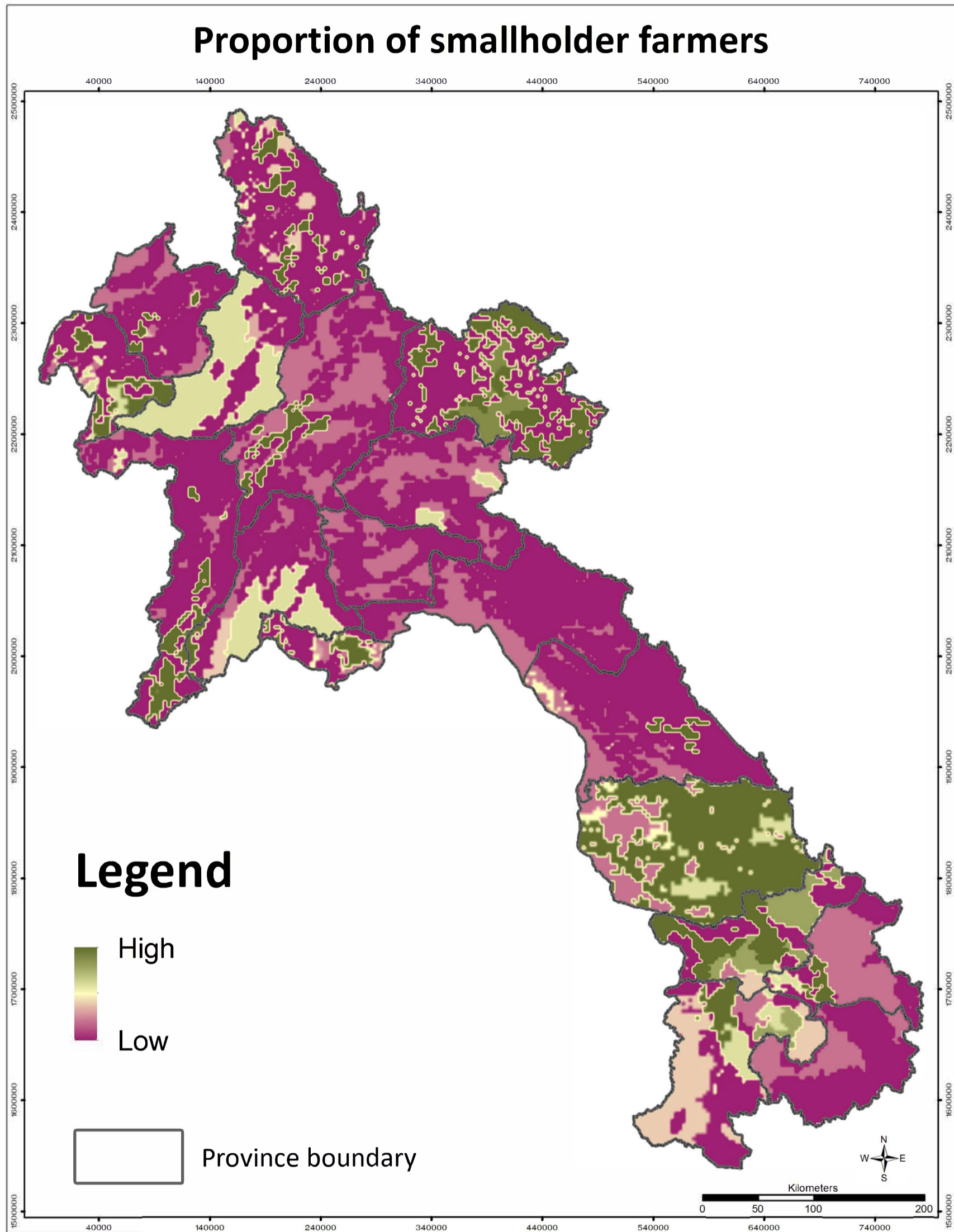
The map shows that there is a high proportion of smallholder farmers in Savannakhet, Salavan, Houaphan, Vientiane Capital, Bokeo, Xaignabouli, Oudomxay and Champasak, whereas lower proportions of smallholders are found in Phongsali, Louangphabang, Louangnamtha, Vientiane Province, Xekong, Khammouan, Xiangkhoang, Attapu, Bolikhamxai and Xaisomboun.



Farmer with her poultry.



Smallholder farmer transplanting rice.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>

Methodology

This indicator was estimated based on the predominant soil type and slope, and associated levels of fertility in each livelihood zone. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information on this indicator. Values were assigned for each criterion in order to determine soil fertility and slope. Values were aggregated for each livelihood zone by calculating the average value. The data was normalized to allow the livelihood zones to be ranked according to the predominance of favourable soil conditions.



Vientiane Province representatives describing soil fertility and slope.

