Interreg NEXT Black Sea Basin

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AGRICOOP

BSB01005 AGRICOOP NATIONAL REPORT

Cooperation through Tech-Based Practices to Struggle Invasive Species and Climate Change for a Sustainable and Resilient Agriculture



PP2-VEDA BULGARIA

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Varna Economic Development Agency

AGRICOOP Project

WP1 - Activity A1.1 - Bulgaria National Report

Identification of Agricultural Crops Most Affected by Climate Change and Invasive Alien Species (IAS)

CONDENSED VERSION

Item	Information
Project	AGRICOOP - BSB01005
Programme	Interreg NEXT Black Sea Basin 2021-2027
Project partner	PP2 - Varna Economic Development Agency (VEDA), Bulgaria
A1.1 Lead organisation	Batumi Shota Rustaveli State University (BSU)
Reporting period	24 December 2025 - 23 August 2026
Territorial focus	Varna Region, Bulgaria
Purpose of this version	Short analytical report retaining the principal methodology, evidence, results, pilot structure, priority crops, priority IAS/pests, GIS framework and recommendations.



1. Executive Summary

This condensed report presents the principal implementation results of AGRICOOP WP1 - Activity A1.1 in Bulgaria, carried out by PP2 - Varna Economic Development Agency (VEDA). The activity identifies agriculturally important crops that are vulnerable to the combined effects of climate variability and change, invasive alien species (IAS) and other relevant crop-health pressures, and establishes an evidence base for subsequent monitoring, early detection, farmer awareness and spatial analysis.

The Bulgarian assessment focused on Varna Region and applied an integrated methodology combining documentary research, stakeholder and farmer consultation, targeted seasonal field validation, multi-criteria crop prioritisation, crop-IAS/pest profiling and GIS-oriented spatial interpretation. The evidence base comprised 50 scientific, institutional, policy, technical and database sources, 30 farmer/agricultural-producer interviews and 15 targeted field visits. Field validation covered the municipalities of Aksakovo, Valchi Dol and Vetrino and representative production systems including cereals, maize, orchards, vegetables and walnuts.

The final crop prioritisation identified five High-Priority crop groups covering eight crops: wheat and maize; cherries and plums; apples and pears; tomatoes; and walnuts. Four equally weighted criteria were applied: agronomic importance, socio-economic importance, climate sensitivity and IAS exposure/impact. Field crops and stone fruits received the highest overall score (5.00), followed by tomatoes (4.25), pome fruits (4.00) and walnuts (4.00).

The assessment confirms that vulnerability in Varna Region is generated by interacting with climatic and biological pressures rather than isolated factors. Drought, high temperatures, soil-moisture deficits, irregular precipitation and extreme events can directly reduce crop resilience and productivity. At the same time, changing climatic conditions may influence pest survival, phenology, reproduction and seasonal activity. The current evidence supports monitoring-relevant interactions but does not justify attributing individual IAS/pest occurrences directly to climate change.

Priority surveillance targets include Halyomorpha halys in fruit systems, Phthorimaea absoluta (syn. Tuta absoluta) in tomatoes, Rhagoletis completa in walnuts, the San José scale in pome fruits and the cereal pest-bug complex in wheat and other cereals. Additional crop-IAS relationships of monitoring relevance include Diabrotica virgifera virgifera in maize and Drosophila suzukii in cherries and plums. The report maintains an explicit distinction between confirmed/established IAS, emerging IAS, surveillance-relevant risks and other economically important pests.

The principal output of A1.1 is a structured, spatially referenced Bulgarian baseline linking crop importance, climate sensitivity, IAS/pest evidence, stakeholder knowledge, field observations and pilot-zone information. This baseline provides the foundation for the next AGRICOOP stages: repeated seasonal monitoring, CPDS-supported climate and pest observation, participatory reporting through tools such as MAPPEST, early warning, GIS-based interpretation and climate-informed Integrated Pest Management (IPM).

