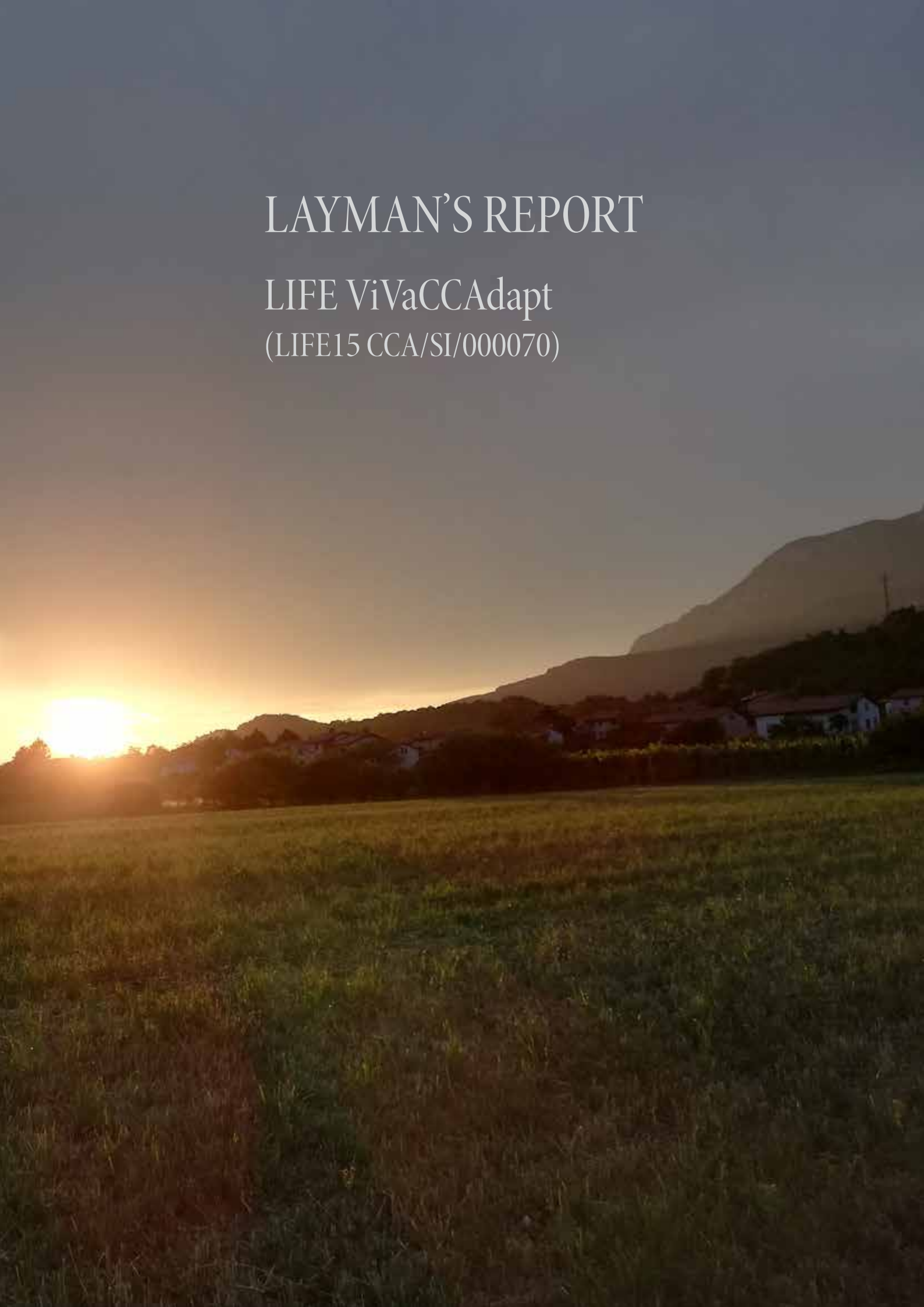

LAYMAN'S REPORT

LIFE ViVaCCAdapt
(LIFE15 CCA/SI/000070)

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1. TERMINOLOGY used within LIFE ViVaC-CAdapt

Adaptation Strategy

Irrigation Decision Support System (IDSS) is a tool feeding the users with the recommended time and quantity of irrigation 5 days in advance. It takes into account the current quantity of water in the soil, the data about the soil characteristics, the water needs of a plant based on its growth stage, the weather forecast and the irrigation technology applied.