Assessment of soil fertility and slope

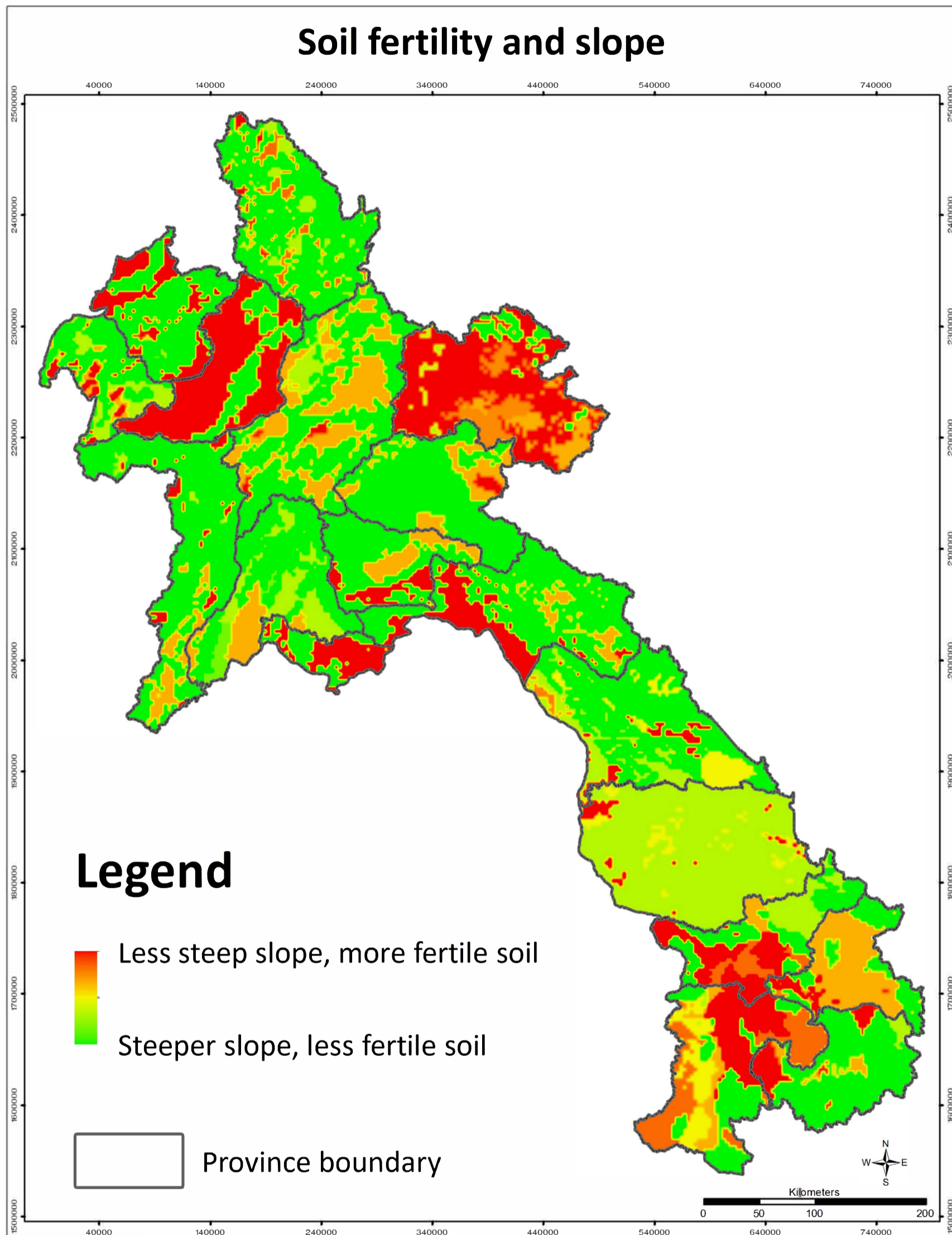
Land is an important natural resource for all living things, including humans, animals and plants. What is more, our dependence on land is increasing due to population growth, resulting in higher production and food requirements, particularly for vegetables and meat. Greater use of technology, and chemical fertilizers in particular, is therefore needed to ensure increased production. However, this can lead to rapid soil degradation caused by ineffective land use unsuited to the soil characteristics practised continuously over many years, leading to the disappearance of soil nutrients as they are washed away each year.

Land erosion is not only a technical problem; it is also a social problem. Land use unsuited to the land’s characteristics, such as its slope, and the impact of this on soil degradation, results in farmers having to find new land, leading to conflict in society.

The map shows soil fertility and slope in the Lao People’s Democratic Republic. More fertile land with gentler slopes is found in Oudomxay, Houaphan, Vientiane Capital, Bolikhamxai, Champasak, Salavan, Xekong, Louangnamtha, Bokeo and Attapu. Medium levels of fertility and moderately gentle slopes are found in Louangphabang, Xaisomboun, Vientiane Province and Savannakhet. The provinces with steeper slopes and less fertile soil are Khammouan, Xaignabouli, Phongsali and Xiangkhoang.



Extension officers learning about soil fertility tests at a farmer field school training of trainers at DALaM.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.



Methodology

This indicator was estimated based on the provision of extension services to farmers in the form of training on crop management. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information on this indicator. A value was assigned for each criterion related to the provision of crop-related training. Values were aggregated for each livelihood zone by calculating the average value. The data was normalized in order to rank the livelihood zones according to the level of training offered to farmers.



Attapu Province representatives discussing the level of access to and uptake of farmer education for crop cultivation.

