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**AGRIENVIRONMENTAL ISSUES:
POLICIES, DEFINITION OF INDICATORS LISTS
AND RELATED IMPLEMENTATION PROCESSES**

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Agrienvironmental issues: policies, definition of indicators lists and related implementation processes¹

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1. Introduction

Environment is one of the dimensions considered both in rural development and in sustainable agricultural policies.

In fact in the European approach, rural development represents the second pillar of the Common Agricultural Policy (CAP) and the related regulation covers environmental issues already integrated the CAP, process started since 1992. On the contrary, the first pillar is concerned on market policy and only recently with the CAP Mid Term Review, through the adoption of the cross compliance principle, a legal binding has been established to require farmers the adoption of environmentally oriented farming practices.

Sustainability itself implies a sustainable use of natural resources and agriculture represents a quite peculiar economic sector since related activities are conducted *within* the environment and almost 50% of the territory is managed by farmers.

Differences between rural development and sustainability - or more precisely sustainable agriculture - approaches can be easily underlined. In fact rural development implies a territorial approach, in general rural *versus* non-rural region performances are compared, and one of the key factors is represented by farms multi-functionality (*activity oriented approach*); environment, social and economic dimensions are included and the dynamic of the process is considered in order to analyse phenomena trends and to assess development progresses. On the other hand, in the sustainability approach, the focus is on natural resources (*resource oriented approach*), which represent a limited and only partially renewable capital, the dimensions considered are still the environment, the social and the economic ones and the concept is applied to the world as a whole (global approach), of course dynamic is taken into account for the necessity of applying the intergenerational equity principle.

Policy makers, in order to evaluate critical phenomena or policy implementation and progress towards established goals, require adequate tools, implying indicators identification and implementation.

Several processes have been started to identify indicator lists, on integration of environmental issues in the agriculture sector, on relevant environmental issues, on sustainability and

¹ This paper has been extracted from “Istat - Bellini G., (2004). *Analysis of data needs and availability for implementation of AEI according to DPSIR logical framework.*” Final report of the project funded under TAPAS action 2003. EC Decision 2003/304/CE. Paper content is thus updated to December 2004.

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sustainable agriculture and on rural development. All of them cover agrienvironmental issues and a harmonisation of lists adopted should be achieved.

In the present study, the legislative approach and the agrienvironmental indicator identification and implementation process have been highlighted.

2. Agrienvironmental issues and related policies

In the following a review of policies related to agrienvironmental aspects are presented.

2.1 Common agricultural policy and rural development

Sectoral policies, implemented at EU level, have to be considered for the role they have been playing in the last decade for taking into account elements for environment protection in order to achieve specific objectives. The CAP reform and the forest management and development protection started in 1992 and has been reinforced later by the communication "Agenda 2000: for a stronger and wider Union" [COM(97) 2000], presented by the Commission the 16 July 1997, oriented to describe the general development perspectives of the European Union and of its policies.

Objectives referring to agriculture in Agenda 2000 are diverse and are directed to comply with the need of increasing the competitiveness of European agricultural products on internal and foreign market with a higher integration of the environmental issues defining and implementing the Common Agricultural Policy. The integration of environmental goals into the CAP and the development of the role of farmers can and should play in terms of management of natural resources and landscape conservation. The environmental needs are met thanks to:

- the reduction in payments to sustain prices converted to direct payments in order to sustain income;
- the possibility for Member States to make direct payments to farmers conditional upon the respect of some specific guidelines;
- the support given to the accompanying measures, particularly the agrienvironmental ones, started with the CAP reform in year 1992. Such measures involve the extensification of production, the reduced use of plant protection products and chemical fertilisers, the conservation of crop and livestock biodiversity and of some particular natural habitats (Reg. 2078/92), and the afforestation of agricultural land (Reg. 2080/92), in order to prevent hydrogeologic problems.

Mentioned objectives can be achieved thanks to the Regulations 1257/99 and 1750/99 on Rural development, through which rural development programme based on environment protection can be adopted at regional level. Farming practices are also mentioned as a fundamental tool to reach the all the above mentioned goals, and organic agriculture is reported as the production method that improves the sustainability of farming activities, contributing to the general aims of the Regulation. CAP reform run through Agenda 2000 has been reviewed at a mid term stage in year 2004 (CAP – MTR, Regulation 1782/2003/EC). Main aim is to simplify the multiple payments scheme in a single one, decoupling payments from a specific production process. Furthermore a ceiling for total CAP cost has been set up at Member State level. The savings originated with a reduction in payments to perform from 2005 until 2012, called modulation process, will be used partly (80% of the total savings) for

financing the second pillar of the CAP, the rural development programme implemented through the already mentioned Regulation 1257/99 and partly for balancing (the remaining 20%) the existing differences in total given subsidies among States. The subsidy will be thus completely run on surface basis² and the monitoring system based on the identification of agricultural parcels through remote sensing will provide basis for geo-referenced data base. Besides increasing financing for rural development plans another positive effect in environmental terms would be the adoption of the cross-compliance principle. Farmer should respect management requirement as referred in Annex III of the Regulation, where for the environment issue several Directives are mentioned (Directives 79/409/EEC on the conservation of wild birds, 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances, 86/278/EEC on the protection of the soil and particularly when sewage sludge is used in agriculture, 91/6776/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, and 92/43/EEC on the conservation of natural habitats and of wild flora and fauna). Good environmental conditions are established under Article 5, where it is stated that each Member State can define its own requirements that may refer also to standards already applied in the context of rural development Regulation. Furthermore priorities in environmental issues and standards to deal with are listed in Annex IV.

In fact the subsidy will be conditional upon the adoption of environmentally oriented practices, to pursue food safety, animal health and welfare and the maintenance of the farm in good agricultural and environmental condition.

Permanent pasture was recognised to have an important environmental role and thus this area has to be maintained in such condition, also set-aside scheme has to be maintained.

2.2 Environmental policies

In the international initiatives framework, it is important to remind the legislation arising in the last decade to prevent and control environment compartment pollution. Compartments covered are air - with respect to gaseous emissions -, water - concerning mainly pollution risk from nitrates and chemical substances, soil - on which legislation still requires a framework to be drawn.

Referring to air, pollutants can be originated from different economic sectors. Effects can be recorded on global scale and can be diverse as acidification and/or climate change. In the following a brief review will be given on such legislative acts referring to agriculture sector.

Referring to *air pollution issue*, legislative initiatives have been taken at international and European level as for the Convention on Long-range Transboundary Air Pollution aimed at controlling and reducing the damage to human health and the environment caused by transboundary air pollution, due to SO₂, NO_x, VOC and NH₃ pollutants, and for the Framework Directive 96/62/EC on ambient air quality assessment and management, and successive **directives** defining limit values. The National Emission Ceilings (NEC) Directive (2001/81/EC) aims to limit emissions of acidifying and eutrophying pollutants and ozone precursors diffuse source into the atmosphere and limits are defined for each Member State. One of the pollutants considered is NH₃.

NH₃ emission is also ruled by the Integrated Pollution Prevention and Control (IPPC) Directive 96/61/EC defining permitting for industrial installations and monitoring activity of

² At first stage should cover all products included in the arable crop regime as well as grain legumes, seeds, beef and sheep. Also the revised payment for rice and durum wheat, and for the milk sector will be with time included. The same will happen for starch potatoes and dried fodder. For some crops requiring still a supporting system a specific supplementary payment is maintained.

production conditions. This Directive covers also the most responsible agricultural production processes in terms of ammonia emission, precisely breeding of poultry or pigs with more than: (i) 40 000 places for poultry, (ii) 2 000 places for production pigs (over 30 kg), or (iii) 750 places for sows, that are the. Directive is oriented to make farms adopting the Best Available Technologies (BAT) in order to reduce such emissions.