Green Windbreak Band (GWB) consists of a tree and bush plantations generally planted in one or more rows to protect against the adverse impact of wind. The main target of GWB is to protect the land against wind erosion and reduce the water evaporation from open agricultural areas.

Climate Change Adaptation Strategy for Agriculture in the Vipava Valley for the period 2017–2021 (Adaptation Strategy) is intended to enhance the performance of the local agricultural sector in adaptation to climate changes, risk management (drought, floods, frost and strong wind) and exploitation of opportunities in agriculture offered by climate change. The strategy allowed us to acquire the professional bases, the range of priority measures and recommendations for the implementation of the measures to adapt the local agriculture to climate change.

Picture 1: TDR probe transmitter

Picture 2: TDR probe for measuring the water content of the soil

Picture 3: Pilot GWB planted during the LIFE ViVaCCAdapt project

2. LIFE ViVaCCAdapt PROFILE

Project title: **Adapting to the Impacts of Climate Change in the Vipava Valley (Prilagajanja na vplive podnebnih sprememb v Vipavski dolini)**

Project acronym: **LIFE ViVaCCAdapt**

Value: **€869,028**

Co-financed by the LIFE programme: **60%**

Co-financed by the Ministry of the Environment and Spatial Planning of the Republic of Slovenia: **20%**

Duration: **from 1 July 2016 to 30 June 2021**

Coordinating beneficiary: **Regional development agency ROD Ajdovščina**

Associated beneficiaries: **BO - MO svetovalno podjetje, d.o.o., HIDROTEHNIK Vodnogospodarsko podjetje, d.o.o, Slovenian Water Institute, Municipality of Ajdovščina, University of Ljubljana, Biotechnical Faculty.**

Implementation: **Vipava Valley, Goriška Region, Slovenia**

3. PURPOSE of LIFE ViVaCCAdapt

Climate change has had a serious impact on the agricultural production in the recent decades: in the Primorska region, an average rise of 1 °C in temperatures was registered in the last thirty years (Slovenian Environment Agency; Environment Situation in Slovenia (from 1971 to 2000), page 19). Not only hot weather, the farming in the Vipava Valley is also affected by the strong wind called *burja*.

The studies have shown that the Adriatic region shall experience a reduction of heat loss into the atmosphere, evaporation will increase and the quantity of precipitation is expected to diminish, resulting in extended and strong period of drought with extreme precipitation also anticipated.

Without the appropriate measures to mitigate the consequences and adapt to climate change, the negative impacts on the agriculture shall only escalate. The effective adjustment can be achieved by developing the right adaptation strategies designed in and for the Vipava Valley which can be applied with some minor alteration also to other regions. It is presumed that the quick adaptation would allow the economy to develop faster.

4. CONTENT of LIFE ViVaCCAdapt

LIFE ViVaCCAdapt project is focused on three measures for adaptation to climate change. IDSS and GWB are intended to the direct implementation, whereas the Adaptation Strategy ensures the regulatory framework of short-term guidelines in agriculture. The measures were developed in collaboration with the experts in agriculture, forestry and nature protection to maximise the effects of the implemented actions. Local farmers and uses of agricultural land, who were actively and directly participating throughout the entire duration of the project, were also included in the process of conception. Their collaboration will be of utmost importance after the project as well since they cover a key role in the implementation of the measures in the wider area. To ensure the sustainability of the measures, the policy-makers on local, regional and national level also participated in the conversations about the future implementation of the actions developed. The promotion of the adaptation measures saw the participation of elementary school pupils, high school and university students who were educated on the agricultural adjustments to climate change.