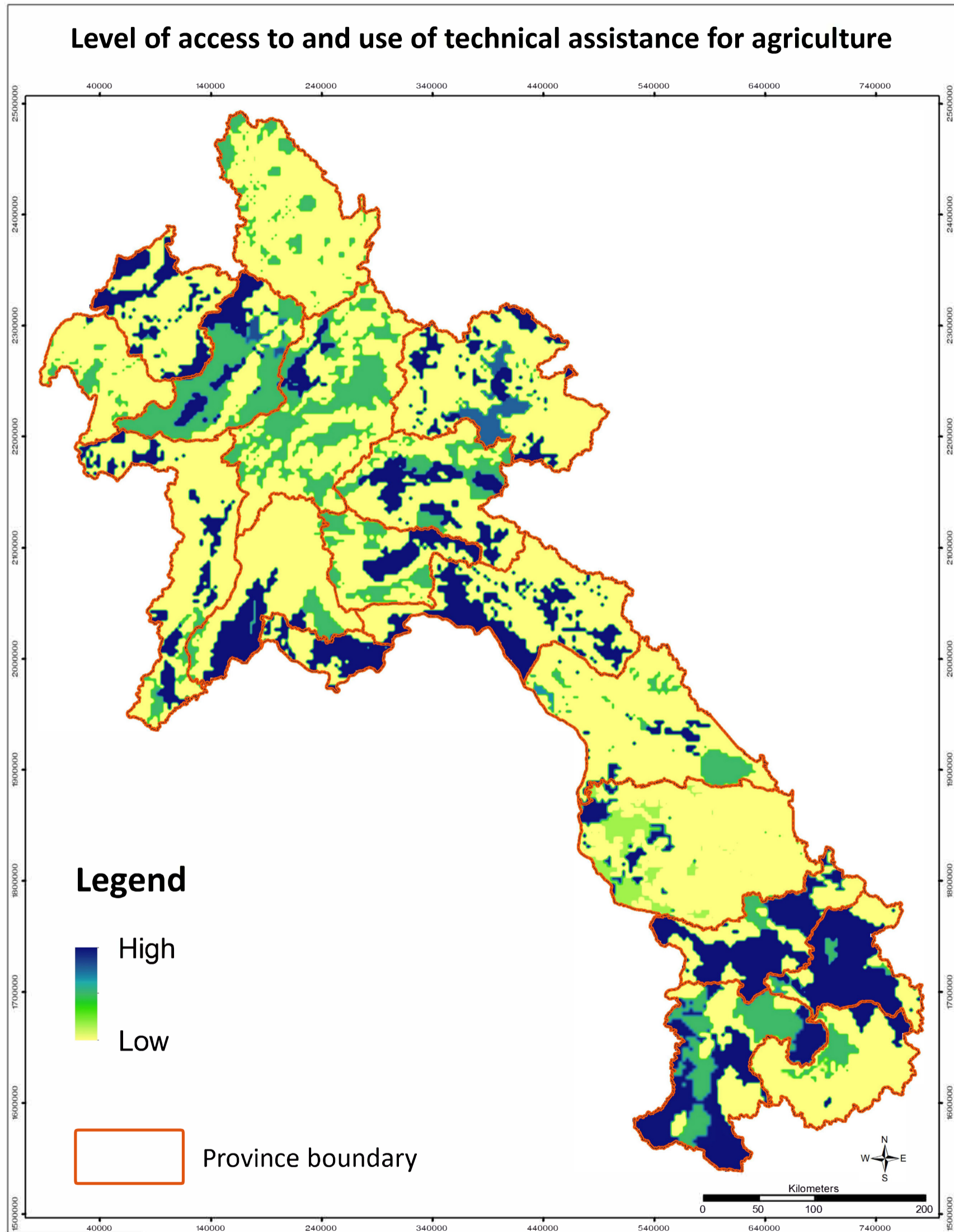
Assessment of level of access to and use of technical assistance for crop cultivation

Agriculture in the Lao People's Democratic Republic is increasing day by day. There is therefore a greater need for technology to ensure increased production by reducing costs, the amount of labour required, and plantation time. To increase the quantity and quality of agricultural produce, herbicides, chemical fertilizer and improved varieties of seeds need to be used, and the conservation of natural resources taken into consideration. Currently, continuous access to agricultural extension services provided by technical service centres and District Agriculture and Forestry Offices is part of the government's long-term plan, as are public information campaigns that make use of online media, magazines, manuals and brochures to inform landowners and agricultural producers of natural resource conservation strategies and local recycling options.

The map shows that a high level of access to and uptake of farmer education for crop cultivation is found in Vientiane Capital, Xekong, Bolikhamxai, Vientiane, Bokeo and Louangnamtha. Lower levels are found in Xiangkhoang, Xaignabouli, Xaisomboun, Champasak, Oudomxay, Louangphabang, Savannakhet, Khammouan, Attapu, Phongsali and Bokeo.



DAFO officer providing training to farmers in the village of Laonart in Savannakhet.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>



Methodology

This indicator was estimated based on farmers' level of access to veterinary care and farmer education for livestock rearing. A survey was produced, and answers were provided by agricultural/livestock experts from the DAFOs, who served as key informants by collecting information on this indicator. A value was assigned for each criterion related to the provision of veterinary and technical assistance for livestock. Values were aggregated for each livelihood zone by calculating the average value. The data was normalized in order to rank livelihood zones according to farmers' level of access to veterinary care and training in livestock rearing.



Salavan Province representatives discussing the level of access to veterinary and technical assistance for livestock.

