

Climate Change Adaptation in agriculture in the Western Balkans

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German Bundestag



1. The Problem

Climate change?

?

I know, I know,
we are very
vulnerable.

2. The Solution

But you need
to adapt.

I know,
I know!

The new reality requires urgent action to adapt the agricultural sector to climate change.

180,000
AGRICULTURAL
PRODUCERS

THREATENING
50%
OF THE TERRITORY
(THE LAND)

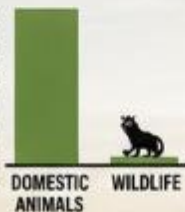
USE OF VARIOUS
PESTICIDES (CIDES)

EXPOSURE

EXPOSES
1.8 MILLION
PEOPLE IN
THE COUNTRY

MANAGES A LARGE NUMBER
OF DOMESTIC ANIMALS

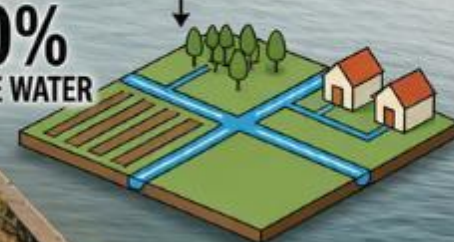
A MUCH
HIGHER
PROPORTION
THAN IN
NATURE



AGRICULTURAL
LAND

CIDES

USES
70%
OF THE WATER



**THE CLIMATE IS CHANGING –
AGRICULTURE IS SUFFERING.**



And the new reality requires new skills,
extensive knowledge, and a great deal of
work.

The Three Little Pigs and Climate Change

A fable to understand threat, risk, vulnerability and adaptation



THREAT (HAZARD):

The wolf represents climate change – extreme heat, drought, heavy rain, storms, floods, frost, etc.



CLIMATE HAZARDS:

More frequent and more intense.



RISK: The possibility that the wolf will cause damage to the pigs and their houses.

VULNERABILITY:

How easily each pig can be harmed.



Straw house:

Very vulnerable.
Easy to destroy.



Stick house:

Somewhat vulnerable.
Better, but still weak.



Brick house:

Low vulnerability.
Strong and resilient.

THE STORY (WHAT HAPPENS WHEN THE WOLF ATTACKS)



HIGH RISK:

High threat +
high vulnerability =
big damage!



MEDIUM RISK:

High threat +
medium vulnerability =
some damage!



LOW RISK:

High threat +
low vulnerability =
minimal damage!

ADAPTATION: BUILDING THE HOUSE

Adaptation means taking action in advance to reduce vulnerability and risk.



Bad adaptation:

Building a weak house
(or two weak houses)
does not protect you.
You are still at risk!



Good adaptation:

Invest in a strong house
(one good solution)
to stay safe and
resilient.



Good adaptation includes:

- Planning ahead
- Strong infrastructure
- Early warning
- Insurance
- Working together

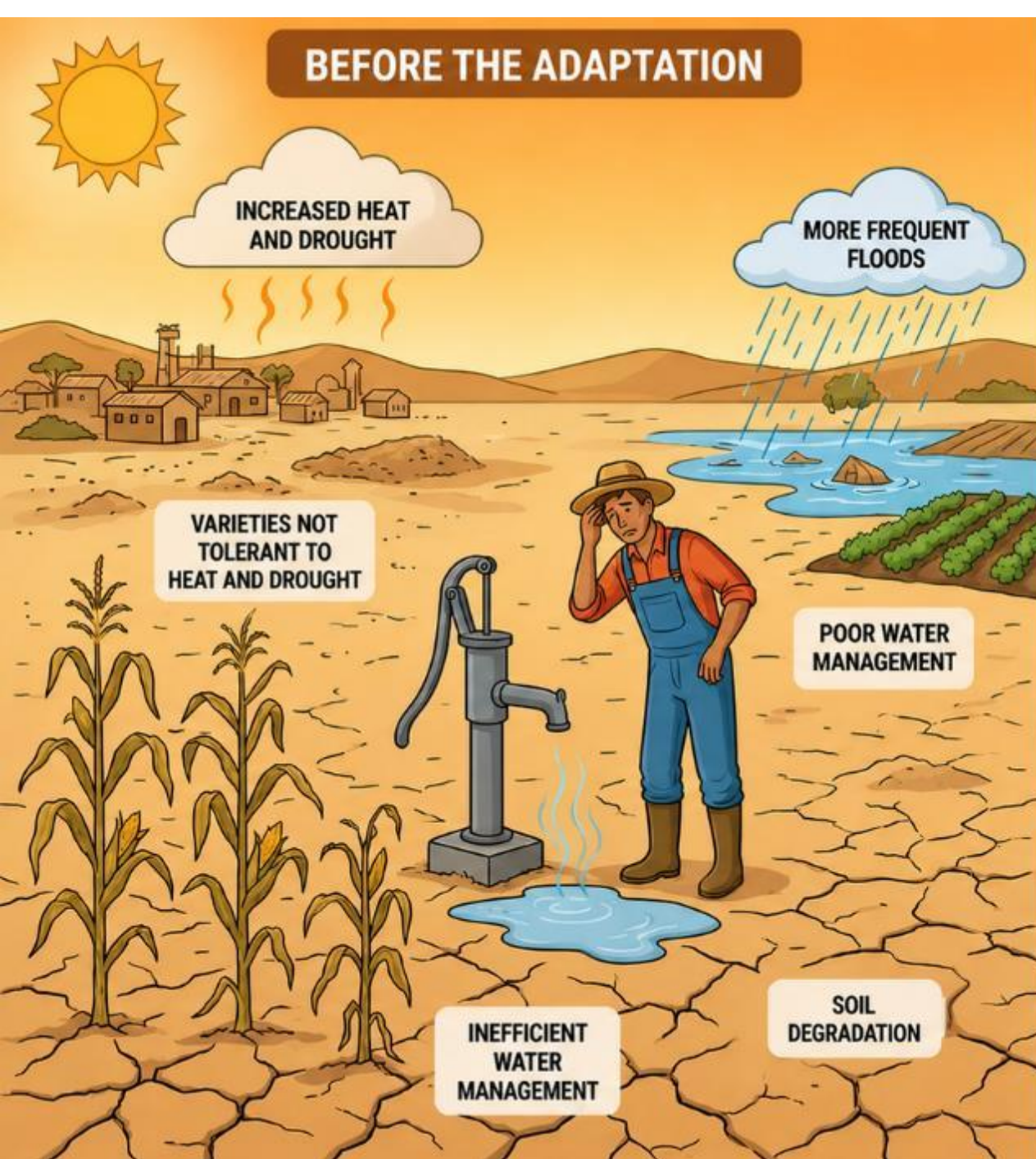


KEY LESSON

Climate change is the threat. Vulnerability determines how badly we are hit. Adaptation (building strong, smart, resilient systems) reduces risk and protects our future.