Referring to the *climate change issue*, legislative initiatives have been taken at international level at the summit of Earth in Rio the Janeiro in June 1992, where the United Nations Framework Convention on Climate Change (UNFCCC) was signed. Furthermore the Kyoto Protocol, in December 1997, established the emission reduction objectives. At present, the treaty is adopted at global level. European Union adopted³ the protocol in 2002 ratifying emissions reduction with different targets per Member States. For agriculture, CO₂, nitrous oxide (N₂O) and methane (CH₄) are the main involved gas. Kyoto Protocol also rules accounting of carbon sequestration realised by agricultural soils as described in Article 3.4 (additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories). Activities that can be considered are "*cropland management*", "*grazing land management*" and "*revegetation*" since they are human-induced. Furthermore, the European Commission communication "Towards a Thematic Strategy for Soil Protection" (CEC, 2002) highlighted the need of a thematic strategy for soil protection, with different objectives, as protecting soil in its role in storing CO₂. According to this communication a scientific soil catalogue considering soil characteristics and recommendation for its conservation and sustainable use should be implemented.

Waiting for the implementation of such strategy, there are some legislative acts already in force at international and national level ruling soil protection. Agricultural land can, in fact, be the final destination for several material of bio-organic nature, so that legislation is required to prevent polluting phenomena.

The utilisation on land of sewage sludge from wastewater treatment of domestic, urban, or industrial origin, is ruled by the Directive 86/278/EEC (whereas management issues - transportation, storage, treatment, etc. - are ruled by the Decree n. 22/1997). Furthermore at national level the Decree 11 November 1996 n. 574 *New rules on agronomic utilisation of sludge generated in olive grinding process* rules the quantity and the modality to spread such materials on land.

Referring to existing legislation on water, concerns are mainly on prevention of water pollution from nitrates of agriculture origin. Main legislative acts are Directive 91/271/CEE concerning the treatment of urban wastewater and Directive 91/676/CEE on prevention of water pollution from nitrates of agriculture origin. The latter provides the identification of areas vulnerable to nitrates, defining also the good practice code (DM n. 86, 19 April 1999). The issue of prevention of water pollution from chemical substances is addressed by a certain number of Directives as the Dangerous Substances Discharges Directive (86/289/EEC), and as the Drinking Water Directive (80/778/EEC as amended by Directive 98/83/EC), which defines the maximum concentration in water for any single pesticide. Lately the Water Framework Directive (60/200/EC) set out a "strategy against pollution of water". As a consequence the first list of priority substances, including plant protection products, to assess and monitor has been adopted through decision 2455/2001/EC and secondly a proposal for a new Directive to prevent groundwater from pollution has been adopted (COM(2003)550).

³ Doc. 2002/358/EC. Council Decision of 25 April 2002, referring to the adoption of the Kyoto Protocol as annex to the framework UN Convention on Climate Change and the implementation of the involved measures.

2.3 Policies for a sustainable development

The sustainable development concept, taking place recently at European level, refers to the definition adopted by the World Commission on Environment and Development (The World Commission on Environment and Development, 1987) at the beginning of the 80s, and based on analysis run on existing relationship between development and the related environmental risk.

In the report written by the Commission, *development* is defined *sustainable* when satisfies the needs of today alive humans without compromising the possibility of future generations of satisfying theirs. In this sense, time is taken into consideration in terms of needs to meet at present and in the future, and in terms of capital (human, economic and social) that can be used in different combinations to satisfy such needs.

All the dimensions included (the economic, social, environmental and institutional one) in the sustainability concept have to be described and monitored over time and space in statistical terms. Referring to very complex concepts an effort to integrate different issues and sectors and different data sources is necessary.

The United Nations Commission on Sustainable Development is the first of all organisms that faced the problem of indicator definition on this subject (UNCSD, 1996). This Commission was settled in 1992 following the United Nations Conference on environment and development held in Rio de Janeiro, in order to monitor the implementation of such agreements at local, national and international level.

The European Council agreed 'a strategy for sustainable development which completes the Union's political commitment to economic and social renewal, adds a third, environmental dimension to the Lisbon strategy and establishes a new approach to policy making' in the Gothenburg summit (June 2001). This strategy focuses on four main areas: combating climate change, ensuring sustainable transport, addressing threats to public health, and managing natural resources more responsibly. In the Communication from the Commission (COM(2001)264 final "A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development") the main threats to sustainable development are identified. Among others, the ones related to agriculture sector are: emissions of greenhouse gases from human activity causing global warming; the longer-term effects of the hazardous chemicals in use; threats to food safety; the loss of bio-diversity, which has accelerated recently; waste volumes continuously growing - even faster than GDP -; soil loss and declining fertility are eroding the viability of agricultural land.

A further document issued by the Commission was released at European Council hold in Seville - in preparation for the Johannesburg Summit – entitled *Towards a global partnership for sustainable development* [Doc. COM(2002) 82 final], that complements the previous document by adding a new external dimension to the ones already drawn up.

Policy also exploited sustainability issue in relation with agriculture activity. A specific action on this sector was promoted through the Commission Communication Directions towards sustainable agriculture [COM(1999)22final], where it has been stated that policies are required to develop EU agriculture on a sustainable path, ensuring an agricultural model which is environmentally sound, economically viable and socially acceptable. Diversification of the economic activities should be considered, also including tourism related activities, and farming should contribute to the maintenance of a viable rural community.

3. Statistics demand arising from legislative initiatives

Statistical demand on agrienvironmental issue can be generated from the political agenda or from the scientific system to deepen knowledge on spreading of environment related phenomena, not covered by legislation.

Referring to policies, the first pillar of the CAP defines monitoring activity for financial tracking purpose only, without reference to agrienvironmental issues, whereas for Rural Development a list of indicators has to be identified and compiled in order to assess implementation of policies at local level and evaluate impacts generated. Agrienvironmental issues are covered by rural development regulation, thus statistics and indicators have to be produced on this matter.

On the contrary, environmental policies are more stringent in terms of reporting activities to undertake, through definition of targets to achieve. In this case monitoring of progresses made towards goals is necessary and data inventories are implemented to produce statistical figures.

As already mentioned, the legislation on gaseous emissions affects agricultural activities.

Referring to NH₃, emission there are different reporting obligations arising from:

- the NEC Directive⁴ (as for the national inventory and emission projections and the national programme on air emissions). Methodologies to use are the ones defined in the EMEP/CORINAIR Atmospheric Emission Inventory Guidebook;
- the IPPC Directive⁵ (as for the creation of the European Pollutant Emission Register - EPER).

Referring to Greenhouse Gas emission, reporting obligation arises from:

- the UNFCCC⁶ (National Greenhouse Gas Inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol have to be implemented; activities involved are the annual reporting of national greenhouse gas inventories and the annual review of the inventories).

Carbon sequestration in agricultural soils is accountable under Article 3.4 of the Kyoto Protocol (additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories). The Marrakech Accord agreed at COP7 in November 2001 sets legally binding guidelines for reporting and accounting for agricultural carbon sinks. Furthermore the European Commission communication “Towards a Thematic Strategy for Soil Protection” [COM(2002)179] requires the definition and implementation of a scientific soil catalogue, including the nature of the soil, its biography, etc.

Legislation on statistics production, at EU level, making data production mandatory, refers to generation and management of waste (Regulation n. 2150/2002/EC), and to the sustainable use of plant protection products - still at a proposal phase –. In the following a brief review on such matter is presented.

⁴ APAT (Agency for the Protection of the Environment and for Technical Services), with the support of the national Research Centre on Animal Production, prepares required data sets.

⁵ The National Emission Register in Italy has been created by APAT.

⁶ The institution in charge of reporting in Italy is APAT.

