



## DEVELOPING A POOL OF NOVEL AND ECO-EFFICIENT APPLICATIONS OF ZEOLITE FOR THE AGRICULTURE SECTOR







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(FP7-ENV-2011-ECO-INNOVATION. Project number : 282865)

Collaborative project (2012-16) subsidized by the 7th FP with 2,014 M€



ECO-ZEO aims at the development of a new pool of green crop protection products, based on zeolites, delivering a wide range of beneficial effects including reduced water consumption, increased crop yield, lower chemical input, crop protection and tolerance to abiotic stress and healthier conditions to workers in agriculture and agrochemical sectors.





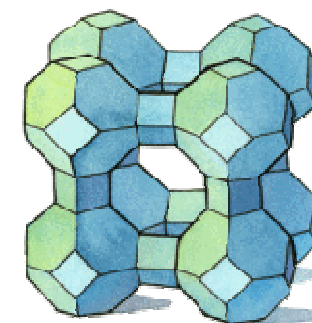


## PRINCIPLES OF ECO-ZEO

ECO-ZEO products will rely on the innovative application of Zeolite 4A to the surface of leaves and fruits and adapted strategies for sustainable crop protection such as chromatic masking , behavior interference and biocontrol.

Zeolites are natural and synthetic crystalline, hydrated aluminosilicates, structured in a three-dimensional rigid network.

Zeolite 4A is a synthetic zeolite with a high selectivity in front of polar molecules as water and carbon dioxide.



**Zeolite 4A**

The developed crop protection solutions will be lab and field trialed for 4 crops : apple , tomato , table grape and orange. The best performing solutions will be validated through demonstration with European farmers.

Sustainability , eco-efficiency and Life-cycle analysis will be performed throughout the project.





## ECO-ZEO's TARGETS AND MAIN QUANTITATIVE OBJECTIVES

Selected Crops and Targeted Main Threats under ECO-ZEO		
Crop	Insect Pest	Fungal Disease
Apple	<i>Cydia pomonella</i> (codling moth)	<i>Venturia inaequalis</i> (apple scab)
Tomato	<i>Tuta absoluta</i> (tomato leafminer)	<i>Botrytis cinerea</i> (botrytis)
Grape	<i>Lobesia botrana</i> (European grapevine moth)	<i>Plasmopara viticola</i> (downy mildew)
Orange	<i>Ceratitis capitata</i> (Mediterranean fruit fly)	

Increase crop yield		Reduction of losses due to abiotic stress		Pesticide savings		Water savings	
Low efficacy	High efficacy	Low efficacy	High efficacy	Low efficacy	High efficacy	Low efficacy	High efficacy
5%	10%	70%	90%	10%	15%	5%	10%

