I. Project overview & main results

The purpose of the EcoPest Project was to develop, apply and demonstrate an economically-viable Strategic Plan for the application of the principles of the sustainable use of pesticides and fertilizers in the pilot area. This was achieved through the minimization of agrochemical inputs and the effective management of related risks. Ultimately, the Project aimed at submitting practical proposals to the authorized regulatory bodies, making the Project’s deliverables directly applicable to both existing requirements and future legislation. The overall progress and implementation of the Project was made according to schedule on the basis of the 14 project actions.

Action 1 was a continuous action involving the management of the project. The respective administrative committees were established at the beginning of the project and exercised oversight of it, performing effectively their assigned function.

In Action 2 which was a preparatory action the starting-point or basis of reference of the Project was established by measuring pesticide inputs and pollutant concentrations in soil and water as well as by monitoring the inputs in agrochemicals. The monitoring network was set up and plant health needs and environmental data were recorded.

Action 3 set up the principles of Low Input Crop Management Systems (LCM) which were afterwards compiled into respective protocols for each crop studied in the project. Furthermore Plant Protection Guidelines were edited by the scientific teams of the project addressing plant protection issues related to the studied crops. All the above documents comprised project’s deliverables and were published and distributed. New practices regarding pesticide application were adopted so that only the necessary amounts of pesticide to be used. The Action’s goals were fulfilled, as the pesticide inputs were significantly reduced in two of the three main crops in the Project area.

In Action 4 the criteria and procedures for identifying the most hazardous pesticides were established allowing a strategy for their substitution to be developed. Furthermore, the pesticides’ active substances were categorized according to their hazardous properties and classified as as candidates for substitution when considered necessary.

In Action 5 a strategy-protocol for minimizing spray drift during application of pesticides was developed. Field measurements of spray drift were carried out before and after repair and recalibration of the spraying equipment used in the area. Furthermore in the field trials conventional and low drift nozzles were used for comparison purposes. Results showed that repaired equipment and low drift nozzles lead to almost 100% minimization of spray drift.
Action 6 was a continuous project action during which the organic (pesticide) residues and inorganic pollutant levels in water and soil were determined. In the same samples ecotoxicological studies were carried out on indicator organisms. This environmental monitoring was carried out for 2010-2011 and 2011-2012 cropping periods (corresponding to 1st and 2nd year of LCM application respectively) and the results were compared to the respective data obtained from the 2009 reference cropping period (baseline survey, where no LCM had been applied). A significant reduction in levels of organic pollutants, reaching 70% of the 2009 levels in the wells of the pilot area was achieved. Accordingly a reduction in toxicity to aquatic and soil organisms was observed as indicated by bioassays conducted.

Empty pesticide containers and spraying residues management was the objective of Action 7 which was completed successfully. In the frame of this action the triple-rinsing technique for the empty pesticide containers was promoted and applied.

In Action 8 general and site specific indicators were developed and monitored to assess environmental quality of the area focusing on soil and water profiles. The indicators were used to determine both simple and complex environmental parameters assessing the area subjected to unacceptable levels of risk. This action was also completed successfully indicating a significant reduction of the area being under unacceptable risk after the application of the LCM.

In the frame of Action 9 the majority of the of the farmers (63%) participating in the project and 100% of the agronomists and spray operators of the project area participated in vocal as well as in practical training in topics related to plant protection through LCM perspective, safe use of pesticides, proper use of equipment, waste management techniques, legislation issues and other topics related to the project implementation. Three main training cycles and various supplementary training events were carried out for this purpose. The respective training material was produced in electronic and printed form and distributed to the trainees and other stakeholders. The action was completed successfully as indicated by the assessment of the various questionnaires distributed at the beginning and the end of the project as well as during the training events.

The objective of Action 10 was the set up of a scheme regarding the certification of spraying equipment and sprayer operators in the Project Area. The respective proposals resulting from the projects conclusions and overall experience acquired were compiled and submitted to the Ministry of Rural Development & Food. The above goal addressed also the checking and repairing procedures of the spraying equipment of the area.