3.1 Waste statistics regulation

Recently the Regulation 2150/2002/EC on Waste Statistics (WStatR) has been adopted to provide a legal basis for the collection of complete statistical data on generation and management of waste from businesses and private households in the Community.

The regulation contains two Annexes: Annex I refers to waste generated by households and economic sectors including waste arising from recovery and/or disposal operations; Annex II defines the list of recovery and disposal operations for which data have to be produced, according to the Waste Framework Directive (75/442/EEC). In compiling the statistics, Member States (MS) shall observe the mainly substance-oriented Waste Statistical nomenclature (EWC-Stat Rev. 3, Commission Decision 94/3/EC), having a direct connection with the European List of Waste which is a process oriented waste nomenclature.

Statistics have to be produced with reference to some aggregated categories, that are different for generation (reported in Annex I of the Regulation n. 574/2004⁷), and for recovery and disposal (reported in Annex II of WStatR)⁸. Data coming from MS according the Annexes of the WStatR will provide an overview of waste lifecycle starting from its generation to its final destination.

During the adoption process of the Regulation in Council and in the European Parliament it was decided to have pilot studies on new and difficult areas in the field of waste statistics and the agriculture, hunting and forestry and fishing was defined as a main area.

In the last year, Istat carried out a pilot project⁹ - specifically for NACE sector A and B - titled “*Methodological approach for statistics on waste generated in Agriculture, Forestry and Fishing*” analysed the phenomenon of waste generation and management in agriculture, hunting, forestry and fishing, in order to draw up a framework in which tools for data compilation can be implemented. The final report of this project contains also a brief review on the legislative content, to which we remind for further details (Istat, Bellini G., Cammarrota M., 2004).

Referring to agriculture, information demand arising from the WStatR requires MS an effort for:

- defining waste generated per sector, specifically for NACE A and B sector;
- establishing the proper waste allocation to the generating economic activity even when the holdings run more than one economic activities;
- describing adopted waste treatment methods;
- defining proper statistical methodologies to quantify waste.

3.2 *Thematic strategy on the sustainable use of pesticides*

Regulation proposal for release of statistics on lists of authorised PPPs, sale and use, per country, is under discussion in the DG AGRI and has been recently presented at the CPS

⁷ As since 1 January 2002 the European Waste Catalogue was repealed and replaced by the List of Waste (LoW, Commission Decision 2000/532/EC, amended by Commission Decision 2001/118/EC), after the coming into force of the Regulation a revision of Annex III and Annex I has been conducted by Eurostat. The Commission Regulation n. 574/2004 amends Annexes I and III of the Regulation 2150/2002. In more details, Annex I of this new Regulation replaces Annex I, Section 2(1) of Regulation 2150/2002 while Annex II of this new Regulation replaces Annex III of Regulation 2150/2002. While this new Annex I integrates the list of waste categories for which statistics have to be produced, the new Annex II replaces the previous *Waste Statistical Nomenclature* with a *Table of equivalence*. This Table of equivalence defines the relationship between the substance oriented waste statistical nomenclature (EWC-Stat Rev. 3) and the European List of Waste (LoW) established by Commission Decision 2000/532/EC. The legal obligation to revise Annex III of the Regulation 2150/2002 was also used to address other technical issues and to improve the coherence between LoW and EWC-Stat.

⁸ In the last months some modifications were made to Annex II of the WStatR accordingly to the changes defined in the Commission Regulation n. 574/2004 for Annexes I and III. In more detail the number of waste categories for the recovery and disposal operations has been revised. The Draft Commission proposal of this new Annex II has been adopted in the SPC meeting on 18 November.

⁹ The project was funded by European Commission

meeting. As stated in the 6EAP measures have to be taken for reduction in use of toxic substances – such as pesticides - and more appropriate techniques to distribute them have to be adopted. Pesticide is a generic term to indicate the substance or the product that kill pests, whether used in agriculture or for other purpose. Pesticides include both ‘*plant protection products*’¹⁰ (PPP), as defined in Article 2 of Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market, and ‘*biocidal products*’¹¹, as defined in Article 2 of Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market. In the following the term PPP will be used instead as legislation in preparation refers to it.

The “*Thematic strategy on the sustainable use of pesticides*” [COM(2002)349 final] has been thus developed in order to reduce impact on human health and the environment. Main objectives are the following:

- minimising the hazards and the risks associated with pesticides use,
- improving controls on the use,
- reducing levels of harmful substances,
- encouraging the use of low-input or pesticide-free crop farming,
- to establish a system to report and monitor progress, including development of appropriate indicators.

Given the existing legislation on authorisation of active substances and the identification of maximum residue levels on food and feedstuff, the idea is to develop a monitoring system that can fill the gap between the first phase and the last one, in the pesticide lifecycle, focusing on use. The thematic strategy underlines trends in use of PPPs, which is still increasing despite policy integration process with environment issues, showing risks associated with production and use of such substances for direct or indirect exposure. It is also underlined which are the lack in knowledge such as, in the indirect exposure case, the effects on specific population target group such as children or elderly, that should be studied specifically, and the potential cumulative effects of different PPPs. Referring to environment spray drift, leaching or run-off, these are identified as causes of uncontrolled dissemination of PPPs that can lead to soil and water pollution. Other causes of pollution can be caused by cleaning of containers and equipments after application, as illegal disposal of PPPs or containers. Biodiversity can also be affected by PPPs use. Such negative effects can be reduced by respect of good application practices, through technical inspection of distribution equipment, by the spreading of new PPPs soluble containers, the introduction of a system of safe collection and destruction of PPPs containers and unused products, a system of weather and pest forecast, and a system of training for farmers, supporting the adoption of low-input or PPPs free farming technique.

As previously described, policies directed to prevent such polluting effects are, among others, the Drinking Water Directive (80/778/EEC) and the Water Framework Directive (2000/60/EC), which set out a “strategy against pollution of water”, together with the already mentioned agri-environmental measures integrated in the sectoral policy with the CAP reform process. This Directives identifies substances to monitor and establishes active substances concentration thresholds to classify the water chemical status.

Instruments for monitoring progresses done are statistics and indicators, thus, beside indicators included in the Irena list (some referring to driving factors, pressures and actual or

¹⁰ PPP are active substances and preparations containing one or more active substances that are used to protect plants or plant products against harmful organisms or prevent the action of such organisms. They can be used in different economic sectors.

¹¹ Biocides are active substances and preparations that are used to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect of pests in non-agricultural sectors. Since some overlapping may occur legislation clarify differences between the two categories.

potential PPPs concentration in soil and water), a proposal for a regulation of the European Parliament and of the Council on pesticides statistics is under discussion (CPS 2004/54/11/en). Main issues are production and delivering of statistics on list of authorised PPPs, sale and use of PPPs per economic sector (Agriculture, Horticulture, Forestry, Uses in public areas, Gardening and use by amateurs, Other sectors of use) and per active ingredient. The regulation will provide indication for the coverage of statistics, the reference period, the periodicity for results transmission to the Commission, and the criteria to depict the quality report. The authorised PPP list, sale and use should have different periodicity (biannual for the list, yearly for sale, every five years for use with a medium term assessment on the most important crops or activities covering 80 % or more of all uses).

In all cases the reporting unit is in weight of active substances contained in PPPs. For this purpose a harmonised list of active substances list, based on the chemical family they belong to, has been prepared.

4. Statistics demand arising from International Organisms

Statistics demand, to monitor achievement of defined targets or to show progresses in the integration of environment related issues in sectoral policy, is organised in indicator lists defined at international level. These lists might have been originated for different reasons and targets, thus overlapping among indicators can be partial or complete, but not necessary. Therefore it is important in indicator development and implementation process to bear in mind which are the main goals to achieve and which are the existing indicators in order to make harmonization possible.