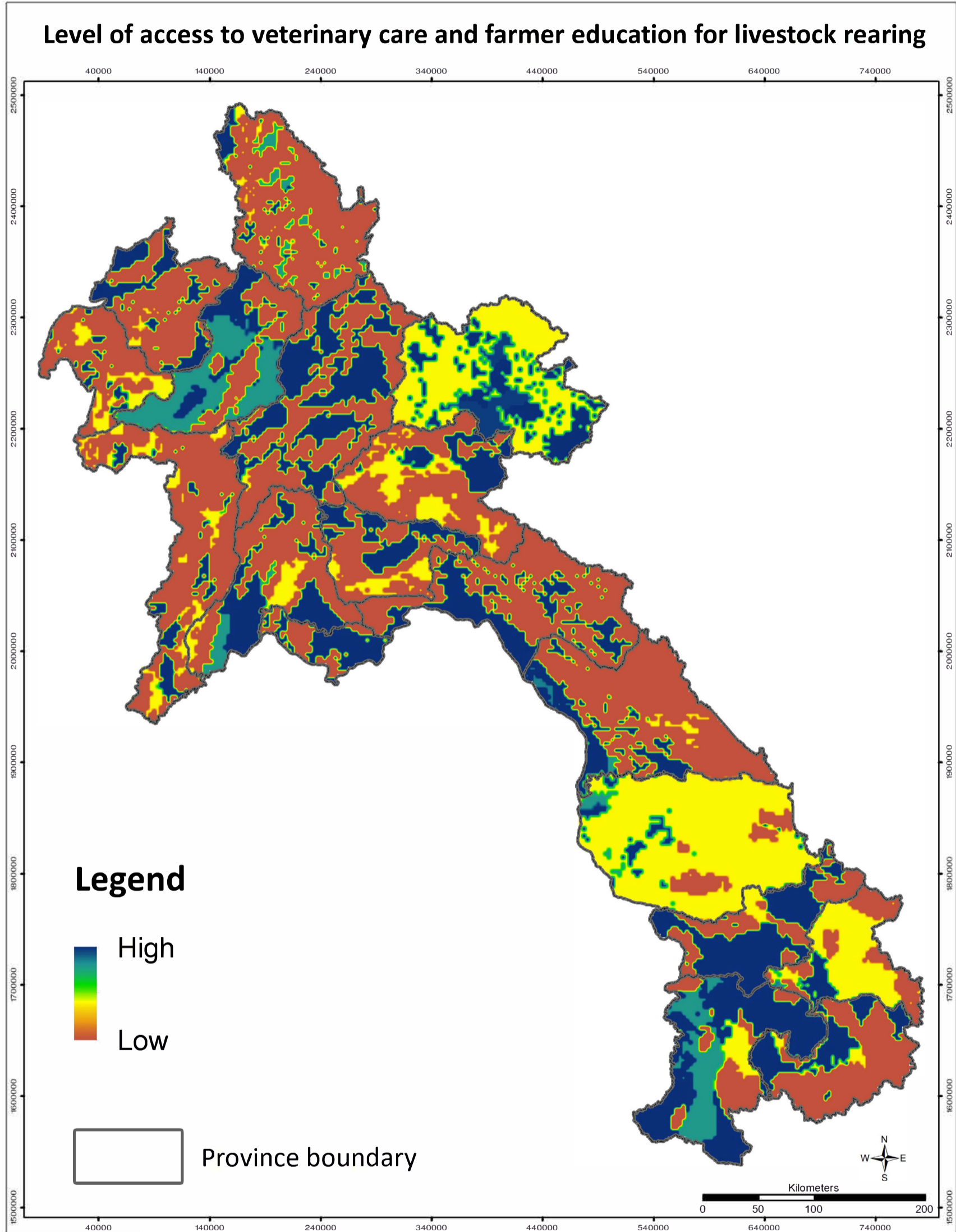
Assessment of the level of access to veterinary and technical assistance for livestock

To reduce poverty, farmers' groups need to be established to act as an intermediary between producers of conventional livestock breeds and consumers and promote and develop sustainable production. While traditional animal varieties are not highly productive, they are well adapted to local conditions and resistant to certain diseases. Many people in rural areas rely on livestock as their main source of income. Access to technical information is needed to increase production, and improve the varieties of animals used and their health. In rural areas, access to animal feed and qualified veterinary services is limited. This is particularly true of access to vaccines and other medication for poultry, pigs, sheep, goats, cows, buffalo and fish.

The map shows the level of access to veterinary and technical assistance for livestock. The following is a list of the country's provinces presented in order of level of access, from high to low: Vientiane Capital, Louangphabang, Bolikhamxai, Salavan, Champasak, Oudomxay, Louangnamtha, Khammouan, Attapu, Vientiane Province, Houaphan, Savannakhet, Xaignabouli, Xekong, Xaisomboun, Xiangkhoang, Phongsali and Bokeo.



Preparation of the mix for multinutrient blocks (urea, rice bran, salt, lime, bone meal, cement) for cattle farming in the village of Long Phong.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of households owning a car or truck for the purposes of supporting their agricultural production and related business activities. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Answers were aggregated for each livelihood zone by calculating the average value. The data was normalized in order to rank livelihood zones according to farmers' level of ownership of vehicles used in agricultural production and entrepreneurial activities.



Xekong Province representatives discussing the level of access to vehicles for agricultural production and related business activities.



