Nitrogen Leaching Coefficient Calculating System 1.0 (NLeCCS)

Technical description

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Overview

Introduction

The Nitrogen Leaching Coefficient Calculating System (NLeCCS) is a highly automatized and flexible method for calculated nitrogen leaching from arable land using agricultural statistics, climate and soil data as the input.
The system consists of several computer programs and databases. The actual simulations are performed by the SOIL and SOILN models. The input to these models is constructed is steps by several programs.

The programs

The programs are:
The Climate Database Constructor 2.0 (CDC)
The Crop Sequence and Management Generator 2.0 (CSMG)
The Average Discharge Calculator 1.0 (ADC)
The SOILNDB 2.1 which runs SOIL and SOILN
The first three programs are completely new and the SOILNDB has been upgraded to the new version, 2.1. All of these programs creates or modifies databases of different kinds.

Short overview of the data flow in NLeCCS

A graphical overview of the process is presented in Fig. 1.

Statistical data

The statistical data that are to be used as input for the simulations are imported to the system as text files in a standardized and fixed file format. These files are manually imported into a MS Excel workbook. Some additional data are also entered into the workbook.

Weather data

The weather data is also included in text file format, but these are imported into a MS Access database with the CDC. The CDC also calculates the length of the growing season from the period's daily average temperatures. The growing season is defined as the period when the temperature is persistently above +4°C.

Management data

These two databases, the climate database and the statistical database, are utilized by the CSMG to generate a semi randomized crop sequence. The number of times each crops appear in the crop sequence is proportional to the area of the crop in the region for which the statistics comes. Also several rules are applicable to the randomization, where certain crops can not follow other crops. The crop sequence is then used as a base to generate a whole management practice, including fertilization, soil tillage, sowing date, catch crop etc for each region. Databases are saved for all soils present in the region, each soil having the same management.

Calibration of water discharge

Before the database can be used to simulate nitrogen losses the simulated water discharge has to be calibrated against a target value for discharge given as input for each region. This is done by simulating a subset of each database, usually 400 years. These result databases are analyzed in the ADC, and an adjusted value for the precipitation correction factor is calculated and applied to the Climate database. This procedure is repeated until the deviation between simulated mean discharge and target discharge is within predefined bounds. The ADC then calculates the concentration of nitrogen in the precipitation from the load (kg/ha) of wet deposited nitrogen given as input and the corrected precipitation. This is written to the SOILNDB input database.

SOILNDB, SOIL and SOILN

SOIL and SOILN are the actual simulation tools, but they are completely wrapped in SOILNDB. SOILNDB's main task in NLeCCS is to feed data to the SOIL and SOILN models and collect the results and save them in an MS Access database, the result database. SOILNDB 2.1 can run several SOILNDB input databases in sequence without the need of user interaction. This is a major improvement since previous versions of SOILNDB.

Compilation of the results

The results of the simulations are read into MS Excel workbooks with an Excel macro. The macro calculates crop mean values for several parameters such as discharge, mineralization, N leaching etc.