In the following the main conceptual frameworks, DPSIR and sustainability schemes, and the related indicators lists are presented, in some cases showing indicators overlapping.

4.1 The DPSIR conceptual model and related lists

Environmental phenomena are for their peculiar nature complex. Reasons for this complexity arise for their origin, for the modalities with which they arise and for the relationship with the territory. The knowledge on the existing relationships, in terms of flows of energy and materials, in the bio-sphere and in the techno-sphere is the first step in phenomenon analysis and for the promotion of programme and actions for the environment protection. The events occurring in the bio-sphere develop according to circles which are basically closed, whereas the actions referring to the techno-sphere imply the use of natural resources coming from the biosphere, mainly to produce goods, and releasing at the same time residues that in turn modify the chemical and physical composition of the receiving media.

At international level the conceptual model to describe such relationships was defined by OECD first and then integrated by the European Environmental Agency. This scheme is known as DPSIR (Driving forces, Pressures, State, Impacts, and Responses). It includes *driving forces*, the activities or contexts that are responsible of pressure on the environment; *pressures*, exerted on environmental media that refers to the abovementioned flows and able to change the state - in qualitative and/or quantitative terms - of environmental resources; *impacts* are thus originated and due to changes in state; the cycle closes with *responses*, that public and private actors apply to prevent damages and/or restore adequate environmental conditions, which in turn will start a new cycle.

According to this framework, agriculture activity is a production process located in the technosphere. This activity modifies in diverse way the biosphere compartments (soil, air,

water), both at local and global level, modifications that depend on several factors and particularly on how farming activity is conducted. In Table 4.1 the DPSIR scheme is presented, showing related relevant components.

Table 4.1 - DPSIR scheme for agriculture sector

DRIVING FORCES	ECONOMIC AND SOCIAL FACTORS	Financial farm resources, Public policy, Technology available, Socio-cultural context, Population
	ENERGY USE	
	FARMER BEHAVIOUR	Farming practices
	ENVIRONMENTAL FACTORS	Agri-ecosystem, Meteorology, Events random
PRESSURES	EMISSIONS	
	NATURAL RESOURCES USE AND OTHER INPUT	Soil, water, nutrients, plant protection product, etc.
STATE	ECOSYSTEM	Biodiversity, Habitat, Landscape
	NATURAL RESOURCES	Soil, Water, Air
IMPACTS	GLOBAL ENVIRONMENT	Habitat and Biodiversity, Natural Resources
RESPONSES	CHANGES IN FARMER' BEHAVIOUR	
	MARKET SIGNALS	
	CHAIN PRODUCTION RESPONSES	
	CONSUMER REACTION	Changes in nutritional habit
	PUBLIC POLICIES	Changes in: Regulations, Economic instruments, Information and education, Research and development, Agricultural policies

4.1.1 ESEPI

The actions defined in the 5th EC Environment Action Programme¹², titled *Towards Sustainability*, for the integration of the environmental issues into the economic policies have been implemented thanks to the European Commission Communication COM(94)670, in which knowledge tools for the actions implementation are identified. The European System of Environment Pressure Indices (ESEPI), aimed at describing in physical terms the pressure generated by human activities on the environment for each environmental issue, represents the operational synthesis. Referring to pressures, the scheme is applied at six economic sectors, including agriculture, and ten different environmental themes, identified on the base of the issue areas on which environmental policies refer to. The themes are: air pollution, climate change, biodiversity loss, marine environment and coastal zones, ozone layer depletion, resource depletion, toxic substances dispersion, urban environmental problems, waste, water pollution and water resource.

The projects, organised according to three modules, made possible ESEPI realization (Jesinghaus J., PIP Project, 1996). The modules are as follows:

- “Environmental Pressure Information System” projects (EPIS), with the objective of preparation of an information system that can provide the environmental pressure indicators required integrating physical and economic data;
- “Pressure Indicators Pilot Projects” (PIP), with the objective of identifying the “demand” for indicators, making reference to the different “environmental problem areas”;

¹² <http://europa.eu.int/comm/environment/actionpr.htm>

- “Sectoral Infrastructure Projects” (SIP), with the objective of keeping in mind the demand, to identify the “supply” of indicators, making reference to the different sectors.

The PIP at first identified a very wide indicators list, which was reviewed in order to include only the priority indicators. In 1999, results of the project *Towards a European System of Environmental Pressure Indicators and Indices* (TEPI) have been published, which included 60 pressure indicators, six for each environmental theme, and not always a direct relationship exists with the economic sector responsible for it.

Following the realisation also of the SIP projects, a final study “Environmental Pressure Indicators – Sectoral Indicators Project: harmonisation of the SIP results” (Istat, *In press*) was carried out to identify a univocal list. Lists of indicators identified with the TEPI report or evaluated by SAG were also taken into account. The criterion adopted to select a limited and significant group of pressure indicators per sector of activity was the relative importance with respect to the “environmental indicators area” and the sectors considered. Referring to selecting criteria, it is important to recall that the former lists of indicators were identified in relation with analytical soundness, political relevance, and elasticity of response of the indicator itself.

In the following the list considered for agriculture sector is reported (Table 4.2). According to this approach only indicators referring to pressures or to driving forces have been identified per environmental problem area.

In more general terms the identification of an indicator list represents a way to better define the basic information needs, and the more they are simple and keep separated different acting pressures the more this data demand is clear. There is thus a general tendency to avoid synthetic indices for whose interpretation ancillary information might be necessary, making phenomenon analysis more complicated.

Table 4.2 – Indicator list defined for the agriculture sector

Environmental problem area	Indicator	DPSIR classification
AIR POLLUTION	Emissions of nitrogen oxides (NOx)	Pressure
	Emissions of non-methane volatile organic compounds (NMVOC)	Pressure
	Emissions of particles	Pressure
	Emissions of ammonia (NH3)	Pressure
CLIMATE CHANGE	Emissions of methane (CH4)	Pressure
	Emissions of carbon dioxide (CO2)	Pressure
	Emissions of nitrous oxide (N2O)	Pressure
	Emissions of nitrogen oxides (NOx)	Pressure
	Emissions of aerosol particles	Pressure
	Emissions of carbon monoxide (CO)	Pressure
LOSS OF BIODIVERSITY	Protected area loss, damage and fragmentation	Pressure
	Wetland loss through drainage	Pressure
	Agriculture intensity: area used for intensive arable agriculture	Driving force
	Clearance of natural & semi-natural forested areas	Pressure
	Change in traditional land-use practice	Driving force
	Pesticide use on land	Pressure
	Loss of forest diversity – increase in exotic monoculture	Pressure
	Increase in cultivations of hybrid cultivars	Pressure
	Loss of genetic resources	Pressure
MARINE ENVIRONMENT	Eutrophication (amounts of nitrogen and phosphorus introduced into waters)	Driving force
	Fishing pressure	Pressure

	Wetland loss in coastal zones	Pressure
	Discharges of halogenated organic compounds	Driving force
	Faecal pollution	Pressure
OZONE LAYER DEPLETION	Emissions of carbon dioxide (CO ₂)	Pressure
	Emissions of nitrous oxide (N ₂ O)	Pressure
	Emissions of methyl bromide (CH ₃ Br)	Pressure
	Emissions of methane (CH ₄)	Pressure
RESOURCE DEPLETION	Nutrient-balance of the soil (nutrient input/ nutrient output)	Pressure
	Timber balance (new growth/harvest)	Pressure
	Exceedance of fish catch quota	Pressure
	Use of energy (total quantity)	Driving force
	Water consumption (total quantity)	Driving force
	Ground water abstraction for agricultural purposes	Pressure
	Surface water abstraction for agricultural purposes	Pressure
DISPERSION OF TOXIC SUBSTANCES	Soil erosion	Pressure
	Consumption of pesticides by agriculture	Pressure
	Emissions of persistent organic pollutants (POPs)	Pressure
WASTE	Index of heavy metals emissions to water	Pressure
	Hazardous waste (according to the directive 91/689/EWC)	Driving force
WATER POLLUTION AND WATER RESOURCES	Waste from agriculture	Driving force
	Pesticides used per hectare of utilised agriculture area	Pressure
	Nutrient (N+P) use (eutrophication equivalents) MS – SIP	Driving force
	Emissions of organic matter as BOD	Pressure
	Emissions of heavy metals, by metal	Pressure
	Ground water abstraction	Pressure
	Surface water abstraction	Pressure
Water used	Pressure	

Source: Environmental Pressure Indicators – Sectoral Indicators Project: Harmonisation of the SIP results contained in Istat, in press publication titled “Contabilità ambientale e “pressioni” sull’ambiente naturale: dagli schemi alle realizzazioni” (Costantino, Femia, Tudini).

