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### Economic Commission for Europe

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#### Joint Task Force on Environmental Indicators

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Item 3 of the provisional agenda

#### Review of selected indicators not covered by the guidelines

### Agri-environmental indicators

#### Note by the secretariat

#### *Summary*

The present note describes the latest developments regarding the production of agri-environmental indicators at the international level and presents proposals for specific indicators for consideration by the Joint Meeting. The proposals are prepared in the format that is used in the United Nations Economic Commission for Europe Guidelines on the Application of Environmental Indicators in Eastern Europe, Caucasus and Central Asia.

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## I. Introduction

1. The linkages between agricultural activities and environmental impacts are complex, reflecting biological processes, variations in natural environmental conditions, socio-economic factors, agricultural and environmental policies and changes in these policies. These linkages are further complicated due to the spatial variation in the effects of agriculture on the environment within and between different countries, and because the impact of many farming practices on the environment can be gradual and cumulative over time. This note was prepared with the assistance of Ms. Ljubov Gornaja, consultant to the secretariat.

2. Currently, the supply of quantitative information on agri-environmental linkages is inadequate. Without such information, however, governments and other users cannot adequately identify, prioritize and measure the environmental impacts associated with agriculture, which makes it difficult to improve the targeting of agricultural and environmental programmes and to monitor and assess policies.

3. The growing demand for information regarding agri-environmental relationships largely reflects the higher public priority being given to environmental improvement in agriculture. The United Nations Commission on Sustainable Development (UNCSD), for example, has requested countries to develop indicators to measure progress in reaching sustainable development, including for agriculture, a goal which emerged from the 1992 United Nations Conference on Environment and Development.

4. The Organisation for Economic Co-operation and Development (OECD) developed an overall framework and approach to establish a set of agri-environmental indicators. A pilot survey on agri-environmental indicators in OECD Member countries was conducted in 1995. Agri-environmental indicators have been used as supporting information across a range of recent OECD studies and activities. In 2008 the report *Environmental Performance of Agriculture in OECD Countries Since 1990* was launched, in which agri-environmental indicators were fully used. The list of OECD Agri-environmental indicators used in this publication is presented in annex I to the present paper. The OECD countries agri-environmental indicators time series database is available on the OECD website at [www.oecd.org/tad/env/indicators](http://www.oecd.org/tad/env/indicators).

5. Within the European Union the Irena<sup>1</sup> Operation is a joint exercise between several Commission Directorates-General (Agriculture and Rural Development, Environment, Eurostat and Joint Research Centre) and the European Environment Agency (EEA). The Irena development resulted in a set of 35 agri-environmental indicators (see annex II), relevant guidelines and data sets. The indicators are classified according to the driving force-pressure-state-impact-response, or model a causal framework for describing the interaction between society and the environment. This framework has been adopted by EEA and is an extension of the pressure-state-response model developed by OECD.

6. Many of the Irena indicators have been developed according to the specificity of the European Union agricultural policy and at present could hardly be produced by countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe.

7. The analysis of the agri-environmental indicators used by OECD and EEA has shown that some of these indicators have already been included in the Guidelines for the

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<sup>1</sup> Indicator reporting on the integration of environmental concerns into agriculture policy.

Application of Environmental Indicators in Eastern Europe, Caucasus and Central<sup>2</sup> prepared by the United Nations Economic Commission for Europe (UNECE). Some indicators could also be produced using basic statistical data collected for indicators already included in the Guidelines. Furthermore, a proposal has been made to include three additional indicators to the Guidelines: water-use intensity by agriculture, cropping and livestock patterns and gross nitrogen balance.