Objectives

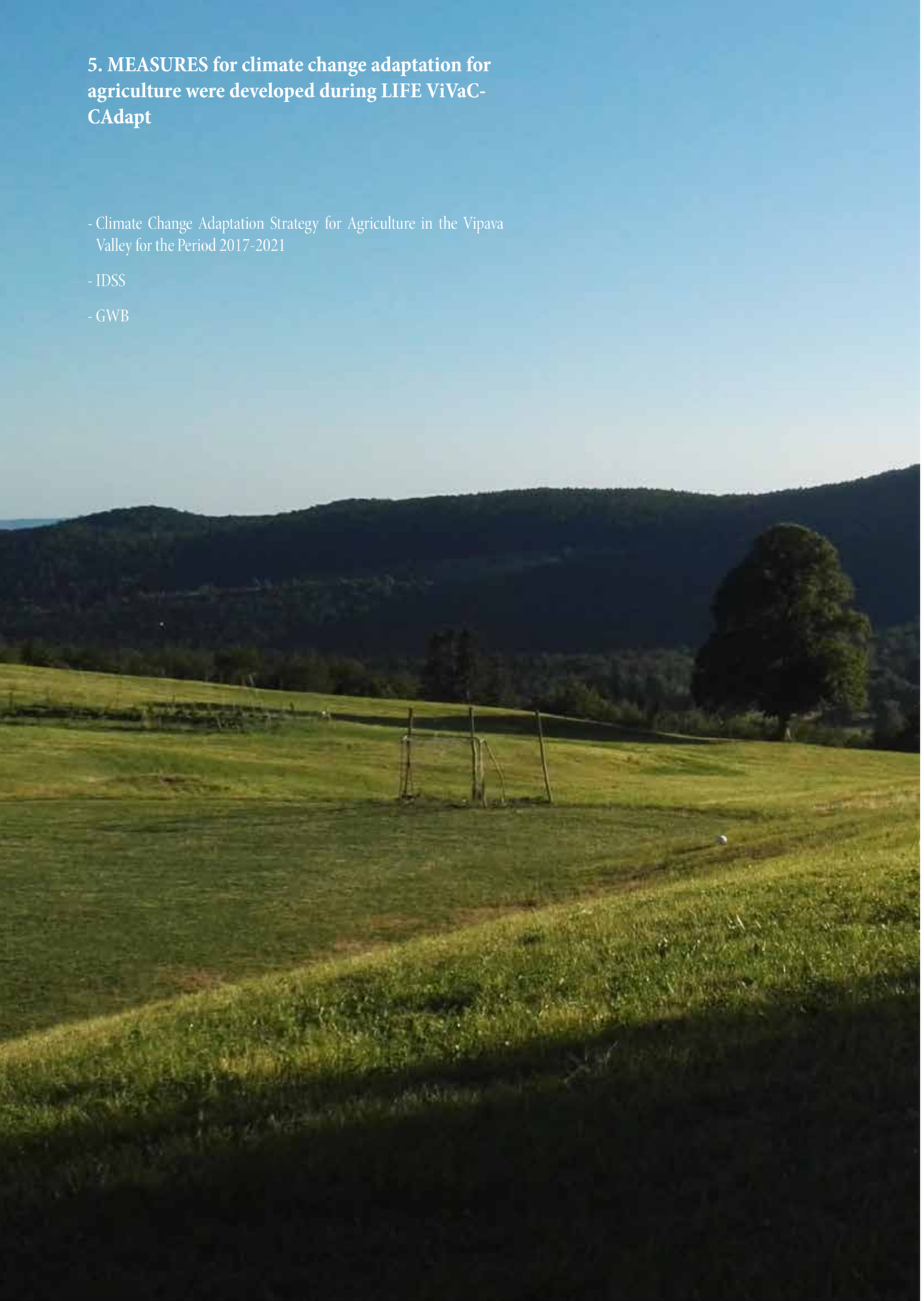
- Analysis of the current situation in the Vipava Valley to support adaptation to climate change;
- Definition of strategic processes for the adaptation to climate change. Planning of a series of measures together with various sectors (agriculture, forest industry, hydrology, transport, tourism, urban planning etc.) with the experts' opinion for the analysis of possible climate effects which could be triggered by the suggested agricultural actions;
- Harmonisation of specific goals and strategic actions. Identification of the main (priority) and other (secondary) adaptation measures to climate change and the proposal of the sequence of their implementation;
- Constitution of a pilot IDSS to streamline water consumption compliant to the requirements of the Water Framework Directive with its adopted and associated contents of the Slovenian Rural Development Programme;
- Assessment of the effectiveness of the existing GWB (simulation). Conception of the demonstrative area in which plant GWB for the dissemination of information and raising awareness on the importance of GWB;
- Elaborate Adaptation Strategy in which the specific features of the area is taken into consideration. The proposed Adaptation Strategy pursues the objectives of the National Environmental Action Programme and the European Environmental Policy which promote sustainable development.