4.1.2 The Irena Project

The Irena (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy) project has been launched in year 2001 following the European Commission Communications COM(2000)20 *Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy*, COM(2001)144 *Statistical Information needed for Indicators to monitor the Integration of Environmental concerns into the Common Agricultural Policy* were published.

The project is coordinated by EEA and other partners involved are DG AGRI, DG ENV, Eurostat and the Joint Research Centre. Thus Commission’s services started the statistical work to develop indicators, identifying proper indicators and related definitions, also identifying available and exploitable data sources or data collection methods, implementing methodologies. This work, done at European level involving - through Eurostat activity - MS, would guaranty harmonisation and comparability of the developed indicators among the MS

themselves. The related final report “[Agriculture and environment in the EU-15: the IRENA indicator report](#)”¹³ (EEA, 2005) is ready.

It is important to remind main aims of the work undergone and the criteria adopted for choosing agrienvironmental indicators.

As stated in COM(2001)144 “a solid set of indicators is needed: i) to help monitor and assess agri-environmental policies and programmes, and to provide contextual information for rural development in general; ii) to identify environmental issues related to European agriculture; iii) to help target programmes that address agri-environmental issues; iv) to understand the linkages between agricultural practices and the environment.

The main criteria for choosing agri-environmental indicators are: a) *policy-relevance* –address the key environmental issues; b) *responsiveness* –change sufficiently quickly in response to action; c) *analytical soundness* – based on sound science; d) *measurability* – feasible in terms of current or planned data availability; e) *ease of interpretation* – communicate essential information in a way that is unambiguous and easy to understand; f) *cost effectiveness* – costs in proportion to the value of information derived.” For each indicator the level of development is indicated through a classification which ranges from *a* to *d*. The group (a) contains indicators for which statistical data to implement them are immediately identified, for indicators in group (b) statistical work might require integration of data coming from different sources, group (c) contains indicators that still need further analysis in order to better define them, and in group (d) indicators are the ones where a deeper methodological work is needed to identify proper indicator. The identified indicators are also classified according to DPSIR scheme. Nevertheless the final indicator classification, depending also on changes occurred during project development, can have been changed. In fact the deepening occurred in indicator analysis revealed that for some of them the reference category needed to be changed, sometimes with an upgrade, in other cases with a downgrade, depending on the phenomenon and on availability of data sources and calculation methodology.

For each indicator a fact sheet a methodology/data fact sheet or an indicator fact sheet has been produced.

Problems encountered and faced in the indicator definition and implementation process at EU level is:

- develop a better indicator definition,
- develop a methodology,
- checking discrepancies between data produced for a given country and data available at country level,
- indicator calculation and evaluation, to find a good descriptor of the investigated phenomenon, and to find an evident relationship between the indicator and the agricultural activity,
- highlight data gaps, at European and at country level.

The former indicator list, as presented in the European Commission (EC) Communication COM(2001)144, is reported in Table 4.3.

¹³ All documentation is available at EEA web site <http://webpubs.eea.eu.int/content/irena/Latestproducts.htm> or on the Eurostat CIRCA web site.

Table 4.3 – Agrienvironmental Indicator list presented in the EC Communication COM(2001)144

DPSIR reference	No.	Indicator	Definition	
Responses	Public policy	1	Area under agri-environment support	Area of farmland covered by the agri-environmental programmes under Regulation 1257/99, classified by type of activity.
		2	Good farming practice	Number of farms complying with regional standards of good farming practice.
		3	Environmental targets	Definition to be developed
		4	Nature protection	Area and percentage of farmland subject to such restrictions, classified by type of farmland.
	Market signals	5.1	Organic producer prices	Index of the relationship between the prices of organic products and those of conventional products
		5.2	Agricultural income of organic farmers	Economic results of organic farms compared to similar sized farms in the same area.
	Technology and skills	6	Holders' training levels	Agri-environmental training of farmers
Attitudes	7	Organic farming	Area under organic farming	
Driving forces	Input use	8	Fertiliser consumption	Fertiliser use by crop and by region.
		9	Pesticide consumption	1) Index of pesticide use, weighted to take into account different types of toxicity and use patterns, etc. 2) Pesticide use, classified according to intrinsic characteristics e.g. toxicities to non-target species, long term effects, persistence in the environment, etc.
		10	Water use	Use of water per €1000 output of irrigated crops.
		11	Energy use	Annual use of energy, by fuel type (i.e. petroleum products, electricity, natural gas).
	Land use	12	Topological change	An inventory of developments classified by type and location.
		13	Cropping/livestock patterns	The share of each holding in each category of the typology, (typology of agricultural practices and strategies to be developed)
	Management	14	Management practices	Definition to be developed
	Trends	15	Intensification/extensification	Only an example is given, the relation between livestock numbers and fodder areas
		16	Diversification	Importance of different categories in the Community Typology. Proportion of farmers with other gainful activities. Ratio of farmers' agricultural/non-agricultural incomes.
		17	Marginalisation	State and evolution of the density of farms with and without successors.
Pressures	Pollution	18	Surface nutrient balance	The soil surface nutrient balance is defined as total nutrient input (organic and mineral fertilisers, atmospheric deposition, fixation by leguminous crops) minus the uptake by crops (including removals by grazing).
		19	CH ₄ emissions	Aggregated annual agricultural emissions of CH ₄ , N ₂ O and CO ₂ , weighted by global warming potential.
		20	Pesticide soil contamination	Definition to be developed
		21	Water contamination	Definition to be developed
	Resource depletion	22	Ground water abstraction/water stress	Annual amount of ground water pumped directly by farmers from ground water sources.
		23	Soil erosion	Location and estimation of the amount of topsoil loss and maps of soil erosion risk. Land cover and agricultural practices in areas at risk.
		24	Land cover change	Matrix of changes in LC classified by type and size.
	Benefits	25	Genetic diversity	1) The total number and shares in production of main crop varieties/ livestock breeds and 2) The number of national crop varieties/livestock breeds that are endangered.
		26	High nature value areas (HNVA)	Definition to be developed
27	Renewable energy sources	Area and volume of production of coppice woodland and of oilseed crop intended for production of biodiesel.		
State	Biodiversity	28	Species richness	Monitoring species linked to typical agricultural habitats
	Natural resources	29	Soil quality	Agricultural areas where there is a mismatch between soil capability and the actual or impending land-use.
		30	Nitrates/ PPPs in water	Definition to be developed.
		31	Ground water levels	Definition to be developed
Landscape	32	Landuse matrix	Number and diversity of memorable elements visible. (To be refined)	
Impact	Habitats and biodiversity	33	Habitat and biodiversity	Density of linear elements and diversity of land cover at the level of the holding.
	Natural resources	34.1	GHG emissions	Greenhouse gas emissions by economic sector.
		34.2	Nitrate contamination	Nitrogen emissions to water by economic sector.
		34.3	Water use	Water use by economic sector
Landscape diversity	35	Agricultural and global diversity	Indices of overall and of agricultural diversity and of their evolution through time.	