8. As a result, the overall list of the agri-environmental indicators recommended for use in countries of Eastern Europe, Caucasus, Central Asia and South-Eastern Asia may consist of the following thirteen indicators:

- (a) Fertilizer consumption: indicator 23 from the Guidelines;
- (b) Pesticide consumption: indicator 24 from the Guidelines;
- (c) Water-use intensity: new proposed indicator;
- (d) Energy use in agriculture: sub-indicator of indicator 25 (final energy consumption) from the Guidelines;
- (e) Agricultural land-use change: can be developed on the basis of data collected for indicator 21 (land uptake) from the Guidelines;
- (f) Cropping and livestock patterns: new proposed indicator;
- (g) Gross nitrogen balance: new proposed indicator;
- (h) Atmospheric emissions of ammonia from agriculture: can be developed on the basis of data collected for indicator 1 (emission of pollutants into the atmospheric air) from the Guidelines – emissions of ammonia by economic activities as defined by the International Standard Industrial Classification of All Economic Activities (ISIC);
- (i) Emissions of methane and nitrous oxide from agriculture: sub-indicator of indicator 6 (greenhouse gas emissions) from the Guidelines;
- (j) Water abstraction: can be developed on the basis of data collected for indicator 8 (freshwater abstraction) – total volume of surface and ground freshwater abstracted annually by economic activities as defined by ISIC;
- (k) Soil erosion: indicator 22 (area affected by soil erosion) from the Guidelines;
- (l) Nitrates in water: can be developed on the basis of data collected for indicators 14 (nutrients in freshwater) and 15 (nutrients in coastal seawaters);
- (m) Share of agriculture in greenhouse gas emissions: can be developed on the basis of data collected for the indicators 6 (greenhouse gas emissions) – greenhouse gas emissions in total and by sectors.

9. A detailed description of three proposed indicators is provided below.

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<sup>2</sup> See United Nations publication, *Environmental Indicators and Indicators-based Assessment Reports: Eastern Europe, Caucasus and Central Asia*, Sales No. E 07.II.E.9. Available on-line at [www.unece.org/env/documents/2007/ece/ece.belgrade.conf.2007.inf.6.e.pdf](http://www.unece.org/env/documents/2007/ece/ece.belgrade.conf.2007.inf.6.e.pdf).

## II. Proposed additional indicators

### A. Water-use intensity by agriculture

#### 1. General description

(a) **Brief definition:** Water-use intensity by agriculture is indicated by the area and type of crops (cereals, pulses and beans, root crops, fruit, vegetables and forage, cotton plants) grown with the aid of full or supplementary irrigation.

10. The indicator can be presented as:

- (i) Total irrigable area;
- (ii) Irrigable area by type of crops grown with the aid of full or supplementary irrigation;
- (iii) Share of irrigable area in the total utilized agricultural area.

11. Utilized agricultural area is taken to be the sum of arable land, permanent grassland and permanent crops, and does not include kitchen gardens.

(b) **Unit of measurement:** for total irrigable area and by type of crops – hectares; for the share of utilized agricultural area – percentage.

#### 2. Relevance for environmental policy

(a) **Purpose:** Total irrigated area is a driving force indicator describing how irrigation develops in relation to the crops grown or showing the extent of irrigated area.

(b) **Issue:** Agriculture is an essential driving force in the management of water use. New production methods and irrigation play an important role in the development of the agricultural sector, but improvements in agricultural productivity often put great pressure on natural resources. That is the case of water use for irrigation especially during dry periods. At the regional level this indicator shows the importance of the agricultural sector in terms of water use.

12. An increase in the irrigated area of a country could imply an increase in water use for agriculture, unless appropriate responses to that trend help keep water resources at sustainable levels. Specific impacts may derive from irrigation such as aquifer exhaustion, increased erosion of cultivated soils, salinization or contamination of groundwater by minerals and desiccation of wetlands with the consequent destruction of natural habitats.

(c) **International agreements and targets:**

- (i) Global and regional level: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes requires that the Parties introduce sustainable water management, including an ecosystem approach and the rational and fair use of transboundary waters.
- (ii) Subregional level: In the European Union, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy obliges the Member States to promote sustainable use based on the long-term protection of available resources. Inter alia, national, regional and local authorities need to introduce measures to improve the efficiency of water use and to encourage changes in agricultural practices necessary to protect water resources and quality.