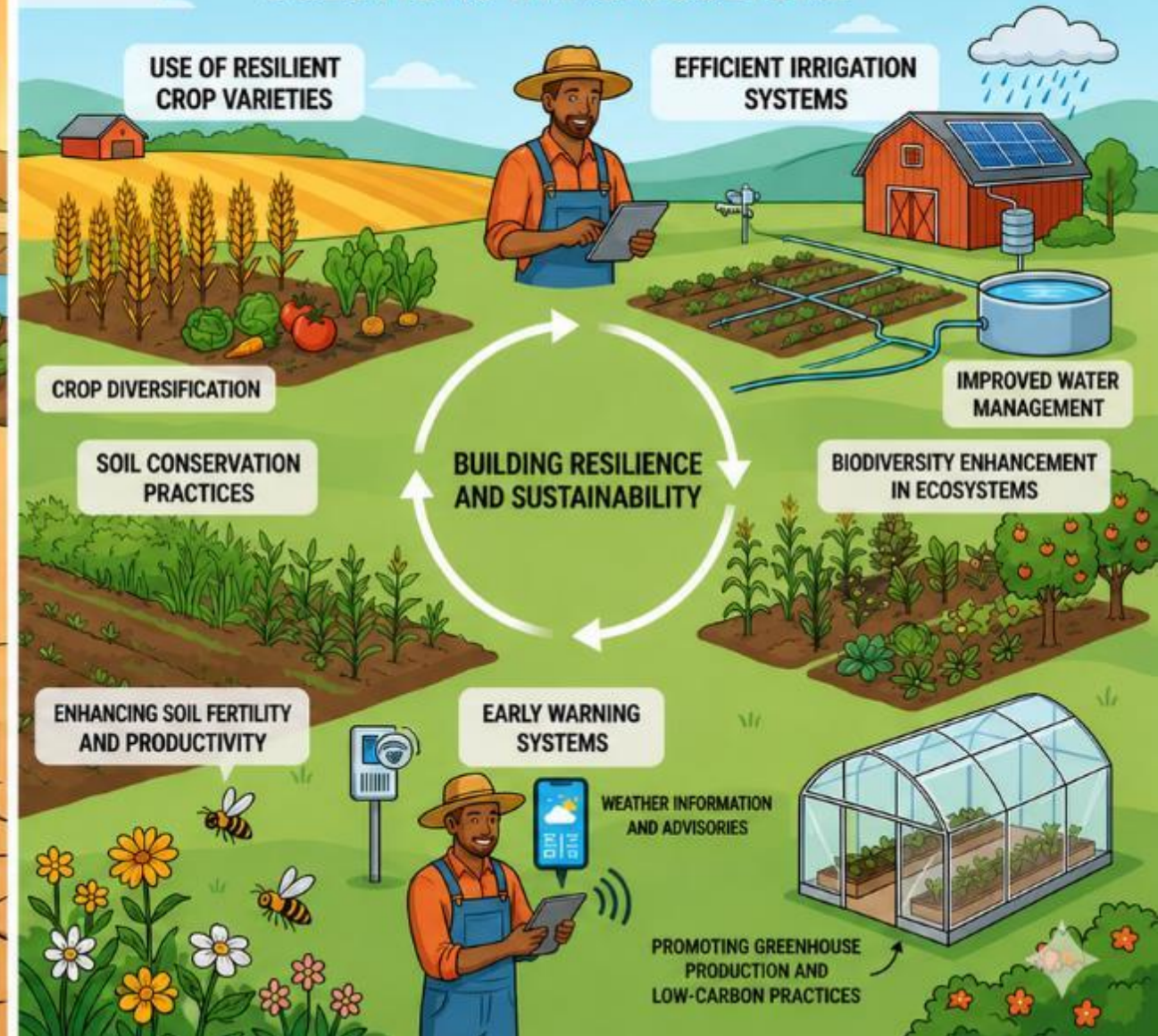


BEFORE THE ADAPTATION



AFTER THE ADAPTATION

ADAPTATION TO CLIMATE CHANGE: SOLUTIONS IN AGRICULTURE





BEFORE ADAPTATION

HIGH TEMPERATURES
DROUGHTS AND DRY SPELLS

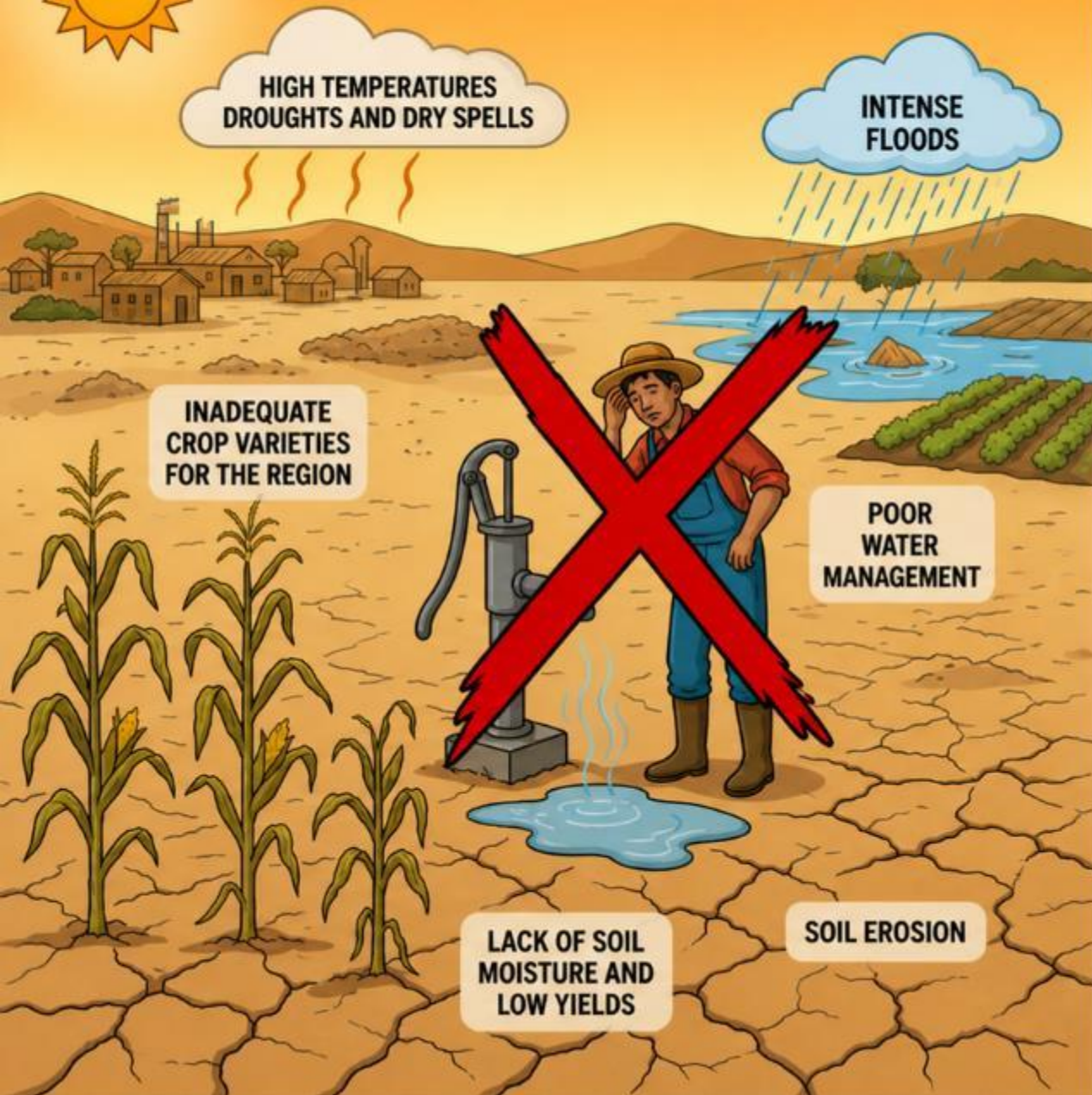
INTENSE
FLOODS

INADEQUATE
CROP VARIETIES
FOR THE REGION

POOR
WATER
MANAGEMENT

LACK OF SOIL
MOISTURE AND
LOW YIELDS

SOIL EROSION



AFTER FARMERS LEFT

WITHOUT FARMERS:
COLLAPSE AND DESOLATION

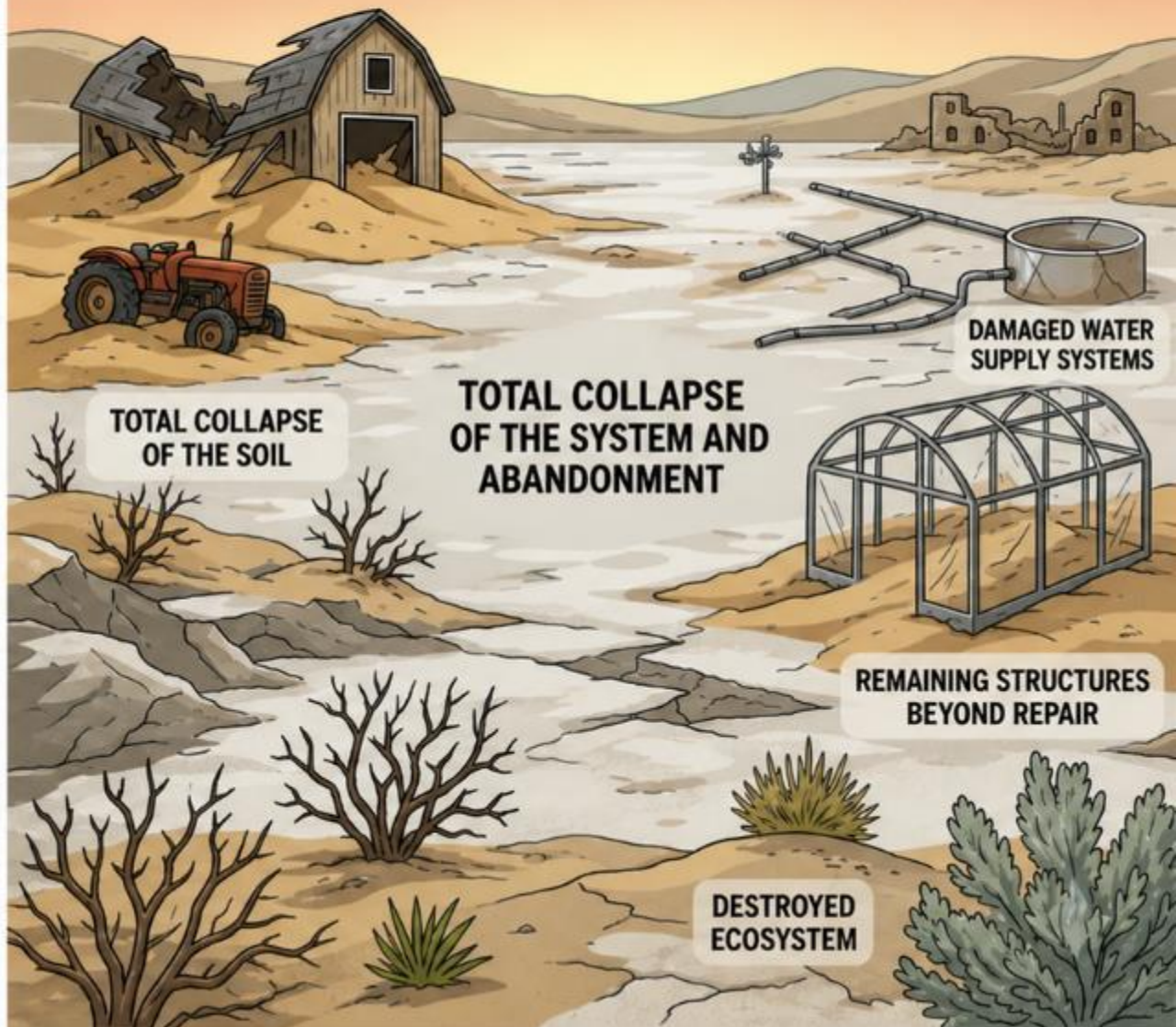
TOTAL COLLAPSE
OF THE SOIL

TOTAL COLLAPSE
OF THE SYSTEM AND
ABANDONMENT

DAMAGED WATER
SUPPLY SYSTEMS

REMAINING STRUCTURES
BEYOND REPAIR

DESTROYED
ECOSYSTEM



SWG RRD – supported activities

Climate Change Adaptation in Agriculture – Status and Prospects in the WB economies

- First joint effort (2023-2024).
- Overview of the status of adaptation to climate change in agriculture in the WBs: Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, and Serbia.
- Focus is on the main developments in the socio-economic context, natural resources (soil and water), crop and livestock sector on country and cross-country level.
- Cross-country Synthesis Report (Volume I) and National Reports (Volume II).



Contributions

Regional coordinators and cross-country sections editors

Martinovska Stojcheska, Aleksandra (Economic and socio-economic aspects)

Mukaetov, Dusko (Soil)

Tanaskovikj, Vjekoslav (Water resources)

Chukaliev, Ordan (Crop production)

Andonov, Sreten (Livestock production)

National reports authors

Economic and socio-economic aspects: Zhllima, Edvin (Albania); Vasko, Željko (Bosnia and Herzegovina); Miftari, Iliriana (Kosovo*); Spahić, Mirsad (Montenegro); Martinovska Stojcheska, Aleksandra (North Macedonia); Kovacević, Vlado (Serbia)

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Crop production: Kullaj, Endrit (Albania); Čadro, Sabrija (Bosnia and Herzegovina); Kuci, Ylber (Kosovo*); Jovović, Zoran (Montenegro); Chukaliev, Ordan (North Macedonia); Vuković Vimić, Ana (Serbia)

Livestock production: Dobi, Petrit (Albania); Rogić, Biljana (Bosnia and Herzegovina); Imeri, Bajram (Kosovo*); Marković, Božidarka (Montenegro); Andonov, Sreten (North Macedonia); Bogdanović, Vladan (Serbia)

The study identified priorities for better adaptation to the CC in agriculture

- Establish a regional **task force** dedicated to coordinating regional adaptation efforts and implementing recommendations and priority activities, identifying funding opportunities, supporting collaboration, and developing joint research projects.
- Effective integration of CC adaptation in agriculture into **future national strategic planning frameworks** for agriculture and rural development in the Western Balkans.
- Develop and implement **capacity building programs** for producers, policymakers, advisors and other relevant stakeholders to improve knowledge and skills for adaptation.
- Conduct **applied research projects** to test and demonstrate potential practices and technologies for adaptation and demonstrate their effectiveness, towards wider adoption.
- Encourage **quadruple helix collaborations** between governments, the private sector, research institutions and civil society organizations to mobilize all resources and expertise.