Results

- Definition of the main farm types, use of agricultural land and farming practices in the Vipava Valley
- Specifically:
  - the scenario of climate changes in the Vipava Valley;
  - the best farming practices to deal with climate change in the Vipava Valley and
  - tthe governance models of climate change.
- The Adaptation Strategy constitutes an extensive strategy of adaptation to climate change for the observed region. The extensive Climate Change Adaptation Strategy for Agriculture in the Vipava Valley.
- IDSS for Vipava Valley for all types of products (i. e., grape, fruit, vegetable) on agricultural lands with various water retention features of the soil. Pilot IDSS is ready for use on a national scale.
- The demonstrative centre (area) with 300 metres of various GWB.
- The comparison between the areas with and without GWB has revealed how the creation on GWB zones on areas experiencing strong and gusty wind is not only reasonable, but instrumental as well.
- The increased awareness of the public about the adaptation to climate change as the best way to preserve natural resources and biodiversity without reducing the quality and quantity of products and compromising the fertility of agricultural land.
- New synergies and networking with LIFE projects alike, and related projects co-financed by other European Union programmes.
- Cooperation of qualified experts who motivated the participants, providing them the latest information and state-of-the-art technology.

5. MEASURES for climate change adaptation for agriculture were developed during LIFE ViVaC-CAdapt

- Climate Change Adaptation Strategy for Agriculture in the Vipava Valley for the Period 2017-2021
- IDSS
- GWB



5.1. Climate Change Adaptation Strategy for Agriculture in the Vipava Valley for the Period 2017-2021

WHY this strategy?

- To enhance the performance of the agricultural sector to adapt to climate change;
- to manage the risks related to extreme weather conditions (drought, floods, frost and strong wind) and
- to take advantage of the opportunity climate change offers in agriculture.

WHAT did we gain?

- Professional starting points;
- series of priority measures;
- recommendations for the implementation of the measures to adapt the local agriculture to climate change;
- measures, together with the strategic action plan for their implementation;
- assessment of potential impacts (exposure, sensibility, adaptive capacity, vulnerability).

KAKO smo pripravljali strategijo?

1. Exploratory Regional Analysis to Support Adaptation of Agriculture to Climate Change in Vipava Valley, i. e., analysis of the situation;
2. analysis of spatial data (soil use, types of farms, irrigation opportunities);
3. overview of the existing good practices of adaptation to climate change (grassing between rows, introduction of new drought resistant plants, irrigation, GWB, hail protection nets, cultivation in protected areas, creation of new water resources for irrigation);
4. identification of 93 measures for adaptation to climate change for agriculture and forest industry;
5. workshop for relevant stakeholders to find the connection between the importance of the measure on a local scale and the role of stakeholders in its implementation;
6. integration with the strategic documents of the municipalities.