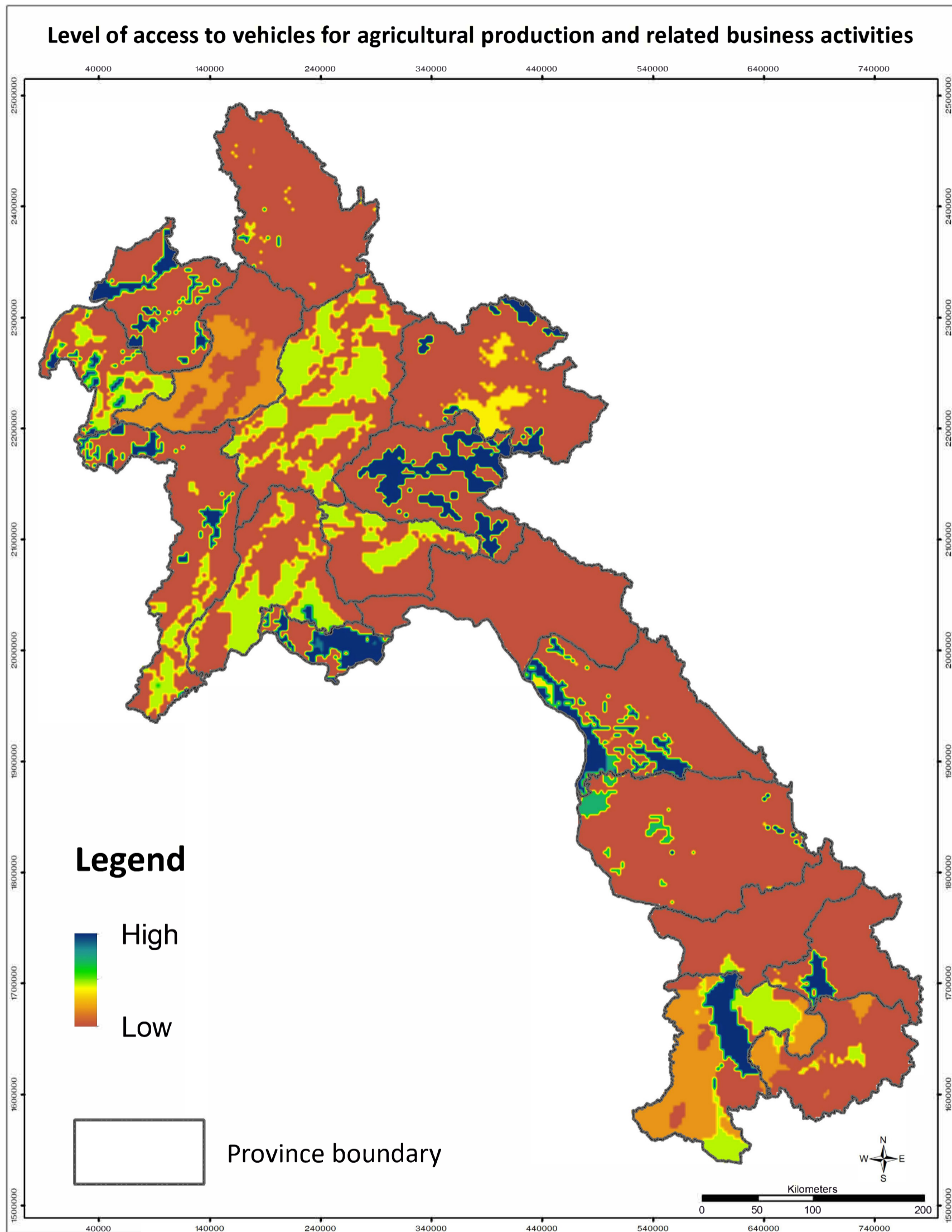
Preparation of a rice field using a mechanical plough.

Assessment of the level of access to vehicles for agricultural production and related business activities

Agricultural development in which farmers use vehicles for production and business is still limited in terms of budget. Investment in agricultural production, particularly chemical agriculture to increase productivity, remains low. However, it is essential for agriculture development to turn to clean agriculture by following a small and medium market plan for our country. The main occupations of residents of rural areas include agriculture and fishery, handicrafts, construction and logistics. The map shows the level of access to vehicles for the purposes of agricultural production and business. Vientiane Capital, Xiangkhoang, Louangnamtha, Khammouan, Champasak, Bokeo, Xaignabouli, Houaphan and Xekong were found to have a high level of access to vehicles. This was followed by Vientiane Province, Oudomxay, Xaisomboun, Savannakhet, Attapu, Xekong and Phongsali. The lowest level of access was in Bolikhamxai Province.



Vehicle allowing a villager in Phongsali Province to carry out their business.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of farming households that own a car or motorbike, reflecting the household’s economic status. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. Answers were aggregated for each livelihood zone by calculating the average value. The data was normalized to determine farmers’ level of access to a vehicle and thus their economic status.



The representative from each group explained the level of access to vehicles for daily travel.