Significant results were achieved in the frame of Action 11 of the project. Proposals to the competent authorities, stakeholders and policy-making public bodies were formed and submitted allowing the EcoPest results to be considered and included in the National Action Plan in the frame of the conformity with the 2009/128/EC Directive and the legislative environmental regulations and guidelines. The action was completed successfully as evidenced also by the assignment of two BPI representatives and their substitutes in the Greek National Action Plan Committee following a respective request from Ministry of Rural Development & Food.
Action 12 was continuous action during the project implementation involving various activities that were carried out for the dissemination of the project and its results at national and international level. In the frame of this project action the project results were presented in 12 national and 17 international conferences, the layman’s report was published and distributed, a series of project publications and informative/training material were produced. Furthermore various dissemination events and workshops were held promoting awareness raising and communication of the projects findings to target groups of interest.

Action 13 was also a continuous action concerning the monitoring of the Project progress and its deliverables and was effectively implemented both for technical and financial parts.

In Action 14 an after LIFE dissemination plan was developed. A series of activities were conducted so as the results and conclusion of the project to be usable within two main axes-pillars namely: a) Compilation of National Action Plan (NAP) for the conformity with the 2009/128/EC Directive for the sustainable use of pesticides as this has been harmonised in the national legislation 4036/2012 for pesticides. The application of this Directive at pilot scale actually constituted at local scale the project implementation itself and b) the formation of an “After-LIFE” era as derived from the project’s results and deliverables that remained as a status in the area, being an example “precedent” not only for the area itself but for the whole country as well. Keystones supporting this plan will be the Ministry of Rural Development & Food -as designated authority regarding the Directive’s implementation at national level- as well as the local municipalities. The latter have already adopted a set of relevant actions -such as the establishment of an environmental “safeguarding team” of volunteers- for the next step utilization of the results and the expansion of the project’s application background in the area.

II. Project implementation

a. The process

The process followed by the consortium in the different Actions was rather new and novel. So far, no similar projects have been implemented in terms of all aspects related to the use of pesticides and their impacts on both human health and the environment. The beneficiaries utilized knowledge obtained from other EU funded Projects (LIFE FOOTPRINT, LIFE TOPPS, FP7 BROWSE) and adapted/used it in a manner that fulfills the milestones and project objectives with innovative strategies proposed.

b. Technical and commercial application

All proposals made in the frame of the project by the beneficiaries were cost effective, a fact proven by the acceptance of local growers. All measures proposed, were
feasible because they have been extracted from in situ applications and testing. One difficult aspect in terms of economic feasibility was the controls of spraying equipment (no national experience).

All actions were taken by the consortium to reduce the repairs/controls needed to the minimum possible, and to produce a spraying machine control system which was mobile and easy to use. This is considered necessary, in order cost reduction to be achieved based on the fact that controls should be made locally, at future.

In addition, external pesticide cost reduction has been achieved in a long term approach considering the reduction of pesticide quantities used (without yield losses) and pollutants in water, soil and air.

c. Success and failures; identification of the relevant success/failure factors

Success stories: Pesticide reductions, environmental quality improvement, intervention in local stakeholders’ mentality, prototype mobile unit for controls of spraying equipment, substitution proposals of the most hazardous pesticides, training of pesticide users and dealers, dissemination, training material, crop protection/fertilisation protocols, increase of safety in use for operators based on knowledge gained.

Failure factors: Although the attitude of the farmers had changed and pesticide containers were collected in the special red bins and transferred to a collection area but not all farmers applied triple rinsing, hence reduced quantities of empty pesticide containers can be recycled at this stage. The project has produced training comprehensive material which has been distributed to local growers in order to address this issue. In addition, BPI has expressed its commitment that scientists of the Institute will attend any workshop organised in the area providing training on rational practices in the use of pesticides.

d. Comparison against the project-objectives

The project objectives of this proposal were 100% fulfilled with more achievements in the deliverables than originally described:

- Through actions 3, 5, 6, 7, 8 a low input agricultural strategy for hazard and risk minimization was developed and implemented. Special focus was given on water protection. In total a 30% reduction of pesticide inputs during two cropping periods was achieved and 70% reduction in concentrations of organic pollutants (pesticides) in the wells of the pilot area.