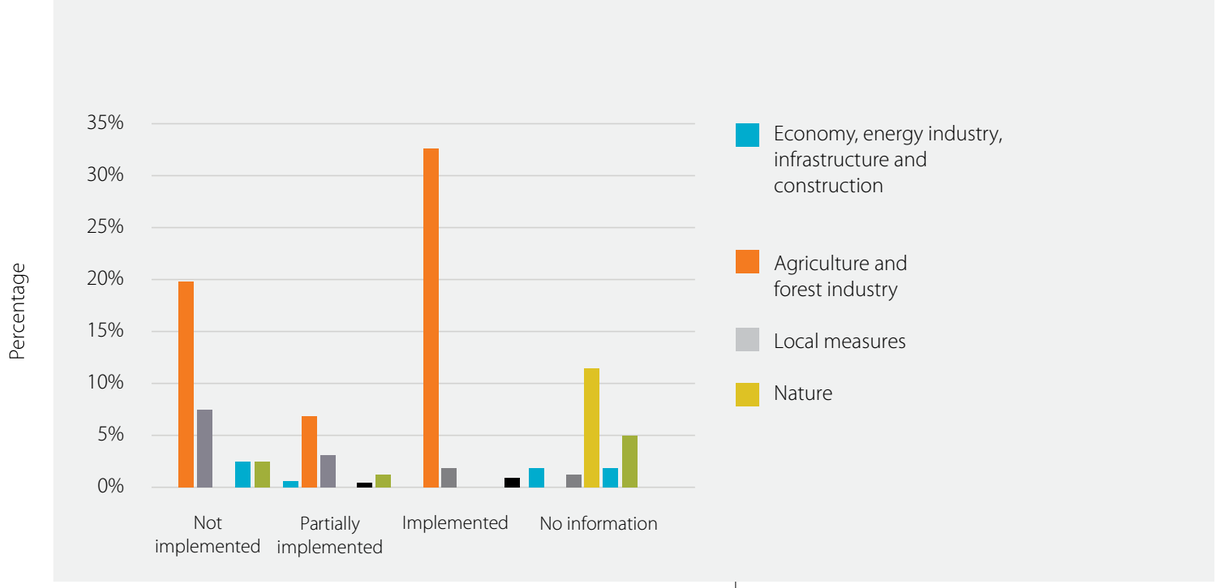


Figure 1: Chart of implementation of measures for adaptation to climate change identified for each content set. On average, as much as 1/3 of measures is not implemented. In the majority of cases, these actions require a coordinated cooperation of multiple stakeholders at the same time.

NOTE: The Adaptation Strategy is under development for other municipalities in Slovenia under the Sustainable Energy and Climate Action Plan (SECAP). The SECAP project sees the collaboration of various sector operating within the municipality.

Picture 4: Vipava Valley

5.2. IDSS

WHY was IDSS applied?

- Because of low agricultural productivity;
- because irrigation proceeded without the use of interrelated basic information required for a professional and correct irrigation (soil characteristics, current water quantity in the soil, growth stage of a plant, weather forecast);
- due to late irrigation;
- due to excessive or poor irrigation.

WHAT is IDSS?

- Irrigation Decision Support System (IDSS) is a tool feeding the users with the recommended time and quantity of irrigation 5 days in advance which takes into account the current quantity of water in the soil, the data about the soil characteristics, the water needs of a plant based on its growth stage, the weather forecast and the irrigation technology applied.

- It is made of four modules and a database:
  - database: user settings (culture, region, soil, irrigation selected), plant cultures and their features, weather forecasts, soil-water measurements and irrigation forecast;
  - Module 1: measurement of water in soil
  - Module 2: weather forecast
  - Module 3: programme for the calculation of need for irrigation based on the IRRFIB water balance monitoring model designed by the Slovenian Environment Agency
  - Module 4: web interface with four tabs:
    - Irrigation recommendation
    - Measurement of water in soil
    - Change of growth stage
    - User settings

- 2016: 35 farmers of the Vipava Valley join the project

- 2017:

  • Installation of the device (transmitter and probe) which measures the water in soil

  • Laboratory analyses of soil (water-retaining properties of soil, texture)

- 2019: IDSS starts operating

- 2020:

  • IDSS upgrade: irrigation recommendation for cubic metre and time of irrigation

  • 6 new farmers from other Slovenian regions join the project within the EIP PRO-Pridelava framework

- 2021:

  • IDSS upgrade: growth stages added for the most common cultures in the region (2 crops, 19 vegetables, 14 perennial plants), change of culture enabled

HOW was IDSS applied?

