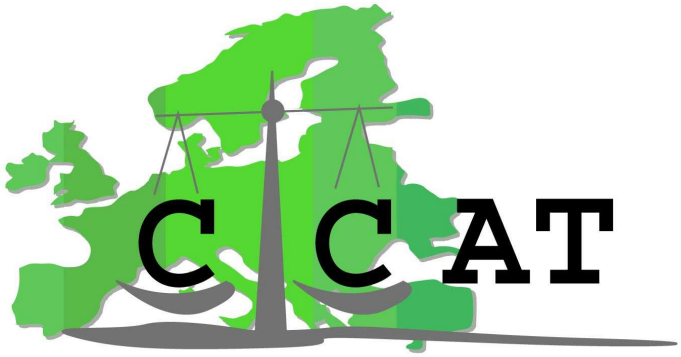

Cross Compliance Assessment Tool

CROSS-COMPLIANCE ASSESSMENT TOOL

Policy-oriented research:
Scientific support to policies SSP

Specific Targeted Research Project (STREP)

Deliverable(s): 2.4 and 3.1:
Report describing the data and information requirements of prototype 1 of the analytical tool
Detailed data and information collection plan for prototype 1 of the analytical tool

Due date of deliverable: [31-06-2007]
Actual submission date: [26-05-2008]

Authors of this report and contact details

Name:	*Partner acronym*
Juliane Mante	*IfLS*
Berien Elbersen	*Alterra*
Jörg Schramek	*IfLS*
Argo Peepson	*CEET*
Merit Mikk	*CEET*
Roel Jongeneel	*LEI*
Markus Kempen	*Uni Bonn*
Dominic Annen	*Uni Bonn*
Patricia Martínez	*UAM*
Juan Oñate	*UAM*
Hans Kros	*ALTERRA*
Wim de Vries	*ALTERRA*

Contact details of first author/editor:
Name: Juliane Mante
Address: Institute for Rural Development Research, Zeppelinallee 31, DE-60325 Frankfurt am Main
Email: mante@ifls.de
Phone: 0049-(0)69 97785777

Disclaimer:
"This publication has been funded under the CCAT project, EU 6th Framework Programme, Priority 8.1 (European Commission, DG RTD, contract no. 44423-CCAT). Its content does not represent the official position of the European Commission and is entirely under the responsibility of the authors."

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

Contents

1 Introduction 5

1.1 General introduction 5

1.2 Data categories and overall data needs 5

1.2.1 Implementation of Cross Compliance 5

1.2.2 Responses to the implementation of Cross Compliance 7

1.2.3 Context information 8

1.2.4 Data for impact assessment 9

1.3 Overview: impact assessment in prototype 1 10

2 Selected indicators for prototype 1 13

2.1 Selected economic impact indicators 13

2.1.1 Selected economic indicators for prototype 1 13

2.1.2 Extensions of selected economic indicators in prototype 2 14

2.2 Selected environmental impact indicators for prototype 1 15

2.2.1 Extensions of selected environmental indicators in prototype 2 17

2.3 Selected land use, landscape and biodiversity indicators 19

2.3.1 Approach to assessing the CC impacts on land use, landscape and biodiversity indicators for prototype 1 19

2.3.2 Extensions of selected land use, landscape and biodiversity indicators in the prototype 2 20

2.4 Selected public health and animal welfare indicators 21

2.4.1 Selected public health and animal welfare indicators for prototype 1 21

2.4.2 Extensions of selected public health and animal welfare indicators in prototype 2 22

3 Data inventory for the implementation of Cross Compliance in the EU member states 27

3.1 Legal implementation 27

3.1.1 Implementation of SMRs/ GAECs in the EU member states 27

3.1.2 Procedure and modalities in case of non-compliance 28

3.1.3 Policy goals for the implementation of SMRs/ GAECs in the EU member states/ regions 29

3.2 Actual implementation by the farmers 29

3.2.1 Types of regions/ areas and farms affected by SMR/GAEC 29

3.2.2 Level of compliance 29

3.2.3 Farmers' behaviour as response to SMR/GAEC 31

4 Data inventory for context information 33

5 Data inventory for impact assessment in prototype 1 34

5.1 Selected economic impact indicators 34

5.2 Selected environmental impact indicators 34

5.3 Data inventory for selected land use, landscape and biodiversity indicators 37

5.4 Selected public health and animal welfare indicators 40

5.4.1 Input data needed for public health indicators 40

5.4.2 Input data needed for animal welfare indicators 40
5.4.3 Input data needed for the degree of compliance 40

6 Conclusion 41

6.1 Detailed data analysis, processing and additional collection plan for prototype 1 41

6.1.1 Organisation and structuring of additional data collection 47

6.2 Rough data collection plan for prototype 2 49

References 54

Annex 1: Description of the COCO and CAPREG databases as main input sources of the CAPRI model 55

Annex 2: Data requirements and data collection plan: provided separately as an Excel sheet 57

1 Introduction

1.1 General introduction

This deliverable combines two main tasks: a) to present the data and information required for the impact assessment of Cross Compliance and b) to identify, whether and to which extent this required information has already been collected by other studies and is available, or to which extent it has to be derived from own data collection and/or is not available EU wide, but can only obtained in case studies. Part a) is especially based on Deliverable 2.3 on the 'operationalisation of the first selection of indicators into impacts of Cross Compliance for the implementation in the first prototype of the analytical tool'. Part b) is based on a review of existing studies and data sources and is adapted to the needs of the prototype 1.

Prototype 1 of the analytical tool is planned to be ready by October 2008. In prototype 1 impact assessments will be undertaken only for a selection of standards, while for prototype 2 practically all standards will be included. Further, it has been determined that the EU-wide assessments for this prototype will be done at NUTS 2 level, while for prototype 2 these assessments will be refined to a more detailed spatial level.

1.2 Data categories and overall data needs

As already described in D2.3 the project aims especially at assessing the effects of an additional compliance. This means that the analysis will focus on those effects which come from standards newly introduced within the context of Cross Compliance and from an additional compliance with pre-existing standards due to an enforcement mechanism of Cross Compliance. For the impact assessment many data from different categories are needed, which will be described below. These required data are categorised into data belonging to the a) concrete implementation of Cross Compliance standards (SMRs and GAEC) in the EU member states, b) responses to the implementation of Cross Compliance, c) context information and d) data directly needed for the impact assessment. Data in the last 2 categories mainly refer to information obtained from existing statistical and spatial data sources. The sequence of the data description is similar to the presented data in the table on data collection for prototype 1 as included in Annex 1 of this report to facilitate comparison and orientation.

1.2.1 Implementation of Cross Compliance

To investigate which impacts on different impact fields can be related to Cross Compliance it is at first necessary to provide an overview of the different Cross Compliance obligations in the EU member states. From these Cross Compliance standards a range of standards will be selected for which the impact assessment will be undertaken. For this selection the focus will be on those ***SMR and GAEC standards*** which can be translated into effect indicators with the models, knowledge and data available to this project.
As already described in former deliverables, the Cross Compliance standards are on the one hand 19 Statutory Management Requirements (Annex III of council regulation (EC) No 1782/2003) which all refer to pre-existing EU-Directives and Regulations. On the other hand there are the standards ensuring Good Agricultural and Environmental Condition of

agricultural land (Annex IV of council regulation (EC) No 1782/2003), which represent new regulations introduced within the context of Cross Compliance. The implementation of the Statutory Management Requirements (SMRs) into national or regional legislation should in principle be uniform in all member states. Nevertheless, the results of former projects[1] show, that the translation of these SMRs into national and/or regional legislation happened in a quite diverse way. For the translation of GAECs into national and regional legislation the member states had a comparatively higher level of freedom than for the implementation of SMRs. The GAEC standards to be developed had to be in accordance with the issues indicated in Annex IV of the regulation, but could be adapted to the special climatic and structural conditions in the member states. This resulted in a quite different implementation of the Cross Compliance standards in the member states which is a crucial fact for the assessment of the impact of these standards.

As already described, in CCAT a distinction is made between the impact of a) standards referring to pre-existing national or regional legislation (mainly SMRs) and b) standards which are newly introduced within the context of Cross Compliance (GAECs). For the first category costs and benefits associated with complying with these standards can't be attributed to Cross Compliance, but to the standard itself. However, Cross Compliance is in this case an enforcement mechanism and has an impact on the degree of compliance. If that's the case, the changes in impacts can be related to Cross Compliance. For the second category (b) both, costs and benefits derived from the compliance with the standard can be related to the Cross Compliance instrument. The emphasis in CCAT lies on the assessment of the effects of this additional compliance with CC standards. In this context, it will not be done measure by measure but as a group of measures related to one directive. Beside the required statistical and spatial data the information of all SMR and GAEC standards in the EU-27 is required to enable the assessments in all impact fields. To ensure a regionalised assessment of the effects of Cross Compliance in the EU-27 it is important to complete the data on national and regional implementation of Cross Compliance standards in the member states, which have been already collected in former studies.

However, it has to be mentioned, that information on SMRs is currently available only for EU-15 + Slovenia and Malta as the rest of the countries will implement these requirements only from 2009 (or 2011 for some standards) onwards. For these countries the final list will be available by the end of 2008.

Beside the concrete implementation of the Cross Compliance standards in the member states and the statistical and spatial data there are also other key data belonging to this issue which are of relevance for the impact assessment.

1. The **short names** synthesise the detailed standards implemented in the surveyed MS/Regions on the basis of their similarities and are needed to enable the impact assessment. They are developed taking into account that they should clearly refer to the topic (e.g. Groundwater (for Groundwater Directive related requirements and similarly Sewage, Nitrates, Birds, Habitat, and Natura) with what SMR deals, with the objective to identify the whole SMR by short name (e.g.: Nitrates – N limits per hectare; Birds – closed season for hunting; Habitat – prohibited farming practices etc.). The methodology for the formulation of short names was developed in the CIFAS project (Schramek et al., 2007). In CIFAS a lot of information on SMRs and GAECs was already collected and characterised according to short names. In CCAT we use the collected CIFAS short name information but we also collect new information for missing countries and new standards and apply the short name

[1] Cross Compliance, CIFAS, Cross Compliance Network

methodology of CIFAS to organise it. The short name methodology will also be further adapted to the needs of the CCAT project.

2. The information of the ***level of punishments in case of non-compliance*** (payment reductions) is relevant insofar, as these potential payment reductions might influence the compliance decision of the farmers. Farmers would probably weigh the costs and the benefits of complying with Cross Compliance against each other, which has an impact on the degree of compliance to be expected. This information would be necessary to enable the endogenization of farmers' compliance decision. Beside this information is also required to calculate the proper amount of payment deduction, which will affect indicators like producer income and producer welfare.
3. The ***degree of compliance*** again is crucial information for the impact assessment of Cross Compliance in the different impact fields. From this degree of Compliance estimation can be made of which part of the farms, farm types, agricultural area and animal population are compliant and non-compliant with the different standards. All these factors are needed as input in the impact assessment. It should however be mentioned that getting information on degree of compliance per region for different farm types will not be easy. It is therefore expected that estimates of compliance levels will also need to be made based on indirect information such as number of breaches and information on farm management practices from other sources such as FADN and experts.
4. The ***degree of compliance per SMR and GAEC in 2005*** is important as a baseline compliance level against which additional changes in compliance level and related impacts can be assessed. A 0% compliance level is not feasible, because there's on the one hand no input information available for this compliance level and on the other hand a 0% compliance level is an unrealistic assumption, because even before Cross Compliance was in place, many farmers complied with these standards. In between the compliance level of 2005 and a 100% compliance level as an end point the scenarios will be determined for which the impact assessments will be undertaken.
5. The information on ***policy goals*** which leaded to the specific design of the implemented Cross Compliance standards in the member states or regions is needed as input for the final selection of the indicators to be used for the impact assessment.

1.2.2 Responses to the implementation of Cross Compliance

This data category contains different issues regarding the responses of farms, farmers and regions to Cross Compliance standards. As already described above, the ***compliance level in 2005*** will be used as a reference year to assess the effects of an additional compliance. To enable a realistic assessment of the ***additional compliance***, the information on the compliance levels in the following years (2006-2008) would also be relevant, but is not crucial as the assessments will take the baseline 2005 compliance level as a starting point and then assess what impacts would be if compliance levels rise to a theoretical 75% and 100% compliance level. However, in some cases the 75% compliance was already reached in 2005. If this is the case we can assume that no differences in impacts occur between the 2005 baseline scenario and the 75% or 100% scenario. Since a lot of countries have very high compliance levels this 75% scenario could be discussed forward taking the compliance figures of different countries into account.
In the results of the assessments such situations should be made visible by identifying it as a separate result class. Since information of compliance levels per standard are hard to get directly, proxy data need to be used to make estimates of the compliance levels. One of the

variables which is available and can be used as a proxy for estimating real compliance levels is information on ***number and types of detected infringements***.
The determination of ***types of farms affected by SMRs/GAECs*** is necessary input information for the modelling as it is clear that different farm types have different effects on for example markets, environment, land use, etc.. On the other hand different farm types are also affected differently by the different CC standards leading to different responses and different cost implications per farm type. Compliance levels at farm type level and also translated further to compliance levels in terms of costs per farm, land use shares and livestock shares is a crucial input for both the economic model (CAPRI) and the environmental models to assess impacts of CC. Information at farm level will certainly be difficult to get and in many cases we will need to work with estimates of level of compliance.
The determination of ***types of regions/areas affected by SMRs/GAECs*** is necessary to develop a direct linkage of the responses to compliance with CC standards to regional specific changes in farming practices that may also have environmental consequences and/or lead to changes in land use. Statistical data on the agricultural sector are generally given per administrative region. Taking the bio-physical heterogeneity of regions into account facilitates the understanding of the constraints farmers face when deciding about responses to CC standards and to assess effects of changes in farming on land use and environment. In prototype 1 calculation of environmental effects will be done at Nuts 2 level which means that they will incorporate an average regional situation in terms of farming (composition of farm population) and the environmental diversity.
However, in prototype 2 the calculation of effects will be done at the (more detailed) level of meaningful environmentally homogeneous entities. For this we will make use of spatially disaggregated farm information derived from former projects. In the Seamless and Dynaspat project a methodology has already been developed to link FADN farm information to bio-physical characteristics, which then allows the clustering of farms to any spatial entity desired, be it an administrative region or a bio-physical entity. This also enables a spatially explicit mapping of CC induced land use changes at the level of e.g. NVZs and HNVs within Nuts 2 regions (HSMU) (see Elbersen et al., 2006).
The issue ***Farmers behaviour as response to SMRs/GAECs*** represents required in-depth information which provides an understanding of the factors needed to predict response. Beside this the information is also needed for validating results obtained by the models concerning farmers' responses to Cross Compliance standards. The information on behavioural aspects would be also especially needed to enable the endogenisation of the compliance decision into the economic models. Data from which factors can be distilled that predict farmers' response need to be available first before a predictive model can be developed. This type of information needs to be collected as soon as possible but will not be used for prototype 1 as the endogenisation of farmer's response will only be included in the CAPRI model in prototype 2 and probably only for a couple of case study regions. The endogenisation will have many advantages of which the main is that we become less data dependent. Another advantage of this endogenisation is that it will become easier to link farmers response to CC to farm types, land use and this is necessary to assess the impacts on environment, land use, landscape and biodiversity. However getting information on farmers response to CC standards is difficult and time consuming to obtain. Also for prototype 2 this information will only be available for a selection of regions.