CLC: Corine Land Cover

FSS: Farm Structure Survey

PESERA: Pan-European Soil Erosion Risk Assessment

Lucas: Land Use/Cover Area frame Statistical survey

ECPA: European Crop Protection Association (Industry)

PEARL: Pesticide Emission Assessment at Regional and Local scales

PPP: Plant Protection Products

4.2 Sustainability framework and related indicator lists

The organisational framework chosen for selecting the indicator list on sustainability was drawn from the one discussed during the 9th session of the Commission on Sustainable Development (CSD) of the UN. Moving from a driving force-state-response approach they finally adopted the one focusing on themes and sub-themes of sustainable development. This approach revealed to be more appropriate to assist national policy decision-making and performance measurement by focusing on relevant policy issues.

Issues covered by theme and sub-theme are reported in table 4.4, as defined by the Commission Communication - upon Council request - in the *Report from the commission to the council, analysis of the 'open list' of environment-related headline indicators* [COM(2002) 524 final].

Table 4.4 - Theme and sub-theme scheme for sustainable development indicators

THEME	SUB-THEME
1. Economic development	Investment Competitiveness Employment
2. Poverty and social exclusion	Monetary poverty Access to labour market Other aspects of social exclusion
3. Ageing society	Pensions adequacy Demographic changes Financial stability
4. Public health	Human health protection and lifestyles Food safety and quality Chemicals managements Health risks due to environmental conditions
5. Climate change and energy	Climate change Energy
6. Production and consumption patterns	Eco-efficiency Consumption patterns Agriculture Corporate responsibility
7. Management of natural resources	Biodiversity Marine ecosystem Fresh water resources Land use
8. Transport	Transport growth Social and environmental impact of transport
9. Good governance	Policy coherence Public participation
10. Global partnership	Globalisation of trade Financing for SD Resource management

Source: COM(2002) 524 final

On the other hand, an indicator framework has been developed also for the sustainability of the agricultural activity. The Commission Staff working paper "Framework for Indicators for the Economic and Social Dimensions of Sustainable Agriculture and Rural Development" (SEC(2001)266) depicts such framework that outlines linkages between different dimensions.

The key issues of sustainability are the maintenance of a certain level of capital stocks (natural, human and man-made capital) as well as achieving efficiency and equity.

Maintenance (protection, renewal) of a combination of stocks (natural, human and man-made) to sustain wellbeing can be done according to different criteria which refer to weak or to a strong sustainability. The *weak* approach implies that different forms of capital can substitute each other which are enough to maintain the total capital, whereas the *strong* one requires the conservation of total capital and of specific components i.e. natural capital must be kept constant or natural capital must be maintained according to carrying capacity or resilience rules.

Sustainability requires the combination of efficiency conditions and inter-generational and intra-generational equity. The inter-generational equity stresses that the use of resources should generate a welfare today that is not at the detriment of future welfare (the essence of the sustainability-definition in the Brundtland report), whereas the intra-generational equity would consist in the possibility for all members of all societies to access to resources, reaching a certain level of wellbeing.

4.2.1 Sustainable Development Indicators

Lately European strategy towards a sustainable development has been characterised by several Councils defining framework and policy content and tools to monitor involved phenomena. At first (March 2000), the Lisbon Council identifies the goal of an economy “knowledge based” with a growing attention to social cohesion. In order to evaluate progresses towards this objectives the Annual Report was set up, based on a shared list of “Structural Indicators”. The Nice Council (December 2000) focused on the relevance of social protection goals, thus improving the indicators identified on poverty and social exclusion area. Stockholm Council (March 2001) stresses the necessity to report on progresses towards Lisbon goals through a properly defined set of indicators. Finally Gothenburg Council (June 2001) defines the strategy for a sustainable development adding the environmental dimension as new pillar of the Lisbon strategy. Thus, in the spring report of Barcelona (March 2002), the structural indicators are presented with the inclusion of the ones on environmental issues.

In order to monitor policy implementation and effectiveness towards defined targets a task force has been set up at Eurostat level by the Statistical Programme Committee to develop a common response to the need for indicators on sustainable development (SDI) (CPS 2004/54/11/en.) taking into account the developing process undergone.

Nevertheless it was agreed that selected indicators were not yet adequate and the Commission upon Council request released the *Report from the commission to the council, analysis of the ‘open list’ of environment-related headline indicators* [Doc. COM(2002) 524 final] in which the ‘open list’ of indicators defined by the Council was analysed, and data and methodology availability were assessed¹⁴.

The list of indicators has been identified adopting a scheme developed in a hierarchical structure with three different level: 1st level refers to the theme and headline indicators are identified, the second level refers to the sub-theme and indicators also have been identified for the related sub-sections, than a third level is available with a more detailed list of indicators.

In the indicator identification process, one of the problems encountered was the proper allocation of a specific issue under the proper theme. In fact, many of the issues of sustainable development can be seen as belonging to more than one theme. Main effort was thus put into

¹⁴ In this document the indicators have been classified according to a feasibility scale, from group 1 - the most feasible - to group 4 - the least feasible one -.

a univocal indicator classification, in order to avoid duplication, trying to better defining boundaries between themes.

From the preliminary list of indicators (SDI/TF/44/04 Rev. 6, 2004), an extract has been realised selecting issues and indicators related to agriculture for the purpose of the present project (table 4.5).

Table 4.5 - List of agriculture related Sustainable Development Indicators

Theme (Level I)	Sub-theme	Level II	Level III	Headline Objectives in the EU SD Strategy (SDS) Presidency conclusions of European Council (EC) Plan of Implementation (PoI) 6th Environmental Action Programme (6EAP)
PUBLIC HEALTH [.....]	FOOD SAFETY AND QUALITY	3. Pesticide residues in food 3a. Pesticide residues in products of plant origin	[.....]	SDS: Make food safety and quality the objective of all players in the food chain. 6EAP: Reduce impacts of pesticides on human health and environment; achieve a more sustainable use of pesticides, a significant overall reduction in risks and use of pesticides consistent with the necessary crop production.
	CHEMICALS MANAGEMENT	4. Chemical index	8. Occupational diseases caused by certain chemical agents	SDS: By 2020, ensure that chemicals are only produced and used in ways that do not pose significant threats to human health and the environment. 6EAP: Dangerous chemicals (especially PBTs) should be substituted with the aim of reducing risks to man and the environment (ground and surface water, air quality).
CLIMATE CHANGE AND ENERGY	CLIMATE CHANGE	1. GHG emissions by sector¹⁵	1. CO ₂ intensity of energy consumption 2. Losses caused by extreme weather conditions (insurance payouts) 3. CO ₂ removed by sinks	SDS: Meet the Kyoto commitment. However, Kyoto is but a first step. Thereafter, the EU should aim to reduce atmospheric greenhouse gas emissions by an average of 1% per year over 1990 levels up to 2020.
	ENERGY	3. Final energy consumption by sector¹⁶	4. Share of renewable energy (including indicative targets), by source 8. Consumption of biofuels, as a % of total fuel consumption in transport	EC Brussels2003: (revised SDS objective) Increase the share of renewable energy with a EU-wide indicative target for renewable energy of 12% of primary energy needs and 21% of electricity needs by 2010. Promotion of 5,75% target for the use of biofuels in transport by 2010.

¹⁵ According to the sectors defined by the Inter-governmental Panel of Climate Change (IPCC).

¹⁶ According to sectors applied in the EU energy statistics.