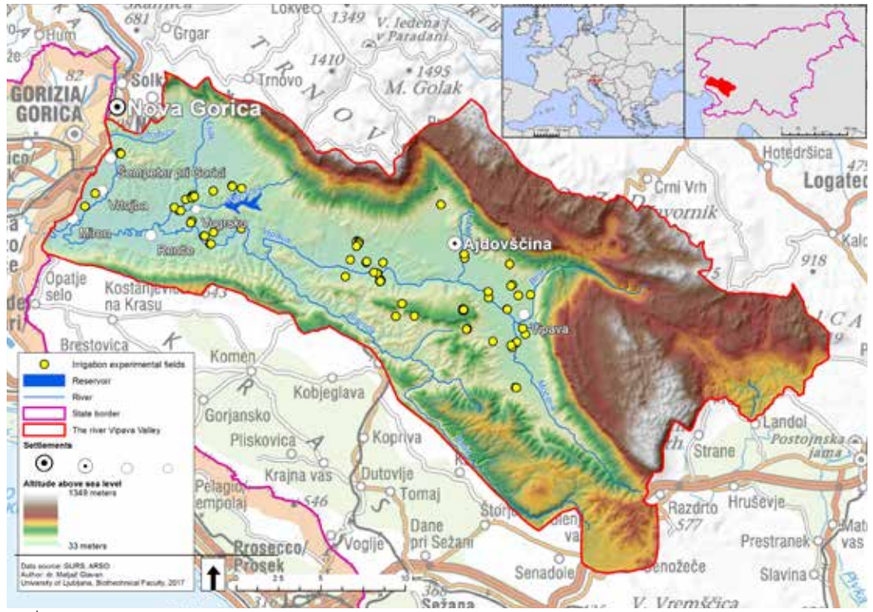


Figure 3: Locations of 35 TDR probes

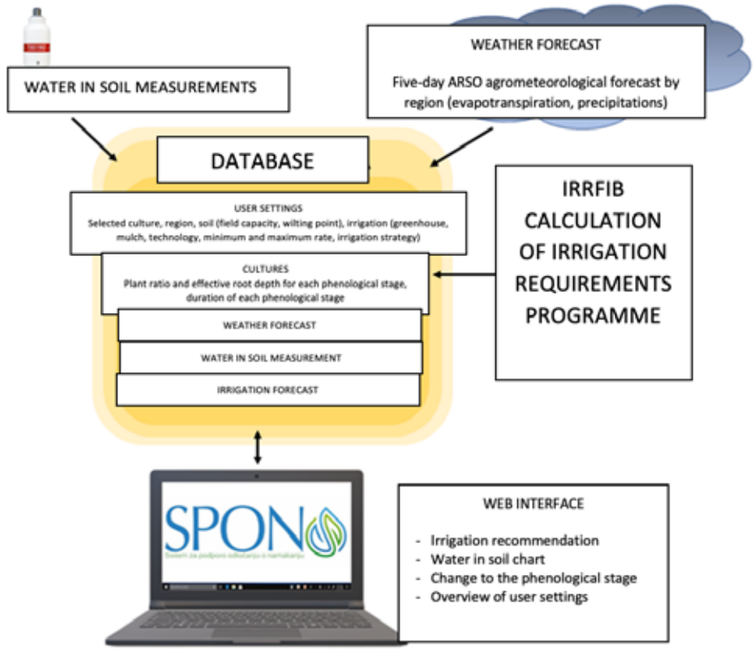


Figure 2: IDSS system scheme

HOW does IDSS work?

IDSS can be applied wherever there is an irrigation system. The irrigation system flow rate must be measured by the farmers directly on their plot. The researchers of the University of Ljubljana, Biotechnical Faculty then take some soil samples from which they will establish its water-retention features. A TDR probe is put in the soil and a transmission unit which communicates the data to the central server on the surface. The system is able to automatically calculate the recommended time and quantity of water for irrigation based on the data collected from the farmer's land and the weather forecasts.