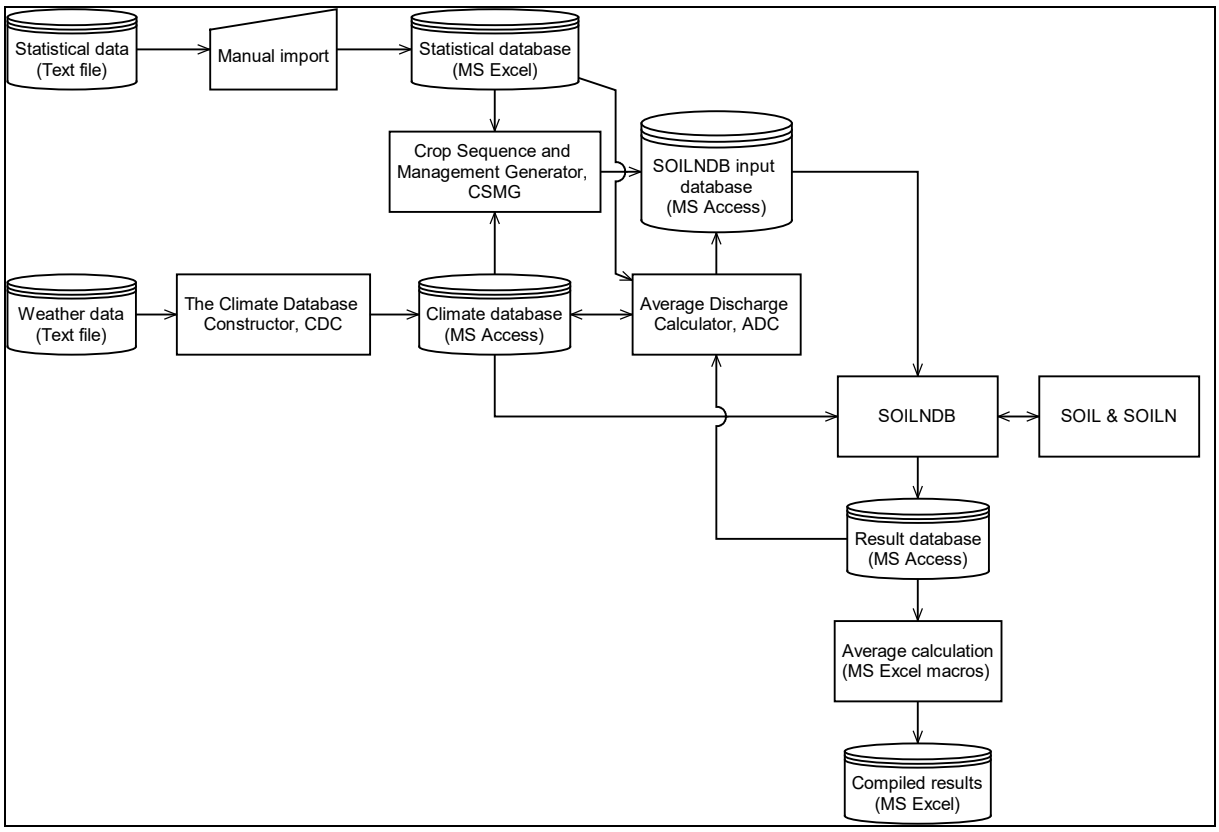

Fig. 1The NLeCCS process

References

Johnsson, H., Larsson, M.H., Mårtensson, K. and Hoffmann, M. 2002. SOILNDB: A decision support tool for assessing nitrogen leaching losses from arable land. *Environmental Modelling and Software, 17:505-517*.

Larsson, M.H., Johnsson, H., Hoffmann, M. & Mårtensson, K. 2002. Technical description of SOILNDB (V 1.0) Teknisk rapport 64. Department of Soil Sciences, Division of Water Quality Research, SLU, P.O.Box 7072, SE-75007 Uppsala, Sweden. 27pp.

Statistical data

Agricultural statistics and soil statistics are delivered in text files with the same formatting as used in the “Statistical database” that are in MS Excel format. The transition of the data from one format to the other is done manually. Se Appendix II for details of the Statistical database.

The Climate Database Constructor (CDC)

The CDC is a program that reads a climate database in text format and saves the climate data in a SOILNDB climate database in MS Access format. It also calculates the start and end dates for the growth season. Some additional user entered data is also saved in the database. The CDC can generate a new climate database or save additional climates to existing databases. Se Appendix I for detailed information on both the text and MS Access versions of the climate databases.

Growth season length.

The metadata table Coupling, Tab. 1, in the MS Access climate database contains among other data the length of the growth season. This is defined to start when daily mean temperature is persistently above a threshold value, usually +4 degrees Celsius in the spring and end in the autumn when daily mean temperature is persistently below the threshold. This is calculated in two steps, first the daily average temperature is calculated, that is the average for Jan 1st, the average for Jan 2nd and so forth. This curve is then smoothed by the application of 20 days floating average. When this mean curve passes the threshold the growth season is stated to start and end. The curve is plotted for visual examination and the start and stop dates can easily be adjusted by the user.