### 3. Methodology and guidelines

(a) **Data collection and calculations:** Trends in irrigated land use are evident from agricultural land-use data that can be compiled within the existing statistical system. The indicator should be based on data from the agricultural census that is carried out every 10 years and intermediate sample surveys conducted between these basic surveys. Statistical services collect information from individual agricultural holdings, which are technical and economic units under a single management engaged in agricultural production. The surveys should cover all agricultural holdings with a utilized agricultural area of at least one hectare and those holdings with a utilized agricultural area of less than one hectare if their market production exceeds certain natural thresholds. The following irrigation data should be collected:

- (i) Total irrigable area (area covered with irrigation infrastructure);
- (ii) Total cultivated area irrigated at least once a year (actual irrigated area);
- (iii) Cultivated area of main crops that are irrigated at least once a year: cereals, pulses and beans, root crops, fruit, vegetables and forage, cotton plants.

(b) **Internationally agreed methodologies and standards:** The Food and Agriculture Organization of the United Nations is working on the harmonization of classification systems and databases to improve national and international land-use information.

### 4. Data sources and reporting

13. In the countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe, ministries of agriculture and State statistical agencies collect data on irrigated area. Aggregated data are published in statistical yearbooks and environmental reports in some countries.

### 5. References at the international level

Commission Decision 2000/115/EC of 24 November 1999, relating to the definitions of the characteristics, the list of agricultural products, the exceptions to the definitions and the regions and districts regarding the surveys on the structure of agricultural holdings.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992).

EEA (2005). *Agriculture and Environment in EU-15 – the IRENA Indicator Report*, EEA Report No 6/2005

EEA (2006). *Integration of Environment into EU Agriculture Policy– the IRENA Indicator-based Assessment Report*, EEA Report No 2/2006. Available from [http://www.eea.europa.eu/publications/eea\\_report\\_2006\\_2](http://www.eea.europa.eu/publications/eea_report_2006_2).

OECD (1999). *Environmental Indicators for Agriculture, Volume 1: Concepts and Framework*. Paris.

OECD (2001). *Environmental Indicators for Agriculture, Volume 3: Methods and Results*. Paris.

OECD (2008). *Environmental Performance of Agriculture in OECD Countries Since 1990*. Paris. Available from [www.oecd.org/document/56/0,3343,en\\_2649\\_33793\\_40374392\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/56/0,3343,en_2649_33793_40374392_1_1_1_1,00.html)

AQUASTAT – FAO global information system on water and agriculture.

Farm structure – Methodology of Community surveys  
[http://epp.eurostat.ec.europa.eu/portal/page/portal/product\\_details/publication?p\\_product\\_code=CA-98-96-493](http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=CA-98-96-493)

[http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Farm\\_structure](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure)

<http://unstats.un.org/unsd/environment/>

## B. Cropping and livestock patterns

### 1. General description

#### (a) Brief definition:

- (i) Cropping patterns: trends in the share of the utilized agricultural area occupied by the major agricultural land uses (arable, permanent grassland and permanent crops).
- (ii) Livestock patterns: trends in the share of major livestock types (cattle, pigs, sheep, goats and poultry).

14. Utilized agricultural area is taken to be the sum of arable land, permanent grassland and permanent crops, and does not include kitchen gardens.

15. The indicator can be presented as:

- (i) Total area of the major agricultural land uses (arable, permanent grassland and permanent crops);
- (ii) Trends in the share of major agricultural land uses in total utilized agricultural area;
- (iii) Livestock numbers of major livestock types (cattle, pigs, sheep, goats and poultry);
- (iv) Trends in the share of the major livestock types.

(b) **Unit of measurement:** for total area of the major agricultural land users – hectares; for the livestock numbers – head of livestock; for the share of major agricultural land uses and major livestock types – percentage.

### 2. Relevance for environmental policy

(a) **Purpose:** The cropping and livestock patterns indicator presents a driving-force indicator and provides information on the state of farming with consequent positive as well as negative influences on the environment. This indicator provides general information on trends in the agricultural sector, which are important to the development of agricultural policy. The link to environmental policies is often only indirect.