- Mapping of the area and targeted environmental monitoring was carried out through actions 2 and 6. Definition of appropriate risk indicators for the estimation of pesticide impact on studied aquatic system was made in the frame of action 4 and 8.
- Training of the local stakeholders was successfully carried out through action 9. As a result of the three training cycles that took place 63% of the farmers and 100 of the local agronomists participating in the project were trained. A full package of training material was produced including training presentations, leaflets, protocols, manuals and training video, all available also in the project’s website.

- Development of National Certification Scheme for spraying equipment and accessories as well as for the professional user of pesticides, distributors and advisers was achieved through the project actions 10, 11 and 14.

- Incorporation of the project’s deliverables in the national environmental policy and legislation was carried out through action 11. More specifically the EcoPest contribution was depicted through the proposals made to Hellenic Ministry of Agricultural Development and Food (MRDF) derived from the workshop organized in the frame of the project at BPI (26/05/2011) addressing the implementation of the new Dir. 128/2009/EC in the country.

- Dissemination of the project and its results was 100% successful (action 12 of the project).

e. Effectiveness of dissemination activities

Dissemination plan of the project has achieved the initially set target. Three television broadcasts were made, publication in national Press (i.e. Greek newspapers «Ta Nea» «Naftemporiki», «Avriani», «Free Sunday», «Real News», «Kathimerini» etc.) and in local Press. The project itself as well as the knowledge gained from it was disseminated in Greece and other countries via the participation of the EcoPest scientists in national, international and EU fora.

More specifically the project and its results were disseminated in 12 national and 17 international conferences, targeting diversified audience (including Frezenius Academy conference, Safe Use Initiative 5th Workshop in Warsaw, Poland, 11th International Conference on the Biogeochemistry of Trace elements” in Florence, etc. Project website, project leaflet, publication of training material and Layman’s Report (Greek and English) were part of the dissemination activities that contributed to the project’s success in this part as well. In addition, the project results were presented to the President of the Hellenic Democracy, Mr Karolos Papulias by the Director of BPI, Dr K. Machera.

f. The future: continuation of the project & remaining threats

The actions that have to be continued after the termination of the project are:
   a) Implementation of local specific- LCM systems
   b) Continuous monitoring and assessment of the risks
   c) Management of wastes
d) Environmental monitoring  
e) Regular control and calibration of machinery  
f) Continuous training of farmers, advisers and retailers  
g) Maintenance of project’s web site  
h) Consideration of methods and practices in the developing legislation  

The EcoPest project should function as a guide (pilot) for the application of the sustainable use of pesticides Directive in our country. Proposals were made by the Leading Beneficiary to the MRDF and 4 members of the EcoPest coordinating beneficiary (BPI) were selected to participate to the National Committee for the compilation of the National Action Plan required for the country by the Directive 128/2009/EC (BPI is the only organization with two participants-all the rest are represented with one). The local community of the EcoPest area, farmers, agronomists, pesticide retailers, pupils will be the basic stakeholders that will continue, on a voluntary basis, to carry out and adopt activities and practices related to the project actions and objectives such as the low input crop management principles, the drift minimization and control, the pesticide containers collection and recycling etc. All this effort will be supported by the local authorities (Prefecture) and will also have the feedback from the EcoPest scientific team when needed. Action 14 of the project addressed all those issues in detail.  

Since the implementation of the principles of the 128/2009/EC Dir will be obligatory, no emerging threats are expected. Possible drawbacks however might appear in case insufficient motivation among farmers occurs due to lack of financial support (e.g. subsidies) through the forthcoming Common Agricultural Policy (CAP) reformation. This would be more apparent mainly in the case where farmers have decided to than the minimum requirements by the obligatory frame of the legislation.  