1.2.3 Context information

The context information includes all data needed for the pre-model calculations and for the knowledge-based assessments of effects on environment, land use, landscape and

biodiversity. It includes data needs on ***farm structure information, farm type distribution*** and data on ***biophysical environment, land use and market conditions***. They can be regarded as a main prerequisite for modelling the effects of Cross Compliance standards in CAPRI and environmental models (for prototype 1 this is MITERRA and for prototype 2 this will also include EPIC and DNDC). They are especially necessary as input for pre-model data analyses in order to adapt data which can eventually be used as model input for CAPRI and environmental models and for further assessment of impacts on landscape and biodiversity. With these data pre-model estimates can be made of:

- the type of farms, land and animals compliant and non-compliant with the different CC standards
- the related costs to be compliant specified per production output (e.g. ton of wheat, litre of milk, etc.) and region.
- The changes in farming practices following the implementation of CC standards of which effects need to be modelled
- The translation of these changes in farming practices into parameters to be used as input into the (environmental) models (e.g. application of cover crop, minimum and maximum livestock densities, maximum fertiliser N-application etc.)

A good elaboration of this information in the pre-model calculation process is crucial to model the regional and farm type specific responses to SMR and GAEC implementation per region. CAPRI then takes the pre-model output to translate (model) this in a farmer's response in terms of producer's income and changes into agricultural markets but also in changes in land use and livestock numbers and composition per region. Basically, it simulates how the relative costs of SMRs and GAECs, estimated in a pre-modelling step outside CAPRI, at different compliance levels, lead to changes in cropping patterns (land use), shifts in animal herd composition and eventual output quantities which lead to changes in income and agricultural markets. The results of CAPRI then flow into the environmental, landscape and biodiversity assessments to be processed further into effects in these respective fields. MITERRA also takes the pre-model parameterisation of changes in practices together with the modelled output of CAPRI in relation to changes in land use and numbers and composition of livestock to model the environmental impact indicators.
For the assessment of the other fields of impact (land use, landscape, biodiversity, animal welfare and public health) both pre-model calculations and modelled output of CAPRI and MITERRA will be used for further knowledge based assessments (see also next section).
In prototype 1 all context data required will be obtained from existing European statistical sources (e.g. FADN and FSS) available at administrative level.
However, for prototype 2 calculations will be made below administrative boundary levels for more environmentally homogeneous (natural) regions such as Nitrate Vulnerable zones (NVZs), High Nature Value (HNV) and Natura 2000 farmland. This will require pre-model and post model disaggregation approaches. Part of these disaggregated data will be obtained from other projects (e.g. Seamless and Dynaspat), but some post-CAPRI disaggregation techniques will be applied in CCAT in order to allocate the model output both to natural and administrative regions. Data requirements for this will not be discussed further in this deliverable, as they are not included in the prototype 1 assessment needs.

1.2.4 Data for impact assessment

This data category relates to two data categories:

1) the primary data sources which are directly needed as input for running the models (in prototype 1: CAPRI and MITERRA) and the assessments on animal welfare and public health

2) the modelled output data of CCAT calculations used as input for further impact assessments. In prototype 1 this only concerns output of CAPRI and MITERRA used for further up-stream calculations especially in the fields of land use, landscape, biodiversity, animal welfare and public health effects.

As already roughly described above, the starting point for the calculation of economic, environmental, landscape and biodiversity indicators consists of the description of the concrete Cross Compliance standards implemented in the EU member states or regions, especially those which cause additional compliance. These Cross Compliance standards have direct and indirect effects. The indirect effects are derived from different assumed compliance levels with these standards which cause effects for the producer's income and economic markets inducing changes in land use and livestock patterns which then have an influence on environment. However, the implementation of SMRs and GAECs at different compliance levels also cause direct effects in the form of changes in farming practices which have an impact on the environmental, land use, landscape, biodiversity, animal welfare and public health indicators.

1.3 Overview: impact assessment in prototype 1

This first prototype will assess effects of a limited number of SMR standards, notably the Nitrate Directive, the Identification and Registration Directive and most of the GAEC requirements. Standards with respect to biodiversity, landscape, health and animal welfare issues are dealt with in a more indirect and qualitative way. The second prototype, which will be developed in a next phase, will consider a more integral treatment of the CC-standards. In Table 1.1 an overview is given of the standards and the selected impact fields which will be assessed in prototype 1 and prototype 2. From this overview it becomes clear that assessments in prototype 1 will only be done at national or Nuts 2 level, while in prototype 2 the assessment will also be done at below administrative boundary levels, such as within bio-physical entities (e.g. environmental zones, altitude areas), sensitive areas (e.g. High Nature Value farmland areas) either EU wide or within selected case studies.

Table 1.1. Scope and assessments in relation to standards and impacts fields in Prototype 1 and 2

SMRs and GAECs	**Prototype 1**		**Prototype 2**		
	Assessment level	***Impact field***	***EU wide assessment of impacts***	***Assessment in case studies***	***Impact field***
Nitrates Directive	NUTS2	MWALBL_U	Yes, spatially detailed assessment	Yes	MWALBL_U
Wild birds Directive	NUTS2	LB		Yes	MLB
Habitats Directive	NUTS2	LB		Yes	MLB
Sewage Sludge Directive	NO		Yes, spatially detailed assessment	Yes	MWSABL_U
Ground water Directive	NO		Yes, spatially detailed assessment	Yes	MWSABL_U

Animal Registration Directive	NATIONAL, NUTS2	MP	Yes, only markets and producers income and public health	Yes	MA_WP
Bovine, Ovine and Caprine Animal Registration Regulation	NUTS2	MP	Yes, only markets and producers income	Yes	MA_WP
Plant Protection Product Directive	NO		Yes, spatially detailed assessment	Yes	MW
Hormones Directive	NO		Yes, only markets and producers income	NO	
Food Law Regulation	NATIONAL	P	Yes	Yes	MP
Regulation (EC) 999/2001 on prevention, control and eradication transmissible spongiform encephalopathies	NO		Yes	Yes	MA_WP
Foot-and-Mouth Disease Regulation	NO		Yes	NO	M
Calves directive	NO		Yes, only markets and producers income	NO	M
Pigs Directive	NO		Yes, only markets and producers income	Yes	MA_W
Animal welfare Directive	NO		Yes, only markets and producers income	Yes	MA_W
Regulations on the hygiene of foodstuffs and food of animal origin	NATIONAL	P	Yes	Yes	MP
Regulation on requirements for feed hygiene	NATIONAL	P	Yes	Yes	MP
Soil erosion-minimum coverage	NUTS2	MWAL_ULB	Yes, spatially detailed assessment	Yes	MWASL_ULB
Soil erosion-minimum land management	NUTS2	MWAL_ULB	Yes, spatially detailed assessment	Yes	MWASL_ULB
Soil erosion-retain terraces	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	MSL_ULB
Soil organic matter-standards for crop rotation	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	MSL_ULB

Soil organic matter-appropriate stubble management	NO		Yes, spatially detailed assessment	Yes	MWAS
Soil organic matter-appropriate machinery use	NO		Yes, spatially detailed assessment	Yes	S
Minimum level of maintenance-minimum livestock stocking density and appropriate regimes	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	MWASL_ULB
Minimum level of maintenance-Protection of permanent grassland	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	MWASL_ULB
Minimum level of maintenance-retention of landscape features	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	ML_ULB
Minimum level of maintenance-Avoiding the encroachment of unwanted vegetation	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	ML_ULB
Minimum level of maintenance-Maintenance of olive groves	NUTS2	ML_ULB	Yes, spatially detailed assessment	Yes	ML_ULB

M=market & producer income; W=water quality; A=air and climate; B=biodiversity; L=landscape; S=soil quality; A_W=animal welfare, P=public health, L_U=land use.

Prototype 2 will basically be an extended version of Prototype 1 where we will refine the assessments both spatially and scientifically and we will concentrate on several case study assessments which allow the incorporation of more detailed information. This will especially enable the estimation of impacts in the fields of animal welfare, public health, landscape and biodiversity for which detailed EU wide information is not available. Case studies will also be used for fine-tuning, calibrating and testing the plausibility of the assessments on other impact fields, especially the ones on water, soil, air and climate.

2 Selected indicators for prototype 1

2.1 Selected economic impact indicators

2.1.1 Selected economic indicators for prototype 1

An overview of the selected economic indicators to be specified in prototype 1 with the CAPRI model are given in Table 2.1. For a further description of how these indicators will be calculated see D2.3 (Jongeneel et all, 2008) and D4.1.1 (Jongeneel and Kempen, 2008).

Table 2.1: Selected economic indicators, available model and evaluation level used in prototype 1

Field of impact	**Indicator**	**Spatial resolution level**			
		group of farms (e.g. types)	**region**	**country**	**EU**
Farm economics	Gross Margin/hectare[2]	X	X	X	X
	Budgetary expenditure	X	X	X	X
	Agricultural Income	X	X	X	X
	Costs of compliance	X	X	X	X
Production-related indicators	Production of main agricultural Products	X	X	X	X
	Export/Import Ratio of main Agricultural Products			X	X
	Competitiveness: change market share			X	X
	Welfare changes related to agricultural production			X	X
Indicators related to land markets	Land allocation	X	X	X	X
	Land price		X	X	X
Indicators related to administration	Costs of controlling CC[3]			X	X

In the Table in Annex 1 they are divided into the following subcategories describing the impact field which is focused by indicators related to:
a) ***Farm economics*** refer to the (changing) costs farmers are facing by complying with the Cross Compliance standards and which impact farmers' production program and land allocation. The decision for a specific degree of compliance is set exogenous in the economic model.
b) ***Production-related indicators*** present those indicators which reflect the impact of Cross Compliance standards based on changes in agricultural production: the changes in agricultural productivity and production itself, related changes in the import/export ratio reflecting the

[2] This indicator can also be interpreted as an indicator of competitiveness.
[3] This indicator is made conditional on availability of information about monitoring and inspection costs, and will be only taken into account if compliance is endogenized.

competitiveness of a region, related changes in the market share reflecting the competitiveness of the sector, and welfare changes related to agricultural production (aggregated monetary utility) which may affect the utility of other sectors trough market exchanges.
c) ***Land markets indicators*** reflect changes in land prices due to Cross Compliance measures. The latter identify income effects depending on land tenure and related effects regarding the substitution of agricultural activities with non agricultural activities.
d) ***Administration indicators*** especially refer to the costs of controlling Cross Compliance standards. These costs are necessary to judge the overall welfare of CC, since more controlling of farms leads to higher cost but reduces the probability of non-compliance.

CAPRI is the main model with which the economic indicators are assessed. A more detailed description of the CAPRI model is already presented in other CCAT deliverables (D2.1/ D2.2 Jongeneel et al., 2007) and D4.1.1 (Jongeneel and Kempen, 2008). In summary it can be mentioned that CAPRI consists of two major modules – the *supply module* and the *module for marketable agricultural outputs*. The *supply module* consists of independent aggregate non-linear programming models representing activities of all farmers at regional or farm type level captured by the Economic Accounts for Agriculture (EAA). The *module for marketable agricultural outputs* is a spatial, non-stochastic global multi-commodity model for about 40 primary and processed agricultural products, covering about 40 countries or country blocks in 18 trading blocks. Bi-lateral trade flows and attached prices are modelled.

There are different data categories needed for the economic impact assessment in CAPRI. Data on the Cross Compliance standards implemented in the member states/ regions are the basis for assessing the costs of (additional) compliance with these standards. The Capri-Pre-Processor calculates the total additional cost per activity and region, taking into account the degree of implementation and compliance of all relevant measures. This tool needs specific background information depending on the respective regulations, which is described in more detail in D2.3 (Jongeneel et al., 2008, p. 32). It needs also input from MITERRA Europe regarding certain changes caused by the compliance with CC standards, e.g. changes in fertilizer input and animal manure excretion due to changes in livestock type and livestock numbers. Finally this data will be stored in a database containing information on additional costs of complying and share of voluntary compliance for each CC measure at a regional and farms type specific resolution. A pre-model calculation tool will use this database to derive activity specific additional cost based on the desired, scenario specific compliance level. With the total cost increases as estimated in the pre-model calculation tool, CAPRI calculates the economical effects and changes in agricultural production (change in animal numbers and in crop area). For the calculation of farm type specific activity levels the CAPRI farm type layer can be used. As statistical data refereeing to farm types are mostly reported at a level higher than Nuts2 an estimation of farm type information at NUTS2 is required, which will be done by some CAPRI model components. For these estimations a combination of data of several statistical data sources (mainly FSS and FADN) is required.