(b) **Issue:** Cropping and livestock patterns determine agriculture's land-use intensity and its influence on environmental resources (soil and water) and habitat diversity. Many of the current farming patterns have developed over centuries and still shape agricultural landscapes today. The same farming type can, however, have very different impacts on the environment depending on local characteristics and management intensity. Agricultural intensity will always be a major influencing factor in determining the environmental impact of farming.

16. Among the major land-use types, permanent grassland is generally considered to be the most important from a landscape and nature conservation perspective. Extensively

managed permanent grassland provides habitats for many specialized plant and animal species. Grazing has created the landscape and habitat diversity of pastoral farming systems, which remain particularly important for the conservation of biodiversity in many regions. Without grazing, especially cattle and sheep, most of these valued agricultural landscapes would disappear. However, the intensification of livestock farming by increasing stocking densities, the use of external feedstuff and increased stabling of cattle in particular also exerts pressure on the environment. This process of polarization, in which abandonment and a rise in stocking density both occur in different locations, poses a threat to biodiversity in semi-natural areas created by extensive livestock farming. Intensive livestock systems, especially pig and poultry production, are one of the main sources of potential nutrient surpluses, with associated environmental impacts on aquatic systems.

**(c) International agreements and targets:**

- (i) Global and regional level: None.
- (ii) Subregional level: In the European Union, Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources provides a general framework for livestock farming through the designation of nitrate vulnerable zones and through the rules on spreading of manure to minimize nutrient leaching and its environmental consequences.

**3. Methodology and guidelines**

**(a) Data collection and calculations:** Trends in farming are evident from agricultural land-use and livestock data that can be compiled within the existing statistical system. The indicator should be based on data from the agricultural census that is carried out every 10 years and intermediate sample surveys carried out between these basic surveys. Statistical services collect information from individual agricultural holdings, which are technical and economic units under a single management engaged in agricultural production. The surveys should cover all agricultural holdings with a utilized agricultural area of at least one hectare and those holdings with a utilized agricultural area of less than one hectare if their market production exceeds certain natural thresholds.

**(b) Internationally agreed methodologies and standards:** The Food and Agriculture Organization of the United Nations is working on the harmonization of classification systems and databases to improve national and international information on cropping and livestock patterns.

**4. Data sources and reporting**

17. In the countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe, ministries of agriculture and state statistical agencies collect data on cropping and livestock patterns. Aggregated data are published in statistical yearbooks in some countries.

**5. References at the international level**

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.

EEA (2005). Agriculture and Environment in EU-15 – the IRENA Indicator Report, EEA Report No. 6/2005.

EEA (2006). Integration of Environment into EU Agriculture Policy – the IRENA Indicator-based Assessment Report, EEA Report No 2/2006. Available from [http://www.eea.europa.eu/publications/eea\\_report\\_2006\\_2](http://www.eea.europa.eu/publications/eea_report_2006_2).



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OECD (2008). Environmental Performance of Agriculture in OECD Countries Since 1990. Paris. Available from  
[http://www.oecd.org/document/56/0,3343,en\\_2649\\_33793\\_40374392\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/56/0,3343,en_2649_33793_40374392_1_1_1_1,00.html).

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Farm structure – Methodology of Community surveys. Available from  
[http://epp.eurostat.ec.europa.eu/portal/page/portal/product\\_details/publication?p\\_product\\_code=CA-98-96-493](http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=CA-98-96-493)

[http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Farm\\_structure](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure)

<http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/gl009931.htm>

## C. Gross nitrogen balance

### 1. General description

(a) **Brief definition:** The balance between all nitrogen added to an agricultural system and nitrogen removed from the system.

(b) **Unit of measurement:** Kilogram per year per hectare.

### 2. Relevance for environmental policy

(a) **Purpose:** The gross nitrogen balance indicator is a pressure indicator and provides an indication of the risk of nutrient leaching by identifying agricultural areas that have very high nitrogen loading.