2. Headline Outputs

Output	Key Bulgarian result	Use in subsequent AGRICOOP activities
Evidence base	50 documented scientific, institutional, policy, statistical, database and technical sources.	Scientific and institutional basis for prioritisation and monitoring.
Stakeholder evidence	30 farmer/agricultural-producer interviews plus consultation with agricultural institutions; dedicated Varna meeting on 18 August 2026.	Validates documentary findings against farm-level experience and identifies monitoring needs.
Field validation	15+ field visits across Aksakovo, Valchi Dol, Vetrino, and other municipalities, continued through August 2026.	Provides georeferenced field evidence and representative monitoring locations.
Priority crops	Five crop groups / eight crops: wheat, maize, cherries, plums, apples, pears, tomatoes and walnuts.	Defines the principal crop systems for subsequent monitoring.
IAS/pest assessment	Priority invasive, emerging and economically important pest pressures differentiated by evidence status.	Supports transparent surveillance and avoids unsupported IAS attribution.
GIS preparation	Spatial framework for pilot municipalities/sub-zones, crop information, coordinates and thematic climate/pest inputs.	Foundation for mapping, hotspot interpretation and future decision support.

3. Climatic and Agroecological Context of Varna Region

Varna Region is situated in north-eastern Bulgaria along the western Black Sea coast. Its agricultural territory combines coastal lowlands, plateaus and inland arable landscapes. The climate is broadly moderately continental with significant Black Sea influence and transitional Mediterranean features. Coastal winters are comparatively mild, while summers are warm to hot and frequently dry. Rainfall is relatively limited and unevenly distributed during the growing season, making drought, summer heat and soil-moisture deficits important constraints for agriculture.

The region has extensive fertile agricultural land and supports large-scale cereal and oilseed production, especially wheat, barley, maize and sunflower. More varied local terrain and microclimatic conditions also support orchards, vineyards, vegetables and perennial crops such as walnuts. This diversity makes the territory suitable for examining how climate exposure and biological threats differ among annual field crops, intensive vegetables and long-lived orchard systems.

Varna's Black Sea location, Port of Varna, road and railway connections, tourism flows and movement of agricultural commodities and planting material create potential pathways for introduction and secondary spread of non-native organisms. Agricultural machinery, soil, seeds, harvested products, roadside vegetation, field margins and disturbed habitats may further facilitate dispersal between farms and settlements.

The climate-crop-IAS interaction is therefore important: warmer conditions and longer frost-free periods may improve overwintering or extend seasonal activity of some thermophilic pests, while drought and heat can weaken crops and increase the economic significance of additional pest damage. Conversely, periods of higher rainfall and humidity may favour other pest or pathogen complexes. These relationships are not simple cause-and-effect associations and require repeated, spatially and temporally aligned monitoring.

Climate/agroecological factor	Main crop relevance	Potential IAS/pest implication
Mild/warmer winters	Phenology and dormancy changes in cereals and perennial crops.	Potentially improved overwintering and earlier seasonal emergence of some pests.
Hot summers / heat episodes	Reduced vigour, fruit quality and reproductive success; critical for maize, vegetables and fruit.	May accelerate development and extend activity of some insect pests.
Prolonged drought / soil-moisture deficit	Major stress for maize, vegetables, orchards and walnuts; higher irrigation needs.	Stressed crops may tolerate pest injury less effectively.
Irregular precipitation / extreme events	Disrupted crop development, field operations and product quality.	Changing moisture conditions may alter pest/pathogen dynamics.
Longer warm periods	Longer growing season but greater heat and water demand.	May extend activity of thermophilic pests such as tomato leaf miner.
Transport and commodity movement	Connect farms to national/international markets.	Potential introduction and spread through commodities, soil, vehicles and equipment.

4. Methodology and Implementation

The Bulgarian A1.1 methodology was designed as a multi-source evidence process rather than a single survey. It combined desk research, evidence-status classification, stakeholder validation, field observation, crop scoring and spatial interpretation. This approach was necessary because the availability and geographical specificity of IAS and crop-health evidence differ substantially among organisms and crops.