2.1.2 Extensions of selected economic indicators in prototype 2

Since the operational CAPRI model allows calculation of all selected economic indicators, the major challenge in this field is the suitable implementation of measures. As different qualities of grassland are important with respect to landscape and biodiversity (high natural value areas) the definition of extensive and intensive grassland must be revised, probably based on

additional information from land cover maps[4] and point observations[5] in combination with expert knowledge. When the availability of raw data regarding different grassland qualities becomes clear, the exact methodology will be developed for prototype 2.
CAPRI actually uses 2002 as base year and 2013 as projection year. For the test case we focus on the base year and the inconsistency with the actual MITERRA base year will be neglected. In the future we envisage moving the base year to 2005. The projection year can be any year between base year and 2020. The projection tool incorporated in CAPRI is quite demanding and hence "harmonized" projection years will be part of Prototype 1.
In the final CCAT tool (but not in the prototype 1) the potential impact of CC-related measures on yields will also be taken into account, where the CAPRI pre-model will use the yield corrections as provided by MITERRA Europe (and background models like DNDC and EPIC) for calculating the total additional cost per activity and region of an implementation of CC standards.

2.2 Selected environmental impact indicators for prototype 1

Indicators selected for the environmental impact fields to be assessed for prototype 1 are given in Table 2.2. They refer to a) air quality/climate (A in table 1.1) , b), physical soil quality (erosion) or chemical soil quality (S in table 1.1) and c). ground and surface water quality (W in table 1.1). It also indicates which indicators will be developed in prototype 1 and in prototype 2. The data-requirements for the assessment described in the rest of the report will more strongly concentrate on the data needs for the indicators developed in prototype 1.

Table 2.2 Indicators predicted by the extended MITERRA Europe, DNDC and EPIC models used in CCAT in prototype 1 and 2.

Compartment	Indicator	Unit	Prototype 1	Prototype 2	Relevant for SMRs/ Directives	Relevant for GAECs
Air/ climate (A)	NH_3 emission	kg NH_3-N/ha/yr	MITERRA Europe	MITERRA Europe; DNDC?	Nitrates	Minimum level of maintenance
	N_2O emission	kg N_2O-N/ha/yr	MITERRA Europe	MITERRA Europe; DNDC	Nitrates	Minimum level of maintenance
	CH_4 emission	kg CH_4/ha/yr	MITERRA Europe	MITERRA Europe; DNDC?	Nitrates	Minimum level of maintenance
Soil (S)	Erosion	m^3 soil/ha/yr	-	EPIC	-	Minimum level of maintenance Soil erosion
	Carbon balance	kg C/ha/yr	MITERRA Europe	MITERRA Europe; DNDC	Nitrates Sewage Sludge	Minimum level of maintenance Soil organic matter
	Nitrogen balance	kg N/ha/yr	MITERRA Europe	MITERRA Europe; DNDC	Nitrates Sewage Sludge	Minimum level of maintenance
	Phosphorous	kg P/ha/yr	MITERRA	MITERRA	Nitrates	Minimum

[4] The CORINE land cover map distinguishes e.g. pasture and natural grassland
[5] The LUCAS survey gives different types of pastures e.g. with or without trees

	balance		Europe	Europe	Sewage Sludge	level of maintenance
	Metal balance	g/ha/yr	-	MITERRA Europe	Nitrates Sewage Sludge Ground water	Minimum level of maintenance
Water (W)	Nitrogen leaching	kg N/ha/yr	MITERRA Europe	MITERRA Europe; EPIC; DNDC?	Nitrates	Minimum level of maintenance
	Nitrogen runoff	kg N/ha/yr	MITERRA Europe	MITERRA Europe; EPIC	Nitrates	Minimum level of maintenance
	Phosphorous leaching	kg P/ha/yr	-	(MITERRA Europe) [1]	Nitrates	Minimum level of maintenance
	Metal leaching	g/ha/yr	-	(MITERRA Europe) [1]	Nitrates Sewage Sludge Ground water	Minimum level of maintenance

[1]The brackets for phosphorous and metals implies that it is not yet sure whether this will be predicted, since the data availability for doing this is limited

The impact of cross-compliance measures on pesticides is not included in the integrated environmental modelling framework because: (i) pesticides are not under cross compliance measures, (ii) the information on pesticide use on a European wide scale is inadequate and (iii) the complexity of modelling pesticide behaviour makes it difficult to make adequate predictions of pesticide accumulation and leaching in response to measures at a large scale.

Although the models used for the calculation of the environmental indicators are already described extensively in other CCAT deliverables they will be described in general terms in order to explain the type of data needs per model and impact assessment.
MITERRA-EUROPE is a transparent and simple (meta-model) model to assess the effectiveness, of mitigation options and strategies for NH_3 and non–CO_2 greenhouse gas emissions (N_2O and CH_4) and N (specifically NO_3) leaching in agriculture. Until now it has been applied to whole EU27. It therefore already works with an extensive database enabling the assessments of most of the indicators specified in Table 2.1 in relation to the Nitrate Directive standards. Quite a significant amount of work is still required to extent the model and the input database for assessing effects of all GAEC standards and of the non-nitrogen related emissions.

MITERRA-EUROPE is programmed in GAMS. It consists of an input module with activity data and emission factors, a set of (packages of) measures to mitigate NH_3 emission and NO_3 leaching, a calculation module, and an output module presenting results in tables and maps. The MITERRA-EUROPE will be extended by including the metal balance, metal leaching and phosphorous leaching. This extension will mainly be undertaken with knowledge available in INITIATOR2 (Dutch model, see other CCAT deliverables of Jongeneel et al., 2007 and De Vries et al., 2008).

The EPIC model is a soil/crop model composed of several simulation components for weather, hydrology, nutrient cycling, pesticide fate, tillage, crop growth, soil erosion, crop and soil management and economics. The model was originally focused on the effect of soil erosion on productivity, but is now an integrated field scale crop-soil model especially well-suited to evaluate crop growth, irrigation requirements (including an option for auto-irrigation), nutrient uptake and cycling, and erosion. It is composed of several simulation

components for weather, hydrology, nutrient cycling, pesticide fate, tillage, crop growth, soil erosion, crop and soil management and economics (Williams, 1995). It predicts the effects of management decisions on soil, water, nutrient, and pesticide movements and their combined impact on soil loss, water quality, and crop yields for areas with homogeneous soils and management.

The DNDC model (Denitrification-Decomposition) is a process-oriented computer simulation model of soil carbon and nitrogen biogeochemistry (Li, 2000; Li et al., 1992; Li et al., 2006; Li et al., 2004). It is a mechanistic detailed model, originally developed for use at the field level and further developed for the use at regional scale. DNDC is a multi-ecosystem model designed for assessing the emissions of N_2O, CH_4, and NH_3 from the soil into the atmosphere and the stock changes of organic carbon in the soil profile on the basis of mechanistic process-understanding. The model consists of two components. The first component, consisting of the soil climate, crop growth and decomposition sub-models, predicts soil temperature, moisture, pH, redox potential and substrate concentration profiles driven by ecological drivers (e.g., climate, soil, vegetation and anthropogenic activity). The second component, consisting of the nitrification, denitrification and fermentation sub-models, predicts greenhouse gas emissions from the soil (CO_2, N_2O, CH_4), the dynamics in soil carbon pools and NH_3 fluxes based on the modelled soil environmental factors.

Both the EPIC and DNDC models make their assessments at a detailed spatial scale (grids or homogeneous spatial units) which are much smaller then administrative boundaries. Assessments at this scale will only be included in prototype 2 and therefore data requirements for these models will only briefly addressed. The data requirements discussed further will therefore mainly relate to the MITERRA-Europe data needs. Furthermore, the models EPIC and DNDC will be included as separate metamodels in terms of e.g. simplified regression functions to be derived from the original models.

Different data categories are needed for the environmental impact assessment in prototype 1. These are systematically discussed in Chapter 5 (Section 2).

Since the environmental models (MITERRA, EPIC, DNDC) mainly focus on the calculation of balances, including atmospheric emissions of N compounds (NH_3 and N_2O) and of CH_4, they require at least annual inputs of the respective elements by fertilizers, animal manure and biosolids (sewage sludge, compost etc). Therefore, information on the application rates and types of fertilizers (nitrogenous, phosphatic, potassic etc), animal manure (cows, pig, poultry etc) and biosolids (sewage sludge, compost etc) to assess the annual inputs of C, N, P and metals is required. (Jongeneel, et al., 2008, p. 43). Since animal manure application rates are determined by the number of livestock and their excretion rates, information on the change in livestock type and livestock numbers is required.

2.2.1 Extensions of selected environmental indicators in prototype 2

For the first prototype, the included SMRs are limited to the Nitrate Directive (ND) (in EU-15 + Slovenia + Malta), with a focus on evaluation with the MITERRA Europe model in interaction with the CAPRI model. Furthermore, the evaluation will take place only at NUTS2 level. This limitation allows a quick start for the first prototype, specifically because the measures are already intensively discussed with the Commission in the context of the EU service contract related to the development and application of MITERRA Europe. In the final version, the impact of measures in the “Sewage Sludge Directive” and the “Groundwater

Directive" will also be included and the evaluation will take place at a much higher spatial detail (use of so-called homogeneous spatial mapping units (HSMUs) instead of NUTS2 level calculations). Furthermore, several additional measures in the GAECS will be evaluated and again at a much higher spatial detail (HSMUs instead of NUTS2 level).

Calculations with EPIC and DNDC model will be implemented for prototype 2. The selected measures in SMRs and GAECs, including the way in which effect indicators will be calculated with one or more models in the final CCAT tool, are presented in annexes of the report on the Environmental Impact Tool (De Vries et al., 2008).
A summary of the differences between the first and the final CCAT tool with regard to the environmental impact field is presented in Table 2.2, as also presented in De Vries et al (2008).

Table 2.3 Resolution in EU wide assessments and environmental impacts fields (air, soil or water quality) *in relation to SMRs and GAECs as evaluated in the first prototype and the final CCAT tool*

SMRs and GAECs	**Prototype (MITERRA)**		**Final tool (MITERRA+EPIC+DNDC)**		
	Resolution assessment level	***Impact field***	***Resolution assessment level***	***Assessment in case studies***	***Impact field***
Nitrates Directive	NUTS2	AW	HSMU	Yes	AW
Sewage Sludge Directive	NO		HSMU	Yes	ASW
Groundwater Directive	NO		HSMU	Yes	SW
Soil erosion-minimum coverage	NO		HSMU	Yes	SW
Soil erosion-minimum land management	NO		HSMU	Yes	SW
Soil erosion-retain terraces	NO		HSMU	Yes	SW
Soil organic matter-standards for crop rotation	NUTS2	S	HSMU	Yes	S
Soil organic matter-appropriate stubble management	NO		HSMU	Yes	ASW
Minimum level of maintenance-minimum livestock stocking density and appropriate regimes	NO		HSMU	Yes	ASW
Minimum level of maintenance-Protection of permanent grassland	NO		HSMU	Yes	ASW

A=air and climate; S=soil quality; W=water quality.

In the test case the year 2000 will be used as the reference year, because this is already present in MITERRA-Europe and the year 2020 as object year. CAPRI actually uses 2002 as base year and 2013 as projection year. For the test case this inconsistency will be neglected. In the future we envisage moving the base year to 2005 (both in CAPRI and MITERRA). The projection year can be any year between base year and 2020. The projection tool incorporated in CAPRI is quite demanding and hence "harmonized" projection years will be part of Prototype 1.

2.3 Selected land use, landscape and biodiversity indicators

2.3.1 Approach to assessing the CC impacts on land use, landscape and biodiversity indicators for prototype 1

For prototype 1 the impacts will be assessed for land use, landscape and biodiversity as a whole. Since for the landscape and biodiversity impact field the linkage to the central modelling tool is often indirect or non-existing, indirect and alternative assessment approaches have been chosen for prototype 1.

It is planned to perform the following assessments for prototype 1:

a) An expert qualitative estimate of the effectiveness of standards for biodiversity and landscape;
b) Assessments of impacts induced by predicted land use changes as a consequence of Cross Compliance;
c) Impact assessments on habitat quality derived from environmental indicators.

a) The expert qualitative estimate of the standards' effectiveness will concentrate on those SMRs and GAECs standards that target the preservation of landscapes and biodiversity. This includes the Nitrate Directive and the Birds and Habitats Directives. For GAECs relevant standards included will be those for soil erosion, soil organic matter and minimum level of maintenance, including the protection of permanent grassland.

In a first step the effectiveness of the standards for biodiversity and landscape will be estimated in form of a ranking by means of a qualitative scale. In a next step the potential effectiveness per NUTS2 is weighted by using the *regional share of UAA, or the share of a specific land use to which the standard is targeted (e.g. olive groves)*. Both, share of UAA and absolute hectares of UAA at NUTS2 level will be used as weighting factors, reflecting respectively the magnitude and the extend of the potential effects. To derive the *expected* effectiveness from the *potential* effectiveness of the standard, the level of compliance with different standards of the land use share per NUTS 2 region under 3 different scenarios of compliance will be used. If these shares of compliance for certain standards per land use category can't be estimated, the regional average compliance levels for all land uses will be used.

b) For the assessment of impacts of changes in land use changes CC the CAPRI model output on changes in land use and livestock composition and numbers is used as input for assessing:

1. change in share of intensive/extensive land use
2. change in density and share of intensive/extensive livestock
3. change in land use diversity (evenness)

There are different data needed for the different impact assessment categories. The data for the *assessment of the changes in share of intensive/extensive land use (1))* come from the CAPRI database, which specifies 35 different land use categories (for the base line situation which is 2005) and the CAPRI model output for the future situations. CAPRI works with the same land use classes as in FSS which includes 34 different crops and permanent grassland. These land use classes will be classified in intensive and extensive categories, taking ecological principles into account. That means that a previous assessment will be made to determine whether a particular crop belongs to the intensive or the extensive modality. Information on certain input levels will be derived from the pre-model CAPRI input data which include estimates on input levels for different crops both in terms of artificial fertilisers,

agro-chemicals and irrigation. The information on fertiliser input levels per crop type per region are delivered by MITERRA to CAPRI.