PRODUCT ION AND CONSUMP TION PATTERN S	AGRICULTURE	5. Nitrogen surplus	8. Livestock density index 9. Share of organic farming 10. Use of selected pesticides	<u>SDS</u> : The CAP should contribute to achieving sustainable development by encouraging healthy, high quality products, environmentally sustainable production methods, including organic production, renewable raw materials and the protection of biodiversity.
MANAGE MENT OF NATURAL RESOURC ES	BIODIVERSITY	1. Sufficiency of Member States proposals for protected sites under the EU Habitats directive	<i>1. Change in status of threatened and/or protected species</i>	<u>SDS</u> : Protect and restore habitats and natural systems and halt the loss of biodiversity by 2010. <u>6EAP</u> : Conservation of species and habitats with a special concern of preventing habitat fragmentation. Ensure that the consumption of resources and their associated impacts do not exceed the carrying capacity of the environment. <u>PoI2002</u> : Achieve by 2010 a significant reduction in the current rate of loss of biological diversity.
	FRESH WATER RESOURCES	3. Fresh water abstraction as % of available resources	<i>6. Index of pesticide risk to aquatic environment</i>	<u>6EAP</u> : Ensure that the rates of extraction from water resources are sustainable over the long term. Achieve quality levels of ground and surface water that do not give rise to significant impacts on and risks to human health and the environment. <u>PoI2002</u> : Develop integrated water resources management and water-efficiency plans by 2005.
	1a. Population trends of farmland birds	LAND USE	4. <i>Land use change (Evolution of built-up, natural and agricultural land)</i> 5. <i>Exceedance of critical loads of acidifying substances and N in sensitive natural areas</i>	<i>7. Total area at risk of soil erosion</i> <i>8. Total area of soil contamination</i> <i>9. Percentage of forest trees damaged by defoliation</i>

Source: DOC. SDI/TF/44/04 Rev. 6 (2004)

Normal text = 'best available' indicator i.e. indicator expected to be available; if numbered with an 'a' then is a proxy indicator for the best needed of the same number.

Italic text = 'best needed' indicators; needed but facing problems of definition, data availability or data quality.

4.2.2 Sustainability of agricultural activity

The Council of Ministers of Agriculture required to wide the work done for agrienvironmental indicators to cover sustainable agriculture, including economic and social dimensions. The Commission Staff working paper "Framework for Indicators for the Economic and Social Dimensions of Sustainable Agriculture and Rural Development" (SEC(2001)266) tries to focus on the above-mentioned issues.

The Communication contains a proposal of indicators fields focusing only on the economic and the social dimension. The exclusion of the *ecological dimension* is due to the fact that it has been already addressed in the Communication "Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy" COM (2000) 20 (European Commission 2000a). Despite this it is stressed that progress towards sustainable development

requires that the three dimensions of sustainability and their interrelations are taken into account in the development and implementation of policies.

Common or similar indicators can be distilled from the SEC(2001)266 and the COM(2001)144 documents. In the following a selection of indicator fields has been done among the ones defined in SEC(2001)266 to highlight full or partial overlapping. Some proposals are also listed. This approach allows achieving the harmonisation of the on-going work, understanding where differences are necessary or where it's possible to identify an indicator that can be used in both data sets. Whatever solution is taken experts of the statistical and related activities sector need to be aware of.

Table 4.6 – Overlapping between SEC(2001)266 and COM(2001)144 indicator lists

SEC(2001)266			COM(2001)144 and Irena Operation	Overlapping/ Meaning/Proposal	
		Indicator field	Implementation/ Related policy indicator	Indicator	
<u>STOKS</u>	HUMAN CAPITAL	Age structure of agricultural labour force (male, female)		Ind. 17 Marginalisation	<i>Share of holders aged >= 55 years was considered a factor affecting farms viability</i>
		Agricultural holders' training levels (male, female)		Ind. 6 Level of the holders' training level (including on alternative production methods)	<i>Complete overlapping exists.</i>
		Agricultural education and training (including on alternative production methods)	(Training) Number of supported hours of vocational training		
	MAN MADE CAPITAL	Farmers' fixed assets outside their ag. core activity (e.g. tourism infrastructure)		Ind. 17 Marginalisation	<i>Overlapping exists in terms of meaning. In-farm pluriactivity can guaranty the viability and a more equalitarian income generation strategy.</i>
Change in farmers' fixed assets outside their ag. core activity (e.g. tourism infrastructure)					
<u>EFFICIENCY</u>	AGRICULTURAL OUTPUT (Food and non-food)	Quantity (in energy terms)	Energy embodied in output in petajoule (PJ) (energy content of feed-grain deducted to avoid double counting) 2 (domestic and Import)	Ind. 11 Energy use	<i>Overlapping exists for the part related to energy input use. Irena doesn't identify a target referring to output energy content</i>
		Infringements on residues/ contaminants legislation	(Investment aids) Gross sales of assisted quality-improved products; share of assisted products sold with quality labels Crops: UAA, UAA in	Ind. 14 Management practices	<i>Good management practices can reduce residues in food and prevent environment pollution phenomenon</i>

		Organic agriculture	conversion; animal sector: Number of farms	Ind. 7 Area devoted to organic farming	<i>Complete overlapping</i>
	<i>FOOD DEMAND</i>	Demand in petajoules (PJ) / Calorie requirements in petajoules (PJ) 3		Missing topic *	
	<i>EFFICIENCY (production)</i>	Energy efficiency	Energy embodied in output in petajoule (PJ) (energy content of feed-grain deducted to avoid double counting) / Energy embodied in non-renewable inputs (fossil fuel and electricity, fertilisers, pesticides, machinery, buildings) in petajoule (PJ) (5-year average to smooth out annual fluctuations in output values)	Ind.11 Energy use (annual use of energy per unit of production, per ha of crop, per livestock unit) *	<i>Overlapping exists</i>
	<i>COMPETITIVENESS/VIABILITY</i>	Value added	1_ Farm net value added / AWU (per region in comparison with EU-average) and other support) / AWU (per region in comparison with EU-average) 2_ Farm net value added / UAA (per region in comparison with EU-average) 3_ Total CAP-support (price and other support) / AWU (per region in comparison with EU-average) 4_ Total CAP-support (price and other support) / UAA (per region in comparison with EU-average)	Ind.1 Area under agri-environment support	<i>Partial overlapping. Indicators developed in Irena operation make calculation of several indicators included the CAP support for Area devoted to agri-environmental measures/UAA. Defining an indicator to show the share of the total CAP support devoted to agrienvironmental measures.</i>
		Composition of farm household income	Farm, farm-related, off-farm income	Ind. 5 Market signals: organic producer price premiums (refers to prices and incomes) Ind. 15: Trends: intensification/extensification, specialisation Ind. 17 Marginalisation	Farm's survival in the market can be realised in several ways, among others applying the organic production method, differentiating agricultural production, adding farm related activities such as agri-tourism.

5. Statistical activity undertaken at national level

Emerging data demand on agrienvironmental issues is a challenge for the national statistical systems. When indicator identification process is on-going, the implementation activity has to proceed in parallel in order to check feasibility and costs of the best needed indicators or, in case it becomes necessary, to find a good proxy of them. At this point, statistical activity is mainly oriented to the assessment of data availability, to data source exploitation through integration of existing survey, or through new data collection, and to develop suitable models in order to calculate them.

At Istat activity of existing surveys integration, where feasible, has been conducted recently and mainly focused on farm structure survey (FSS), whereas, for specific phenomena, an *ad hoc* surveys or analysis seemed to be necessary as the case for use of plant protection products or for water used for irrigation purpose.