(b) **Issue:** The gross nutrient balance for nitrogen provides insight into links between agricultural nutrient use, changes in environmental quality and the sustainable use of soil nutrient resources. A persistent surplus indicates potential environmental problems; a persistent deficit indicates potential agricultural sustainability problems. Water contamination by nitrates is one of the main problems associated with agricultural activities, because nitrates are highly soluble and migrate easily into groundwater through the soil and to surface water through run-off.

(c) **International agreements and targets:**

(i) Global and regional level: The Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

(ii) Subregional level: In the European Union, Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources is aimed at reducing water pollution caused or induced by nitrates from agricultural sources and at preventing further such pollution. A threshold nitrate concentration of 50 mg/l is set as the maximum permissible level, and the Directive limits applications of livestock manure to land to 170 kg of nitrogen per hectare per year.

### 3. Methodology and guidelines

(a) **Data collection and calculations:**

18. The gross nitrogen balance indicator estimates the potential surplus of nitrogen on agricultural land. This is done by calculating the balance between nitrogen added to an agricultural system and nitrogen removed from the system per hectare of agricultural land. The gross nitrogen balance indicator accounts for all inputs and outputs from the farm, and includes all residual emissions of nitrogen from agriculture into soil, water and air.

19. The indicator calculation should be based on the OECD/Eurostat national nutrient balances methodology, which takes into account all input and output matters in the farm.

20. Input nitrogen matters consist of:

- (a) Total amount of applied fertilizers
  - (i) Inorganic fertilizers
  - (ii) Organic fertilizers (organic inputs from non agricultural sources):
    - Urban compost, and
    - Sewage sludge spread on agricultural land.
- (b) Manure
- (c) Nitrogen fixation by legumes
- (d) Deposition from the air
- (e) Other minor sources (e.g. seeds and planting material)

21. Output nitrogen matters include:

- (a) Harvested crops placed on the market, including also forage crops
- (b) Grass and crops eaten by livestock

22. The following data are needed for nitrogen balance calculations: Crop area; livestock numbers; livestock excretion rates; fertilizer rates; nitrogen fixation; atmospheric deposition; yields.

(b) **Internationally agreed methodologies and standards:** A full explanation of the nitrogen balances is provided by the *OECD/Eurostat Gross Nitrogen Balances Handbook*.

#### **4. Data sources and reporting**

23. In the countries of Eastern Europe, Caucasus and Central Asia, and of South-Eastern Europe, ministries of agriculture and State statistical agencies collect data on crop area, livestock numbers, fertilizer rates and yields.

#### **5. References at the international level**

Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC).

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

EEA (2006). Integration of Environment into EU Agriculture Policy– the IRENA Indicator-based Assessment Report, EEA Report No 2/2006. Available from [http://www.eea.europa.eu/publications/eea\\_report\\_2006\\_2](http://www.eea.europa.eu/publications/eea_report_2006_2).

EEA (2005). Agriculture and Environment in EU-15 – the IRENA Indicators Report, EEA Report No 6/2005.

OECD/Eurostat (2003). OECD/Eurostat Gross Nitrogen Balances Handbook. Paris.

OECD (1999). Environmental Indicators for Agriculture, Volume 1: Concepts and Framework. Paris.

OECD (2001). Environmental Indicators for Agriculture, Volume 3: Methods and Results. Paris.

OECD (2008). Environmental Performance of Agriculture in OECD Countries Since 1990. Paris. Available from [www.oecd.org/tad/env/indicators](http://www.oecd.org/tad/env/indicators).

AQUASTAT – FAO global information system on water and agriculture.

[http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Farm\\_structure](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure)