Tab. 1. The coupling table.

Field	**Meaning**
station	Name of the climate station, same as the name of corresponding climate table.
latitud	Latitude of the climate station.
preca0	Precipitation correction.
preca1	Snow fall correction, added to preca0 at times of snowfall.
c_upet2	End of plant uptake period.
ley_upst1	Start of ley uptake period.
ley_upet3	End of ley uptake period.
ley_i_upet3	??????
w_wheat_upst1	Start of winter wheat uptake period.
w_wheat_upet3	End of winter wheat uptake period.
w_rye_upst1	Start of rye uptake period.
w_rye_upet3	End of rye uptake period.
w_barley_upst1	Start of winter barley uptake period.
w_barley_upet3	End of winter barley uptake period.
w_rape_upst1	Start of winter rape uptake period.
w_rape_upet3	End of winter rape uptake period.
comments	Comments.

Minimum requirements

The Climate Database Generator 2.0 is written in MS Visual Basic.NET 2003.
Minimum requirements are Windows 98, Windows 2000, Windows XP or higher, 128 Mb memory and a display with a resolution of 1024 * 768 pixels.

The Crop Sequence and Management Generator

Introduction

The ‘Crop Sequence and Management Generator’ (CSMG) provides a highly automated process for creating the SOILNDB input database needed to run SOILNDB, this used to be a much more manual process, slow and cumbersome and prone to errors, is also much more flexible than the earlier process.

The CSMG reads data from two databases, generates a crop sequence based on the proportion of the different crops in the region. Then the managements, such as fertilization, sowing, harvest and tillage is added and a complete management database is constructed which includes everything needed to run the SOILNDB-model.

Input

The Crop generator is dependent on two databases. The ‘Statistical database’ primarily contains data about the managements of the crops and data about the soils, and the ‘Climate database’ contains climatological data. The climate database is the same as used by SOILNDB during the simulations.

Climate database

The climate database consist of two parts, a table named coupling, Tab. 1, which contains additional data of the climates and an unspecified number of tables containing the actual climatologial data.

Statistical database

The Statistical database is a MS Excel workbook that contains 26 sheets, each containing either agricultural data or switches used in the generation of the management database. Se Tab. 2 for an overview of the tables and Appendix II for details. The language used in the database are at the moment Swedish but could with relative ease be translated into another language, this would demand minor reprogramming.

Each sheet can contain data for several regions or fields. A new region is simply added by adding a new row to the existing tables.

Tab. 2. The sheets in the Statistical database and a short description of their contents.

Excel sheet	Description of content
Fånggröda areal	Area of catch crop
Grödoareal	Crop areas
Grödor	A collection of switches applying to the crops
Halmskördad areal %	Removal of straw and residues
Handelsgödsel	Amount of fertilizer applied
Jordarter	Soil characteristics
Jordartsfördelning	The proportion of different soils in the regions
Jordbearbetningstidpunkt	Tillage date
JordbearbettidpunktInförVall	Tillage date before leys
JordBearInförHöstBearbFånggröda	Tillage date before autumn tilled catch crop
KärnN	Content of N in harvested biomass (grain, seeds or roots)
Målavrinning	Goal discharge of water (not used by CSMG, but by ADC)
Manure Incorp höst	Switch: manure incorporated when applied in autumn
Manure Incorp vår	Switch: manure incorporated when applied in spring
N-dep	Atmospheric deposition of nitrogen
N-fix i slåttervall	Nitrogen fixation in leys
Områden	The names of the defined regions
OrganiskHalt	Soil organic content
PotentielltFånggrödeUpptag	Potential N uptake by catch crop
Såtid	Sowing date
Skörd	Harvest
Skördtid	Harvest date
Skördtid2	Second harvest date for ley
Stallgödsel	Amount of manure applied and area manure is applied on
Stallgödsel höst %	Percentage of areas that receive manure in the autumn
Stallgödselspridningstidpunkt	Manure application date

Reading databases

Both databases are read into the computers memory and stored as an internal database, as a dataset that contains several datatables. This is done to increase the speed during the composition of the management database and it also necessary in order to present the user with relevant data.