Establish a regional task force

- The Task force is established and fully operational
- Composed of 30 researchers (national experts on soil, water crops. Livestock and agricultural economy)
- Representatives of Ministries of Agriculture (six)
- Representatives of Ministries of Environment (six)
- Supporting staff from SWG-RRD
- Total of about 50 persons working together on same topic

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Objective

National document guiding the effective integration of climate change adaptation in agriculture into future national strategic planning frameworks for agriculture and rural development

(via jointly agreed unified methodological approach and structure)



Aims of the document

One national document prepared by the group of experts in each WBC (experts for economic and socio-economic aspects, soils, water, crop and livestock)

- **Establish context** by providing a brief introduction, short review/mention of key relevant documents currently in place, and identifying the **key stakeholders** to be involved for an effective integration of climate change adaptation in agriculture into future national strategic planning frameworks
- **Conduct a SWOT analysis** assessing the strengths, weaknesses, opportunities, and threats related to climate change adaptation in agriculture.
- **Define objectives** to be taken into account for national strategic planning related to climate change adaptation in agriculture.
- **Propose a policy mix** and an outline list of actions including possible instruments and measures to address adaptation climate change challenges in agriculture.
- **Conclude and recommend** by summarizing the key findings and offering recommendations for future action.

**IN FINAL PHASE, 4th NATIONAL WORKSHOPS CYCLE CO-ORGANISED
WITH MINISTRIES PLANNED FOR AUTUMN 2026**

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Capacity building

- **Capacity building for ministry staff** (Bar, March 2025; Tirana, May 2026)
- **Capacity building for extension and advisory services - EAS** (regional level Tirana, May 2026; national level workshops May/June and September/October 2026)
- **Training material** ⇨⇨⇨

Training Manual for Agricultural Extension and Advisory Services in the Western Balkans

ADAPTATION TO CLIMATE CHANGE IN AGRICULTURE



Publisher: The Regional Rural Development Standing Working Group in South East Europe (SWG) Blvd. Goce Delcev 18, MRTV Building, 12th floor, 1000 Skopje, North Macedonia

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Skopje, 2026

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Motivation and purpose

- The training manual has been developed as a **practical resource to support climate change adaptation in agriculture**. Its purpose is to **equip extension agents and agricultural advisers with the knowledge, tools, and practical guidance required to effectively support farmers in adopting climate-resilient and climate-smart agricultural practices**.
- **Target group:** Primarily intended for use in the Western Balkan countries/territories by both public and private advisory services, while also being relevant to a wider audience, including agricultural producers, policymakers, development practitioners, researchers and other stakeholders engaged in agricultural adaptation and rural development.



- Understand key climate change risks affecting agricultural systems in the Western Balkan region.
- Apply climate-resilient and climate-smart practices related to soil, water, crop and livestock management.
- Identify and prioritise adaptation options appropriate to different production systems and local contexts.
- Use basic economic tools to assess the costs, benefits and viability of climate adaptation measures.
- Support farmers in making informed decisions through effective advisory and extension approaches.
- Strengthen the adoption of sustainable practices that improve productivity, resilience, and efficient use of natural resources.

An aerial photograph of a rural landscape showing a mosaic of agricultural fields in various shades of green and yellow. A large, colorful abstract graphic, composed of several overlapping organic shapes in teal, light green, purple, orange, and blue, is positioned on the right side of the image. The text 'Expected learning outcomes' is written in a bold, white, sans-serif font, centered within the lower portion of the graphic.

**Expected
learning
outcomes**

Structure

- A **systems perspective**, linking climate risks with soil and water management, crop and livestock production, technology choices, and farm-level economics and investment decisions.
- Modules prepared by **regional teams of experts** drawn from the thematic groups of the Regional Expert Advisory Working Group – Task Force on Climate Change Adaptation in Agriculture.
- **191 pages, 47 tables, 60 figures (incl. photos), 17 boxes**

To enhance usability, the manual is structured around five thematic modules:

Module 5
Economic assessment of agricultural climate adaptation

Module 4
Climate adaptation in livestock production

Module 1

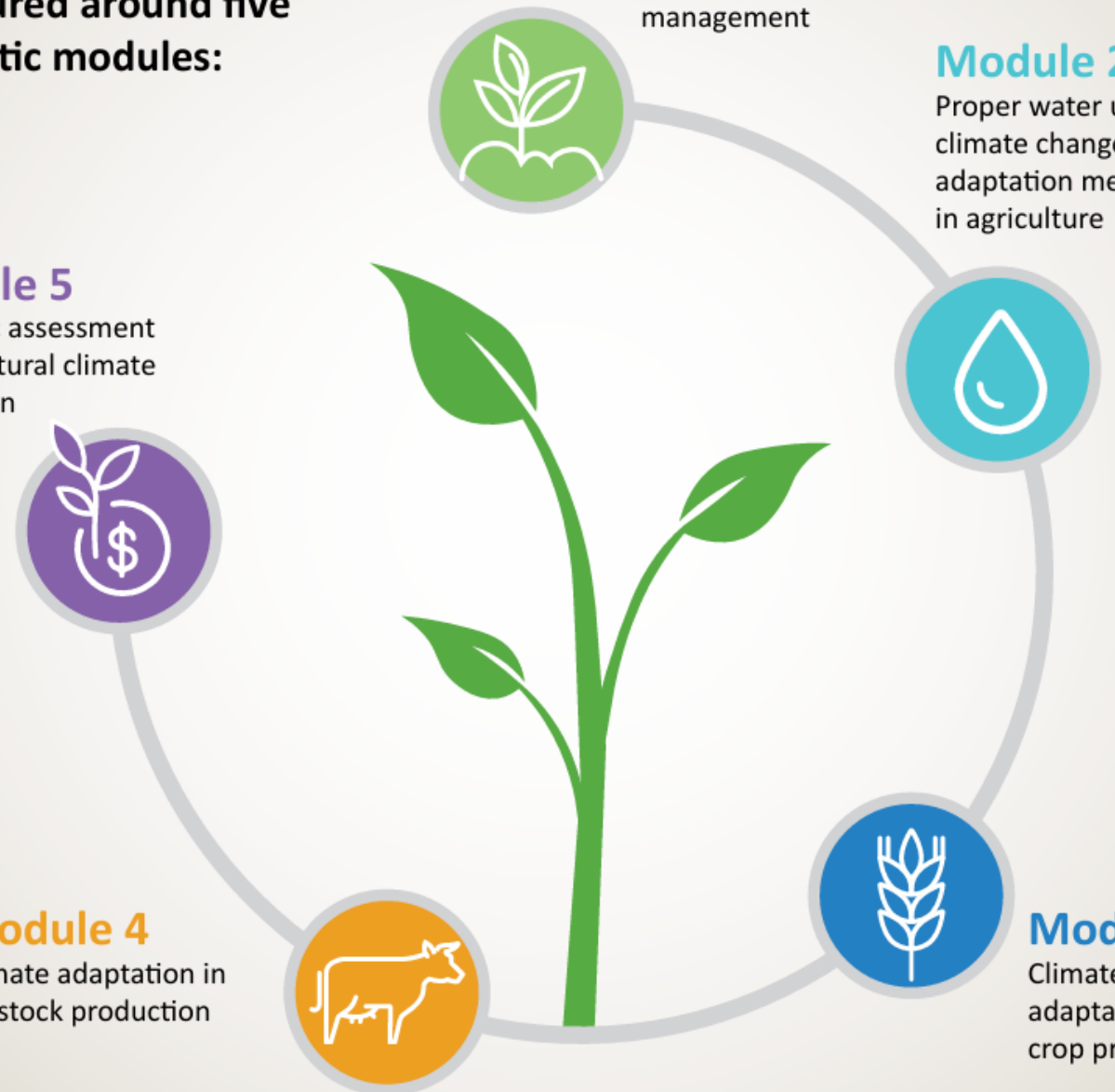
Building climate resilience through sustainable soil management