<http://www.efma.org>

<http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>

## Annexes

### Annex I

#### Organisation for Economic Co-operation and Development Agri-environmental Indicators

| <i>Theme</i> | <i>Indicator title</i>                              | <i>Indicator definition</i>                                                                                                                                           |
|--------------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soil         | Soil erosion                                        | (a) Area of agricultural land affected by water erosion in terms of different classes of erosion: tolerable, low, moderate, high and severe                           |
|              |                                                     | (b) Area of agricultural land affected by wind erosion in terms of different classes of erosion: tolerable, low, moderate, high and severe                            |
| Water        | Water use                                           | (a) Agricultural water use in total national water utilization                                                                                                        |
|              |                                                     | (b) Use of groundwater in total national groundwater utilization for agricultural purposes                                                                            |
|              |                                                     | (c) Area of irrigated land in total agricultural land area                                                                                                            |
|              | Water quality                                       | (a) Nitrate and phosphate contamination derived from agriculture in surface water and coastal waters                                                                  |
|              |                                                     | (b) Monitoring sites in agricultural areas that exceed recommended drinking water limits for nitrates and phosphorus in surface water and groundwater (nitrates only) |
|              |                                                     | (c) Monitoring sites in agricultural areas that exceed recommended drinking water limits for pesticides in surface water and groundwater                              |
|              |                                                     | (d) Monitoring sites in agricultural areas where one or more pesticides are present in surface water and groundwater                                                  |
| Air          | Ammonia emissions, acidification and eutrophication | Share of agricultural ammonia emissions in national total ammonia emissions                                                                                           |
|              | Methyl bromide use and ozone depletion              | Agricultural methyl bromide use expressed in tonnes of ozone depletion potential                                                                                      |
|              | Greenhouse gas emissions and climate change         | Gross total agricultural greenhouse gas emissions (carbon dioxide, methane and nitrous oxide), and their share in total greenhouse gas emissions                      |
| Biodiversity | Genetic diversity                                   | (a) Plant varieties registered and certified for marketing for the main crop categories (cereals, oilcrops, pulses and                                                |

| <i>Theme</i>    | <i>Indicator title</i> | <i>Indicator definition</i>                                                                                                                                                          |
|-----------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |                        | beans, root crops, fruit, vegetables and forage)                                                                                                                                     |
|                 |                        | (b) Five dominant crop varieties in total marketed production for selected crops (wheat, barley, maize, oats, rapeseed, field peas and soybeans)                                     |
|                 |                        | (c) Area of land under transgenic crops in total agricultural land                                                                                                                   |
|                 |                        | (d) Livestock breeds registered and certified for marketing for the main livestock categories (cattle, pigs, poultry, sheep and goats)                                               |
|                 |                        | (e) Three dominant livestock breeds in total livestock numbers for the main livestock categories (cattle, pigs, poultry, sheep and goats)                                            |
|                 |                        | (f) Livestock (cattle, pigs, poultry and sheep) in endangered and critical risk status categories and under conservation programmes                                                  |
|                 |                        | (g) Status of plant and livestock genetic resources under in situ and ex situ national conservation programmes                                                                       |
|                 | Wild species diversity | (a) Wild species that use agricultural land as primary habitat                                                                                                                       |
|                 |                        | (b) Populations of a selected group of breeding bird species that are dependent on agricultural land for nesting or breeding                                                         |
|                 | Ecosystem diversity    | (a) Conversion of agricultural land area to (land exits) and from (land entries) other land uses (forest land, built-up land, wetlands and other rural land)                         |
|                 |                        | (b) Area of agricultural semi-natural habitats (fallow land, farm woodlands) in the total agricultural land area                                                                     |
|                 |                        | (c) National important bird habitat areas where intensive agricultural practices are identified as either posing a serious threat or a high impact on the area's ecological function |
| Farm management | Nutrient management    | (a) Number (area) of farms (agricultural land area) under nutrient management plans                                                                                                  |
|                 |                        | (b) Farms using soil nutrient testing (agricultural land regularly sampled and analysed for nutrient content)                                                                        |
|                 | Pest management        | Arable and permanent crop area under integrated pest management                                                                                                                      |
|                 | Soil management        | (a) Arable land area under soil conservation practices                                                                                                                               |
|                 |                        | (b) Agricultural land area under vegetative cover all year                                                                                                                           |
|                 | Water management       | Irrigated land area using different irrigation technology                                                                                                                            |