For assessing the effects on the *livestock density indicator (2)* the input comes from the present livestock patterns and the - by the CAPRI model predicted - changes in livestock mix and numbers. For the assessment for certain livestock types (LU) the indicator LU/ha UAA will be directly used, such as for pigs and poultry. Since other types of livestock, such as dairy, beef, sheep and goat, can be managed either in an intensive or extensive way, an estimation of their intensity needs to be made in advance. A decision on which indicators will be used for this estimation is still to be made. Potential indicators considered are LU/ha UAA, LU/ha of fodder and milk yield per cow which can again be derived from the pre-model input data from CAPRI.

For the assessment of changes in *land use diversity (evenness) (3)* the land use classes used in the CAPRI model will be classified according to similarity of structure and appearance. According to the EUROSTAT definitions following three classes are considered: arable crops, permanent crops, grasslands/set aside/fallow land. The diversity will be calculated of these 3 classes for each scenario, using the evenness part of the Shannon's Diversity Index, which is described in more detail in D4.3.1 (pg. 19ff). The evenness of the compliance scenarios will be compared with the baselines evenness. From this can be derived where in what degree an increase in land use diversity can be expected, assuming this will lead to higher landscape diversity, and a higher biodiversity.

c) For the assessment of changes in environmental quality on habitat quality the modelled CAPRI-MITERRA output will be used. This means that only the effects of the standards addressed by the CAPRI/MITERRA prototype 1 assessments can be taken into account. In relation to the SMRs this will only include the effects of the Nitrate Directive and for GAECs all standards will be included for as far as assessed with the CAPRI and MITERRA models in prototype 1. The following environmental indicators will be used for this prototype 1 impact assessment:

- Air: Emissions of ammonia in kg NH_3-N/ha/yr
- Water: Nitrates in water, including leaching in kg N/ha/yr and concentrations in mg NO_3/l

The interpretation of changes in the environmental qualities will be based on the idea that an increase in environmental quality (above a certain level, which still needs to be defined) will lead to an improvement of biodiversity.
How these assessments are performed is discussed in more detail in the Deliverables 2.3 (Jongeneel et al, 2008) and 4.3.1 (Oñate et al., 2008).

From the former it is clear that there are 3 land use indicators to be calculated, 2 indicators for biodiversity and 2 for landscape. What data needs are required to assess these is discussed in Section 5.3.

2.3.2 Extensions of selected land use, landscape and biodiversity indicators in the prototype 2

Regarding the land use based assessments following extensions will be made in prototype 2: For the impacts of land use change as a consequence of Cross Compliance in the first prototype only positive and negative impacts for biodiversity/landscape as a whole will be assessed, without specifying for e.g. birds/mammals/ invertebrates/ plants. In a later stage we

might go into more detail if we think this is necessary and feasible. For the assessment of changes in land use diversity due to Cross Compliance standards in prototype 2 we might have spatially more detailed information on land use than on NUTS2 level, and we might then consider to increase the number of land use classes and use the complete Shannon Index (only the evenness part of the Shannon Index will be used in the first prototype).

In a later stage, for **prototype 2**, it is further envisaged that:

1) The environmental models will be applied to environmental regions which are smaller then NUTS2 regions and which are characterised by a more homogeneous environment. Model calculations will then deliver a better picture of the CC effects taking account of the larger variation in combinations of farming practices with very localised bio-physical environmental factors.
2) More detailed combinations between the qualitative assessment of pressures on different impact fields of biodiversity/landscape and the present state of biodiversity will be made. This can however only be done where state data are available as this will enable us to make a prediction of changes in certain species groups (such prediction can be made with e.g. the LARCH model or we use quantitative relationships between farming practices and species numbers derived from e.g. countryside survey elaborated in SEAMLESS). This will only be possible for case studies for which we have information on the state of certain species groups.

2.4 Selected public health and animal welfare indicators

2.4.1 Selected public health and animal welfare indicators for prototype 1

In general, there are some problems in the impact assessment for the public health and animal welfare field (for further details see D2.3 p. 51). Public health and animal welfare is mainly related to the way the production processes are organized rather than to the amount of production factors used, applied input mix and produced output mix and output levels, therefore the linkage to the CAPRI-MITERRA model is rather indirect and often not existing. Hence, a more independent approach is proposed, which focuses on a selected number of aggregated indicators, of which some have the potential to be linked to the model-tool.
A specific effort lies in the method of selection or in the further development of feasible indicators. A combination of desk research and case-study was chosen to at least recover part of the desired information.

In the first prototype of the tool only EU-wide indicators (at European scale) will be involved. Therefore only 6 of the already selected indicators will be implemented, which are roughly presented in Tab. 2.3.

Table 2.4: Selected public health and animal welfare indicators, involved models and evaluation level used in prototype 1

Field of impact	**Indicator**		**Spatial resolution level**		
		Involved models	HSMU	NUTS2	NUTS0
Public Health	Incidence rate of food-borne illness, infections and intoxications				X
	Government investments in food safety measures				X
	Occurence of salmonellosis				X
	Degree of compliance				X
Animal Welfare	Degree of compliance				X
	Milk yield	CAPRI		(X)*	X
	Number of offspring	CAPRI			X

*Available at NUTS2 level up to 2004

The data needed for this impact assessment have different sources. EUROSTAT sources can be used for the public health indicators incidence rates of food-borne illnesses, infections and intoxications, occurrence of salmonellosis, and government investments in food safety measures. The information needed for the animal welfare indicators number of offspring per sow/cow per year and milk yield per cow per year (l/cow) can be derived from the CAPRI database up to the year 2004 and from a statistical database up to the year 2006 or rather 2007.
The data needed for the degree of compliance will partly be derived from the IEEP-Project „Evaluation of the application of cross compliance as foreseen under regulation 1782/2003“. This data includes in addition to the total numbers of SMR inspections and breaches, the proportions of breaches by SMR on NUTS0 level. Unfortunately the IEEP data only refer to the legal acts No. 1-8a (environmental issues, registration of farm animals), because these are the only SMRs which were applicable as from the first of January 2005. That’s why for prototype 2 it is necessary to translate its values into the SMRs of the legal acts No. 9-18 as well as the Regulation (EC) No. 852/2004 that are focussed on the issues of public health or animal welfare.

2.4.2 Extensions of selected public health and animal welfare indicators in prototype 2

Whereas the indicator data for the first prototype of the tool is available on European level most of the indicator data for the second prototype will be assessed locally. This will be achieved by an in-depth case study to be carried out January and / or February 2009 that provides specific topic-related information. Further a desk study aims at surveying the existing literature and detail studies done in this field at member state level. The latter will include both officially published and grey literature. Based on this a general and systematized picture of the state of the research will be made. The case study will be carried out in Austria in the region Styria and the assessments in Styria will be conducted on different measurement levels. In addition to the farm-level assessments, there will be interviews with experts of local food monitoring authorities and certification companies. Farm scenarios will be created (e.g.

with the help of the CAPRI model) which will be used as reference for the other case regions regarding their different conditions.
The main criteria for the selection of indicators for the second prototype of the tool were described in D4.4.1. On the basis of these criteria following additional indicators to be used in prototype 2 have been selected (Tabel 2.4):

Table 2.4: Overview of the additionally selected indicators in the area of Public Health and Animal Welfare for prototype 1

Reference area	Organisation / Indicator framework	Selected indicators	Reasons for the selection of the indicators
Public health	EFSA: Infectious food-borne diseases	Salmonella in fresh pig meat	•Available Data for the selected case regions •Available indicator data: national level (DE, ES, AT, NL, CZ,…) •Appropriate time dimension of the data •Significance for public health (KRÄMER, 2002; KUNZ, 1993; MÜLLER et al., 1996; FEHLHABER, 2003) •At least indirect Relevance for SMRs •Significance for animal welfare (FEHLHABER, 2003; ALTER, 1999; MAUERSBERGER, 2002): Premortal stress of animals for slaughter increases the risk of microbiological zoonoses)
		Salmonella in fresh bovine meat	•Available Data for the selected case regions •Available indicator data: national level (DE, ES, AT, CZ,…) •Appropriate time dimension of the data •Significance for public health (KRÄMER, 2002; KUNZ, 1993; MÜLLER et al., 1996; FEHLHABER, 2003) •At least indirect relevance for SMRs •Significance for animal welfare (FEHLHABER, 2003; ALTER, 1999; MAUERSBERGER, 2002): Premortal stress of animals for slaughter increases the risk of microbiological zoonoses)
		Salmonella in feed material	•Available Data for the selected case regions •Available indicator data: national level (DE, ES, NL, AT, CZ,…) •Appropriate time dimension of the data •Significance for public health (KRÄMER, 2002; KUNZ, 1993; MÜLLER et al., 1996; FEHLHABER, 2003) •Relevance for SMRs
		Campylobacter in fresh pig meat	•Campylobacteriosis is the most frequently reported zoonosis in the EU (EFSA, 2007) ➔ Significance for public health (KRÄMER, 2002; MÜLLER et al., 1996; FEHLHABER, 2003) •At least indirect relevance for SMRs •Significance for animal welfare (FEHLHABER, 2003; ALTER, 1999; MAUERSBERGER, 2002): Premortal stress of animals for slaughter increases the risk of microbiological zoonoses) •Available data in at least two case regions •Available indicator data: national level (DE, ES, NL, AT,…)
		Campylobacter in fresh bovine meat	•Campylobacteriosis is the most frequently reported zoonosis in the EU (EFSA, 2007) ➔ Significance for public health (KRÄMER, 2002; MÜLLER et al. 1996; FEHLHABER, 2003) •At least indirect relevance for SMRs •Significance for animal welfare (FEHLHABER, 2003; ALTER, 1999; MAUERSBERGER, 2002): Premortal stress of animals for slaughter increases the risk of microbiological zoonoses) •Available data in the case regions •Available indicator data: national level (DE, IT, NL, ES, CZ, AT,…)
		In development: Controls and inspections of food and	•Significance for public health (KRÄMER, 2002) •Relevance for SMRs

		feed (to be specified) Application is advised but depending on the availability of indicator data. The data will be published in 2008 (in a pocketbook).	
		Membership in certification schemes	•High significance for public health (FEHLHABER, 2003) •The membership in certification schemes has financial effects on the farmer (QS, 2007) •Data can also be surveyed •Relevance for SMRs •Practicability of the indicator
		Veterinary costs per animal per year	•Significance for public health •Data has to be surveyed •Relevance for SMRs •Practicability of the indicator
Animal welfare	Animal Needs Index 35L/2000 for cattle	Space allowance	•Good availability of data in Austria •Relevance for SMRs •Most of the respective SMRs have strong cost implications on the farmer •Appropriate time dimension •The Animal Needs Index or several of its indicators can be used to asses the standard of animal welfare in other case regions •High significance of the Animal Needs Index for animal welfare (HÖRNING, 2004; OFNER, 2003; AMON, 2002; BARTUSSEK, 1988, 1990 & 1995) •Suitable spatial level •Practicability of the indicators
		Lying & rising	
		Stall size & boundaries	
		Movement of tether	
		Yards / pasture	
		Softness, cleanliness & slipperiness of the lying area	
		Daylight in animal house	
		Air quality	
		Technical condition of equipment	
		Cleanliness of pens / feeding/drinking areas	
		Cleanliness of animals	
		Animal health	
	Animal Needs Index 35L/1995 for feeding pigs	Width of feeding grounds	•Good availability of data in Austria •Relevance for SMRs •Most of the respective SMRs have strong cost implications on the farmer •Appropriate time dimension •The Animal Needs Index or several of its indicators can be used to assess the standard of animal welfare in other case regions •High significance of the Animal Needs Index for animal welfare (HÖRNING, 2004; OFNER, 2003; AMON, 2002; BARTUSSEK, 1988, 1990 & 1995) •Suitable spatial level •Practicability of the indicators
		Watering place	
		Temp. access to watering place	
		Space allowance	
		Yards and pasture	
		Softness, cleanliness & slipperiness of the lying area	
		Daylight in animal house	
		Air quality	
		Technical condition of equipment	
		Cleanliness of pens / feeding/drinking areas	
		Record keeping in animal house	
		Animal health	
	Animal production and welfare committee of the	Muck out interval of the stables	• Relevance for the SMRs • Practicability of the indicator • Significance for animal welfare (BOCKISCH et al., 1999) • Significance for public health

	German Society for Animal breeding	Width of the drove alleyways	• Relevance for the SMRs • Practicability of the indicator • Significance for animal welfare (BOCKISCH et al., 1999)
	Own development	Degree of compliance: proportion of breaches by SMR [%]	•Relevance for SMRs •High significance for animal welfare (LEI) •The degree of compliance has financial effects on the farmer (LEI) •IEEP-data available
		Membership in certification schemes: Number, date of certification and type of certification scheme	•The membership in certification schemes has financial effects on the farmer (QS, 2007) •Data can also be surveyed •Relevance for SMRs •Practicability of the indicator
		Farm attributes: training intervall of personel, stocking rate of animal transports (m^2/animal), type of housing system	•Significance for animal welfare (ROUSING et al., 2000; BOCKISCH et al., 1999; VON BORELL & VAN DEN WEGHE, 1999) •Relevance for SMRs •Practicability of the indicator
		% of early deaths per year	•Significance for animal welfare (ROUSING et al. 2000 & 2002; MANTECA & VELARDE, 2007, KNIERIM et al., 2003; WILLEN, 2004) •Relevance for SMRs •Practicability of the indicator
		Disease level: Number and kinds of diseases per animal per year	•Significance for animal welfare "disease can be regarded as an important welfare indicator, because it is in many cases associated with negative experiences such as pain, discomfort or distress" (ROUSING et al., 2000 & 2002; HUGHES & CURTIS, 1997; VON BORELL & VAN DEN WEGHE, 1999; KNIERIM et al., 2003; WILLEN, 2004) •Relevance for SMRs •Practicability of the indicator
		Veterinary costs per animal per year	•High significance for animal welfare •Data has to be surveyed •Relevance for SMRs •Practicability of the indicator

3 Data inventory for the implementation of Cross Compliance in the EU member states

Under this data category different subcategories of required data and their specific purposes have been mentioned in chapter 1.2.1. The following subcategories have been indicated: a) overview of the different Cross Compliance obligations (SMRs/ GAECs) in the EU member states, b) the short names for SMRs/ GAECs, c) the level of punishments in case of non-compliance (payment reductions), d) the degree of compliance, e) the level of compliance per SMR and GAEC in 2005 and f) goals which leaded to the specific design of the implemented Cross Compliance standards in the member states or regions.