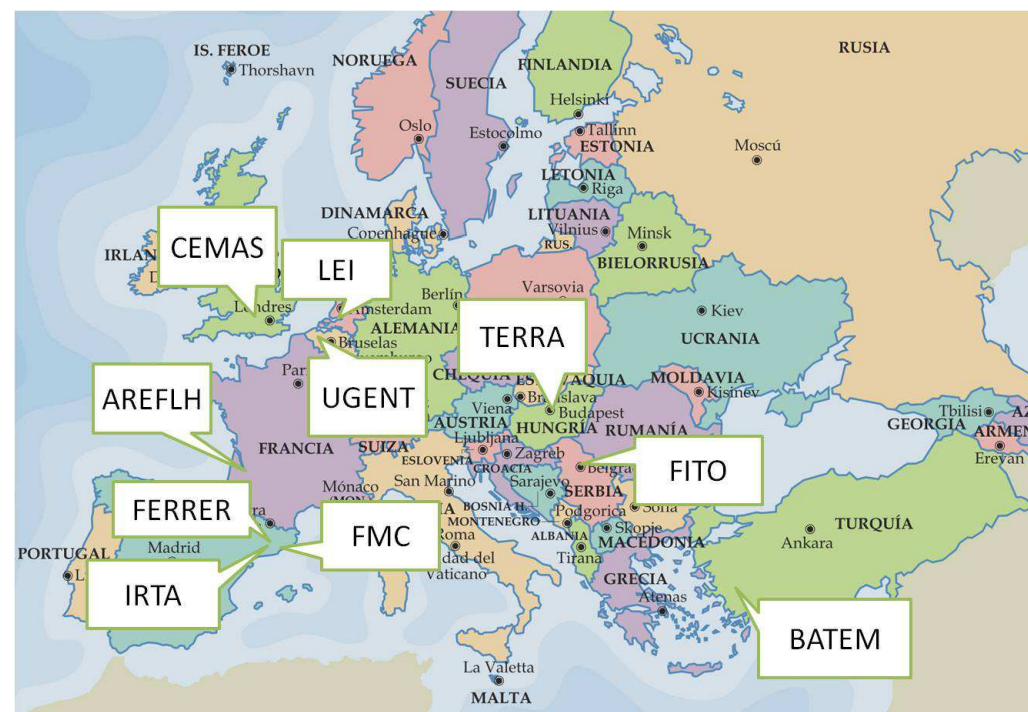
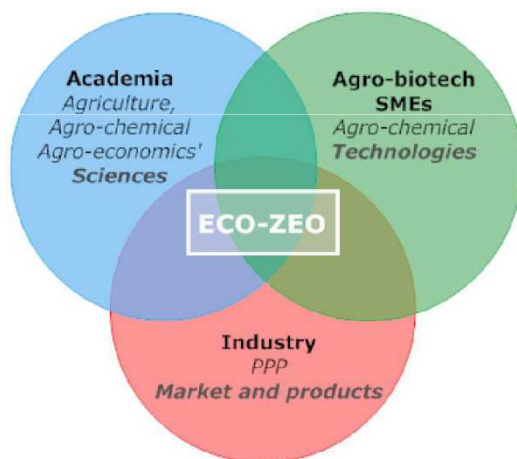




## ECO-ZEO's CONSORTIUM



ECO-ZEO consortium is constituted by 10 participants from 8 different countries covering Research Organizations (IRTA, BATEM, LEI and UGENT), Industry (FMC and FITO), Agro-biotech SMEs (TERRA, FERRER and CEMAS) and a EU Association of farmers (AREFLH) as a necessary background to ensure successful development of new Sustainable Crop Protection Strategies.







## ECO-ZEO's CONSORTIUM → ACADEMIA

The role of the Academia is to ensure the accomplishment of the scientific challenges of the project .

ACADEMIA				
Partner Name	IRTA	BATEM	LEI	UGENT
Type of Organisation	Agriculture Research Organisation	Agriculture Research Organisation	Agro-Economics Research Organisation	University. Crop Protection Dept.
Background	Crop Protection Apple and Tomato	Crop Protection Orange and table grape	Sustainability analysis	Agro-chemicals:
Main tasks assigned in the project	Lab screenings of formulations and Field Trials	Lab screenings of formulations and Field Trials	Sustainability Data analysis	Selection of Active ingredients, Design of formulations and reformulations





## ECO-ZEO's CONSORTIUM → AGROBIOTECH SME's

The role of the Agro-biotech SMEs is to ensure the accomplishment of the technological challenges of the project

AGRO-BIOTECH SMEs			
Partner Name	TERRA	FERRER	CEMAS
Type of Organisation	Agro-biotech SME	Agro-biotech SME	Agro-chemical Laboratory
Background	Carriers, bio-control agents, microorganisms	Formulation with Essences and Plant Extracts	Formulation, eco-toxicology and efficacy studies, certification
Main tasks assigned in the project	<i>Selection of Active ingredients, Design of formulations and reformulations</i>	<i>Selection of Active ingredients, Design of formulations and reformulations</i>	<i>Selection of Active ingredients, Design of formulations and reformulations</i>





## ECO-ZEO's CONSORTIUM → INDUSTRY

The role of the industrial partners is the product development and the exploitation related objectives of the project