| <i>Theme</i>        | <i>Indicator title</i>  | <i>Indicator definition</i>                                                                                                                                                                                                                                                                      |
|---------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |                         | systems                                                                                                                                                                                                                                                                                          |
|                     | Biodiversity management | Agricultural land area under biodiversity management plans                                                                                                                                                                                                                                       |
|                     | Organic management      | Agricultural land area under certified organic farm management or in the process of conversion to an organic system                                                                                                                                                                              |
| Agricultural inputs | Nutrients               | (a) Gross balance between the quantities of nitrogen inputs (e.g. fertilizers, manure) into, and outputs (e.g. crops, pasture) from farming<br><br>(b) Gross balance between the quantities of phosphorus inputs (e.g. fertilizers, manure) into, and outputs (e.g. crops, pasture) from farming |
|                     | Pesticides              | (a) Pesticide use or sales in terms of tonnes of active ingredients<br><br>(b) Risk of damage to terrestrial and aquatic environments, and human health from pesticide toxicity and exposure                                                                                                     |
|                     | Energy                  | Direct on-farm energy consumption in national total energy consumption                                                                                                                                                                                                                           |
|                     |                         |                                                                                                                                                                                                                                                                                                  |

*Source: OECD (2008). Environmental Performance of Agriculture in OECD Countries Since 1990. Available from <http://www.oecd.org/tad/env/indicators>.*

## Annex II

### Agri-environmental indicators in the Irena operation

| <i>DPSIR</i>          | <i>No.</i> | <i>IRENA indicator</i>                                  |
|-----------------------|------------|---------------------------------------------------------|
| <b>Responses</b>      | 1          | Area under agri-environment support                     |
|                       | 2          | Regional levels of good farming practice                |
|                       | 3          | Regional levels of environmental targets                |
|                       | 4          | Agricultural area under nature protection               |
|                       | 5.1        | Organic producer prices and market share                |
|                       | 5.2        | Organic farms incomes                                   |
|                       | 6          | Farmers' training levels                                |
| <b>Driving forces</b> | 7          | Area under organic farming                              |
|                       | 8          | Mineral fertilizer consumption                          |
|                       | 9          | Consumption of pesticides                               |
|                       | 10         | Water-use intensity                                     |
|                       | 11         | Energy use                                              |
|                       | 12         | Land-use change                                         |
|                       | 13         | Cropping and livestock patterns                         |
|                       | 14.1       | Farm management practices: soil cover                   |
|                       | 14.2       | Farm management practices: tillage                      |
|                       | 14.3       | Farm management practices: manure                       |
| <b>Pressures</b>      | 15         | Intensification/extensification                         |
|                       | 16         | Specialization/diversification                          |
|                       | 17         | Marginalization                                         |
|                       | 18.1       | Gross nitrogen balance                                  |
|                       | 18.2       | Atmospheric emissions of ammonia from agriculture       |
|                       | 19         | Emissions of methane and nitrous oxide from agriculture |
|                       | 20         | Pesticide soil contamination                            |
|                       | 21         | Use of sewage sludge                                    |
|                       | 22         | Water abstraction                                       |
|                       | 23         | Soil erosion                                            |

| <i>DPSIR</i> | <i>No.</i> | <i>IRENA indicator</i>                                   |
|--------------|------------|----------------------------------------------------------|
| <b>State</b> | 24         | Land-cover change                                        |
|              | 25         | Genetic diversity                                        |
|              | 26         | High nature value areas(farmland)                        |
|              | 27         | Production of renewable energy from agricultural sources |
|              | 28         | Population trends of farmland birds                      |
|              | 29         | Soil quality                                             |
|              | 30.1       | Nitrates in water                                        |
|              | 30.2       | Pesticides in water                                      |
|              | 31         | Groundwater levels                                       |
|              | 32         | Landscape state                                          |
|              | 33         | Impact on habitats and biodiversity                      |
|              | 34.1       | Share of agriculture in greenhouse gas emissions         |
|              | 34.2       | Share of agriculture in nitrate contamination            |
|              | 34.3       | Share of agriculture in water use                        |
|              | 35         | Impact on landscape diversity                            |

*Source: EEA (2005). Agriculture and Environment in EU-15 – the IRENA Indicator Report, EEA Report No 6/2005.*