III. Analysis of long-term benefits  

a. Environmental benefits  

Direct / quantitative environmental benefits  

Pesticide minimisation and fertilizer optimization achieved through EcoPest contributed directly both to resource savings and environmental safety. Spray drift control through the EcoPest proposed strategy addresses also environmental benefits issues as well as reduced pesticide losses (off target). Reductions in the level of green house gas emissions derived from the reduction in fuel use due to less-frequent pesticide application in the three cropping systems (cotton, maize and plum tomatoes) in the pilot area.  

In the literature, it is reported a reduction of 2,7 Kg/ha of carbon dioxide emissions per spray application. In cotton and maize, banding of herbicides (PRE- and POST-
emergence, respectively) would result in 50% decrease of spraying. Use of “Weed-Seeker” lowered the spraying application as well. Extrapolation for the whole plain of Kopaida for the three-targeted crops such as cotton (27.000 ha), maize (3.000 ha) and plum tomatoes (2.000 ha) would result in total CO$_2$ savings of 78,000 Kg. This amount is equivalent to removing 37 cars from the road for one year, based on the assumption that every car contributes around 2,083 Kg CO$_2$ per year.

Furthermore, the application of minimum tillage system instead of the conventional one is estimated to reduce the soil emission of carbon compounds contributing to global heating by 90%.

Relevance for environmentally significant issues or policy areas

Application of the 128/2009/ EC Directive was in pilot scale for the first time in Greece, 1107/2009 (substitution).
Furthermore the added value of this project and its actions is related to:
- The Regulation EC No 396/2005 on maximum residue limits of pesticides in food and feed
- The Common Agricultural Policy (CAP)

b. Long-term sustainability

Long-term / qualitative environmental benefits

In the frame of the project a number of thematic maps have been produced providing detailed information on the specific hydro-geological characteristics of the area addressing the vulnerability of the area land and water bodies to pollution. These maps -that did not exist prior to the project- is a useful tool that can be utilized by local and public stakeholders and scientists to monitor the status, the potential risk and the ongoing progress of the environmental quality of the area and protect it accordingly.

Long-term / qualitative economic benefits

The application of LCM systems apart from the “environmental friendly” approach also has a positive long term cost saving effect considering the reduced quantities in pesticides and fertilizers that are used in the frame of the low input practices adapted
through them without affecting negatively the yield or the commercial quality of the products produced.

**Long-term / qualitative social benefits**

Positive influence on the health protection of the farmers, the bystanders and the residents of the area could be addressed as long term qualitative social benefits deriving from the EcoPest projects related to both the minimisation and the safe use of pesticides.

c. Legislation/policy indicators

The following indicators have been proposed by the project output (general indicators, Action 8 of the project) addressing safety issues on pesticides use and can be applied in European level:

- Percentage of farmers and agronomists that have been trained on principles of sustainable use of pesticides
- Percentage of farmers using personal protection equipment
- Percentage of spraying equipment that comply with the requirements of the Dir. 128/2009/EC and the respective European EN standards.
- Percentage of application of spray drift reduction strategy (use of antidrift nozzles, buffer zones etc)
- Quantities of solid agrochemical waste collected in the agricultural area
- Use rate of the specific liquid pesticide waste management system by the farmers
- Types and amounts of pesticides used
- Degree of application of Integrated Pest Management System (IPM)

Given that the aforementioned risk indicators have been officially proposed to the public authorities (MRDF) and stakeholders to be incorporated into the national legislation and policy through the national action plan addressing the Dir. 128/2009/EC requirement they also reflect the legislation and policy indicators that have derived in the frame of the project.

d. Measures taken to ensure environmental, economic and social sustainability after the end of the LIFE financing, remaining threats

- The compilation and support of a volunteers’ team from farmers and agronomists for the environmental protection of river Voiotikos Kifissos aiming at carrying out activities of environmental “safeguarding” and agrochemical waste monitoring, collection and management.
- Dissemination of the projects results in a comprehensive form to school pupils and concurrent establishment of cooperation with teachers of environmental training courses.
- Cooperation of the municipal authorities of the pilot area with other stakeholders’ adjacent municipalities to extend the pesticide waste management system to adjacent municipalities.

