ANNEX 1

IMPACT ASSESSMENT PROCEDURE (IAP)

Working Document

(Reflects 2005 state of development of the method)

Note: Definitions are given in annex 1, pages 6-7

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IMPACT ASSESSMENT PROCEDURE (IAP)

1. INTRODUCTION

The procedure was developed in 2004[1] in an effort to document the identification of environmental aspects of olive culture and the evaluation of significance of direct environmental impacts that these aspects cause, in the framework of EMAS / ISO 14001. The practical need for that was to rationalize Good Agricultural Practice in olive crop, in the sense that resources should be directed to actions that would have the most benefit / least risk for the environment, while at the same time would be beneficiary for farmer's income. Both these elements are equally required for sustainability of olivecrop. So, after its restoration and validation, IAP could evolve to a robust decision making tool for multi-objective optimization of oliveculture.

Use of IAP will provide an objective way to identify and prioritize the most significant environmental aspects of agriculture for each parcel of an olive grove implementing EMS. It gives thus to the farmer -through an advisor- the opportunity to minimize the most significant negative impacts, and then to tackle the next in significance and so on, achieving thus continual improvement. In the same sense he can enhance the positive impacts of agriculture. Overall, a farmer can improve his environmental performance, at the same time as he is improving his income, in a systematic way.

Most of the terms that appear in this text are described in "Terminology" section in Annex 1.

2. PREREQUISITES

2.1 Elaboration of the 5 tables of the "SAGE10-03 - IAP-Working Document Appendices Draft" is required during the preparation stage of the project. These tables refer to the following:
- Table 1: Scope of IAP. Identified Aspects, Impacts and Endpoints
- Table 2: Combinations of Impacts with various Aspects and Endpoints, as Triplettes.
- Table 3: Parameters that have been identified and the definition of each.
- Table 4: Value classes for parameters.
- Table 5: Triplettes examined against the parameters affecting each of them. Each parameter has a weight (0 to +10 if it increases an impact and 0 to -10 if it decreases it).

2.2 A trained advisor is needed to collect the necessary information on environmental parameters as well as farmer's practices, and to carry out Impact Assessment Procedure. Consistency of data is obtained by training of the advisor, on best timing and SOPs for sampling, for timing and recording field observations and for best techniques to interview farmers, and evaluate the usefullness of their records.

3. STEPS OF IMPACT ASSESSMENT PROCEDURE

The following steps are included:

3.1 Collect all available data on the parameters of the parcel. Some data are collected by interview with the farmer, some by visual observation of the olive grove, while others from documentation, i.e. lab results, farmer's records, meteorological data etc.

3.2 Classify each parameter according to the value classes of table 4 of Appendix 1*.

3.3 Use table 5 of Appendix 1* to fill-in the value class of each parameter, for each of the triplettes.

3.4 The estimation of the significance of the impact, if the activity (aspect) is performed on that parcel -under the circumstances defined by the values of all parameters contributing to the triplette - is based on the following calculation, per triplette:

$$\text{Impact Significance} = P \times (L + I + A + C)$$

where:

P (0-100) = The probability that the impact will occur

L (0 or 5) = Violation of legal requirements (L=5) or not (L=0) if the impact will occur

I (0 - 5) = Expected intensity of the impact (I = 0 means negligible, and I = 5 means extreme)

A (0 - 5) = Area that will be affected by the impact (A=0 when it will be restricted only to the area of the activity, while 5 = very broad diffusion of the impact, even to the stratosphere).

C (0 – 5) = Cost to recover the previous status, or correction cost (C=0 is when natures recovers spontaneously and fully, while 5 is a long term effect, costly to bring back to previous state).

Thus the value of impact significance, i.e. the score of the triplette can range from 0 – 2000 points.

[1] It was part of the work funded by Reg. 1334 / 2001 for the development of Good Agricultural Practices for Olive Crop. The procedure was developed to an acceptable level for testing in the field for one year, but funding was discontinued before it was given a chance for more field testing, and proper correction, revision and finally validation.

Scoring decisions have to be based on consistent and firm criteria, subject to specific training.