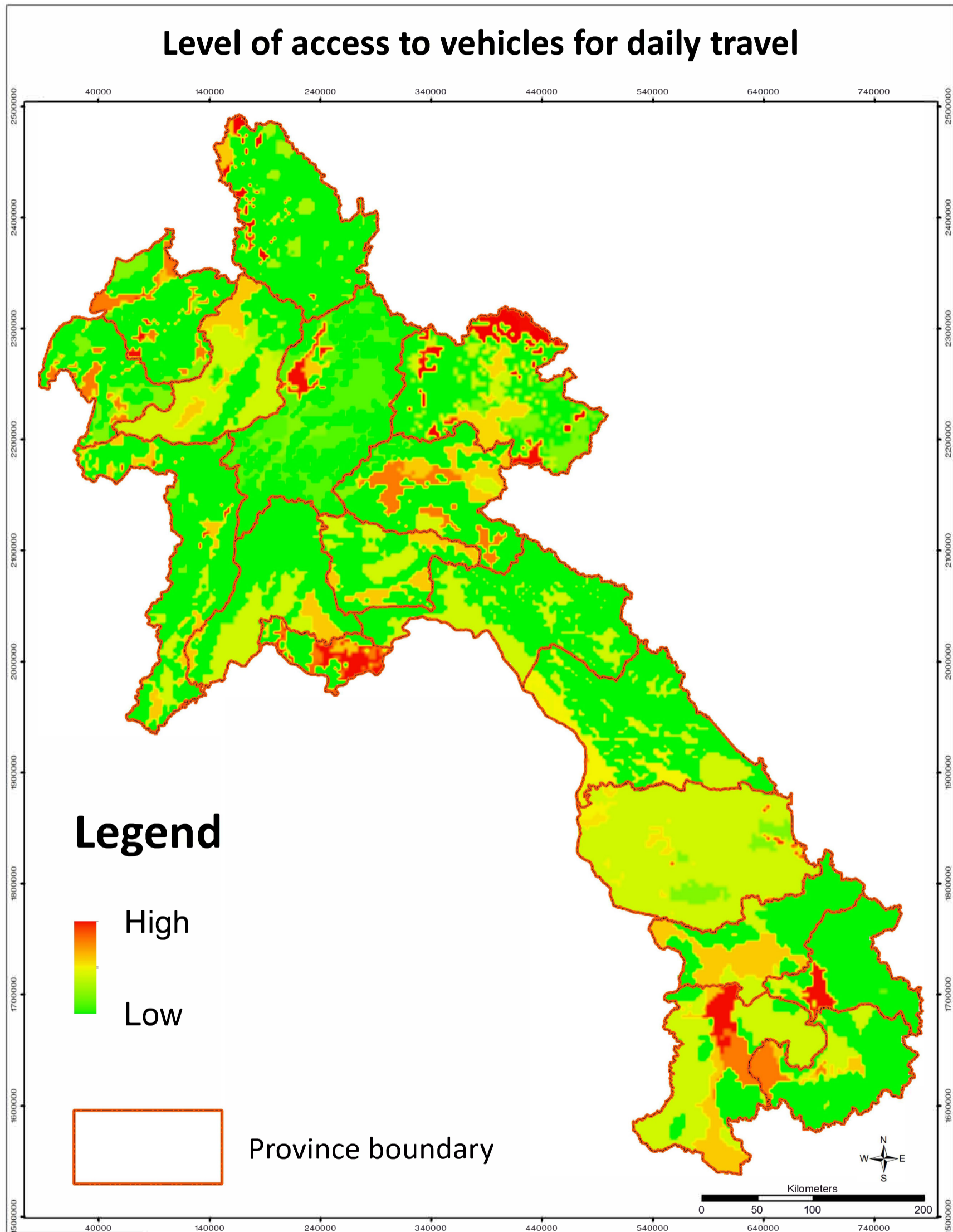
Assessment of the level of access to vehicles for daily travel

The development of infrastructure for transportation has contributed to the socioeconomic development of the Lao People’s Democratic Republic. Nevertheless, the transport systems in rural areas remain insufficient for meeting society’s requirements, especially those of rural farmers. There are a number of issues with the transport network affecting farmers, such as a lack of proper roads, traffic problems creating long delays, dust and mud, and accidents. Improvements to the road network are currently being rolled out across the country to help deal with a growing population and increasing demand for agricultural produce. In line with government strategy, farmers are orienting production towards urban areas. This has led to a greater requirement for travel and vehicle use, particularly vehicles used for daily travel. Access to vehicles and the selection of which vehicle to use are based on farmers’ individual objectives and requirements, such as the need to access cropland, transport produce and expand crop production areas.

The map shows a high level of access to vehicles for daily travel in Vientiane Capital, Houaphan, the Bolaven Plateau of Champasak Province, Salavan, and Xekong, as well as some parts of Louangphabang and Phongsali. A lower level of access to such vehicles was found in Xiangkhoang, Louangnamtha, Bokeo, Attapu, Xaignabouli, Oudomxay; Savannakhet, Viengtiene Province, Xaisomboun, Bolikhamxai and Khammouan.



Vehicle for daily use in Nang Khiaw.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the proportion of households that had access to irrigation infrastructure, and the proportion of households with available water to support agriculture during dry periods. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. A value was assigned for each criterion relating to the availability of water during dry periods. A composite value was calculated from both responses. Answers were aggregated for each livelihood zone by calculating the average value. The data was normalized to determine farmers' level of access to water for agriculture.



A map showing the availability of water for agriculture.