Module 2

Proper water use and climate change adaptation measures in agriculture

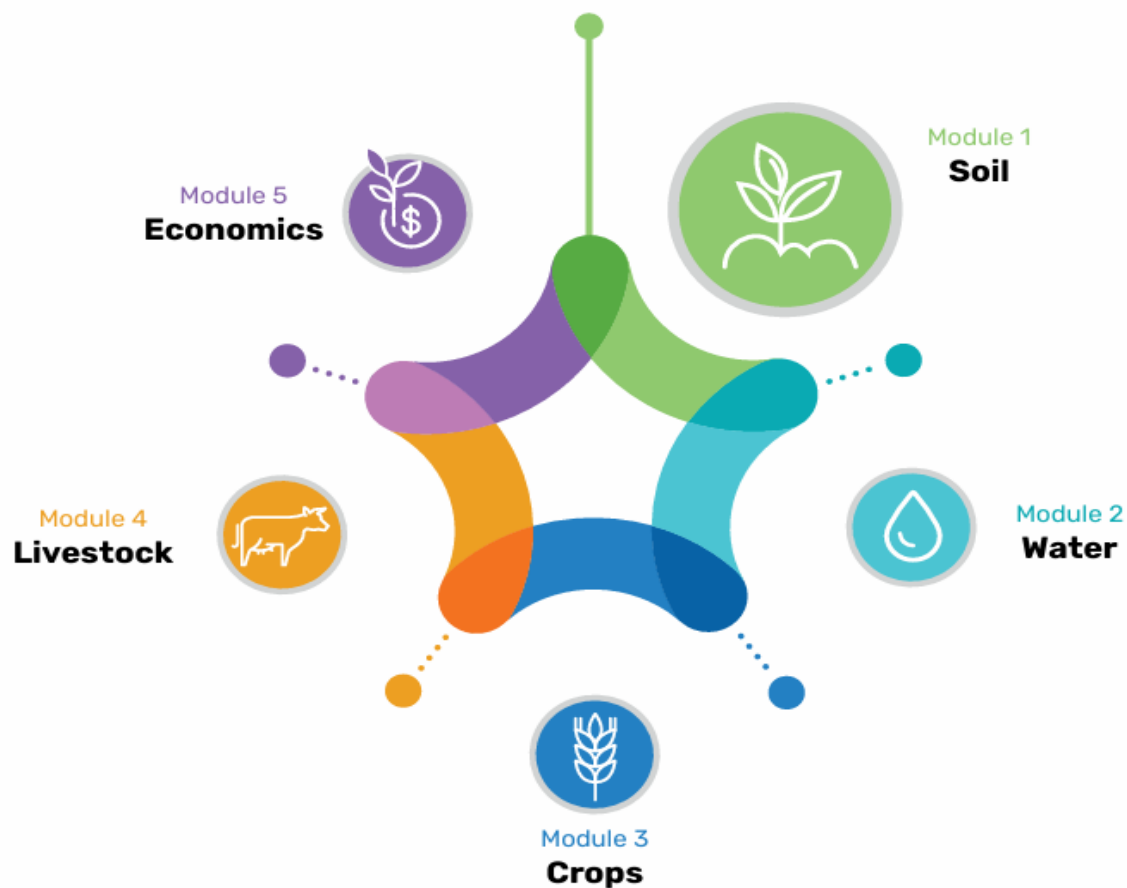
Module 3

Climate adaptation in crop production



Module 1: Building Climate Resilience through Sustainable Soil Management

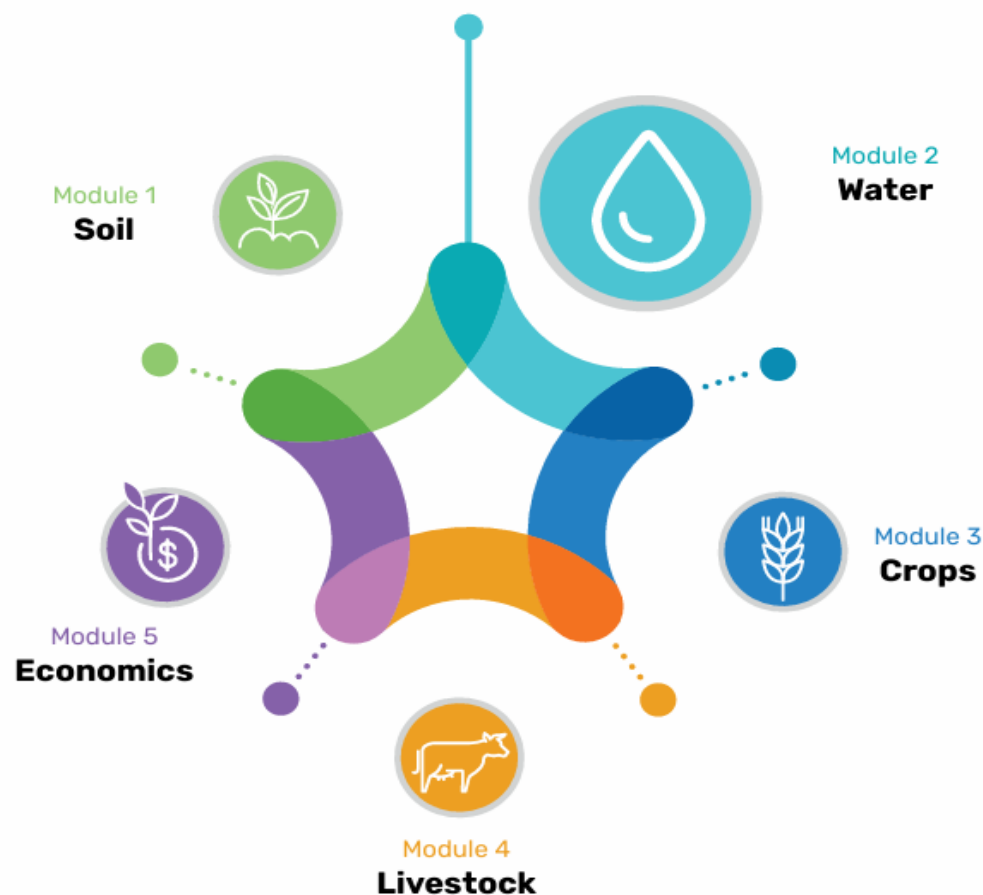
Dushko MUKAETOV¹, Pandi ZDRULI², Dragana VIDOJEVIĆ³,
Mirko KNEŽEVIĆ⁴, Hamdija ČIVIĆ⁵, Xhevdet ELEZI⁶



Understand the role of soil in climate-resilient agriculture and apply sustainable soil management practices that enhance soil health, reduce degradation, and improve resilience to climate variability.

Module 2: Proper Water Use and Climate Change Adaptation Measures in Agriculture

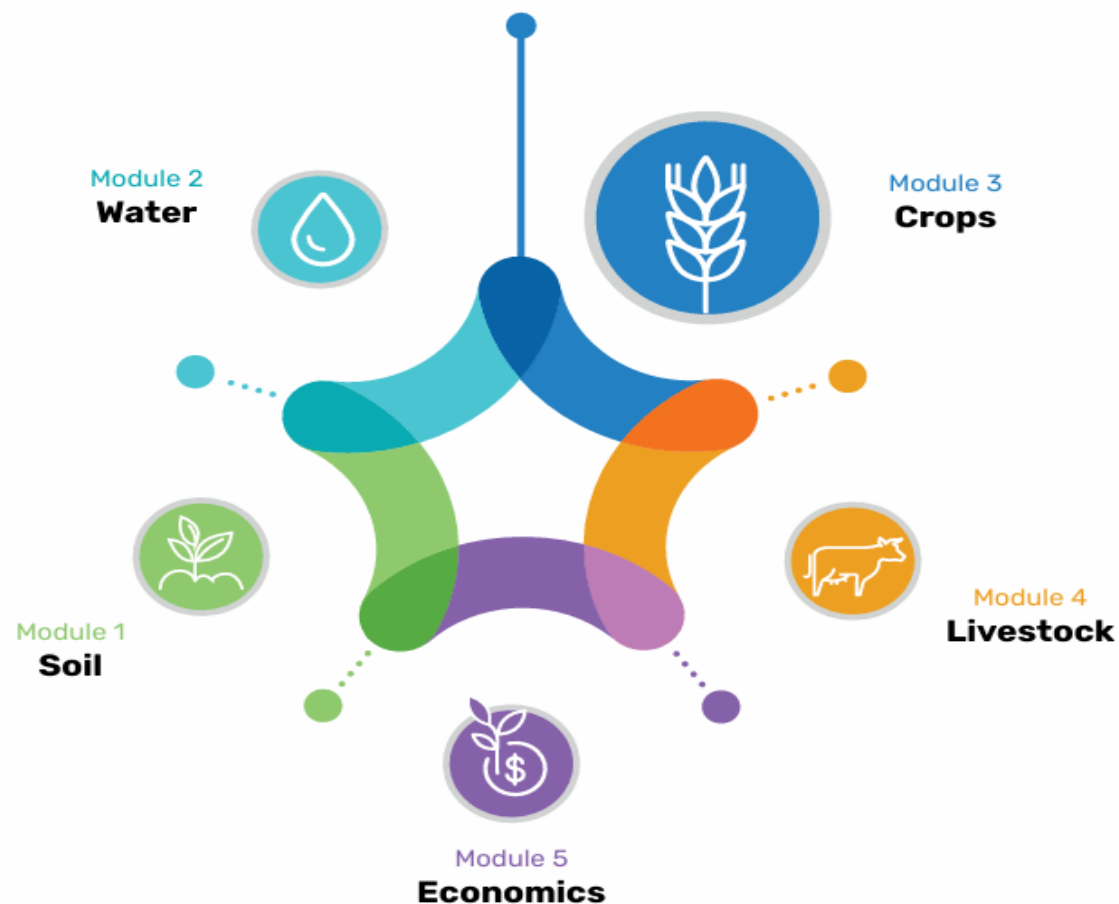
Vjekoslav TANASKOVIK¹, Ružica STRIČEVIĆ², Pandi ZDRULI³,
Avdullah NISHORI⁴, Mirko KNEŽEVIĆ⁵, Mihajlo MARKOVIĆ⁶



Assess climate-related impacts on water availability and crop water demand, and support the adoption of efficient irrigation practices, water-saving technologies, and climate-smart water management measures at farm level.

Module 3: Climate adaptation in crop production

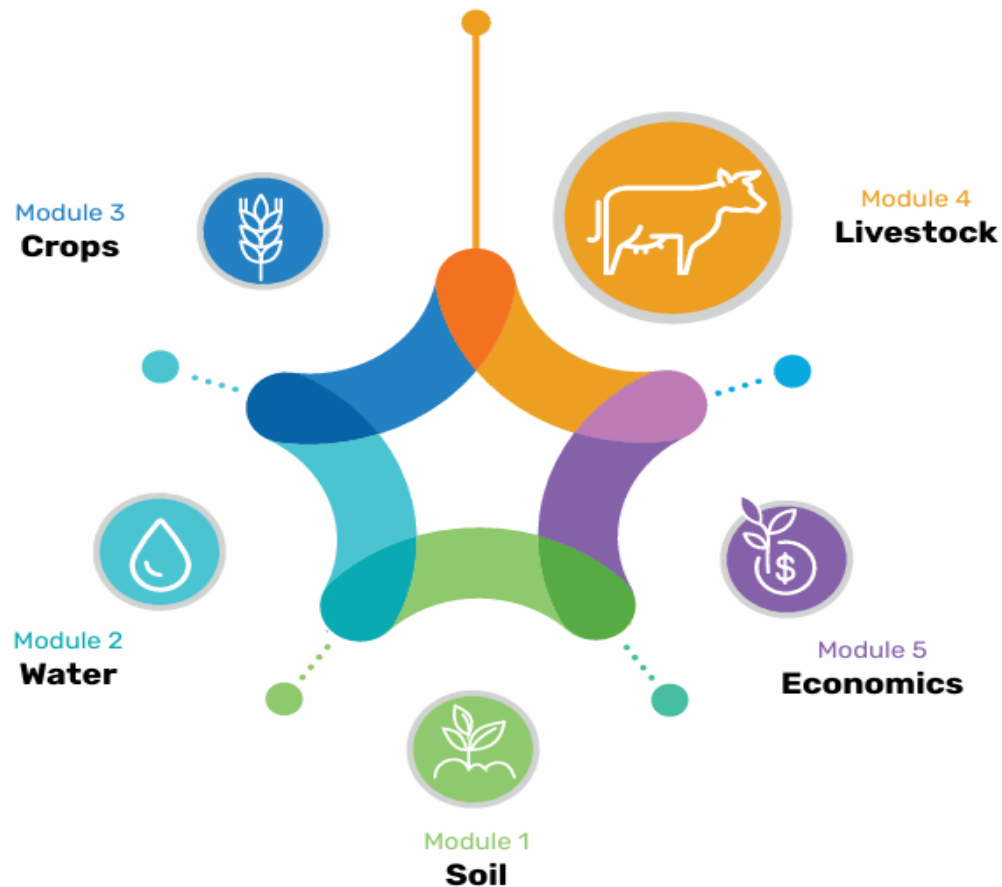
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Ylber KUČI⁴, Zoran JOVOVIĆ⁵, Djordje MORAVČEVIĆ⁶



Identify climate risks affecting major crop production systems and advise on crop-specific and system-based adaptation measures to improve yield stability and resilience.