In the example below the impact Pollution by ammonia is examined in the context of the triplette:

Aspect	Impact	Endpoint
Use of fertilizers	**Pollution by ammonia**	Air

The parameters that have been identified as contributing to this triplette are the following.
a. Type of fertilizer
b. Time between application and rain
c. Temperature post application
e. Soil pH
d. Soil ion exchange
e. Soil pH

In Table 4 of Appendix 1* the value classes are given for each parameter

To predict the significance of the impact under the circumstances highlighted in the table below, it is supposed that fertilizer rate of use is within reasonable limits, i.e. no surplus conditions are created. (values are only indicative):

		Value Classes		
Parameters:	Weight	Low (Best)	Medium	Low (Worst)
a. Type of fertilizer	**10**	No Ammonia	Ammonia	Ammonia+Urea
b. Time between application and rain	**9**	Within 24 hours	1-4 days	> 4-7 day
c. Temperature post application	**8**	<10^{0}C	10^{0}C-20^{0}C	> 20^{0}C
d. Soil ion exchange capacity (Meq/100gr)	**6**	>18	12-18	<12
e. Soil pH	**5**	6-8	5-6 ή 8-8,5	<5 or >8,5

In the above example the values of a worse case scenario could be:

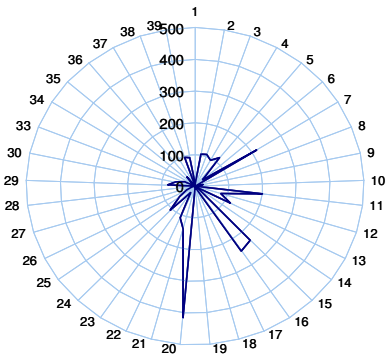
P = 100% probability of pollution as the farmer is a user of ammonia+urea containing fertilizer
L = 0 as there is no law against using it.
I = 3 i.e. intermediate intensity, as it is used in cool and rainy period but in soil with low IAC,
A = 5 as ammonia can be broadly diffused at this temperature, and
C = 5 for Cost. As there is no way that the farmers can reverse the diffusion of ammonia in air

The quantification of impact's significance is 100*(0+3+5+5) = **1300** points, i.e. quite high.

The conclusion is that the tradition of the farmer to use ammonia+urea containing fertilizers in early spring causes a significant impact. An improvement objective for the specific parcel would be to reduce the fertilizer gradually. The advisor can propose alternative plant nutrition / fertilizer method that can be tested by the farmer, so that pollution will be systematically nullified. The advisor has to combine the objective of reduction of pollution with the improvement of economic efficiency of plant nutrition. So, it is not simply a replacement of one fertilizer with another one but a holistic review of plant nutrition.

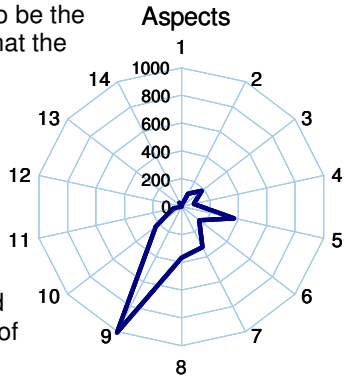
However, even if a parcel has been treated with ammonia + urea in winter (temperature <10^{0}C and frequent rainfall) and if the soil properties are within the optimal limits, the impact could be smaller. It will be near zero of course if the fertilizer used does not contain any ammonia. On the contrary, the impact may be very high (proportional to the rate used) if an ammonia fertilizer is traditionally used late in spring, with limited chances of rain and higher temerature.

The above scoring exercise is repeated for every triplette. The overall picture for the parcel is shown schematically in the following spider diagram. Numbers 1-30 represent the 30 impacts that have been identified (see column B of Table 1, in Appendix 1*). In this example from an olive grove in Crete (2005) the following impacts were found of higher significance:

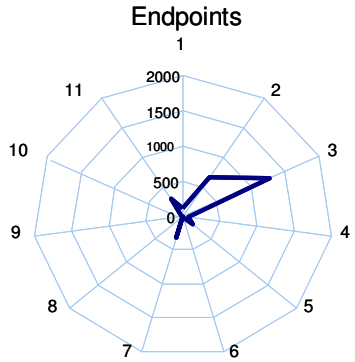


20 = Injuries to personnel
16 = Biodiversity on soil
15 = Biodiversity in soil
07 = Dispersion of soil pathogens
11 = Soil compaction

Environmental Profile of the parcel is completed by looking in the aspects that are mostly responsible for the predicted impacts, as well as in the endpoints that need the most attention. So,



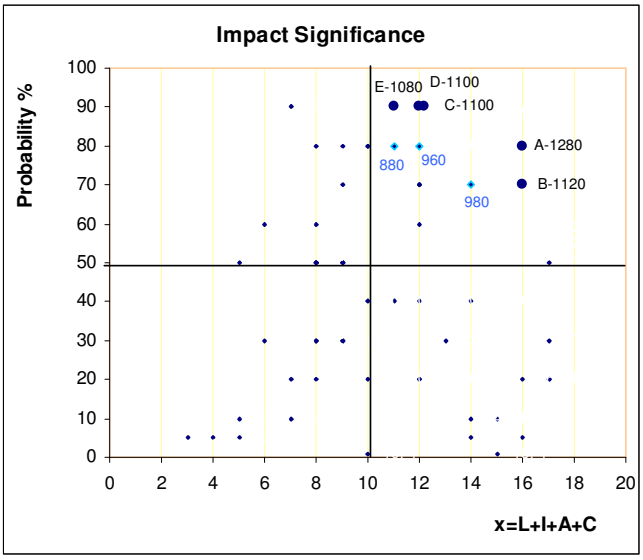
Aspect # 9 (soil cultivation) seems to be the aspect that has to be modified, so that the Endpoint # 03 (soil) and Endpoint # 02 Man (farm workers)



will be less exposed to the mentioned impacts.