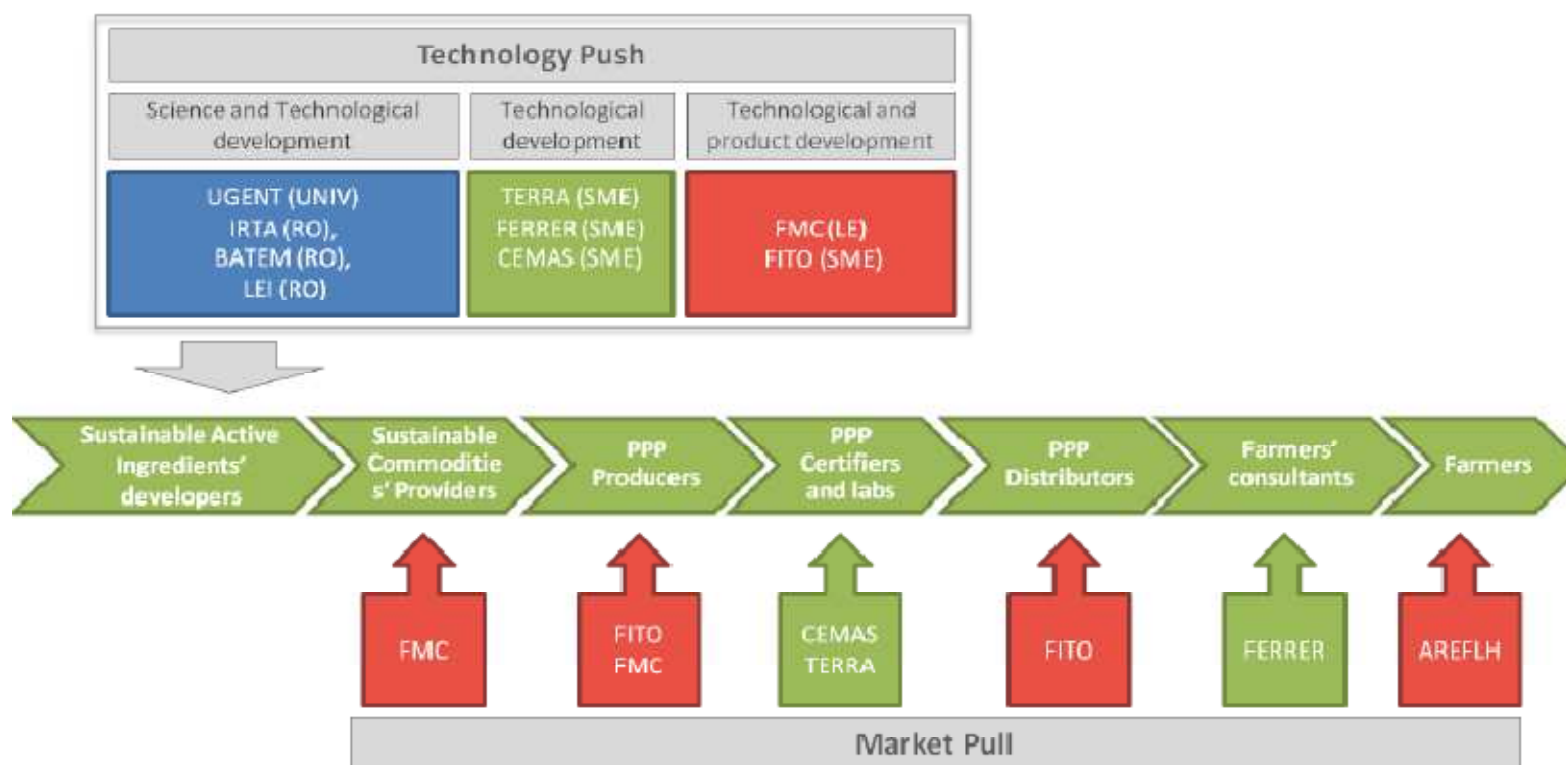
INDUSTRY			
Partner Name	FMC	FITO	AREFLH
Type of Organisation	Large Enterprise Zeolite Production	SME PPP Production and distribution	EU Association of farmers
Background	Zeolite and Mineral pigments	Chemical Standards and additives	Dissemination of Sustainable Plant Protection Strategies
Main tasks assigned in the project	<i>Selection of Active ingredients, Design of formulations and reformulations</i>	<i>Selection of Active ingredients, Design of formulations and reformulations</i>	<i>Dissemination, Best Practices and Deployment with End users</i>





## ECO-ZEO AND VALUE-CHAIN

The ECO-ZEO consortium covers all value-chain of the Crop Protection Products , from the farmer (end user) to the industry and technology providers.