1. Desk review and evidence assessment: 50 sources covering agriculture, climate pressures, IAS/pest occurrence, host-crop relationships, plant health, regulation and monitoring.
2. Evidence hierarchy: records were differentiated as direct national/local evidence, reliable scientific or official evidence requiring limited geographical extrapolation, and credible/emerging risk requiring further local confirmation.
3. Stakeholder consultation: 30 farmer/agricultural-producer interview records were complemented by institutional consultation and the dedicated 18 August 2026 meeting in Varna.
4. Targeted field validation: 15 visits were carried out across the three pilot municipalities Aksakovo, Balchi Dol and Vetrino. Seasonal work continued through August to improve coverage of fruit development, ripening, harvest and pest detectability.
5. Multi-criteria crop prioritisation: candidate crops were scored from 1 to 5 against four equally weighted criteria - Agronomic Importance, Socio-economic Importance, Climate Sensitivity and IAS Exposure/Impact.
6. Crop-IAS/pest profiling: selected crops were linked to relevant harmful organisms, evidence status, damage types, monitoring indicators and pilot locations.
7. GIS-oriented preparation: coordinates, crop profiles and thematic climate/pest information were organised for subsequent spatial monitoring and interpretation.

A key methodological principle was to avoid interpreting national occurrence or a recognised host association as proof of occurrence or damage at an individual pilot site. The report therefore treats field validation as a baseline for subsequent monitoring rather than as a statistically representative estimate of IAS prevalence across Varna Region or Bulgaria.

5. Pilot Zones and Field Validation

Three municipalities were selected as the Bulgarian AGRICOOP pilot zones: Aksakovo, Valchi Dol and Vetrino. The final consolidated pilot structure contains seven village-level sub-zones. Earlier field-validation records covered six principal sub-zones; the final pilot framework subsequently incorporated Brestak in Valchi Dol to add a specialised root-crop context. The network was selected to represent contrasting crop systems, climate sensitivity, pest/IAS relevance, accessibility for repeated monitoring and potential suitability for Climate and Pest Detection Stations (CPDS).

Pilot zone	Sub-zone	Main crops	Key monitoring rationale
Zone 1 - Aksakovo	Krumovo	Cherries, plums, apples, pears	Fruit-system monitoring; H. halys, San José scale and other orchard pests; heat/drought interactions.
Zone 1 - Aksakovo	Lyuben Karavelovo	Tomatoes, potatoes, onions	Tomato leaf miner; temperature, drought and seasonal variability.
Zone 1 - Aksakovo	Botevo	Wheat, maize, sunflower, barley	Cereal bugs/rootworms; drought, heat and rainfall variability.

Zone 2 - Valchi Dol	Boyana	Wheat, maize, sunflower	Comparative field-crop monitoring under drought and high summer temperatures.
Zone 2 - Valchi Dol	General Kiselovo	Wheat, maize, sunflower	Replication/comparison of cereal and maize pest observations.
Zone 2 - Valchi Dol	Brestak	Carrots	Specialised root-crop system; carrot fly/aphids; moisture and heat variability.
Zone 3 - Vetrino	Belogradets	Walnuts	Walnut husk fly; perennial crops and climate-pest interaction.

Aksakovo provides the greatest diversity of production systems, Valchi Dol enables comparison within predominantly arable landscapes while adding a specialised carrot sub-zone, and Vetrino contributes a clearly defined perennial walnut system. Together, the locations form a practical monitoring continuum across different agroecological conditions in Varna Region.

Stakeholder consultation broadly supported the selected focus on economically relevant crops and on both established pest pressures and emerging IAS risks. Farmers and institutions emphasised practical identification information, early-warning mechanisms, accessible monitoring methods, timely advisory support and stronger communication between producers and agricultural services. Some producers expressed interest in future AGRICOOP monitoring and use of the MAPPEST mobile application. Because the Bulgarian stakeholder dataset does not provide a sufficiently reconciled basis for reliable prevalence percentages, the results are interpreted qualitatively rather than as statistically representative rankings.

6. Results and Main Findings

6.1 Evidence and stakeholder findings

The desk review established a sufficiently broad and traceable evidence base for crop prioritisation, IAS/pest assessment and monitoring design. The principal knowledge gaps concern unequal availability of municipality-level evidence, limited quantitative information on IAS-related yield and quality losses, incomplete pilot-site confirmation for some emerging IAS, and the lack of long time series combining pest occurrence, crop phenology and climate variables.