Integration of FSS started with the 1998 survey with a specific section on “territory and environment” mainly focusing on farmland system structure, on soil management practices, on water, pesticide and nutrient use (EUROSTAT AE/WG/045/05.3(2003)). Then the Agriculture Census follows and most of the questions were reported, some of them with changes, mainly due to the necessity of simplifying the questionnaire and to lessen burden on respondents, and mainly oriented to shift from a “quantitative” request to a “qualitative” request (i.e. hectares ploughed with a specific tillage practice *vs* farms adopting a specific tillage practice).

In year 2002, the survey on fruit tree plantations is run and this was the occasion to deepen some particular phenomena related to use of PPPs¹⁷ (kind of equipment used, quantity of spread products and decision criteria adopted for the intervention) and of fertilisers, since the fruit tree category represent one the most spread kind of crops. The PPPs use issue has been exploited also by means of specific surveys, carried out as TAPAS actions. Several crops as vine, olive and apple trees, maize, other cereals and potatoes have been surveyed for this reason.

Lastly, FSS run in year 2003 represented the tool for collecting information on generation and management of waste and of bio-organic by-products at farm level. Most of the questions referring to agrienvironmental issues proposed in previous years were kept, adding few new ones.

Focuses on specific phenomena were done through Eurostat funded research projects as for water resources and water use in agriculture, waste generated and managed at farm level.

In the following table a list of issues covered in order to give highlights on statistical activity undergone at national level is presented.

Table 4.7 – List of theme and sub-theme covered at national level and related data source

Theme	Sub-theme	Data source
Air pollution, climate change and resource depletion and water pollution (relevant farming practices)	Livestock per category and specie	FSS Agriculture Census
	Shed characteristics	
	Manure storage	
	Manure storage characteristics (mixed and slurry only)	
	Manure treatment	
	Spreading of manure	
	Spreading of other bio-organic materials	
	Spreading of fertilisers	
	Nutrient distribution practices	
	Soil protection practices	
	Tillage practice	
Planting to avoid herbicides spreading		

¹⁷ Beside PPPs use data, statistics are also available on PPPs sale per category (fungicide, insecticide and acaricides, herbicide, biological, other and insect traps), toxicity class, and on related active substances.

	Crop rotation	
	Crop residues management	
Toxic substances dispersion, loss of biodiversity and water pollution (<i>relevant farming practices</i>)	Spreading equipment	Survey on fruit trees
	Spreading decision criterion	
	Integrated production Organic farming	Survey on fruit trees, FSS Agriculture Census
	Pest magement (area of spreading)	FSS Agriculture Census
	PPPs (area of spreading)	Survey on fruit trees FSS Agriculture Census
	Holders training level	FSS Agriculture Census
Toxic substances dispersion, loss of biodiversity and water pollution (<i>input use</i>)	Use of PPPs (per function - fungicides, insecticides and acaricides, herbicides and other products –)	Ad hoc sample survey on farms, Survey on some fruit trees
	Use of active substances	
Water resource (<i>qualitative aspects</i>)	irrigated area	FSS Agriculture Census
	irrigable area	
	irrigated area by crop type, by irrigation system	
	kind of water source (surface water, ground water, wastewater treatment plant)	
	water used for livestock's drinking purposes (basic data for estimation model)	
Waste	In farm generation and management of by-products and waste.	FSS

At first, the issue on adopted agricultural practices is faced. The importance of these practices is due to the fact that generated pressures can be mitigated enormously (in the DPSIR scheme agricultural practices are classified as *Driving forces*). Also legislation attention on such matter is growing highlighting that farmers' skills and behaviour, and technologies applied, can really make agriculture more environmentally friendly. In statistical terms, they also represent relevant parameters to take into account in some indicator estimation, as for

emissions, and might represent themselves indicators. With the overview presented becomes evident that data source exploitation undergone in Istat went beyond data requirements arising from existing indicators lists. The idea behind it was that adoption of agricultural practices is a critical issue, and monitoring is necessary.

A confirmation on such issue is given by the methodologies applied to estimate gas emissions, as ammonia (NH₃) - which is relevant for the *air pollution* environmental theme -, and carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) - which are the relevant greenhouse gases for the *climate change* issue.

Modelling, in the gas emissions estimation activity, is a quite relevant activity and basic data or emission factors might be not available and require assumption and hypothesis to be made. For NH₃ emissions calculation, animal breeding (with respect to housing, storage, manure application and grazing practice) and agricultural soils (with and without fertilizer application) are the main basic data taken into account. CO₂ emission from agricultural soils – knowing initial organic matter content – is calculated with respect to agricultural practices applied. In the estimation of the most significant greenhouse gases (CH₄ and N₂O) emissions, enteric fermentation, manure management, rice cultivation, agriculture soils, and field burning of agriculture residues are considered. Methane emissions from enteric fermentation and nitrous oxide emissions from direct agriculture soils are the most relevant source categories in this sector.

Work undertaken at Istat level tried to fill data gaps, with the support of APAT researchers, for data required in such modelling activity. In many cases data needs refer to agricultural practices - as already seen - and existing surveys on farms might be exploited for such purpose. Knowing models applied is helpful also in terms of agricultural practices indicator definition. In fact the most relevant agricultural practices are highlighted and these can in turn be identified as indicators. This process becomes evident with the IPPC directive that identifies technologies that have to be adopted in order to reduce NH₃ emission. In fact, environmental policies require monitoring of specific pressures that affect the environmental media and are increasingly focusing on specific and critical phases of the pressure generation process, which most contribute to the final total pressure. Referring to agriculture, it is necessary to identify the most critical phases that might be represented by the adopted agricultural practices. As a consequence, in the indicator definition process, we have to consider as indicators the ones describing the pressure itself – representing the priority data demand - and at the same time it is reasonable to include also the ones describing the most critical phases identified. These indicators would refer to critical agricultural practices that affect a specific pressure (i.e. gas emissions and related manure management, etc.).

Referring to natural resource use, an analysis on water use in agriculture for irrigation purpose, as agriculture represents the most water consuming economic sector, was performed showing which indicators can be calculated, referring to irrigated crops, to irrigation system adopted and to source of water exploited.

Referring to PPPs use analysis performed showed that criterion adopted to make intervention in pest management makes changes in the quantity of the toxic products used, thus such agricultural practices might be relevant to survey.

As other economic activity, agriculture contributes to generation and management of waste, a regulation has just been adopted on this matter and an evaluation of the phenomena is necessary. A pilot project¹⁸ was conducted to verify the possibility of using a sample survey

¹⁸ The project was funded by EC.

in order to monitor such phenomena. Preliminary conclusions have been drawn in the final report of the related project (for a full dissertation see document Istat – Ballin, 2004).

6. Conclusion and further work

Environment is one of the dimensions considered both in rural development and in sustainable agricultural policies. Furthermore agrienvironmental issues are tackled under different policies. Thus references to integration of environmental issues into sectoral policies and environmental targets to achieve and to the sustainability concept have been made.

Indicators are identified as main tool for monitoring phenomena, policy implementation, and progresses towards identified targets. Indicators to implement have been presented in diverse lists, and different frameworks and objectives are identified depending on the context in which the phenomena analysis is conducted.

These lists have been originated for different reasons and targets, thus overlapping among indicators can be partial or complete, but not necessary. Therefore it is important in indicator development and implementation process to bear in mind which are the main goals to achieve and which are the existing indicators in order to make harmonization possible.

Overlapping between indicators identified for relevant agrienvironmental issues and for sustainability of agriculture has been already highlighted. The same process should be undertaken with the indicators list referring to rural development, as they also cover the environmental dimension.

Indicator feasibility and compilation has to be tested in the implementation process. Data availability assessment would make evident data gaps and statistical activity would proceed on the right path in order to meet arising data demand. At national level, growing attention has been devoted to such matter and statistical information on relevant agrienvironmental issues is available. The implementation process revealed that existing indicators lists might be integrated with indicators on relevant agricultural practices, which can be easily investigated through existing surveys.

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