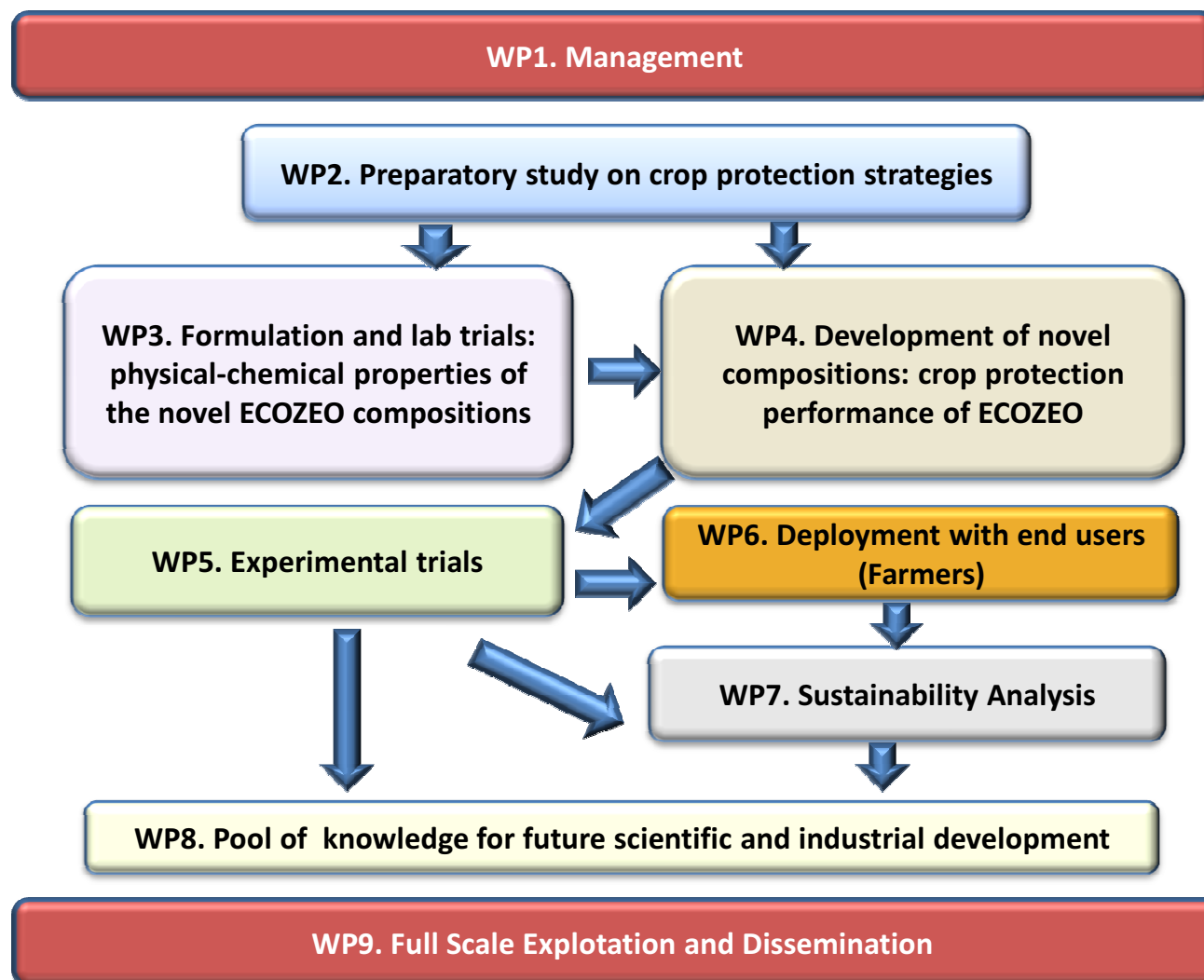
## ECO-ZEO WORK PACKAGES: DESCRIPTION AND LEADERSHIP