6.2 Final crop prioritization

Priority crop/group	A	B	C	D	Overall	Class
Field crops - Wheat & Maize	5	5	5	5	5.00	High
Stone fruits - Cherries & Plums	5	5	5	5	5.00	High
Tomatoes	5	5	3	4	4.25	High
Pome fruits - Apples & Pears	4	4	4	4	4.00	High
Walnuts	4	4	4	4	4.00	High

All five crop groups fall within the High-Priority category. Field crops and stone fruits received the maximum score because they combine strong agricultural and socio-economic importance with high climate sensitivity and relevant pest/IAS exposure. Tomatoes remain a high priority because of their importance and the strong relationship with tomato leaf miner. Apples/pears and walnuts add high-value perennial systems in which repeated climatic and biological damage may accumulate over multiple seasons.

6.3 Priority IAS and pest surveillance framework

Priority organism	Crop(s)	Pilot location	Status/relevance	Principal monitoring approach
Halyomorpha halys - brown marmorated stink bug	Cherries, plums and other fruit	Aksakovo / Krumovo	Invasive alien pest; high priority	Pheromone trapping, visual inspection, climate monitoring
Comstockaspis perniciosa - San José scale	Apples, pears	Aksakovo / Krumovo	Alien/economically important fruit pest; EU RNQP	Orchard inspection, crawler monitoring, temperature data
Phthorimaea absoluta (syn. Tuta absoluta) - tomato leaf miner	Tomato	Aksakovo / Lyuben Karavelovo	Established invasive alien pest; high priority	Pheromone traps, crop inspection, CPDS/climate data
Cereal pest-bug complex (Eurygaster spp.)	Wheat and cereals	Botevo; Boyana; General Kiselovo	Economically important pest complex; species confirmation required	Field scouting, population counts, crop phenology and climate
Rhagoletis completa - walnut husk fly	Walnut	Vetrino / Belogradets	Invasive/emerging walnut pest; high priority	Yellow sticky traps/attractants, fruit inspection, climate monitoring

Additional relationships remain important in the wider crop catalogue. Drosophila suzukii is a significant surveillance target for cherries and plums, particularly from fruit colouring through harvest. Diabrotica virgifera virgifera is a well-founded invasive surveillance target in maize. Other established crop-health organisms, including codling moth and San José scale in pome fruits, remain relevant but should not automatically be presented as IAS unless the ecological and regulatory status supports that classification.

6.4 Crop-specific vulnerability and monitoring priorities

Wheat and maize

These crops have the widest spatial representation in the pilot territory. Key climate pressures are drought, soil-moisture deficit, heat during critical development stages and irregular precipitation. Monitoring should combine crop phenology, visual symptoms, pest occurrence, adult trapping where relevant, georeferenced photographs and temperature/rainfall information. In maize, western corn rootworm deserves particular attention because larval root feeding can reduce water and nutrient uptake and increase lodging.

Cherries and plums

Stone fruits are highly sensitive to late frost, drought, heat, irregular rainfall and extreme events. Drosophila suzukii and H. halys are particularly relevant surveillance targets. Monitoring should intensify from fruit colouring through ripening and harvest and combine trapping with direct fruit inspection, orchard-margin observations and climate information.

Apples and pears

Pome fruits are perennial, high-value crops exposed to cumulative climate and crop-health pressures. H. halys is a relevant IAS target, while San José scale and codling moth remain important crop-health organisms. Monitoring should include dormant-season inspection, crawler/fruit observations, crop phenology and temperature data.

Tomatoes

Tomato production is sensitive to heat, water availability and humidity. The tomato leaf miner is the strongest crop-specific invasive pest relationship in the vegetable profile. Pheromone trapping, inspection of leaves and fruits, sanitation records and temperature/humidity observations are central to continued monitoring.