Module 4: Climate adaptation in livestock

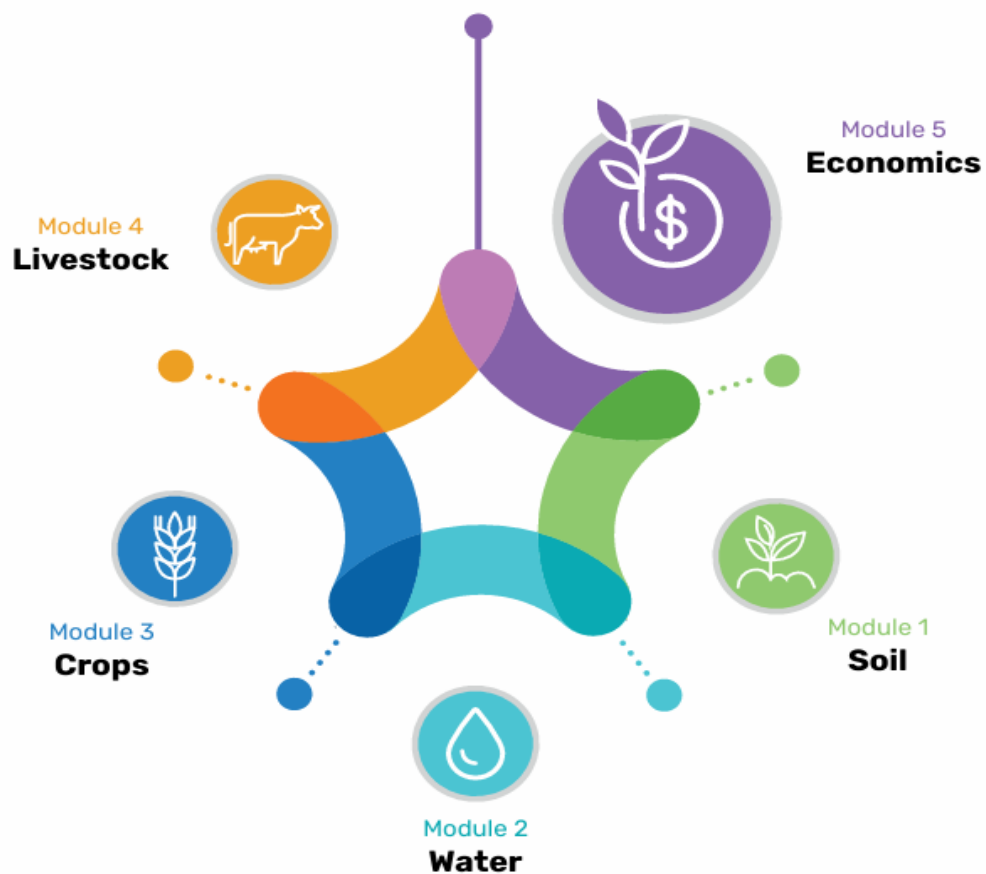
Sreten ANDONOV¹, Petrit DOBI², Biljana ROGIĆ³,
Bajram IMERI⁴, Božidarka MARKOVIĆ⁵, Vladan BOGDANOVIĆ⁶



Recognise climate-related challenges in livestock systems and promote adaptation strategies that enhance animal health, productivity, and system sustainability

Module 5: Economic assessment of agricultural climate adaptation

Aleksandra MARTINOVSKA STOJCHESKA¹, Željko VAŠKO²,
Vlado KOVAČEVIĆ³, Edvin ZHLLIMA⁴, Mirsad SPAHIĆ⁵, Rina DINAJ⁶



Apply basic economic analysis tools, including budgeting, depreciation and investment appraisal methods, to evaluate the costs, benefits and feasibility of agricultural climate adaptation measures.

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Applied research projects – Example from North Macedonia

- Demonstration pilot within the GIZ WB Adapt Project - Climate Smart Farming Solutions in North Macedonia





Climagri Project



Funded by the Ministry of Education and Science of the Republic of North Macedonia

Example: Maize at Silking Stage in Pelagonia

Hazard: heat wave.

Exposure: a large area under maize at the silking stage.

Sensitivity: silking is a very sensitive stage (small impact → large yield reduction).

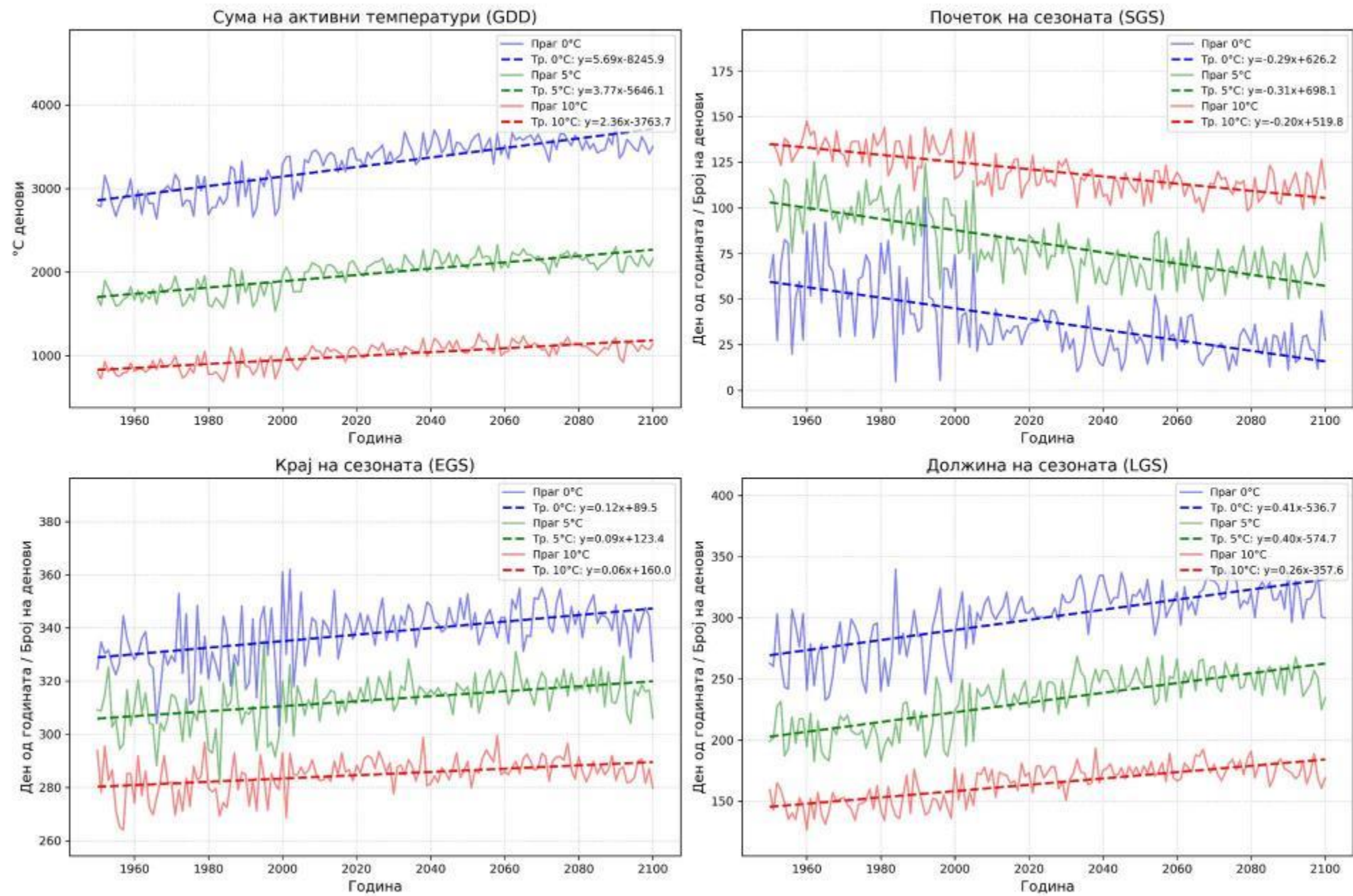
Adaptive capacity: if sensors and a good irrigation schedule are in place, damage is reduced.

Vulnerability: high without control/adaptation; lower with adaptation.

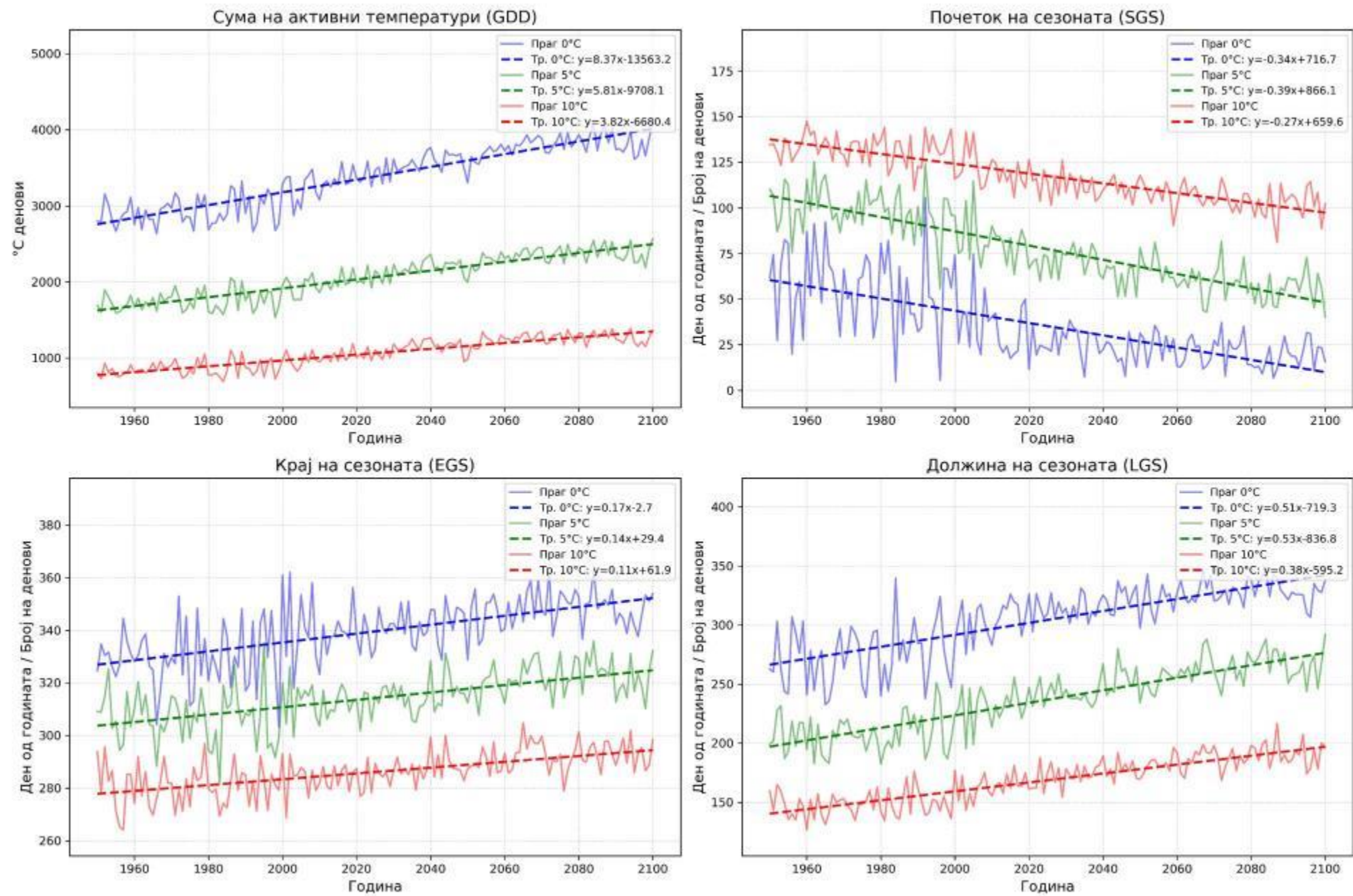
Risk: depends on how often the heat wave occurs and how severe the consequences are.