WP No.	WP Title	Type of Activity	WP Leader No.	WP Leader Short Name	PM	Start Month	End Month
WP 1	Management	MGT	1	IRTA	32.6	M1	M48
WP 2	Preparatory study on crop protection strategies	RTD	4	UGENT	30	M1	M6
WP 3	Formulation and lab trials: physical-chemical properties	RTD	7	FITO	29	M3	M10
WP 4	Development of novel compositions: crop protection performance of ECO-ZEO	RTD	8	CEMAS	38.5	M6	M13
WP 5	Experimental trials	RTD	2	BATEM	28	M11	M34
WP 6	Deployment with End-Users (Farmers)	DEMO	9	AREFLH	24.5	M30	M46
WP 7	Sustainability Analysis	RTD	3	LEI	27	M31	M48
WP 8	Pool of knowledge for future scientific and industrial developments	RTD	1	IRTA	30.5	M1	M48
WP 9	Full Scale Exploitation and Dissemination	Other	10	FMC	29.7	M1	M48
				<b>TOTAL</b>	<b>269.8</b>		





## ECO-ZEO WORK PLAN







## WP1. Management

**WP leader:** IRTA

**Duration :** 48 months

### Objectives:

- ✓ To coordinate and manage the project in a professional manner.
- ✓ Coordinating the Executive Board.
- ✓ Implementing and coordinating the quality assurance plan.
- ✓ Ensuring all administrative, legal and financial issues are managed to guarantee that all EC requirements for reporting are met.
- ✓ Implementing efficient communication plan: internal and external.





## WP2. Preparatory study on crop protection strategies

**WP leader:** UGENT

**Duration :** 6 months

### **Objectives:**

- ✓ Definition of overall specifications of novel ECO-ZEO compositions, for water efficiency, increase of crop yield, abiotic stress and biocontrol.
- ✓ Theoretical and empirical understanding of key properties of Zeolite-4A (Specially interactions with additives and active ingredients).
- ✓ Full risk assessment for each product type/formulation, with specific emphasis on human health.
- ✓ Selection and ranking of a set of **additives** for enhancing physico-chemical properties of the novel ECO-ZEO compositions.
- ✓ Selection and ranking of a set of **active substances** to be used as complementary active ingredients in the novel ECO-ZEO compositions.





## WP3: Formulation and lab trials: physical-chemical properties

WP leader: FITO

Duration : 8 months

### Objectives:

- ✓ Development of one or more new types of formulations with Zeolite 4A as main basic active ingredient.
- ✓ Two categories of formulations:
  - Other minor components are added to get alternative presentations such as **WDG**, **SC** or better **adherence** .
  - Improved functional mixtures prepared to work with active ingredients (WP4).
- ✓ Initial assessment of physical and chemical changes of the ingredients after formulation (perspective of human health).
- ✓ Develop suitable physico-chemical properties as regards the efficacy as a catalyst of photosynthesis and gas exchange.
- ✓ Develop suitable physico-chemical properties as regards product stability, storage stability, transport (logistics) and handling operations by the end-users (farmers).





## WP4: Development of novel compositions: crop protection performance of ECO-ZEO

**WP leader:** CEMAS

**Duration :** 8 months

### Objectives:

- ✓ Develop new zeolite-based compositions to be applied on plant's surface with beneficial effects for water efficiency, increase of crop yield, tolerance to abiotic stress and crop protection.
- ✓ Demonstrate efficacy against the main threats for each crop.
- ✓ Demonstrate the effect of using Zeolite 4A as a carrier to give additional persistence to the complementary active ingredients (repellents, pesticides or fungicides).
- ✓ Develop strategies to provide stability and persistence of the overall effects. Initial assessment of changes in the physical, chemical and phenotypical properties of the ingredients after formulation, relevant from the perspective of human health.
- ✓ Perform preliminary lab screenings on efficacy and toxicity.
- ✓ Redesign and reassess, if necessary, the intermediate formulations in case of negative or non-conclusive results.
- ✓ Rank and select the top-performing formulations for experimental field trials (WP5).