3.1 Legal implementation

3.1.1 Implementation of SMRs/ GAECs in the EU member states

Regarding the required overview of the different ***Cross Compliance obligations*** in the EU member states this information has been already collected by former studies which have been already described in D2.1/D.2.2 (Jongeneel et al, 2007): the Cross Compliance project coordinated by LEI, the CIFAS project coordinated by the IfLS and the Project „Evaluation of the application of cross compliance as foreseen under regulation 1782/2003“ coordinated by IEEP. The available data of these studies complement each other, but there are still data gaps which have to be filled, at least for the final prototype. The CIFAS study provides information on Cross Compliance implementation in 15 EU member states[6]. For these member states all GAEC standards are described, but concerning the SMRs only the SMRs 1-5. They refer to the five environmental and habitat directives applicable from January 2005. This gap is partly filled by the IEEP study, carried out later than CIFAS. It provides the GAEC standards in the EU-25 member states (apart from Malta and Cyprus) and the SMR standards 1-15 (in EU-15 + Slovenia and Malta), which additionally refer to the fields identification and registration of animals; public, animal and plant health and notification of animal diseases. Information on the SMRs 16-18 with regard to animal welfare is mainly available from the project “Cross-compliance – Facilitating the CAP reform” for the countries Italy, Netherlands, Germany and UK. For all other countries these SMRs are lacking. However, for prototype 1 the already available information on Cross Compliance standards is sufficient. As regards the GAECs only the data on Malta and Cyprus and Bulgaria and Romania are missing.

An overall data gap also exists in that the information is in general collected at national level, but regional specifications are still missing for most large countries where decentralised authority is given to regions to implement the CC standards (e.g. Spain, Germany, Italy, UK, Belgium, Austria). Especially with regard to the Habitats and Birds Directives in many countries regional standards have been implemented to adopt these standards to specific regional conditions. This implies that data gaps are also partly existent at regional levels and it needs to be assessed which regional data gaps can still be filled for prototype 1 and which for prototype 2. Although in Germany, being a federal state, the implementation of cross compliance is under the responsibility of the single “Länder”, nation-wide Cross Compliance standards have been developed by a working group, which have been adopted by all German

[6] Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Poland, Slovenia, Spain, Sweden, United Kingdom,

Länder without modifications (Alliance Environment, 2007a). For UK and Belgium the regional implementation of the Cross Compliance standards is available from the IEEP study (apart from the SMRs 16-18). However, for Italy, Spain and Austria there remain data gaps on regional implementation of CC standards. In the IEEP study (Alliance Environment, 2007b) as well as in the Cross Compliance study for Italy (de Roest, 2006) only information is given on the regions which have introduced specifications of the national CC obligations, but the regional specifications as such are not described. The same applies to the regional legislations in Spain and Austria which were mainly mentioned in the IEEP study but not concretely described. Overall it is clear that all remaining data gaps need to be filled for prototype 2.

Short names, which allow a classification and systemisation of the standards implemented in the surveyed MS/regions on the basis of their similarities, have also been developed within the CIFAS-study. In CIFAS they were developed taking into account, that they should clearly refer to the topic (e.g. Groundwater for Groundwater Directive related requirements and similarly Sewage, Nitrates, Birds, Habitat, and Natura) with what SMR deals, with the objective to identify the whole SMR by short name (e.g.: Nitrates – N limits per hectare; Birds – closed season for hunting; Habitat – prohibited farming practices etc.). The same short names were used for the similar requirements related to one Article of certain Directive. In the case one Article was too wide, several short names were used. Moreover, in some cases, it was necessary to specify the short name in more detail - this was done by a third level in the short name. As a result, a short name for each single SMR was developed and each short name of SMR appeared only once per region/country.

For prototype 1 the shortnames are for instance required for the qualitative assessment of the potential effectiveness of the CC standards for biodiversity and landscape quality (see D4.3.1 pg 12f). The CIFAS-short names contain information on the EU-Directive they refer to and the main topic of the standards and requirements at different level of aggregation. At present stage they have been of use for the CCAT-project, but in line with the objectives of CCAT they will probably have to be revised and for some standards newly developed according to the requirements of the project. Thus, the short names should also provide information, for which impact assessment the respective requirement and standard is relevant for (field of impact). It is expected that a further refinement of the translation of the standards to the short names will still be in process until the end of 2008 because for 10 countries the final information on SMRs will be available only by late autumn 2008. For the current stage of the project the CIFAS-short names should be slightly modified/extended for prototype 1 in order to include also missing SMRs from the MSs not covered by CIFAS study.

3.1.2 Procedure and modalities in case of non-compliance

The ***level of punishments in case of non-compliance*** is available from the IEEP study in the EU-25 apart from some data daps in certain member states. The data requirements with respect to punishment-levels depend on their planned use in prototype model 1 and 2. As long as punishment is not used as a factor to endogenize compliance behaviour in the CAPRI model, the only role of the punishment level is in calculating the proper amount of payment deduction, which will affect indicators like producer income and producer welfare. It is in this latter way that the info will be used, since compliance behaviour will be treated as exogenous. Whereas the Cross Compliance regulations provide the formal deduction rates there is a band-width that local authorities can use. The available information allows to make a best estimate of how different member states use their room for manoeuvre. In case the Health Check of the CAP will lead to further changes or adjustment in the punishment rules (e.g. minimum fines in case of violation of requirements), it will be important to account for this update.

3.1.3 Policy goals for the implementation of SMRs/ GAECs in the EU member states/ regions

The ***goals*** which leaded to the specific design of the implemented Cross Compliance standards in the member states or regions (f) are mainly available from the IEEP study, regarding the SMRs at least in the EU-15. Where this information is available at a general level from the legislative and policy documents (see also Deliverable 2.1—2.2) it is important to have more detailed information at a derived level. This in particular holds for the Nitrate Directive, which will be the key example, explored in Prototype 1. The general goal of this Directive is operationalized by amongst others specifying a maximum level of fertilization (Nitrate application from organic manure is since 1999 limited to 170 kg./ha). However, several Member States opted and acquired a derogation allowing for higher application rates for certain soils and land-use types. In particular in Prototype 2 (and to a lesser extent also for prototype 1) information about the maximum application rates and there regional distribution is necessary.

3.2 Actual implementation by the farmers

3.2.1 Types of regions/ areas and farms affected by SMR/GAEC

Information on ***types of farms affected by SMRs/GAECs*** and ***types of regions/areas affected by SMRs/GAECS*** is available from the IEEP evaluation study and the Cross Compliance project.

3.2.2 Level of compliance

The existing ***degree of compliance*** per member state and per farmer can partly be derived from the IEEP evaluation project and the Cross Compliance projects estimates, but these data only refer to the legal acts 1-8a which are focussed on environmental and animal registration issues. A third source are the rates of compliance that are implicit in the MITERRA model, which is mainly based on expert information. The latter source will be used as a starting point for Prototype 1, at least as far as the environmental SMRs are concerned. These need to be supplemented with own estimates on the remaining requirements selected for Prototype 1 (e.g. identification and registration, GAECs). These estimates will have to be made on basis of the existing information. How these estimates are done, is described in D2.3 (Jongeneel et al, 2008, p.. 31ff.) and D4.1 (Jongeneel and Kempen, 2008, p. 9ff.).

Estimates of ***the level of compliance per SMR and GAEC standard in 2005*** in the EU-25 can partly be derived from other studies (e.g. the IEEP evaluation study and the Cross Compliance project estimates). However, where this information is missing, which is most strongly the case for all animal welfare and public health related SMRs, own estimates will need to be made. For the SMRs 16-18 related to Animal Welfare which were implemented in 2006 or 2007, the baseline year to be assessed will be 2006 or 2007 respectively. Furthermore these levels of compliance also need to be translated further to farm types per Nuts 2 region and then to shares in total land use and livestock population. For the Animal welfare and Public health SMRs data on implementation levels of these standards will not be collected for prototype 1. The same applies to collection of national data for the translation into short-names.

- The baseline year for which we will need to assess levels of compliance for these standards will be the year they were implemented under CC (so 2006 and 2007). In order to use the estimated levels of compliance for these SMRs as modeling input in CAPRI/MITERRA we will convert the 2006 and 2007 levels of compliance to a 2005 level by adding a correction factor (e.g. -2% compliance lower compliance in former years).

The planning of the collection of missing data on SMRs 10-18 needs to be further discussed. The question is very much, whether the information on short names and implementation levels can be collected for whole EU or only for a selection of regions.

Several sources are available (CC project and IEEP inventory study), which need to be analysed and complemented to create our own best estimates. Within this estimation procedure it might be useful to take into account the FADN data, in particular for obtaining results differentiated for farm type and region. The same applies to ***the level of additional compliance for the years 2006, 2007 and 2008***. Insights into additional compliance with measures after the introduction of CC is still very limited. Getting information, especially for creating the baseline situation against which changes can be measured is very important but very challenging and it is not expected to obtain this information before May 2009 (only available for prototype 2). In particular the Identification and Registration and Nitrate Directive requirements appear to create difficulties for farmers to satisfy. Therefore the assessments of the compliance levels in prototype 1 are focused on these regulations. These assessments are described in more detail in D4.1 (Jongeneel en Kempen, 2008).

At this moment with regard to prototype 2 we expect that we may be able to get information about compliance and additional compliance in 5 different ways:

- Collect per country the monitoring and inspection results. When using this information we need to know how representative these data are for the whole farming population. Obtaining a good estimate of the representativity will probably not be possible and will therefore be an additional complication. The main complication here is the fact that sample selection made by inspection authorities is mainly risk-based, only 15-25% of inspected farms are selected randomly. Therefore these data can't be directly used as estimates of the level of compliance in 2005. Also, taking into account the implemention time of CC requirement, level of compliance in 2005 is available for GAECs in EU-25 and for SMRS in EU-15 + Slovenia and Malta.
- Use FADN and/or FSS data and ancillary assumptions or accounting rules in order to estimate likely (minimum) levels of compliance. This is in particular helpful in case compliance rates might expected to depend on clear farm characteristics, such as animal density and landuse.
- Obtain expert estimates from extension services. This will deliver better representative results then the first option, but it will be very time intensive to get these estimates for all regions in EU. Since there's an obligation to give CC advice from 2007 on it can be expected that advisers should be quite aware of the compliance situation. Actually most of the new member states don't have an advisory system on CC functioning yet, because the list of the SMRs was not existing. It will start to work probably from 2009 and first feedback from advisers will be available only at the end of 2009. Right now it is possible to get just an opinion on possible compliance based on their other advisory work.
- Through a farmers survey. This will certainly require a good picture of what is really happening on the ground. However, since surveys like this are very time

consuming it will only be feasible within the scope of this project to do such a survey in a limited number of case study areas.

- Participation in voluntary certification schemes. This information can be collected from the organizations managing these certification schemes. Also collecting this information EU wide will require much time investment and is most probably not possible in every MS.

Overall it is already clear that the last 3 data collection options are not feasible to apply to the whole EU within the scope of this project. Probably the best option is to go for the first option and try to be as efficient as possible by not repeating the data collection exercise and use the data that have already been centrally collected by IEEP and DG-Agri. Additional data collection can then be done in different case study areas. However, it is still difficult to estimate the real compliance, because sample selection made by inspection authorities is mainly risk-based. Therefore inspection results do not reflect necessarily the real situation. However, decisions related to the representativity need to be made.

In general, for CCAT it is expected that it will be very difficult to make reliable estimates of compliance with all different standards and sub-standards for all regions in the EU, but we will base the estimates on the best sources we have access to. For prototype 1 the available information on the degree of compliance per member state and per farmer and the level of compliance per SMR and GAEC in 2005 are sufficient to obtain best estimates. With respect to prototype 2, which uses a lower aggregation level as well as considers more SMRs and GAECs the currently available information has to be extended by own estimates.
Information on the ***number and types of detected infringements in 2005*** is available from the IEEP evaluation study and the Cross Compliance project, but from IEEP it is only available for the SMRs 1-8a referring to environmental issues and the registration of farm animals. As with the degree of compliance described above, own estimates will have to be made to fill these gaps. This of course only applies to SMRs implemented in 2005, and not for the SMRs 9-18 on animal welfare and public health.

3.2.3 Farmers' behaviour as response to SMR/GAEC

Within the CCAT project an investigation has been done to explore the possibilities to endogenize compliance behaviour. The main reason for this was that if sufficient and reliable insight into this could be obtained, it would provide a basis for two subsequent steps. The first step would be to use this information as a cross-check or estimator for assessing the base year compliance level. But, more importantly, as a second step it would help to assess how changes in incentives (e.g. the height of the direct payments, the monitoring and inspection rate, price changes for agricultural outputs and inputs) would affect the degree of compliance. Rather than having to rely on scenario's in which the level of compliance (improvement) is pre-specified changes in compliance could have been simulated.

The lack of information on ***farmers behaviour as response to SMRs/GAECs*** with regard to reasons for different levels of compliance and adjustments in in- and output factors did us decide not to use this kind of information in the assessments of prototype 1. Neither is this planned for prototype 2. This information is especially needed to enable the endogenisation of the compliance decision into CAPRI. Unfortunately currently as far as is known no information on behavioural response to compliance incentives is currently available. Moreover, from the more general literature it becomes clear that the compliance decision not only depends on financial incentives (expected cost-benefit evaluations by farmers), but also

by other variables such as social reciprocity, moral standards and risk attitude (Herzfeld and Jongeneel, 2008).