IDSS works on the IRRFIB water balance model designed by the Slovenian Environment Agency. The system starts calculating of the irrigation recommendation every day after 9 a. m. during the growth stage. Farmers have access to the irrigation recommendation and the charts showing the quantity of water in soil through the online interface and can be viewed on any type of device.

The first results of irrigation data analysis before and after indicate that thanks to IDSS farmers gradually change their irrigation practices. The positive changes can be seen in the shorter duration and higher frequency of irrigation. The study has revealed that before IDSS was introduced, farmers irrigated their land not frequently enough, and when they did it, the watering lasts too long, thus causing water losses. The experiences gained from LIFE ViVaCCAdapt project show that a 25% reduction of water consumption, a 24% reduction of energy and 24% less CO_2 emission caused by irrigation can be achieved by farmers using IDSS.

User satisfaction survey implies that the majority of farmers is satisfied with the IDSS system and express their willingness to continue using the platform and would recommend it to other growers, too.

NOTE: By the end of 2021, IDSS shall be launched by the Slovenian Environment Agency (ARSO) and will operate until 2022.

5.3. GWB

WHY was GWB applied?

- To reduce the negative impact and damage burja wind is causing to agricultural land.
- To substantially reduce the wind erosion of fertile soil.
- To significantly reduce the evaporation of water from land, thus increasing the resistance to drought.
- Beneficial influence of the lower water consumption for irrigation.
- The right type and structure of GWB which increase considerably the vegetal and animal biodiversity in the agricultural landscape.
- GWB provide shelter and food to small wild animals of the region, and other.

HOW was the demonstrative GWB applied?

- 2016: Analysis of the impact of GWB: presentation of measuring stations
- 2017:
  - Analysis of the condition of GWB at the time
  - Analysis of wind conditions
  - Workshop with stakeholders
- 2018:
  - Analysis of the impact of GWB: definition of the optimum features and effectiveness
  - Obtaining the consent to plant from the Land Bank;
  - Land surveying: 1500sqm=300m x 5m, distribution into 6 areas of 250 sqm;
  - Land preparation (tree and bush felling, excavation of tree stumps, tillage);
  - Realisation of the plantation study;
  - Selection and supply of seedlings;
  - Plantation of GWB
- 2018-2021:
  - Monitoring and maintenance

- Each location must be considered individually (land size, plantation restrictions etc.);
- Windbreak must be planted as perpendicularly as possible to the wind direction;
- Windbreak must be at least 10 metres high and occupy leastways 1/10 of the area we want to protect;
- The band width (minimum 2 metres, optimum 5 to 10 metres) and treetop density is important, undergrowth is essential;
- Windbreak should be at least 10-times longer compared to its height.

WHAT are the best aspects and conditions to plant GWB?

A trial 300-metres-long and 5-metres-wide demonstrative GWB was planted, with the total area of 1500 sqm divided into 6 surfaces, each planted with a different combination of trees and bushes. The plantation was carried out with the help of professionals and based on expert analyses. Based on the plantation study conducted by the Slovenia Forest Service, a high planting density was intentionally observed because a slight decline is expected before the windbreak reaches its full functionality.

The section in which trees and bushes are proved to grow the most successfully is planted with seedlings of 120 to 150cm in height. This portion was planted with:

- 17 black alders;
- 17 field maples;
- 34 field elms;
- 34 common hornbeams;
- 11 Norway maples;
- 11 common oaks and
- 12 cherry trees.

- Total: 136 seedlings (5336 seedlings per hectare).