## WP5: Experimental trials

**WP leader:** BATEM

**Duration :** 24 months

### Objectives:

- ✓ Definition of treatments' application strategies for field trials.
- ✓ Performance of field trials with the selected prototype compositions, on all four crops.
- ✓ Collection of data linked to efficacy against pests, diseases, water consumption and other eco-efficiency indicators defined in WP6.
- ✓ Performance of complementary eco-efficiency lab trials.
- ✓ Ranking and selection of the top-performing prototype formulations for the subsequent stages of sustainability analysis and demonstration with the farmers (end-users).





## WP6: Deployment with End-Users (Farmers)

**WP leader:** AREFLH

**Duration :** 17 months

### **Objectives:**

- ✓ Demonstrate the new applications with end-users in a non-experimental environment.
- ✓ Reporting the feedback from farmers to validate in a real scenario the overall expected impacts of the deployment of the new technology and to design a reliable market approach strategy.





## WP7: Sustainability Analysis

**WP leader:** LEI

**Duration :** 18 months

### Objectives:

- ✓ Evaluation of the findings of experimental trials related to sustainability indicators.
- ✓ Definition of eco-efficiency indicators and their assessment against the experimental trials.
- ✓ Life Cycle Assessment of the novel applications at the industry and farm level.
- ✓ Up-scaling of the sustainability assessments at farm level towards broader spatial scales.





## WP8: Pool of knowledge for future scientific and industrial developments

**WP leader:** IRTA

**Duration :** 48 months

### **Objectives:**

- ✓ Compile the ground knowledge for users and industrial suppliers of ECO-ZEO's applications.
- ✓ Define a ground scientific methodology for the development of further applications of Zeolite-4A for surface crop protection.
- ✓ Define a conceptual scheme for industrial up-scaling with a thorough theoretical design of an industrial production plan.
- ✓ Industrial methodology for up-scaling of further applications.
- ✓ Definition of an agenda for future research based on the needs and obstructions identified during the project.





## WP9: Full Scale Exploitation and Dissemination

**WP leader:** FMC

**Duration :** 48 months

### Objectives:

- ✓ To formulate an exploitation plan in line with the economic-sustainability objectives of ECO-ZEO and update the preliminary business case.
- ✓ To ensure intellectual property rights (IPR) protection and use of foreground.
- ✓ To promote the compliance with the regulatory constraints through standardization and certification.
- ✓ To raise awareness about the progress and benefits of ECO-ZEO via various dissemination actions targeting end users, the scientific community and the general public.