Walnuts

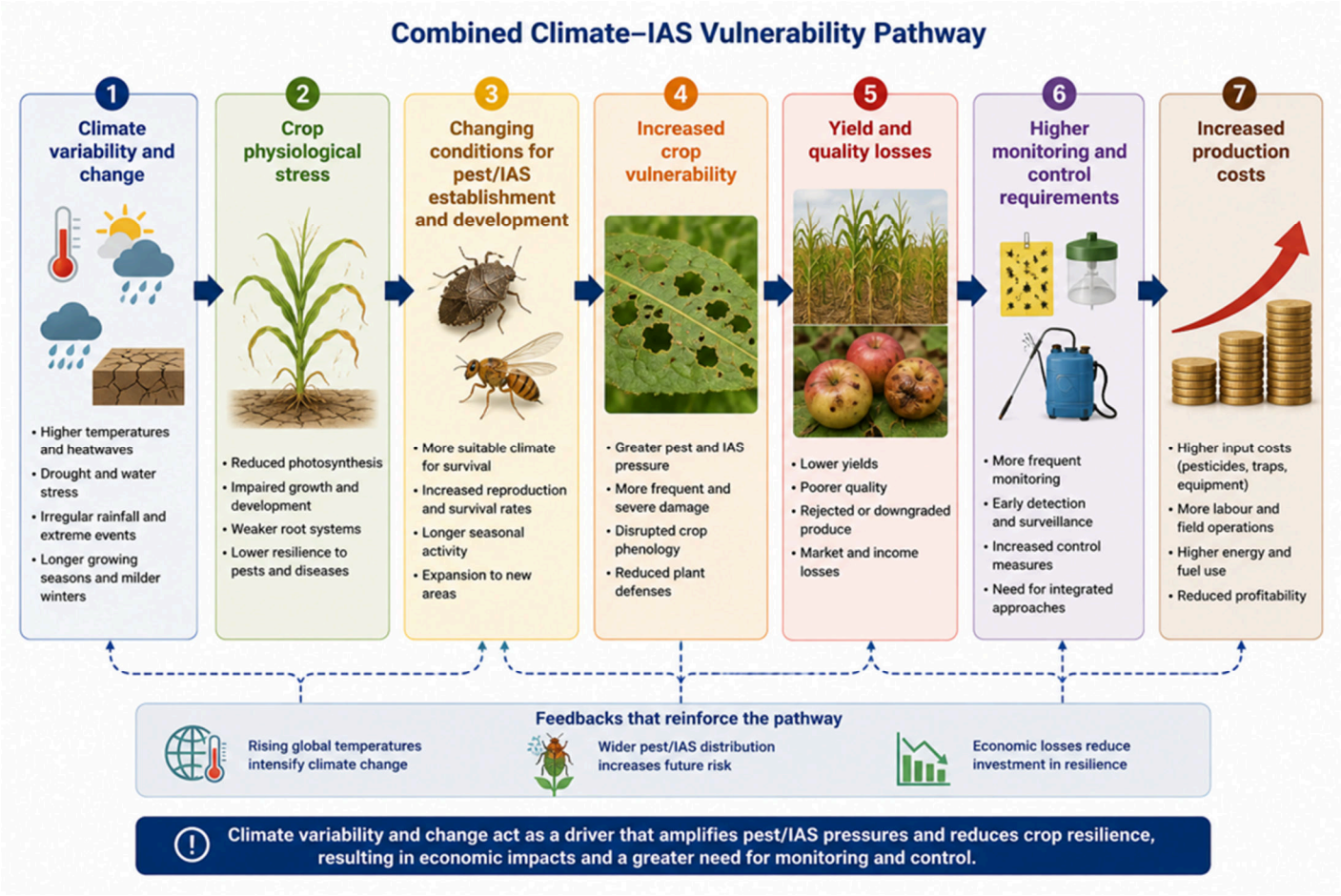
Walnut plantations provide a long-term perennial monitoring system. Drought, extreme heat, irregular rainfall and late frost may affect tree condition and nut development. R. completa is the priority invasive pest; adult

Trapping should precede visible damage because larvae develop inside the husk. Fallen infested nuts and fruit symptoms should be documented and linked with seasonal climate data.

6.5 Integrated climate-crop-IAS finding

Conceptual relationship: Climate variability and change -> crop physiological stress -> changing conditions for pest/IAS establishment and development -> increased crop vulnerability -> yield and quality losses -> higher monitoring and control requirements -> increased production costs.

Conceptual pathway of combined climate–IAS vulnerability, illustrating how climate-related crop stress and changing conditions for IAS/pest development can increase crop vulnerability, production losses and management costs, is presented visually in the next figure:



7. GIS and Spatial Interpretation

A GIS-oriented spatial framework was prepared to organise the Bulgarian pilot information and support future interpretation of crop-IAS-climate relationships. The framework links pilot municipalities and sub-zones with geographical coordinates, crop profiles, IAS/pest observations and thematic climate information.