The above example shows how the method followed by the Impact Assessment Procedure can be used to compare totally different aspects of cropping, with justified focus.

Inorder to prioritize the actions needed for environmental improvement the advisor can be assisted by the following diagram which allows to select the variable that can be reduced more easily and with less expense. The example reflects a case of wine grapes in central Greece. The five impacts that exceed 1000 points in significance are expressed by the following triplettes:



A: Fertilization-Pollution-Gr. Water
B: Fertilization-Poor Nutrition-Crop
C: Irrigation-Depletion-Reserves
D: Fertilization-Pollution-Surf. Water
E: Plant Protection-Pollution-Soil

The diagram facilitates the advisor to select the type of action needed to reduce the probability and/or one or more of the variables L, I, A and C, by altering the parameters of the aspect. For example by using more efficient irrigation method, soil cover by mulch etc. the farmer may reduce water loss significantly. The variable “intensity” may drop to 1 from a current value of 4. This will make the overall score to 800 instead of current 1100.

In the case of fertilization it appears that a considerable increase in organic matter would stabilize the nutrition of grapevines and reduce the probability of pollution, by reduction of frequent synthetic fertilizer use (and surplus formation). All the above alterations are in line with cost reduction, so farmers are willing to listen. Having in mind farmer’s income is a pre-requisite to make farmers have a drive to improve environment. So, when examining the options on how to reduce the significant environmental impacts it is required that the advisor ensures that the actions he proposes do not harm or -even better- enhance the economic result of the parcel. A help in doing so is the Parcel’s Production Capacity (PPC - sample shown in

second spreadsheet of Appendix 1) which is based on the same parameters that are used for Impact Assessment Procedure.

Scoring impacts is an auxiliary method to rank impacts according to their significance. It is not to be used for measurement of impacts.

Actual measurement is important not only for impacts but also to monitor the changes of parameters that contribute to impact reduction, as well as for monitoring economic results. The degree of targeted changes for both environment and economic results can be measurable, so improvement rate can be monitored in the context of an Environmental Management System. The result of management of improvements is summarized in the Parcel Performance Sheet (PPS), which is produced every year (sample shown first spreadshhet in Appendix 1).

ANNEX 1

Definitions

Aspect (EMAS / ISO 14001-adapted): Element of farmer's activities (e.g. choice and use of a fertilizer) that can interact with the environment. The term ''aspect'' coincides in part with the term "Pressures" of DPSIR model. Modification of aspects is the objective of the instructions that farmers receive by their advisors (Responses in DPSIR).

Environmental Impact (EMAS / ISO 14001-adapted): Any change to the environment, whether adverse or beneficial, wholly or partially resulting from the farmer's environmental aspects. As used here, the term "impact" is not very different from the one used in DPSIR model.
Impacts from agricultural activities on a parcel are in most cases subtle and inconspicuous in the short term. Some exceptions e.g. dead ladybids as a result of a single application of a Plant Protection Product tend to get most of the attention, while others not. For example, the point when salinization becomes obvious is reached only after many applications of improper irrigation. For this reason, in the present approach all identified impacts are systematically assessed; i.e. only as a result of scoring low in Impact Assessment Procedure can they be considered insignificant.

Environmental Profile (**EP**): It is the expression of the overall environmental vulnerability of a given parcel detailing the aspects and enpoints that relate to the most significant impacts.

Impact Assessment Procedure (IAP): It is the procedure for the objective evaluation of the risk that Environmental Impacts occur. This evaluation serves as a measure of impacts relative significance and therefore the significance of the aspects that cause them. The information produced by Impact Assessment Procedure is summarized in Environmental Proflile, which expresses an estimate of environmental vulnerability to farming activities.

Indirect Environmental Aspects (Reg. 761/2001, Annex VI): As a result of the activities, products and services of an organisation there may be significant environmental aspects over which it may not have full management control, e.g. the environmental performance and practices of suppliers.

EMS: Evironmental Management System implemented by farmers groups that use either ISO 14001 and / or AGRO 2-1 / 2-2 (greek standard quite similar to ISO 14001).