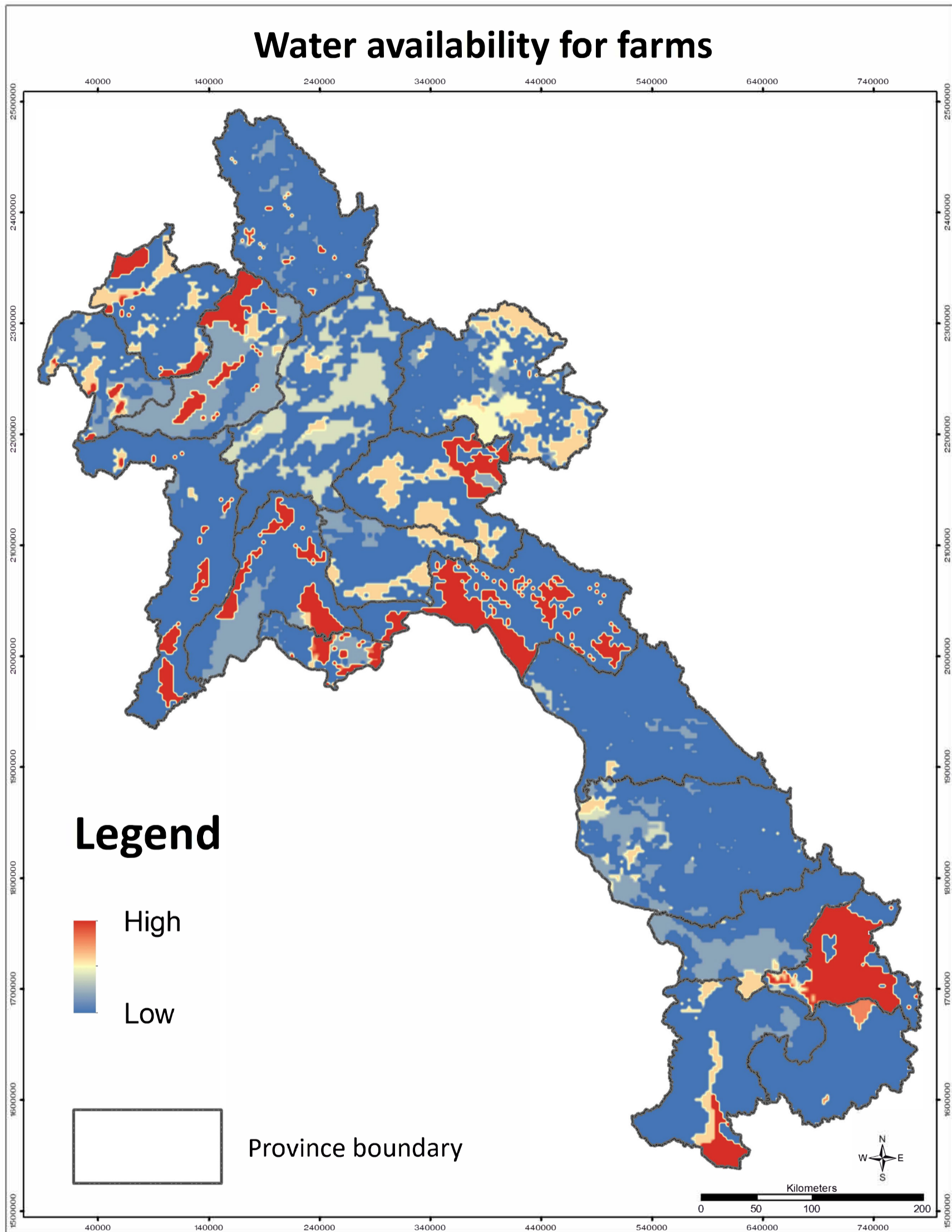
Assessment of the availability of water for agriculture

Effective water supply is vital in agricultural production to ensure the growth of crops and animals, a key component of food security. There are a number of different ways of supplying water supply via irrigation systems to crops, such as pumping systems, reservoirs, gates, gravity irrigation and public irrigation. Generally, water supply relies on government investment aimed at increasing rice and crop production during the dry season on the large, medium and small plains located along the Mekong River and its tributaries, such as the Phaohao, Nguadeng, Namthang, Larntui, Meuang Nam, Meuang Phieng, Vientiane, Bolikhamxai, Xebangfai, Xebanghieng, Xedon, Champasak and Attapu plains.

The map shows that the provinces with a high level of availability of water for agriculture are Bolikhamxai, Xekong, Vientiane Capital, Vientiane Province, Oudomxay, Xaignabouli, Champasak, Xiangkhoang, Louangnamtha, and Bokeo. This is followed by Houaphan, Louangphabang, Xaisomboun, Savannakhet, and Phongsali. The provinces with a low level of water availability for agriculture are Attapu, Salavan and Khammouan.



Whitong irrigation reservoir.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>.

Methodology

This indicator was estimated based on the type of entities or agencies involved in the provision of water for household use. A survey was produced, and answers were provided by agricultural experts from the DAFOs, who served as key informants by collecting information for this indicator. A value was assigned for each criterion. Answers were aggregated for each livelihood zone by calculating the average value. The data was normalized to rank livelihood zones according to the level of community involvement in water provision across multiple livelihood zones.



Representatives from each group discussed the level of community involvement in water provision.