Insufficient motivation among farmers due to lack of financial support could be a potential threat to the degree of implementation of the above as mentioned in paragraph above.

e. Long term sustainability indicators

Long term sustainability indicators are the knowledge that was produced and the existing knowledge that was transferred to the project’s target groups in combination with the awareness raising of the local community along with the change in the mentality of the above groups towards a more environmental friendly attitude. These indicators were and can always be measured on quantitative basis -and thus evaluated accordingly- via the participation statistics in the training courses and events as well as through the feedback reflected from answered questionnaires that were used in those courses.

IV. Replicability, demonstration, transferability, cooperation

a. Transferability & Potential for Commercialisation, including cost-effectiveness compared to other solutions, benefits for users:

- Improved health & labour conditions (trained operators, use of personal protection equipment, promotion of occupational safety for operators, workers and bystanders),
- Less nuisance to others (spray drift control, minimization of point sources of contamination, cleaner natural resources, aesthetic and environmental improvement of landscape due to appropriate empty pesticides plastic containers disposal),
- Replicability/reproducibility already achieved in Thessaly through LIFE08 ENV/GR/0000570 Hydrosense project implementation (accepted by growers)
- Market conditions were influenced related to the use of pesticides for cotton which is a crop of national importance for the country.
- Pressure from the public as a factor of response to the need for running such a project in the area was depicted based on achieved improvements, willingness to participate in questionnaires and training activities, volunteers offered to participate in field trials.
- The cross-border transferability of EcoPest results has already started. In the frame of a European Project related to Support to BiH (Bosnia-Herzegovina) Plant Health Protection Administration Service (Contract No EUROPEAID /128353/C/Ser/BA) a meeting was held between a member staff of BPI (invited expert in BiH) with Officials in the field of Pesticides. During this meeting, the outline of a Rule Book related to pesticides sustainable use that was produced
for the local growers to address the principles of the Dir. 128/2009/EC, was presented and discussed by staff of the Services of BiH. Specifically, during this meeting with Mr Renato Knezevic, Head of the Plant Protection Products and Fertilizers Department of PHPA, Ms Akulovic Snezana, Project Coordinator and the Team Leader (TL), several articles of the Directive were mentioned and questions were raised related to e.g. training duration proposed by the EcoPest experts and related subjects, pesticide remnant and empty container management etc. Based on the issues discussed, a folder containing EcoPest dissemination material (presentations), the Layman’s report, videos/photos and the LCM Protocols was prepared and was electronically submitted to the Head of the Section for Plant Protection Products and Fertilisers and a member staff of PHPA (12/07/2011).

It was noted that information contained in the LCM Protocols could be used by local experts to produce similar information material for farmers and other operators in BiH on the condition that a request should be officially sent, in advance, to Benaki Phytopathological Institute for approval. Currently, as notified by the TL, the whole general LCM protocol text is being translated (contents were translated by the BPI expert).

b. Project networking

A list of beneficiaries, stakeholders, scientific and public bodies, and other projects that have been involved in the project’s network of dissemination and knowledge exchange activities is given below:

- OPERA Research Center (http://www.operaresearch.eu/)
- Agricultural University of Athens
- Hellenic Ministry of Rural Development and Food
- Hellenic Ministry of Environment, Energy and Climate Change
- Municipality of Livadia
- LIFE09 ENV/GR/000302 SAGE10 (http://www.sage10.gr/)
- LIFE08 ENV/GR/0000570 Hydrosense (http://www.hydrosense.org)
- BROWSE FP7 project and its partners (www.browseproject.eu)
- BiH (Bosnia-Herzegovina) Plant Health Protection Administration Service, Plant Protection Products and Fertilizers Department of PHPA

Through the aforementioned networking a bridging of science and policy has been accomplished via a transparent platform of debate towards the issues addressing the sustainability in agriculture.

c. Innovation

The innovation level of the project is mostly reflected in the following:

- Prototype construction and use
- Weed seeker
- Simultaneous application of all the provisions of the 128/2009/EC Directive at EU level
- Application of novel predictive models for the estimation of pollution risk at farm and catchment level
- Thematic maps of the pilot area