## ECO-ZEO MILESTONES

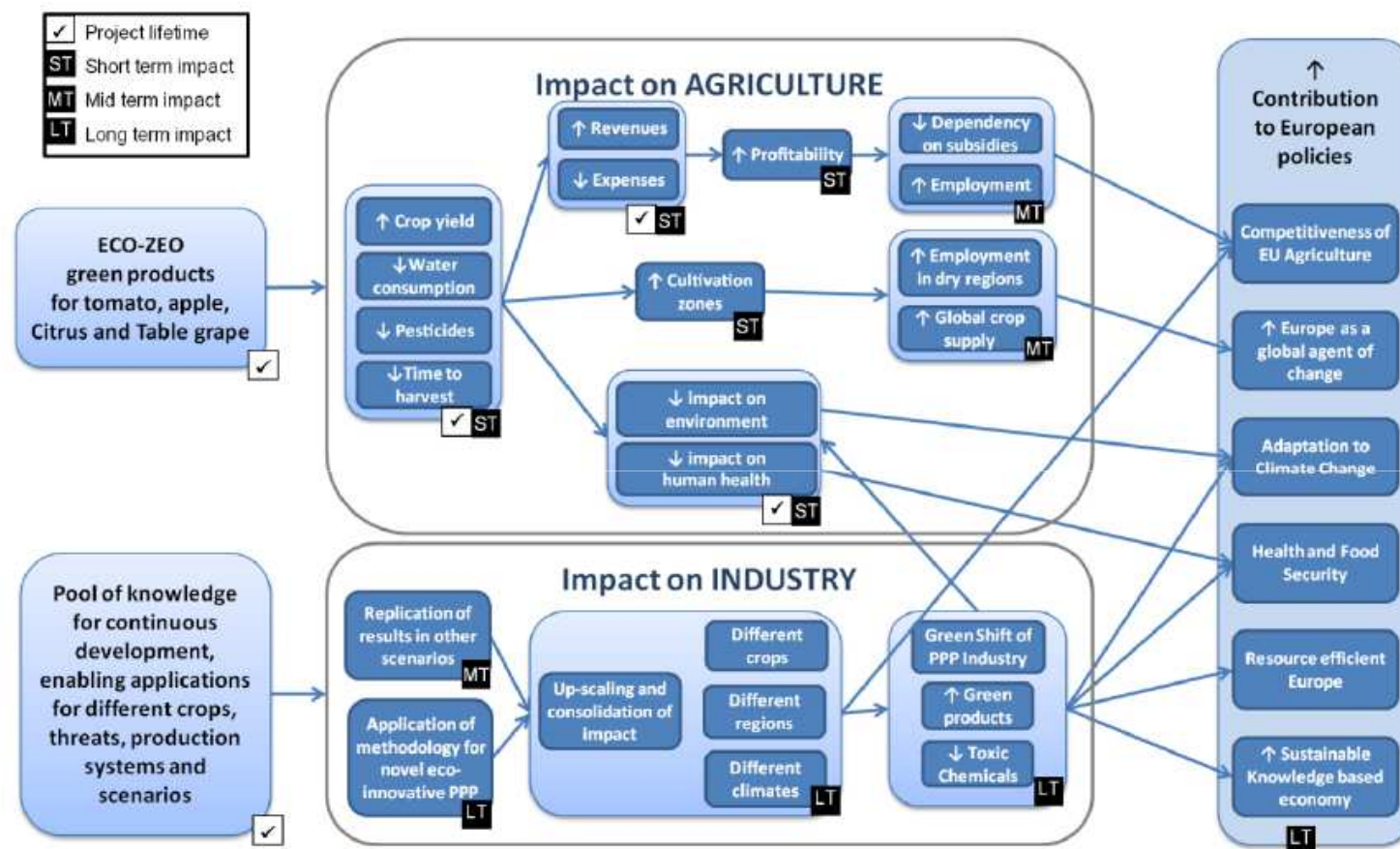
Milestone No.	Milestone Description	WP(s) Involved	Expected Date <sup>1</sup>	Means of Verification <sup>2</sup>
1	Public announcement of project	WP 9	<b>M1</b>	D9.1
2	First array of compositions with baseline effects (zeolite as only active ingredient)	WP2	<b>M6</b>	Deliverable: D2.2
3	Selection of best performing compositions with baseline and target-specific effects for experimental (field) trials.	WP3, WP4	<b>M13</b>	Deliverable: D4.3
4	End of first round of field trials and plan for future registration and certification	WP5, WP9	<b>M24</b>	Deliverable: D9.2
5	End of second round of field trials, conclusions and selection of best performing ECO-ZEO products	WP5	<b>M34</b>	Deliverables: D5.2
6	End of Demonstration with farmers	WP6	<b>M45</b>	D6.3
7	Conclusions of evidence-based sustainability analysis: overall eco-efficiency, resource balance (LCA) and up-scaling of conclusions	WP7	<b>M48</b>	Deliverables: D7.2, D7.3
8	Pool of knowledge for further joint development and exploitation	WP8, WP9	<b>M48</b>	Deliverables: D8.1-8.4, D9.3
9	Publication of the ECO-ZEO White paper	WP5, WP6, WP8, WP9	<b>M45</b>	D9.1







## ECO-ZEO IMPACT DIAGRAM







[www.ecozeo.eu](http://www.ecozeo.eu)