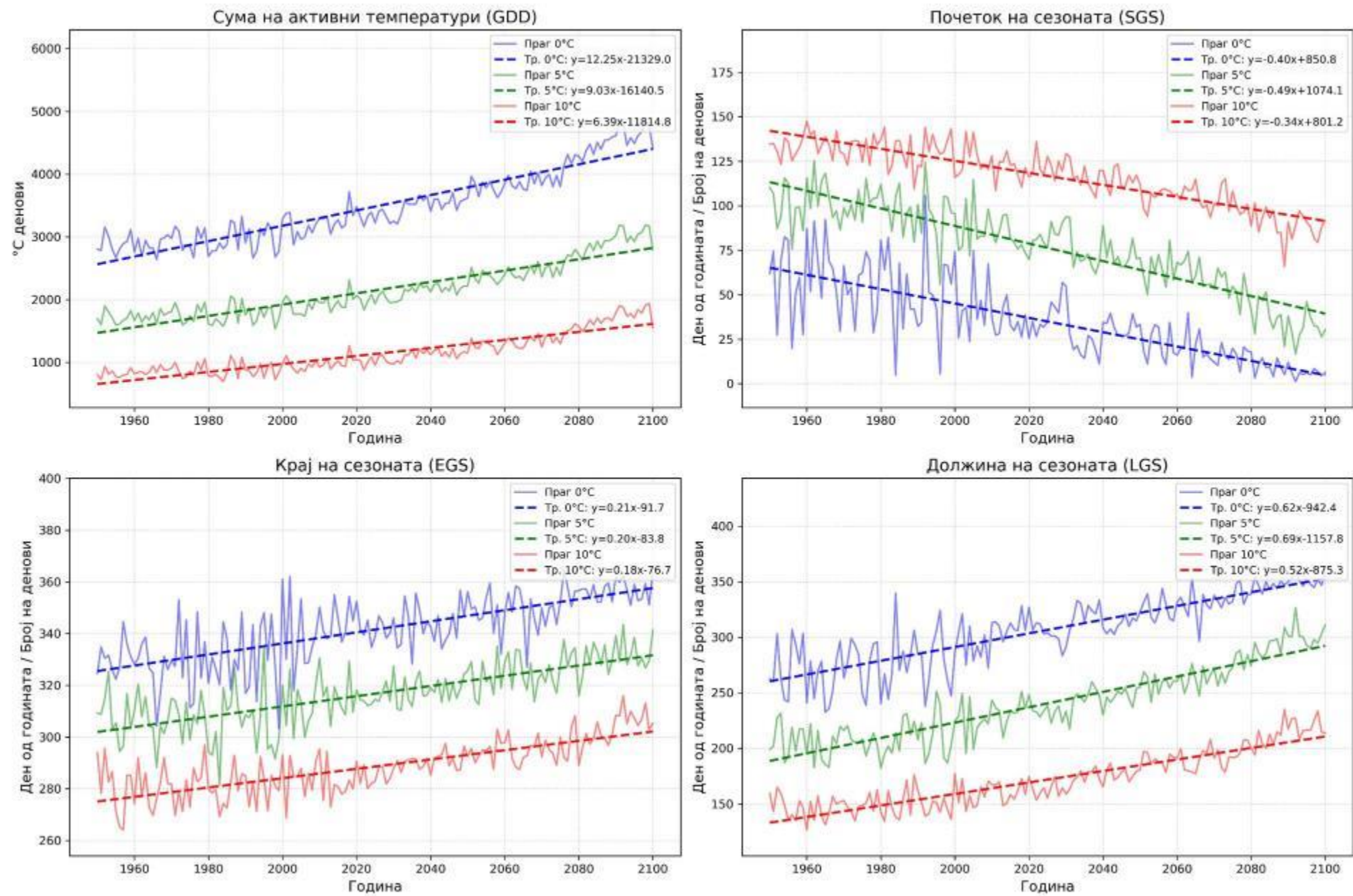
Agroclimate: GDD, Start of the season, End of the season, Season duration for 0,5 and 10 oC, RCP 2.6



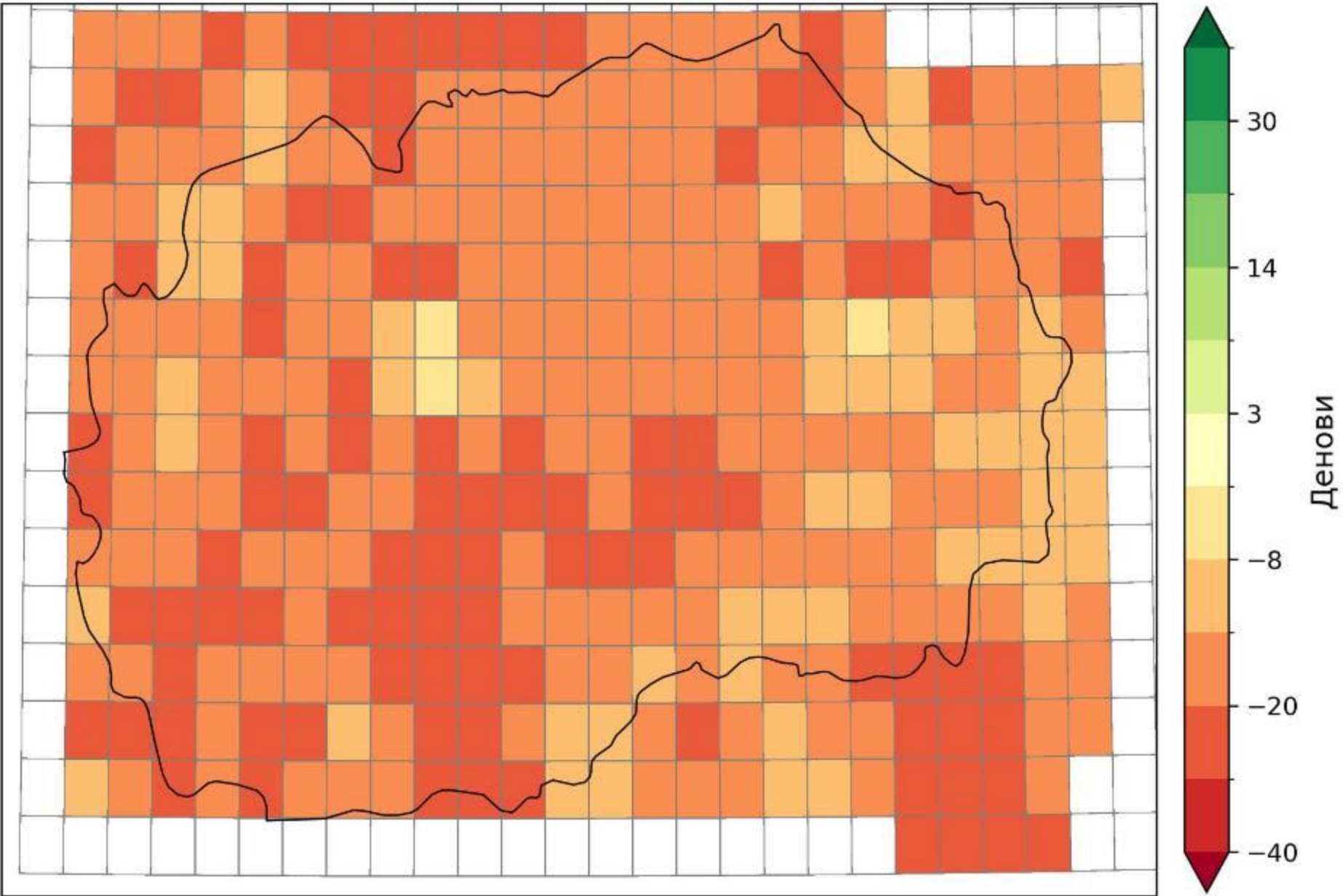
Agroclimate: GDD, Start of the season, End of the season, Season duration for 0,5 and 10 oC, RCP 4.5



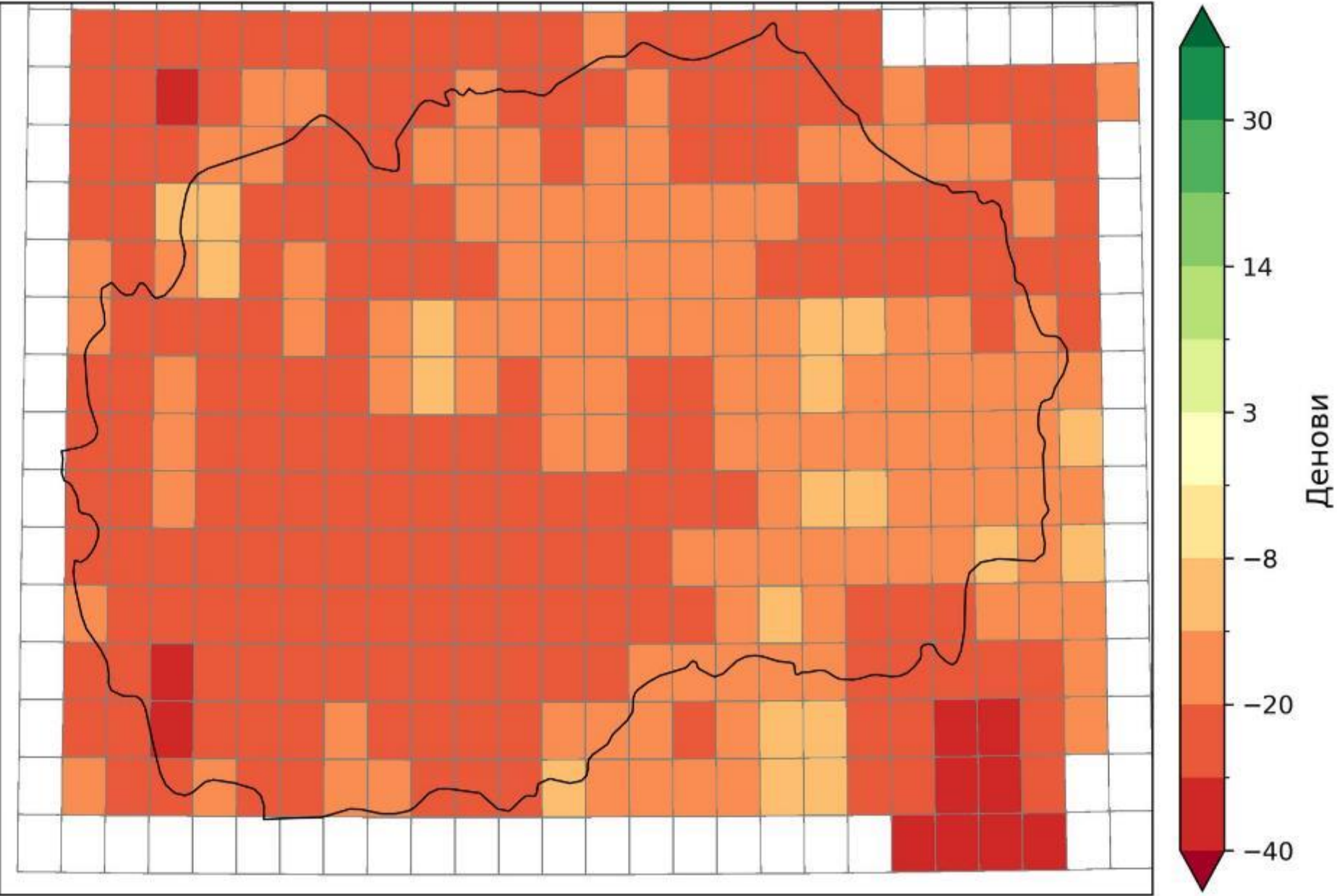
Agroclimate: GDD, Start of the season, End of the season, Season duration for 0,5 and 10 °C, RCP 8.5