4 Data inventory for context information

The context information needed in CCAT referring to land use, farm information, market conditions and the biophysical environment as presented in the D3.1 Excel table, raises no data collection problems for prototype 1. The farm type specific activity levels and regional shares can be calculated from FADN data. As FADN data is mostly reported at a level higher than Nuts2 some CAPRI model components already enable estimation of farm type information at NUTS2 combining FADN, FSS and EUROSTAT data. The land use per region depicted by 35 land use classes to be used for the CAPRI has been derived from EUROSTAT data, which use the mainly the same land use classes.

The mapping of the biophysical environment can be obtained by the spatial allocation approach developed by the DYNASPAT project. The spatial allocation approach of the farm information to bio-physical entities has been elaborated by the SEAMLESS project. For this approach the land use information and other attributes assigned to the HSMUs[7] in the Dynaspat project are taken as the main input basis. The results of both disaggregation approaches for land use in the Dynaspat project and for FADN farm information in SEAMLESS are delivering good results in terms of validation. The allocation results for land use and FADN farms are available for the whole EU-15. However, both approaches are planned to be further improved for prototype 2 and it is now explored whether they can be extended to the New Member States.

Information on market conditions, that is, the price for agricultural products as the respective indicator, can be derived from the CAPRI-COCO database for the EU-27, which is fed by the Economic Accounts for Agriculture (EAA). These data are sufficient for the CCAT project.

[7] Homogeneous Spatial Mapping Units

5 Data inventory for impact assessment in prototype 1

5.1 Selected economic impact indicators

There are no data gaps occurring for data needed for the calculation of the farm economic indicators in prototype 1 as presented in the D3.1. The gross margin/ha, budgetary expenditure and the agricultural income are calculated by the CAPRI model which is fed by the COCO database based on FADN/EUROSTAT data for the EU-27 at Nuts 2 level. Calculations on costs of compliance, competitiveness (profitability) and the costs of inspection on farm have been already undertaken by the Cross Compliance project. However, these data will also be processed from the CAPRI model and its pre-model tools.
The same applies to the production related indicators and the indicators related to land markets and administration. Apart from the administration related indicator costs of controlling CC these indicators are calculated by the CAPRI model for the EU-27 at NUTS2 level or partly farm level. For the calculations in prototype 1 there are no data gaps left. The indicator Costs of controlling is made conditional on availability of information about monitoring and inspection costs, and will be only taken into account if the degree of compliance with CC is endogenized within the economic model CAPRI (see further discussion e.g. in D2.1/D2.2 pg.). This indicator is related to the compliance decision, since more controlling of farms leads to higher cost but reduces the probability of non-compliance. The endogenisation depends on the availability of sufficient empirical information on factors that determine farmers' response to CC, which is planned to be derived by surveys in a selection of regions in Europe as this information provides an understanding of the behavioral response parameters needed to specify the model. Since endogenizing CC response will not be done in the first phase of this project (its feasibility will first be investigated in a couple of case studies) the information on costs of controlling will be of use for prototype 2, but not for prototype 1.

5.2 Selected environmental impact indicators

The information which is generally needed for all balances (a) calculated by MITERRA, includes the application rates and types of fertiliser (nitrogenous, phosphatic, potassic etc), animal manure (cows, pig, poultry etc) and biosolids (sewage sludge, compost etc) to assess the annual inputs of C, N, P and metals. The yield of harvested crops are needed, because element outputs always include net crop removal, being the product of harvested crop yield and element contents in the harvested crop. For this data category no input data problems are expected for prototype 1. For the calculation of application rates of animal manure in MITERRA information on the change in livestock types and livestock numbers from CAPRI, manure excretion factors from the RAINS model and MITERRA results are used as input data. Also the statistics on crop yields which determine the yield of harvested crops are derived from the CAPRI model which is mainly fed by FADN data and from MITERRA model results. The application rates and types of fertiliser will be calculated by the MITERRA model in prototype 1 at NUTS2 level, for this calculation statistical data from FAO and IFA are used as input as well as results from the MITERRA modelling. The application rates of biosolids will be obtained in the MITERRA model by using FAO statistics and own N contents as data basis (see the use of sewage sludge indicator in the data category chemical soil risk).

Table 5.1: Data requirements and availability in projects for prototype 1 environmental impact assessments

Type of data required	**Main sources from which information can be derived**	**Already available in project and/or additional data needs**
Annual application rates of fertilisers (kg/ha/crop type) and types of fertilisers (nitrogenous, phosphatic, potassic)	FAO, IFA	Yes available already on national and regional average levels. Further improvements in both spatial and sub-category detail would be preferred.
Annual manure production and application rates (kg/ha/crop type) specified per type of manure (cows, pigs, poultry, goat, sheep, other).	FSS or COCO, RAINS, GAINS	Yes available already on national and regional average levels. Further improvements in both spatial and sub-category detail would be preferred.
Animal manure excretion rates		Yes available already on national and regional average levels. Further improvements in both spatial and sub-category detail would be preferred.
Changes in livestock composition and numbers as response to CC standards	Modelled output of CAPRI	Yes
Inputs by atmospheric deposition	EMEP	Yes already available, but further differentiation of this information would be useful
Nitrogen fixation as product of harvested crop requiring information on crop area and yields	FSS and COCO	Yes available
Changes in cropping patterns as response to CC standards	Modelled output of CAPRI	Yes
Soil factors such as pH, and organic carbon content to determine the leaching from root zone to water	European soil map; WISE/SPADE database	Yes
Climate factors such as, precipitation and evapotranspiration	CRU/MARS climate data	Yes

The data which are needed for the calculation of indicators reflecting the influence on the water quality are categorised into seven sub-issues. The gross nitrogen balance is calculated

by the MITERRA model at NUTS2 level using CAPRI statistics on crop yields, MITERRA statistics on grassland yields and other MITERRA model results (N2 fixation, Atmospheric N deposition, N contents in fertilizers, animal manure, biosolids and crops) as input.

Also for the gross phosphorus balance CAPRI statistics on crop yields are used as data basis. Nitrogen leaching and nitrogen run-off (in % of N applied) and the share of nitrates in ground and surface water derived from agriculture will be calculated by the MITERRA model for prototype 1 using own model results (e.g. N leaching fraction; N run-off fraction). However, for prototype 2 there's the idea to derive a meta-model from the EPIC model since the model is also best suited for the calculation of crop uptake and thus for the prediction of nutrient balances and leaching. DNDC also calculates N uptake and N leaching, therefore, for the overall nitrogen and carbon balance some benchmarking tests will be made to assess the difference between EPIC and DNDC and to ensure consistency between all simulated emission fluxes in a later stage of the project. For the indicators phosphate and metal leaching (occurrence in leachate and runoff water) it is not yet clear whether the required data can be obtained for these indicator calculations in prototype 1. For the calculation of phosphate leaching data on oxalate extractable Al and Fe contents are required which are unfortunately not available in European databases like WISE or SPADE. Therefore it must be investigated, whether these data are available in national soil databases, and if not, the indicator will have to be skipped for prototype 1 and postponed to prototype 2. For the metal leaching indicator the missing data can probably be derived from the European databases WISE and SPADE, but it will most likely also have to be postponed to prototype 2.

The selected indicator reflecting the impact on air quality is the contribution of agriculture to total atmospheric emissions of ammonia (NH3) calculated by the MITERRA model with the required input of number and type of animals and type of stables and manure storage. There are no data gaps for the calculation of this indicator for prototype 1.
The climate relevant indicators selected for prototype 1 are the emissions of methane by agriculture, emissions of nitrous oxide by agriculture, gross total GHG emission from agriculture in CO2 equivalents and the contribution of agriculture to total emissions of the greenhouse gases CO2, CH4, and N2O calculated by the MITERRA model with the specific emission input factors/parameters as additional input. Also for the calculation of these indicators in prototype 1 no data gaps occur.
The selected indicators related to physical soil risk in will only be treated in prototype 2.
The data requirements for the gross phosphorus balance have been already described above.
Since the data necessary for calculating metal balances are probably not available in time, this indicator will most likely have to be postponed to prototype 2. Carbon balances are calculated by the MITERRA model.
The top soil organic carbon content calculated by the MITERRA model requires MITERRA model results and soil data but will probably be postponed to prototype 2. For the calculation of chemical soil risk indicators in prototype 1 no data gaps exist.

5.3 Data inventory for selected land use, landscape and biodiversity indicators

In Table 5.2 an overview is given of the land use, landscape and biodiversity indicators to be assessed in prototype 1 and the data needs.

Table 5.2: Overview of the selected indicators for land use, biodiversity and landscape and the data needs and main data sources to assess them

Indicator	**Data needs for assessment**	**Data sources**
Changes in intensive and extensive crops share	a. Present land use shares (35 land use classes) b. Future land use changes c. Average input levels per land use per region and changes in input levels	a. COCO/FADN data (available) b. CAPRI-MITERRA model output c. COCO/FADN data and modelled output CAPRI-MITERRA
Changes in intensive and extensive livestock share	a. Present numbers and composition of livestock population per region b. Future changes in numbers and composition of livestock population per region c. Average stocking density, milk yield levels, input levels per region and changes stocking density, yield and input levels	a. COCO/FADN data (available) b. CAPRI-MITERRA model output c. COCO/FADN data and modelled output CAPRI-MITERRA
Changes in land use diversity (evenness)	a. Present land use shares (35 land use classes) b. Future land use changes c. Data on nationally protected sites and tourist attendance	a. COCO/FADN data (available) b. CAPRI-MITERRA model output c. SENSOR project
Change in habitat quality caused by CC standard's effects on environment	a. Emissions of ammonia (kg NH_3-N/ha/yr b. Nitrates in water, including leaching in kg N/ha/yr and concentrations in mg NO_3/l (water quality). c. Gross Balances for Carbon Nitrogen and Phosphorous	a. and b. and c. CAPRI-MITERRA model output
Effectiveness of CC	a. Short name descriptions of all SMR	a. Existing data

standards on biodiversity and landscape	and GAEC standards per region included in PT1 for whole EU for as far as available b. UAA and land use per farm type c. Estimation of Compliance levels per standard per farm type per region in 2005	sources and additional data collection in CCAT b. COCO and FSS c. Existing data sources, additional data collection CCAT and own best estimates

How the indicators of land use based assessments chosen for prototype 1– the changes in cropping and livestock patterns expressing the intensity or extensity of the agricultural production - are calculated, has been roughly described pointing Section 2.3. These changes are calculated by the CAPRI model which is fed by FSS, FADN and other EUROSTAT data.
.
The data for the *assessment of the changes in share of intensive/extensive land use* come from the CAPRI database (COCO), which specifies 35 different land use categories (for the base line situation which is 2005) and the CAPRI model output for the future situations. CAPRI works with the same land use classes as in FSS which includes 34 different crops and permanent grassland. Information on certain input levels will be derived from the pre-model CAPRI input data which include estimates on input levels for different crops both in terms of artificial fertilisers, agro-chemicals and irrigation. It is expected that there are no data gaps occurring for the calculation of this indicator in prototype 1. For prototype 2 it is expected to further improve these indicators to a more spatially detailed level, instead of working with NUTS 2 averages, and this requires input of down-scaled data on land use and farm management data coming from SEAMLESS and DYNASPAT projects and from post-model disaggregation approaches to be applied in CCAT in prototype 2.

For assessing the effects on the *livestock density indicator* the input comes from the present livestock patterns and the - by the CAPRI model predicted - changes in livestock mix and numbers. Additionally for the assessment for certain livestock types (LU) such as dairy, beef, sheep and goat, which can be managed either in an intensive or extensive way, an estimation of their intensity will be made in advance. Again the main data source for this assessment is the CAPRI database, COCO and modelled output of CAPRI on changes in livestock numbers and livestock composition. There are no additional input data missing for the calculation of this indicator in prototype 1. Also for this indicator for prototype 2 it is expected to further improve these indicators to a more spatially detailed level, instead of working with NUTS 2 averages. It will require input of down-scaled data primary data on livestock numbers and types and farm management data coming from SEAMLESS and from post-model disaggregation in CCAT of CAPRI modelled output.

For the assessment of changes in *land use diversity (evenness)* in prototype 1 the land use classes used in the CAPRI model according to the EUROSTAT definitions will be classified according to similarity of structure and appearance. The diversity will be calculated by using the evenness part of the Shannon's Diversity Index. Also for this indicator category no further data collection has to be undertaken for prototype 1. For the assessment of the landscape diversity probably two additional indicators will be used in prototype 1, depending on the

availability of the required input data: Nationally protected sites/landscapes/ World heritage sites and Tourist attendance, non-residential/ Tourist attendance residential. The required data can most likely be obtained from the EU SENSOR project after April 2008 and after that it can be judged whether there will be remaining data gaps to be filled.

The area and share of semi-natural (extensive) habitats (e.g. fallow, permanent grassland, hedgerows, and other linear elements) have also originally been planned to be used as an indicator for landscape diversity. However as described for the biodiversity indicators, this indicator can not be used mainly because in the CAPRI model it is not yet feasible to distinguish between improved grassland and semi-natural grassland. Therefore, it will have to be postponed to prototype 2. Furthermore, like with the two other indicators on intensity, in prototype 2, spatially more detailed data will become available through pre- and post-model disaggregation approaches enabling the specification of the evenness indicator on a higher spatial detail.

Data of the Corine land cover database as additionally indicated in the D3.1 Excel table are needed to further develop and extend the spatial allocation approach of the farm information to bio-physical entities elaborated in the SEAMLESS project (HSMU approach). This approach will for instance be improved by including the Corine land cover information as an explanatory variable in the regression model (see Jongeneel, et al., 2007 p. 114f.). The Corine land cover database has already been used by several projects and is available. This however will not be done in prototype 1, but in prototype 2.

The selected environmental indicators reflecting a change in habitat quality to be used in prototype 1 are Emissions of ammonia in kg NH_3-N/ha/yr (air quality) and Nitrates in water, including leaching in kg N/ha/yr and concentrations in mg NO_3/l (water quality). They will be derived from the output produced by the environmental models. The input data required for these indicators have been described under point 5.2. For the first prototype the output of the environmental model MITERRA (in the form of environmental indicator values) will be used as input for a qualitative assessment of effects on farmland biodiversity within regions.