Picture 6: planting of the first seedlings in pilot GWB

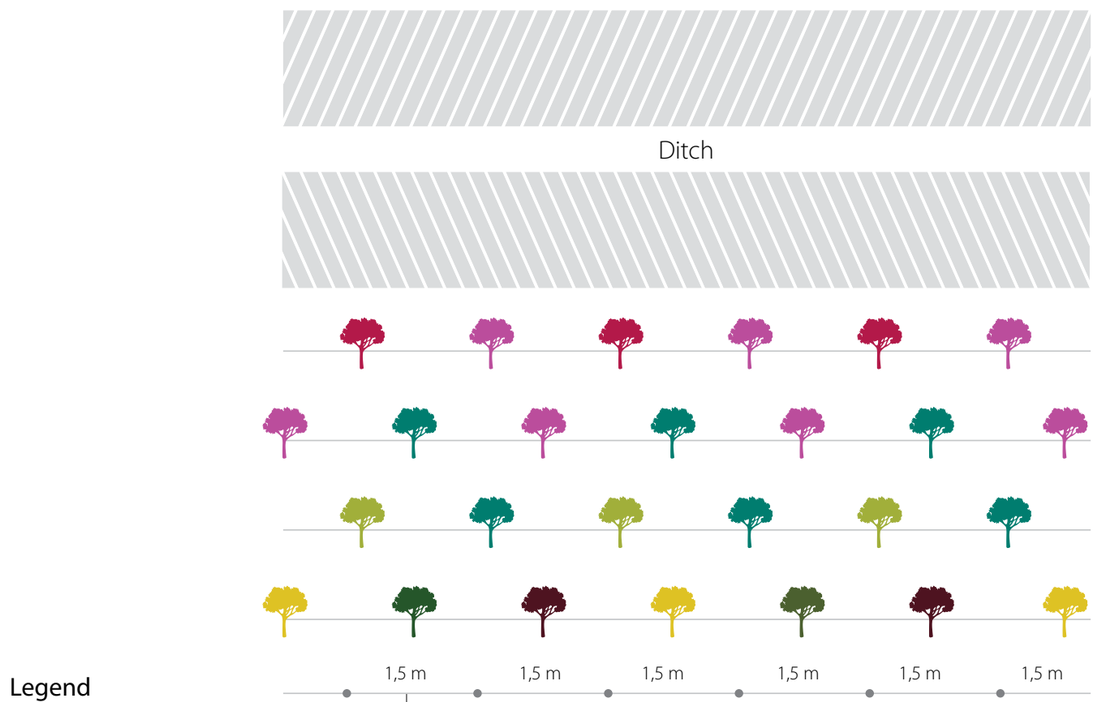


Figure 4: Chart of the most successful section of the plantation

- Current height: between 200 and 500cm (0.5-3.5m of growth);
- Despite the burja wind, the trees are relatively straight;
- The horizontal profile of the plantation seems solid.
- Negatives: the support poles the trees require for at least two years significantly increase investment costs.

The seedling that underperformed the most were the ones between 200 and 250cm high.

- Negatives: high seedlings are more expensive.
- Negatives: high seedlings required a larger planting pit.
- Negatives: high seedlings require support poles, thus increasing the costs of plantation.

NOTE: The project of planting new GWBs in the Vipava Valley, which is expected to be put into action from 2022 onwards, is supported by the Ministry of Agriculture, Forestry and Food of the Republic of Slovenia which expects to enforce the measure M04.4 - Unproductive Investments (and the plantation of GWB fall right in this category) within the 10th amendment of the Rural Development Programme 2014-2020.

Picture 7: Current condition of the LIFE ViVaCCAdapt pilot GWB

Editor:
Patricija Štor

Text authors:
Janez Furlan
Rozalija Cvejić
Klavdija Česnik
Luka Honzak
Katja Klančnik
Karin Kompare
Jože Papež
Marina Pintar
Štefan Trdan
Polonca Vodopivec
Luka Žvokelj
Patricija Štor

Photographs by:
Patricija Štor (1, 3, 4, 5, 6)
Archive of the University of Ljubljana, Biotechnical Faculty (2)
Archive of the Municipality of Ajdovščina (7)

Images by:
Slovenian Water Institute (1)
Luka Honzak and Luka Žvokelj (2)
Matjaž Glavan (3)
Mitja Turk (4)

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Ajdovščina, June 2021