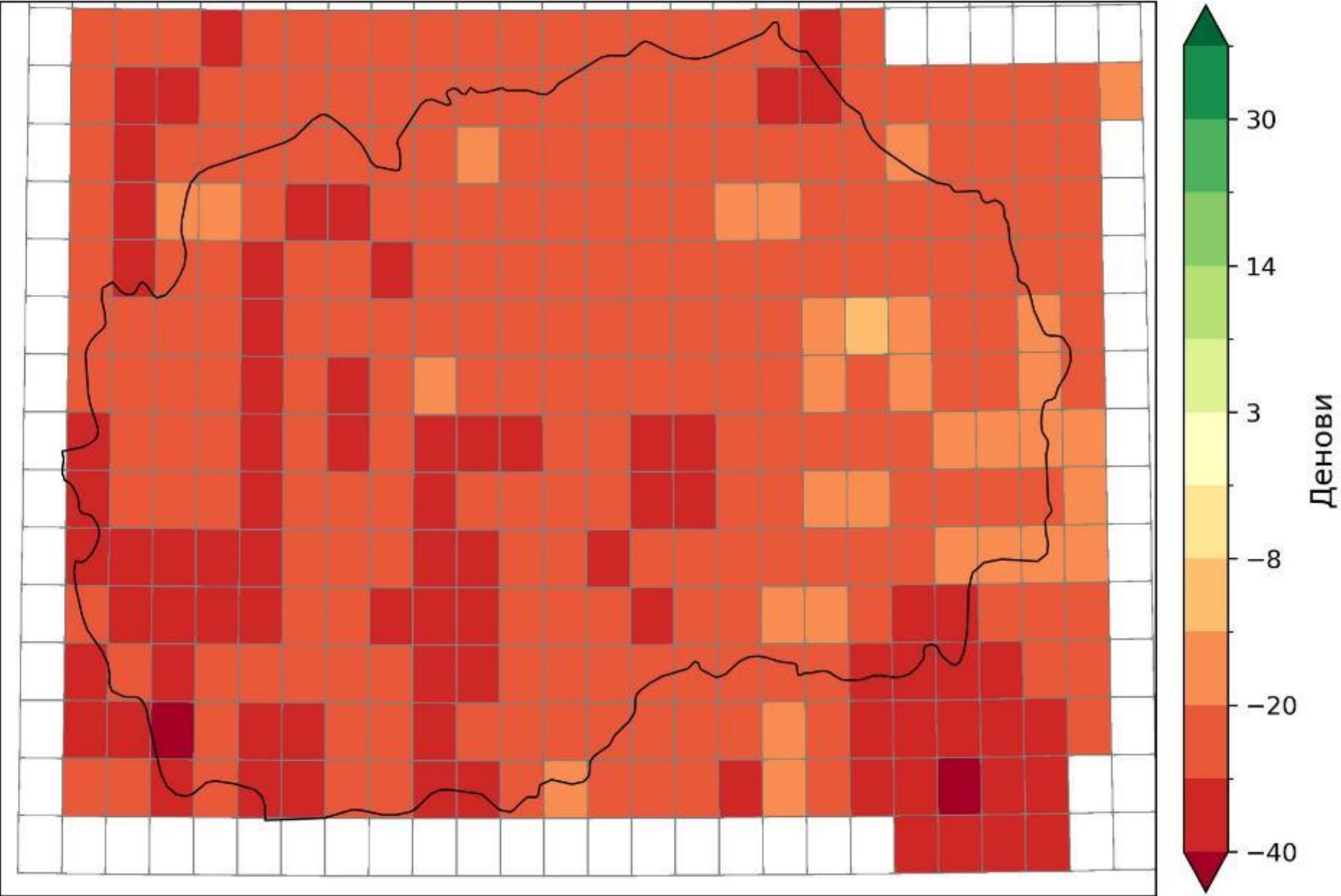
Anomalies in the start of the season for base temperature 10 °C, period 2016-2054 vs referent period 1976-2005, RCP 4,5



Anomalies in the start of the season for base temperature 10 °C, period 2036-2065 vs referent period 1976-2005, RCP 4,5



Anomalies in the start of the season for base temperature 10 °C, period 2061-2090 vs referent period 1976-2005, RCP 4,5



What is conclusion?

- The start of the season (period of temperatures higher than 10°C) will be:
 - 15-25 days earlier In near future
 - 20-30 days earlier in mid future and
 - Up to 40 days earlier in far future
- Similarly, the end of the season will be later
- Season will be up to 50 days longer in far future

What is conclusion?

- Adaptation measure:

Sowing the maize earlier to avoid hottest period of the year as period of silking



We just introduced new hazard late spring frost

- What about eventual frost? What about false spring?
- Find your data analyst, and crop modeler!
- Ask about risk of frost appearance after the date of earlier sowing.
- Ask about date of the tasseling/silking appearance in case of the earlier sowing and eventual heat stress and/or drought in the new period.
- Use the climate scenarios for next 20-30 years from the beginning of the adaptation measure implementation
- If no frost after the sowing and no heat waves during tasseling/silking period and no severe droughts you can consider this measure as adaptation solution

How to proceed

- If there is drought and irrigation is available in the region, please do the modelling of the water availability for the period of tasseling/silking.
- If there will be enough water for irrigation than proceed with the measure, if not please consider other adaptation options.
- If no frost after the sowing and no heat waves during tasseling/silking period and no severe droughts (or there is enough water for irrigation) you can consider this measure for further processing (consultative process/participatory approach)

Now you have good proposal for adaptation measures?

- In next step run the crop model with parametrization corresponding two cases with and without the measure.
- Nevertheless, the measure should be discussed with other stakeholders, if they think tat measure is applicable and feasible for their region proceed with economic impact.

Early warning system for frost protection?

- The early information is worthless if farmers are not equipped for frost protection.
- If they are equipped then a much better solution is to digitalize the process
- When temperature will drop below certain threshold the protection system should automatically start
- When temperature will increase above the safe temperature threshold the system will shut down automatically.
- It is essential to invest in equipment for frost protection

Similar approach can be used for drought

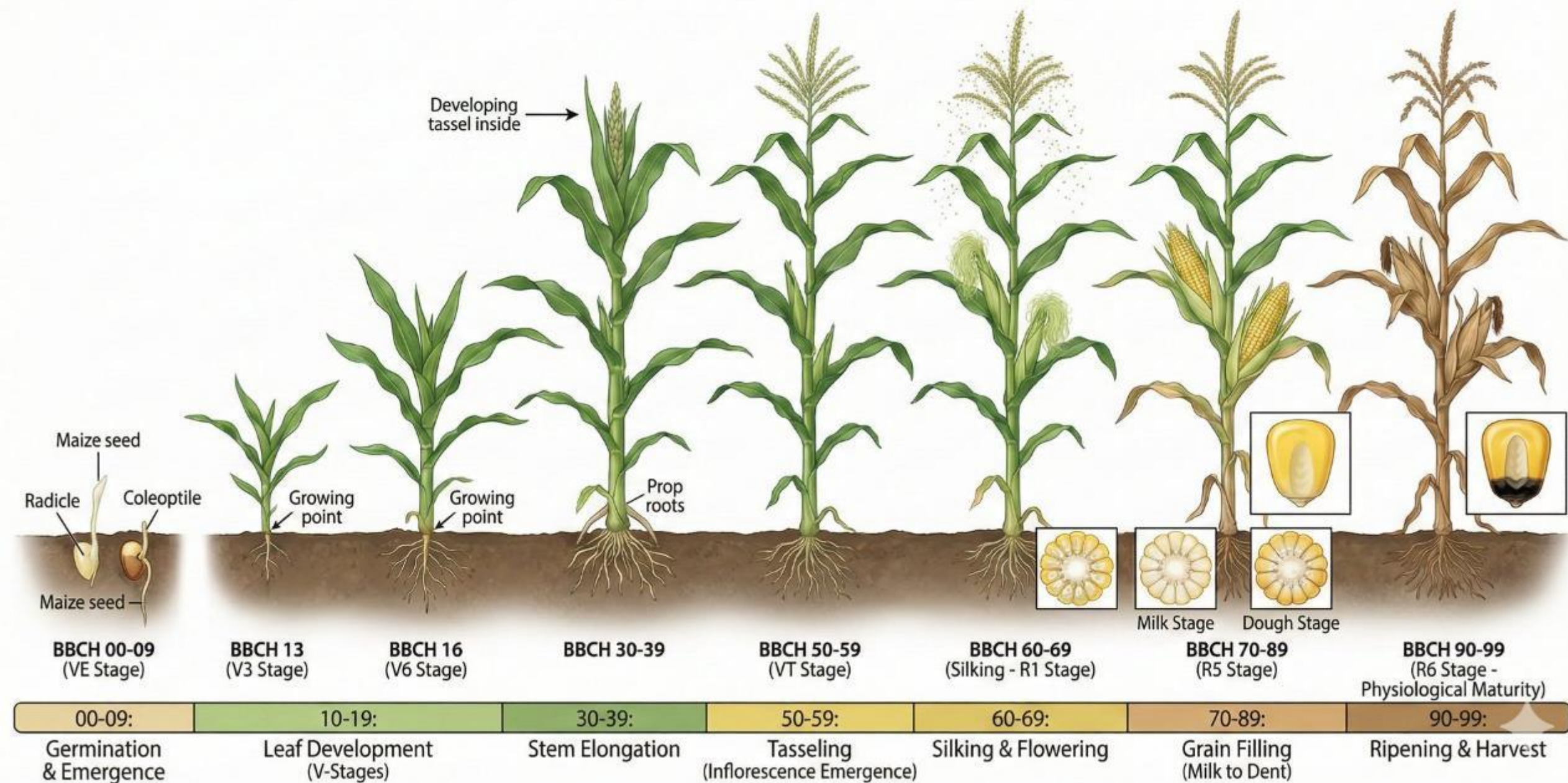
Therefore priority is in equipping the farms and digitalisation