The spatial approach is intended to evolve from static mapping towards an updateable evidence system. Future records should include validated species observations, trap results, georeferenced photographs, crop damage, phenology, CPDS and other climate data, and evidence status. This will support comparison among sites, identification of possible monitoring hotspots and more targeted surveillance.

The GIS framework must preserve the distinction between confirmed site evidence and wider emerging or surveillance-relevant risks. A species recorded nationally or elsewhere in Europe should not be mapped as confirmed at a pilot's location without appropriate local validation.

8. Integrated Conclusions and Recommendations

Activity A1.1 has moved the Bulgarian AGRICOOP pilot from initial identification of vulnerable crops and harmful organisms towards a structured crop-IAS-climate monitoring framework. Its value lies in integrating agricultural importance, climate sensitivity, biological pressure, stakeholder knowledge, field evidence and geographical information within a common analytical structure.

The final portfolio of five High-Priority crop groups is representative of the main agricultural systems selected for monitoring in Varna Region. The corresponding pest framework covers invasive alien pests, emerging risks and economically important non-IAS pest complexes across orchards, vegetables, field crops and walnut production. The pilot network in Aksakovo, Valchi Dol and Vetrino provides a complementary spatial basis for repeated observations under different agricultural and agroecological conditions

The next implementation stage should convert this baseline into a progressively richer monitoring and early-warning system. The following priorities are recommended:

1. Continue systematic seasonal monitoring during crop- and pest-specific vulnerable periods, using repeated observations rather than isolated inspections.
2. Integrate pest observations with temperature, precipitation, drought, soil-moisture and extreme-event information, including CPDS data where available.
3. Strengthen early detection of emerging IAS, focusing on vulnerable crops, phenological stages and potential pathways of introduction and spread.
4. Maintain and progressively update the Bulgarian crop-IAS catalogue. New records should include date, location, crop, organism, evidence status, validation method, photographs, observed damage and relevant environmental conditions.
5. Develop the GIS framework into a practical spatial decision-support resource incorporating validated species records, trap results, crop damage, phenology and climate data.
6. Strengthen farmer and stakeholder participation in reporting unusual pest occurrences and crop symptoms, including use of AGRICOOP monitoring tools such as MAPPEST.
7. Support climate-informed Integrated Pest Management (IPM), linking pest occurrence with crop phenology and climatic conditions to improve timing and targeting of interventions.
8. Maintain cooperation with agricultural advisory, plant-health, research and regional institutions to strengthen validation, dissemination and practical uptake.
9. Preserve a precautionary evidence-based interpretation of climate-IAS relationships. Climate change should not be presented as the direct cause of individual pest occurrences without repeated, aligned evidence.

In conclusion, the Bulgarian A1.1 baseline provides the methodological and spatial foundation for subsequent AGRICOOP monitoring, early detection, farmer awareness and climate-informed agricultural risk management. Repeated field observations, validated pest records, farmer participation, CPDS/climate information and continuously updated GIS data can progressively strengthen understanding of where and when climatic stress and IAS/pest pressure coincide, supporting more resilient and sustainable agricultural management in Varna Region and knowledge exchange across the wider Black Sea Basin.

Selected References and Evidence Sources

The full national report contains a 50-source evidence base. For this condensed version, only the principal categories of sources are retained; detailed bibliographic entries should be consulted in the full report.

- European and Mediterranean Plant Protection Organization (EPPO) Global Database - species distribution, host associations and plant-health status.
- Bulgarian agricultural, plant-health and risk-assessment publications and institutional information.
- Regional Directorate of Agriculture - Varna and relevant national agricultural information.
- Scientific literature on Halyomorpha halys, Drosophila suzukii, Diabrotica virgifera virgifera, Phthorimaea/Tuta absoluta, Rhagoletis completa, cereal pest bugs and other crop-health organisms.
- AGRICOOP Bulgarian stakeholder workbook, farmer/agricultural-producer interview records, consultation records, field registers, GPS coordinates and photographic observations.
- AGRICOOP crop-scoring matrix, IAS inventory/master list and GIS-oriented pilot-zone datasets.

Note: This condensed report intentionally omits photographs, illustrative figures, detailed species biology, repeated descriptive passages and several supporting tables from the full national report while preserving its principal findings, evidence cautions and implementation logic.