As for the assessment of the effectiveness of standards for biodiversity and landscape we will use the regional share of UAA (or the share of a specific land use to which the standard is targeted, e.g. olive groves) to weight the potential effectiveness per NUTS2. The logic is that the greater the UAA, where the standards are to be implemented, the higher their potential effect on biodiversity will be. Both, share of UAA and absolute hectares of UAA at NUTS2 level will be used as weighting factors, reflecting respectively the magnitude and the extend of the potential effects. Since certain CC and SMRs standards are targeting particular land uses and crops, such as cereals, permanent grasslands, permanent crops or olive groves, the possibility to particularize in these cases the weighting exercise according to the regional share or hectares of these land uses will be investigated and possibly partly applied in prototype 1 and fully in prototype 2.

To come from a *potential* effectiveness to an estimate of the *expected* effectiveness the level of compliance is introduced in the analysis. This requires estimates on the land use share per NUTS 2 region estimated to be compliant with different standards under 3 different scenarios of compliance (the baseline situation in 2005, 75 % and 100 % compliance). However, if it turns out to be problematic to estimate shares of compliance for certain standards per land use category we will work with the regional average compliance levels for all land uses.

5.4 Selected public health and animal welfare indicators

5.4.1 Input data needed for public health indicators

There are different data sources to be used for the chosen indicators in prototype 1. Statistical databases can be used for the public health indicators incidence rates of food-borne illnesses, infections and intoxications (source: WHO), occurrence of salmonellosis (source: Eurostat), and government investments in food safety measures (source: Eurostat). For these indicators there are no remaining data gaps.

5.4.2 Input data needed for animal welfare indicators

The information needed for the animal welfare indicators number of offspring per sow/cow per year and milk yield per cow per year (l/cow) can be derived from the COCO database up to the year 2004 and from the Eurostat database up to the year 2006-2007.

5.4.3 Input data needed for the degree of compliance

As already described, the data needed for the degree of compliance will partly be derived from the IEEP-Project „Evaluation of the application of cross compliance as foreseen under regulation 1782/2003“. Unfortunately the IEEP data only refer to the legal acts No. 1-8a (environmental issues, registration of farm animals). That’s why it is necessary to translate its values into the SMRs of the legal acts No. 9-18 as well as the Regulation (EC) No. 852/2004 that are focussed on the issues of public health or animal welfare. How this will be done, has been already described above.

6 Conclusion

6.1 Detailed data analysis, processing and additional collection plan for prototype 1

One of the characteristics of CCAT is that it builds upon information already collected in other projects (Seamless, CIFAS, CC-project and IEEP-study) and existing models (CAPRI and MITERRA). In consequence several of the required data don't have to be collected within CCAT, since they are already available to the project partners from the above mentioned sources.
Nevertheless, the data inventory of the different data categories and impact fields reveals that there are still some important data gaps to be filled for the indicator specifications selected for prototype 1. Table 6.1 provides an overview of the data gaps for prototype 1 and specifies how and when these data can be expected to be obtained.

Some indicators initially planned to be used for prototype 1 will not be collected in time and will therefore only become available for prototype 2 assessments. As described in the chapters 3-5 on data inventory the final selection of indicators to be analysed in prototype 1 was in the end also influenced by the timely availability of the required data needed as input. Based on this decision of the selected indicators to be analysed in prototype 1 following data requirements remain for prototype 1:

Remaining data requirements for prototype 1 belonging to the category **Implementation of Cross Compliance at national or regional level in the EU** are the ***full text of SMRs in the new member states*** and the ***short names*** of the SMRs which will be analysed in prototype 1 (only for EU-15). As regards the GAECs the data on Malta and Cyprus and Bulgaria and Romania will have to be obtained. The ***full text of SMRs in the new member states*** will most likely be available in October/ November 2008 for the SMRs 1-8, which will be collected by own studies of the national implementation of these SMRs in the new member states undertaken by partner 6 (CEET). In the course of these case studies also the missing GAEC data in the new member states can be collected. Problems to be expected for this field could be that the SMRs are not yet developed in all new member states and can therefore not be provided for all new member states. The ***short names*** needed for the classification and categorisation of the data which will have to be developed/modified for prototype 1 by partners 4 and 6 will be ready in time for the SMRs investigated in prototype 1. A first proposal for the method of this short name development is presented in 6.1.1. At this stage it is however not yet clear whether the newly collected data will also be in time for inclusion into prototype 1.

The data that is most strongly lacking and that is definitely required for prototype 1 impact assessments in all fields is the level of compliance with SMR and GAEC standards in the baseline year 2005. For the impact assessments in all fields implementation levels per standard are required specified per Nuts 2 region and further translated to shares of farms, farm types, Utilised Agricultural Area (UAA) and livestock types compliant and non-compliant. For the modelling of impacts on markets it is important to know how many farms comply and as a consequence have certain costs and/or benefits from this that leads to changes in their farm management, production, income, land use and composition and size of the livestock population. The same applies for the assessment of effects on environment, land

use, landscape and biodiversity. Effects on these fields depend strongly on the share of UAA and livestock compliant and non-compliant as compliance may lead to e.g. lower emissions and better conditions for landscape and biodiversity.
Unfortunately, information on implementation levels of CC standards is generally not directly available from existing studies (e.g. IEEP evaluation study) and even most paying agencies will not be able or willing to provide this information. It's even more complicated and time consuming to collect this information per Nuts 2 region and specified per farm type group. In spite of this there are several sources of information, such as the Cross Compliance project, expert judgement from paying agencies, farm advisors, FADN proxy indicators, from which indirect indicators can be derived. These can then be used to make best estimates on compliance levels per region. We are aware that this will not deliver a complete overview of compliance levels, but it should be possible to obtain enough information from which first best estimates can be made and which can be further improved in later stages of the project or by end-users that have their own sources of information. Best estimates of compliance levels were also made within the scope of the Cross compliance project for the selection of SMR and GAEC standards. CCAT can build on these estimates and make an effort to further improve these data.

In relation to the statistical and spatial data sources that are needed as context information for pre-model calculations and as baseline input for the CAPRI and MITERRA model it is already clear that these are available. All data sources needed are already available within the consortium and no data gaps are identified in these for the planned assessments in prototype 1. For prototype 2 assessments however, in which data are needed at higher then Nuts 2 resolutions, some additional data collection efforts will need to be made and spatial disaggregation approaches will need to be applied. However, overall few foreseeable missing data needed for the **environmental impact field** remain for the analysis in prototype 2 (see Table 6.2).

As for most of the assessments of impacts on land use, landscape and biodiversity it is clear that they depend on modelled output data of CAPRI and MITERRA assessments. For most of these model results there is no uncertainty at this stage on the timely availability for prototype 1. The data required for the landscape diversity indicators (nationally protected sites/landscapes/ world heritage sites and tourist attendance, non-residential/ tourist attendance residential) will most likely be obtained from the EU SENSOR project after April 2008 by partner 1 (Alterra) and after that it can be further judged whether there will be remaining data gaps to be filled.

For prototype 1 for the **public health and animal welfare** indicator assessment there is a limited data collection needed for specification of indicators available in EUROSTAT and WHO data sources. For prototype 2 the data collection requirements are very large however and preparation of a case study data collection has already started to ensure timely availability of the data in the field of animal welfare and public health for prototype 2.

Table 6.2 provides an overview of the data gaps which still remain for prototype 2. This overview can't present all data requirements for prototype 2 since not all assessments are fully clear at this stage in the project. Therefore, it intends to present only a rough data collection plan for the missing data to be derived for prototype 2.

Tab. 6.1 Remaining data gaps for prototype 1 and how to derive these missing data

Issue/ Impact field	Type of data requirement	What is missing?	Source and availability of missing data	Availability of missing data	Actions to be taken to collect missing data	Who undertakes data collection/ further action	Expected date, when missing data will be available	Expected to be available for	
								Prototype 1	Prototype 2
Implementation of Cross Compliance at national or regional level in the EU	Legal implementation: Full text of SMRs and GAECs to be assessed in prototype 1	Full text of SMRs and GAECs of New Member States (beside Slovenia and Malta) and of most NUTS 2 regions in larger EU countries (e.g. Spain, Italy, Austria)	National legislation, so all paying agencies (and with UAM (in Spanish version)	Will be available for SMRs 1-8 and most GAECs. Not developed yet in all MS.	CCAT data collection	Argo Peepson, Merit Mikk (CEET) & Juan, Patricia (UAM)	New MS data November 2008 (PT2) and Spanish data September 2008. Italy and Austria in January 2009??	X	X
	Short names of SMRs and GAECs to be assessed in prototype 1	Short names SMRs of New Member States (beside Slovenia and Malta) and of most autonomias in Spain	CIFAS and further own elaboration, provided Full text information is available	Will be available for SMRs 1-8 and most GAECs Not developed yet in all MS Will not be available for SMRs new MS for PT1,	Modifying CIFAS short names, development of new	Jörg (IfLS); Merit, Argo, Juan?		X	X
	Farmers behaviour as response to CC implementation	Reasons for different levels of compliance			Needs to be collected as soon as possible probably in number of case studies				X?
		Information on			Needs to be				X?

		farmers adjustments in in- and output factors			collected as soon as possible probably in number of case studies				
	Modalities and non-compliance	Number of breaches per SMR and GAEC to be assessed in PT1	IEEP study and paying agencies	Will be available for most MS at national level, requires desaggregation to region	Needs to be extracted from IEEP reports and translated to Nuts 2 level				
		Levels of punishment in case of non-compliance	IEEP study and paying agencies	Will be available for most MS at national level, requires desaggregation to region	Needs to be extracted from IEEP reports and translated to Nuts 2 level	Juliane, Merit, Argo	Ready June 2008	X	
	Implementation of CC standards	Types of EU farms (e.g. dairy, arable, etc.), regions (e.g. NVZ, olive groves, mountain areas with terraces) effected per standard	IEEP study/Cross Compliance study, expert knowledge	Will be available	Needs to be extracted from former studies and expert based	Juliane, Merit, Argo	Ready June 2008	X	
		Number and type of detected infringements per SMR and GAEC (to be assessesd in PT1)	IEEP study and paying agencies	Will be available for most MS at national level, requires desaggregation to region	Needs to be extracted from IEEP reports and translated to Nuts 2 level	Juliane, Merit, Argo	Ready June 2008	X	

		Level of compliance in 2005 per standard (included in PT1 assessment) per Nuts 2, specified in % of farms per farm type	IEEP, paying agencies, expert judgement	Will at least be available as best guess estimates for all standards assessed in PT1 for at least EU15- and maybe some new MS	Needs to be extracted from indirect indicators from IEEP and CC study and FADN and CCAT consultations with paying agencies.	Juliane, Merit, Argo, Berien, Roel, Juan, Patricia	Ready September 2008	X	X
For all impact assessments (Economic, Environmental, land use, landscape, biodiversity, animal welfare and public health)	Short names of SMRs and GEACs to be assessed in prototype 1	SEE ABOVE FOR SPECIFICATION							
	Level of compliance per standards (included in PT1) per NUTS2 expressed in % of farms, UAA and livestock	No information at all available	IEEP, Paying agencies, CC project and expert judgement	Will at least be available as best guess estimates for all standards assessed in PT1 for at least EU15- and maybe some new MS	Needs to be extracted from indirect indicators from IEEP and CC study and FADN and CCAT consultations with paying agencies.	Juliane, Merit, Argo, Berien, Roel, Juan, Patricia	Ready September 2008	X	X
Landscape assessment	Nationally protected sites/landscapes World heritage sites	ha, location points; partly unknown	World Database on Protected Areas, SENSOR project	Probably available		Janneke		X	
	Tourist attendance, non-residential and Tourist	e.g. numbers of nights booked in hotels; partly unknown	EUROSTAT database on tourism, SENSOR project	Probably available		Janneke		X	

	attendance residential								
Public health and animal welfare indicators	Occurrence of food-borne illnesses, government investments in food safety,	Incidence of food borne illnesses and investment rates in food safety	Eurostat and WHO	Certainly available	Data collection through contacting Eurostat and WHO	Dominic	Ready June 2008	X	

6.1.1 Organisation and structuring of additional data collection

The different data categories needed for prototype 1 which have additionally to be collected, need to be organised and stored in a way, that they meet the model requirements and can be used for the assessments.

The steps for organising and structuring these data categories are described below.

A) Implementation of Cross Compliance at national or regional level in the EU

Full text of SMRs and GAECs/short names:

An excel database will be built based on the modified CIFAS-database structure. It will mainly consist of following basic information: a) full text of SMRs and GAECs of all MS and of most NUTS 2 regions in larger EU countries and b) short names of SMRs and GAECs to be assessed. For this database the information collected in the CIFAS-study and the IEEP project will be updated according to the needs of CCAT. Since the IEEP data are often more detailed, the CIFAS data on Cross Compliance standards will most likely be replaced by the IEEP data. Additional data on SMRs 1-8 (and others if available) and GAECs will be collected for new MS-s by the end of 2008.
The short names of SMRs and GAECs provided in CIFAS will be further developed. A first approach for the development is described underneath.
To ensure that the data stored in the database can be used by the models, they will be transferred into an ACCESS database. This database has been already started to develop, but needs further refinements.

Following procedure for analysing and classifying the collected data on Cross Compliance standards in the EU member states is envisaged:

Short names for SMRs and GAECS on one hand should provide a brief characterisation of the standards in relation to those factors that are of importance for assessing their potential impacts. On the other hand it is the purpose to translate SMRs/GAECS to potential farm practices and costs to translate them into model input variables for MITERRA and CAPRI respectively. Before prototype 1 will be implemented this will first be done prototype 0 in which only an assessment will be made of the Nitrate Directive. Just a limited number of SMRs of the Nitrate Directive have been identified by Partner 1, which may allow an impact assessment:
a) balanced N fertilizer application;
b) maximum manure N application standard of 170 kg N per ha (except where a derogation applies).
c) no fertilizer and manure application in winter and wet periods
d) limitation to fertilizer application on steeply sloping grounds
e) manure storage with minimum risk on runoff and seepage
f) appropriate fertilizer and manure application techniques, including split application of N
g) prevention of leaching to water courses riparian zones buffer zones
h) growing winter crops;
i) obligatory establishment of fertiliser plans on a farm-by-farm basis and the keeping of records on fertiliser use;

Relevant SMRs will be identified and short names created with the help of Task 4.1 and 4.2 which involve the implementation of the CAPRI and MITERRA models.