DIGITAL TOOLS AND APPLICATIONS IN SMART AGRICULTURE

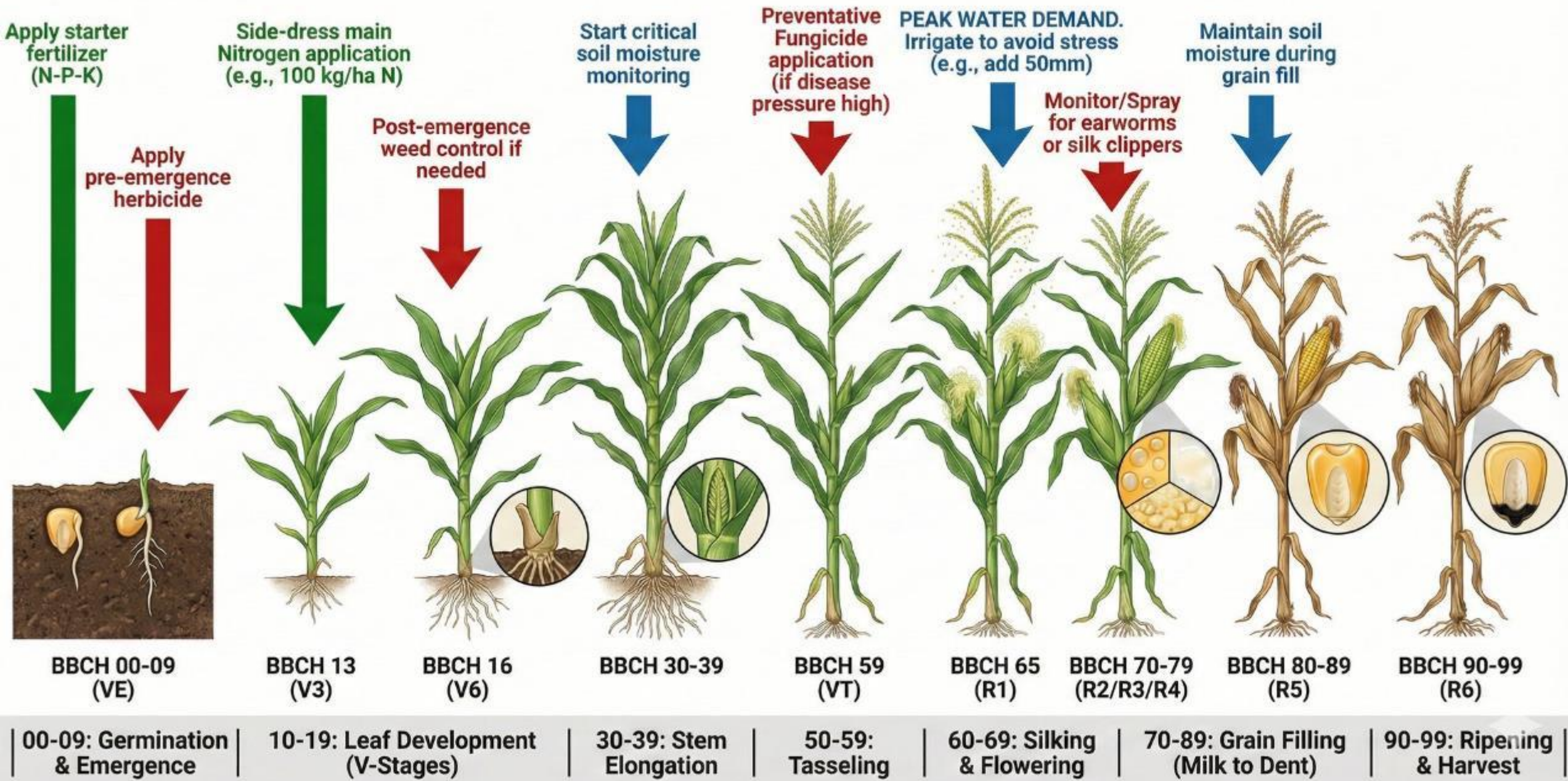
CLIMATE-SMART AGRICULTURE



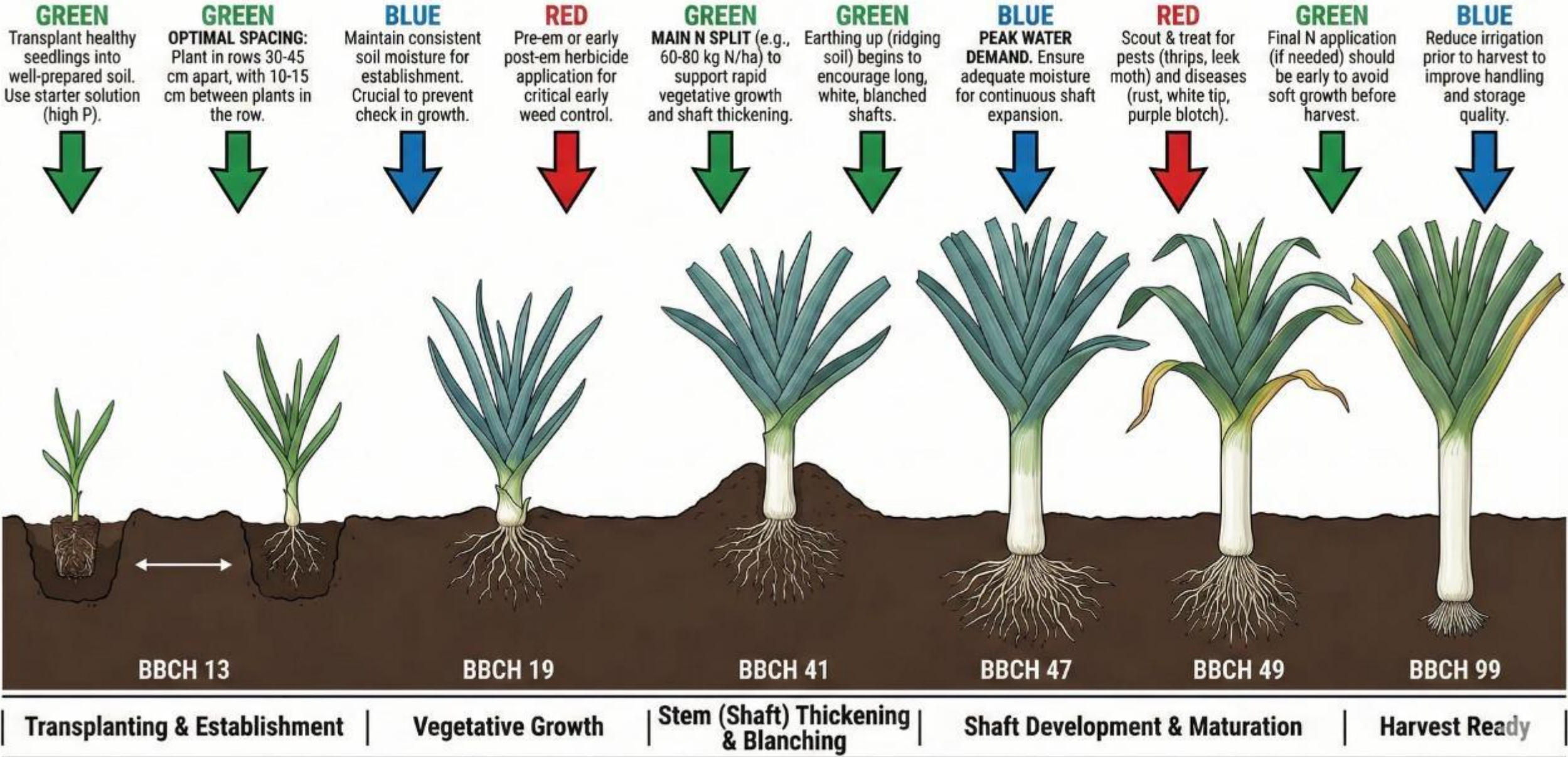
Maize Growth Stages and Development (BBCH Scale)



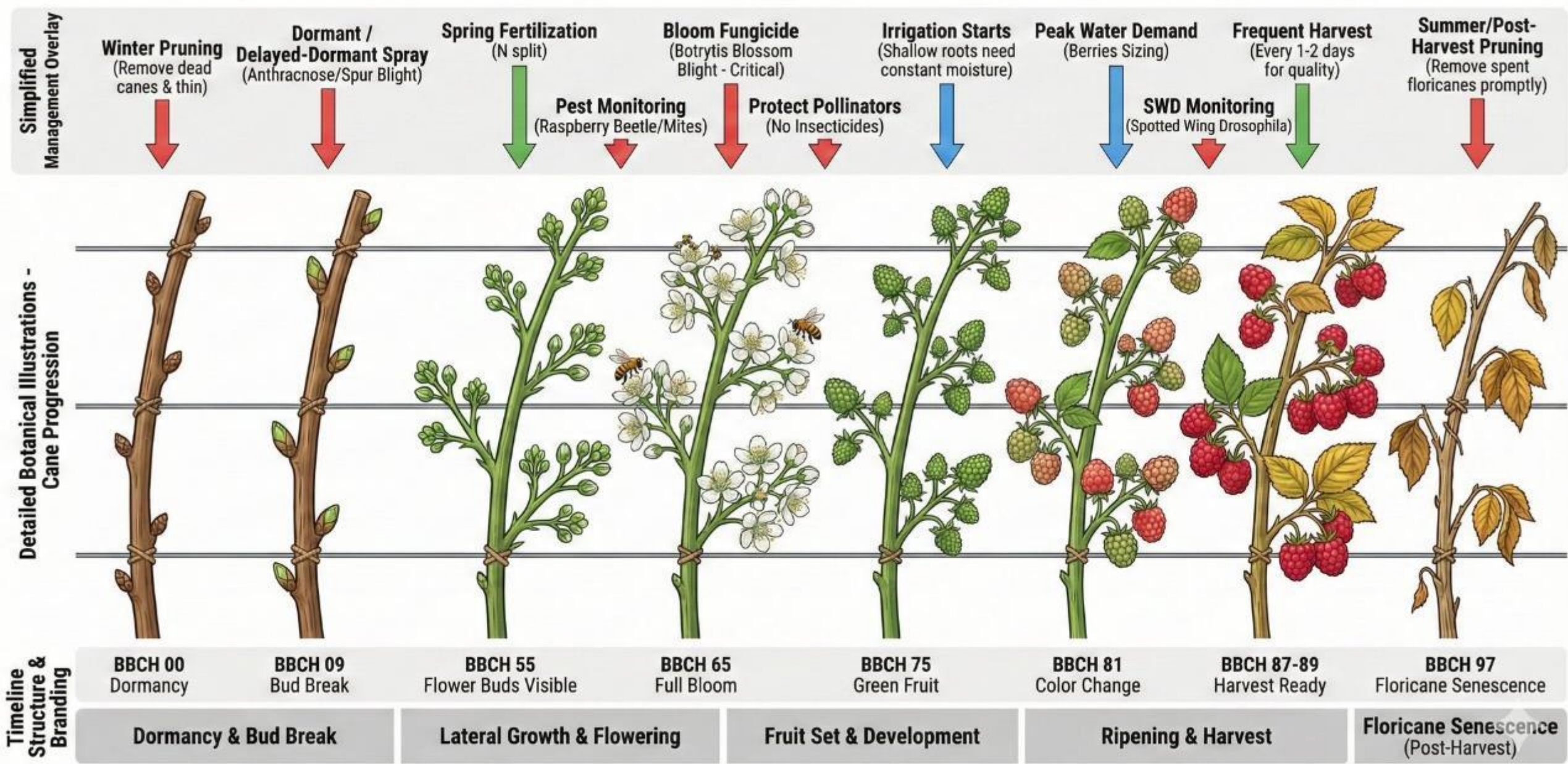
Maize Growth Stages (BBCH Scale) and Agronomic Management Guide



Leek Growth Stages (from Transplants) & Detailed Integrated Management



Annual Raspberry Growth Cycle (Floricanes) & Integrated Management (BBCH Scale)



Training Manual for Agricultural Extension and Advisory Services in the Western Balkans

Thank you
for your
attention