Endpoint: The medium on which an aspect is exerted. For example, the use of agrochemicals (aspect) can pollute (impact) *water* or *soil* or the *product*, i.e. three different media.

Note:The term will be changed to "Compartment" inorder to avoid confusion with the term "endpoint" (as contrasted to "midpoint") used in LCA methodology.

Environmental Impact Measurement: Accurate determination of the magnitude of an impact to the environment, e.g. increase in concentration of a pollutant in a river as determined by analysis in a laboratory of a properly taken sample, or reduction of the number of weed species in a herbicide treated parcel.

Environmental Performance Indicators (EPIs): Units measuring the state of the environment (e.g. % soil organic matter, as an indicator of soil fertility), as well as quantified aspects and parameters (e.g. Kg of Plant Protection Products active inredients / annum / Ha as an index of charging environment with potential pollutants, or volume of water used for irrigation in q.m. / annum / Ha).

Olive grove sustainability: The long term perspective of an olive grove with regard to stability of the agro-ecosystem, including productivity so as to sustain farmers' living, if not prosperity. Self dependent economic viability is indispensable part of environmental management. The target situation would be dependence mainly on local labour and mechanical technology, with minimal other inputs and tentative restriction of interventions only to the ones provided for by regulations 834/889 for organic farming.

Parameter: Environmental Property (E) of a parcel either inherent (annual precipitations in the area) or attributed (e.g. adjacent summer resort) or historical producer's activity (P) (e.g. depth / frequency of soil cultivation) that influences current state of environmental vulnerability

and productivity of the given parcel. The term coincides in part with the term "State" of DPSIR model. From a different angle if parameters had only negative effect the term could also coincide with the term "hazard". However, in the context of Environmental Management Systems an Impact can be either negative or positive for the environment. For example, in olive groves, the parameter "orientation to sunlight" may have multiple positive effects on both environment and productivity.
Note: P parameters are related to the Environmental Aspects.

Parameter Weight: Arbitrary values, playing the role of temporary regression coefficients. They range between 0-10 and they represent the significance of a parameter for the impact to be expressed. So, the parameter "half life" of a Plant Protection Product may have a highly significant effect on bird toxicity (possible value = 10), but much lower significance for soil fertility loss (possible value = 6).

Parameter values: Numerical values or classes showing the gradient that a parameter can get, e.g. in the example above the half life of a Plant Protection Product can get values of < 7 days (low), 7-30 days (medium) and >30 days (High). Gradient for a parameter may differ from impact to impact. Depending on whether the assessment is carried out quantitative or qualitatively the results will be presented either in values or in descriptive classes. Either way, assessment per parcel must be easily carried out. Results will be used as input in the calculation of the significance of the respective impact.

Parcel: A plot of land with an olive grove, physically separated from neighbouring crops. Each parcel is unique among all farmer's parcels in that it differs from any other parcel in at least one parameter, e.g age of trees, or soil type or irrigation etc. So, a parcel is a plot of land as uniform as possible. This means that if a single parcel is very large, that –if reasons exist- it will have to be separated in (sub-) parcels in order to ensure uniformity.

PPC Parcel's Production Capacity. It is the inherent potential of the parcel for yield in Kg of olive oil / Ha, as it is defined by a number of critical parameters (irrelevant of farmers' practices). It can be estimated by comparing to an ideal parcel for olive grove (Annex 2).

Triplette: A combination of an Aspect, an Impact and an Endpoint, represented by the respective codes, e.g. if code 03 is attributed to soil and code 06 is attributed to underground water, then code *02-02-06* could be Irrigation (aspect) - *Salinization* (impact) - *Underground Water* (endpoint) while *02-02-03* could be Irrigation-Salinization-Soil. A triplette is unique as long as it differs from other triplettes in at least one of the following:
a) The aspect. This is related to variables that may be the target of improvement. So, if the result of assessment shows a highly significant impact, the remedial actions as well as monitoring of their implementation have to be specific for this aspect.
b) The impact. This is to allow specificity of the environmental indicator. Also focus of initial assessment, and -tentatively- measurement,
c) The endpoint. This is important in order to specify the element of the environment that is affected by the impact, and to plan appropriately the sampling procedure for impact estimation or measurement.
The necessity for such a coding system is to set up a matrix of all possible combinations, as a pre-requisite for comparison of their relative signicance. The basis of Impact Assessment Procedure is to compare impacts, indifferent in which area of scientific discipline they are studied.
Current triplettes are shown in Appendix 2 of Annex 1 (working document).

Scope of Impact Assessment Procedure: The entirety of **impacts**, **aspects** and **parameters** that are considered relevant to be subjects of the procedure.