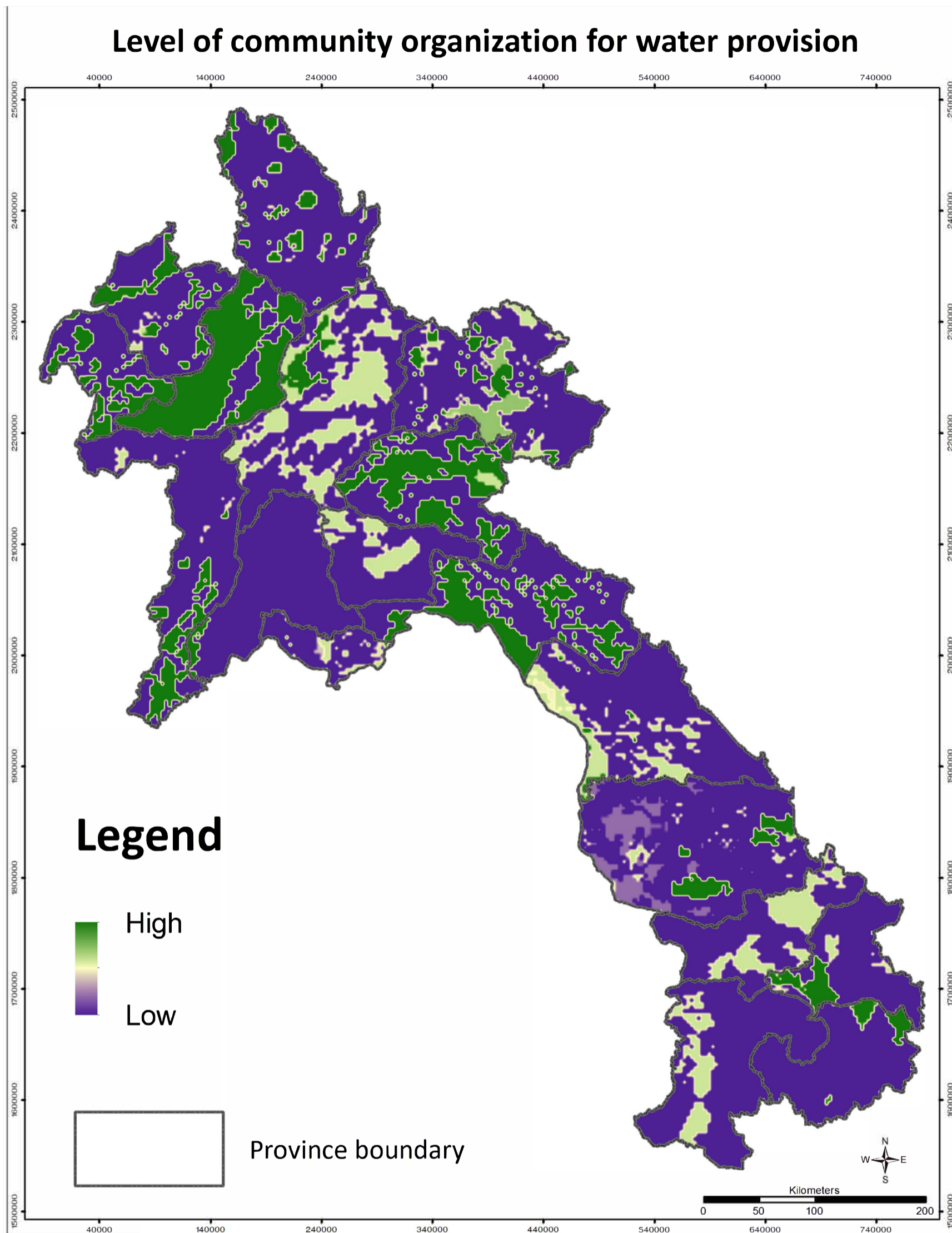
Assessment of the level of community involvement in water provision

As a result of climate change, storms and hot or cold weather can occur at times outside their usual seasons, which has an effect on the quantity and quality of agricultural produce. The availability of qualified water for use in people’s daily life, such as water for domestic use, is vital, which is why it is such an important consideration. In most areas of the Lao People’s Democratic Republic, and in rural communities in particular, government bodies, especially local authorities, are endeavouring to find clean, high-quality water sources by mobilizing the budget from different sources, sectors, related organizations, and units in order to follow the Government’s policy of devolving water resource management to the local level. The effective use of water is managed in multiple ways: via community groups, regulations and policies, management systems and system maintenance.

The map shows the level of community involvement in water provision in the Lao People’s Democratic Republic. The following is a list of the country’s provinces presented in order of level of involvement, from high to low: Oudomxay, Bolikhamxai, Xiangkhoang, Louangnamtha, Bokeo, Xaignabouli, Phongsali, Houaphan, Savannakhet, Attapu, Xekong, Louangphabang, Khammouan, Salavan, Champasak, Xaisomboun, Vientiane Capital and Vientiane Province.



Community preparing to make use of meteorological services for agriculture Phakkou-Gnai village in Laongam district, Salavan in 2018.



Source: Livelihood maps and data by FAO, Alliance of Bioversity International and CIAT, DALaM and NAFRI of MAF, and DMH of MONRE, 2022.
<https://lirms-dalam.net/?thematic=sava>

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