The short names could be created according to the following pattern. A short name will consist of 4 variables:

Variable 1 will reflect the Directive the SMR refers to (e.g. 01=Bird Directive; 02=Groundwater Directive, 03=Sewage Sludge Directive,…).

Variable 2 will refer to the identified SMR categories and sub-categories which will be analysed and will specify as detailed as possible what concrete management practice(s) implementation entails. (see e.g. a-i for the Nitrate Directive above, which have to be extended to the SMRs and GAECs referring to the other Directives to be analysed). For instance 0101=crop specific application-vulnerable zones; 0201 N limits per hectare - manure, etc.

Variable 3 will represent the impact field the indicator refers to. Since we have 9 different impact fields (1 Market & Producer income, 2 Water Quality, 3 Air and Climate ... 9 Land use) a 9-digit code could be developed, in which the first figure characterises the main impact field, the following figures additional impact fields ranked according to the relevance of the SMR to the respective impact field (e.g. 200000000 would be the variable 3 of an SMR which impacts exclusively water quality; 230000000 the variable 3 of an SMR which impacts water quality + air and climate).

Since it is also important to indicate, how the main impact fields are potentially impacted, this information should be included either as an additional variable (Variable 4) or in a separate short document (table). How to include the information must be further discussed. Examples for the kinds of impacts to be indicated for the influence on producers income could be: higher costs for investments in manure storage, higher administrative time investment, lower spendings on artificial fertilisers, higher costs for manure transportation etc. A fixed list of these factors can be produced before hand.

Modalities and non-compliance/implementation of CC standards:

An excel database will be built, which will consist of all data needed for calculation of compliance levels per SMR and GAEC per NUTS2. Since reliable direct information on compliance levels per single standard, farm type and NUTS2 is missing, this database will include several indirect data needed for the assessment. The assessment approach will be standard specific. Therefore, for every Directive for which the compliance levels of the single measures will be assessed, an own excel database will be developed. These databases will contain direct and indirect information on compliance levels for the specific Directive, but also statistical background information from FSS and FADN databases.

The results of the compliance levels assessment will then be transferred to the central CCAT database.

B) Impact assessment

The additional statistical and spatial data to be collected for prototype 1 as specified in Table 6.1 will be stored in the statistical and spatial database developed by WP3 and WP5.

6.2 Rough data collection plan for prototype 2

Tab. 6.2 Rough data collection plan for prototype 2

Issue/ Impact field	Subissue/ Indicator	Missing data	Source of missing data	Availability of missing data	Way of data collection	Who undertakes data collection	Expected date, when missing data will have been obtained
Implementation of Cross Compliance at national or regional level in the EU	**Full text of SMRs**	SMRs 16-18	National legislation		Case studies (Austria, Germany?)	Dominic (Uni Bonn)	
		Full text of SMRs of New Member States (beside Slovenia and Malta) and GAECs for MT, CY, Ro, BU)	National legislation	Will be available for SMRs 1-8	CCAT data collection		October/November 2008?
	Regional implementation of SMRs/GAECs	Italy, Spain, Austria	Regional legislation		Survey of regional legislation	Spain: Juan (UAM); Italy: ?; Austria: ?	
	Level of compliance per SMR/GAEC in 2005	Level of compliance per SMR/GAEC in 2005	National/regional control/paying agencies				Month 28
Responses to implementation of SMRs/GAECs	**Level of compliance 2005 (preferably specified per standard, farm type and Nuts 2)**	Level of compliance 2005 SMRs/GAECs	National Monitoring and Inspection Agencies (information often confidential, but		a) Monitoring and inspection results; b) Expert estimates from extension services; c) Farmers survey; d)	Uni Bonn, LEI, Alterra will collaborate on getting best estimates fitting in with model	

			might be partly available)		Participation in voluntary certification schemes	scale and requirements	
	Level of additional compliance 2006, 2007, 2008	Level of additional compliance 2006, 2007, 2008			a) Monitoring and inspection results; b) Expert estimates from extension services; c) Farmers survey; d) Participation in voluntary certification schemes		
	Number and types of detected infringements 2005						
	Farmers behaviour as response to CC implementation	Reasons for different levels of compliance			Needs to be collected as soon as possible probably in number of case studies		
		Adjustments in in- and output factors			Needs to be collected as soon as possible probably in number of case studies		
Environmental indicators	**Metal balances**	Data on metal inputs through (deposition, manure, sewage sludge, fertilizer) and removal by crops		Partly available	Literature, European statitistics and expert judgements	Alterra	Month 33

	Metal leaching (IF INCLUDED!)	Present metal contents in the soil Detailed soil property data	Possibly national soil databases European databases WISE, SPADE	Not known yet	Check national soil databases	Alterra	Month 33
	Phosphorus balances (improvement compared to prototype 1)	Better data on P inputs through (manure, fertilizer) and removal by crops		Partly available	Literature, European statitistics and expert judgements	Alterra	Month 33
	Phosphorus leaching (IF INCLUDED!)	Al and Fe Oxalate	National soil databases	Not known yet	Check national soil databases	Alterra	Month 33
	All PT1 data at HSMU level	For PT1 data is only available at HSMU level	Spatial explicit data	Partly available	From other ongoing EU projects (NitroEurope, Seamless) and the use of downscaling procedures	Alterra	Month 33
Landscape, biodiversity and land use	**Species richness, species population trends (farmland birds)**	Species richness, population trends at adequate scale and with sufficient replication in time.		Probably only available for one or two case studies	Probably case studies	UAM coordinates	Not yet clear, maybe Month 32
	Spatial complexity/corridors and linkages between habitats	Information at adequate scale.		Probably only available for one or two case studies	Probably case studies	UAM coordinates	Not yet clear, maybe Month 32
	Share of High Nature Value Farmland of UAA	Not adequate output from the models to operationalise them.	EEA and JRC		It will be operationalised in a later stage of the project.	Alterra (Berien?)	

	Area and share of semi-natural (extensive) habitats (e.g. fallow, permanent grassland, hedgerows, other linear elements)	Distinction of improved and seminatural grasslands in CAPRI	CAPRI		It will be made feasible in CAPRI	Uni-Bonn (Markus?)	
Public health indicator data	**Eurostat: Inspections of food and feed**	Indicator data	Eurostat	The data will be published in 2008 (in a pocketbook ("from farm to fork statistics 2007"))	Monitoring and inspection results	Eurostat / Dominic	May 2008
	Own development: Memberships in certification schemes	Indicator data	Case study Austria		Case study: farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
	Veterinary costs per animal per year	Indicator data	Case study Austria		Case study: farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
Animal welfare indicator data	**Animal Needs Index data for cattle**	Existing Indicator data & current indicator data (to be surveyed)	AREC Raumberg-Gumpenstein / case study		Existing data / Farm assessments in Austria	AREC Raumberg-Gumpenstein /	Existing data: June 2008 / farm assessments: January 2009
	Animal Needs Index data for feeding pigs						
	Animal production and welfare committee of the German Society for Animal breeding: Muck out interval of the stables	Indicator data	Case study Austria		Case study: Farm assessments	AREC Raumberg-Gumpenstein / Dominic	January 2009
	Animal production and welfare committee of the German Society for Animal breeding: Muck out interval of	Indicator data	Case study Austria		Case study: Farm assessments	AREC Raumberg-Gumpenstein / Dominic	January 2009

	the stables: Width of the drove alleyways						
	Farm attributes: training interval of personal, stocking rate of animal transports (m^2/animal), type of housing system	Indicator data	Case study Austria		Case study: Farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
	Average Milk yield per cow per year (l/cow)	Current indicator Data (2009)	Case study Austria		Case study: Farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
	% of early deaths per year	Indicator data	Case study Austria		Case study: Farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
	Number of offspring per animal per year	Current indicator data (2009)	Case study Austria		Case study: Farm interviews	AREC Raumberg-Gumpenstein / Dominic	January 2009
	Disease level: Number and kinds of diseases per animal per year	Indicator data	Case study Austria		Case study: Farm interviews	AREC Raumberg-Gumpenstein	January 2009

References

Alliance Environment (2007a) *Cross Compliance evaluation. National report on implementation of Cross Compliance: Germany. Final report.*

Alliance Environment (2007b) *Cross Compliance evaluation. National report on implementation of Cross Compliance: Italy. Final report.*

Annen D. (2007) *Report on how to develop the indicators of impacts of CC on food safety, animal welfare and health. EU Strep CCAT Deliverable 4.4.1*.

De Roest K. (2006) Mandatory standards in 7 EU countries and 3 non-EU countries (IT Report). *EU Strep Cross Compliance – Facilitating the GAP reform. Compliance and competitiveness of European agriculture.*

De Vries, W. J. Kros, G. Velthof ,D. Oudendag, R. Jongeneel, A. Leip, M. van der Velde and M. Kempen, 2008. *Development and application methodology of environmental impact tool to evaluate cross compliance measures. EU Strep CCAT Deliverable 4.2*.

Heckelei T., Jongeneel R. and M. Kempen (2008) *Report on the design and development of the economic impact generator of CC. EU Strep CCAT Deliverable 4.1*.

Herzfeld, T. en R. Jongeneel (2007). *Economics of compliance: developing a theoretical framework.* Paper presented at Green Week Scientific Conference: Enhancing the Capacities of Agricultural Systems and Producers, January, 16th and 17th, 2008, Berlin.

Jongeneel R, and Elbersen B. (eds.) (2007) General approach to the assessment of the impacts of CC in the EU and list of indicators. *EU Strep CCAT Deliverables 2.1. and 2.2.*

Oñate J., Elbersen B. and J. R. Klein-Lankhorst (2008) Design and development of land use change, landscape and biodiversity impact generator as a component of the CCAT analytical tool, prototype 1. *EU Strep CCAT Deliverable 4.3.1*.

Velthof, G., D. Oudendag & O. Oenema, et al., 2007. *Development and application of the Integrated model MITERRA-Europe.* Service contract European Comission “Integrated measures in agriculture to reduce ammonia emissions” Contract number 070501/2005/422822/MAR/C1 Task 1

Annex 1: Description of the COCO and CAPREG databases as main input sources of the CAPRI model

6.2.1.1.1 COCO data base (UniBonn)

General Information		
	Year / Edition	Present (continuously updated)
	Title of content	Complete and Consistent Data set for CAPRI and CAPSIM model at national level
	Abstract	Based on NewCronos and FAOSTAT, the data set comprise complete and mutually consistent time series for Hectares/Herd size, Output coefficients, Production, Market balances, Economic Accounts and Unit value prices (incl. consumer prices)
	Metadata source	
	Documentation	Via CAPRI working paper (http://www.agp.uni-bonn.de/agpo/rsrch/capstr/pap02-04.doc) and CAPRI and CAPSIM model documentation
History dataset		
	History	Available since 2001; replacement of the former "SPEL-EU data base"
Dataset Identification		
	Keywords	Hectares/Herd size, Output coefficients, Production, Market balances, Economic Accounts and Unit value prices (incl. consumer prices)
	Maintenance	Continuously (yearly releases)
	Scale	Not relevant
	Restrictions	No official data; access so far restricted to the users of the CAPRI and CAPSIM modeling systems
Spatial Information		
	Coordinate system	Not relevant
	Extent	The data cover currently: • EU 25, • Bulgaria and Romania • Norway
	Temporal coverage	1985 – 2004 (currently); no gaps
	Objects/attributes	Table columns (agricultural activities, farm and market balances, EAA positions, prices), Table rows (outputs, inputs, activity levels, income indicators, animal requirements) About 50 agricultural production activities and about 50 primary/secondary products.
Distribution information		
	Source	CAPRI network
	Copyright	CAPRI network
	Distributor	University Bonn, Institute for Agricultural Policy
	Availability	Available on CD in relation to following the CAPRI training session and via ftp
	Format	Specific binary format. Export via Pivot-Viewer DAOUT into several formats (TXT, CSV, HTML, GMS).
	On-line delivery	

6.2.1.1.2 CAPREG data base (UniBonn)

General Information		
	Year / Edition	Present (continuously updated)
	Title of content	Complete and Consistent Data set for CAPRI model at regional level
	Abstract	Based on COCO (taken as fixed and given) and REGIO, the data set comprise complete and mutually consistent time series for Hectares/Herd size, Output and input coefficients, Production, Market balances, Economic Accounts and Unit value prices (incl. consumer prices), income indicators, animal requirements and environmental indicators (N,P,K balances, GHG emission, NH3 emissions) at NUTS II level
	Metadata source	
	Documentation	Via CAPRI model documentation
History dataset		
	History	Available since 1997
Dataset Identification		
	Keywords	Hectares/Herd size, Output and input coefficients, Production, Market balances, Economic Accounts and Unit value prices (incl. consumer prices), income indicators, animal requirements and environmental indicators (N,P,K balances, GHG emission, NH3 emissions)
	Maintenance	Continuously (yearly releases)
	Scale	Not relevant
	Restrictions	No official data; access so far restricted to the users of the CAPRI modelling systems
Spatial Information		
	Coordinate system	Not relevant
	Extent	The data cover currently: • EU 25, • Bulgaria and Romania • Norway At NUTS II level
	Temporal coverage	1985 – 2004 (currently); no gaps
	Objects/attributes	Table columns (agr. activities, farm and market balances, EAA positions, prices), Table rows (outputs, inputs, activity levels, income indicators, animal requirements, env. indicators) About 50 agricultural production activities and about 50 primary/secondary products.
Distribution information		
	Source	CAPRI network
	Copyright	CAPRI network
	Distributor	University Bonn, Institute for Agricultural Policy
	Availability	Available on CD in relation to following the CAPRI training session and via ftp
	Format	Specific binary format. Export via Pivot-Viewer DAOUT into several formats (TXT, CSV, HTML, GMS).
	On-line delivery	

Annex 2: Data requirements and data collection plan: provided separately as an Excel sheet