Randomization of crop sequence and management

The number of crops in the crop sequence is calculated in accordance with their relative area of the crop in the region. A 10% area of barley in a region results in 1000 occurrences in a 10000 year sequence. The crops are assigned to manure application or fertilization according to the relative areas. In the case of manure application spring or autumn application is distributed according to relative area. Straw incorporation is distributed and randomized within each crop. The crop sequence and management is then randomized with constrictions. The constrictions are of the type: crop X cannot occur after crop Y. There are 13 predefined constrictions and 12 user defined.

Catch crop

The catch crop is divided into three types; “Spring cultivated catch crop”, “Autumn cultivated catch crop” and “Spring cultivation without catch crop”. The catch crop in the later case is weeds and spilled seeds that germinate after harvest. The nitrogen uptake associated with each type of catch crop is taken from the Statistical database, and can be changed by the user to adapt the catch crop to a specific type.

Soils with high clay content are not normally cultivated in spring. In order to allow for this the actual amount of catch crops can be recalculated. The two spring cultivation practices are removed from clay soils and distributed among the other soils and on autumn cultivated catch crop on all soils, Tab. 3, according to the relative area of clay soils. The recalculating affects all the soils equally in the region i.e. not only those that have an area greater than zero. Two sets of catch crops are distributed in the internal crop sequence, with redistribution and without redistribution; this allows the user to use the same crop sequence without catch crop, with catch crop and with redistributed catch crop when generating the SOILNDB input database.

Tab. 3. Change in catch crop areas (ha) after recalculating the areas to avoid spring cultivation on clay soils. sccc = spring cultivated catch crop, accc = autumn cultivated catch crop, sc = spring cultivation, tot. = total area

Org.	Spring barley	Winter wheat	Ley	Sugar beets	Winter rape	Fallow	Oats	Spring wheat	Winter rye	Winter barley	Spring rape	Potatoes
sccc	6164	2911	0	0	0	0	1420	1716	700	689	183	0
accc	4483	7278	0	0	0	0	1033	1830	350	424	46	0
sc	1121	485	0	0	0	0	387	229	156	212	46	0
tot.	11768	10674	0	0	0	0	2840	3775	1206	1325	275	0
Sand												
sccc	7688	3631	0	0	0	0	1771	2140	873	859	228	0
accc	5591	9077	0	0	0	0	1288	2282	437	529	57	0
sc	1398	605	0	0	0	0	483	286	195	264	57	0
tot.	14677	13313	0	0	0	0	3542	4708	1505	1652	342	0
Clay												
sccc	0	0	0	0	0	0	0	0	0	0	0	0
accc	5591	9077	0	0	0	0	1288	2282	437	529	57	0
sc	0	0	0	0	0	0	0	0	0	0	0	0
tot.	5591	9077	0	0	0	0	1288	2282	437	529	57	0

Nitrogen fixation

Nitrogen fixation is treated as an addition to fertilization in SOILNDB. For leys a specified amount of nitrogen, given in the statistical database, is added to the nitrogen fertilization. For other crops capable of nitrogen fixation, the amount of nitrogen added to fertilization is calculated as the difference between added nitrogen and nitrogen needed to reach the target harvest. This is automatically calculated and not visible to the user.

Maximum harvest

The simulated harvest should be as close as possible to the given target harvest. If the maximum harvest in the model is equal to the given target harvest this would not be possible, as the simulated harvest would be smaller some years due to nitrogen deficiency in the soil. In order for the model to reach the given target harvest in average the concept of maximum harvest is used. This allows the model to simulate a larger harvest than the target harvest some years. The maximum harvest value is calculated from the target harvest +10%, this factor is defined in the statistical database, Tab. 11.

Nitrogen deposition

Nitrogen deposition is divided in two parts, wet and dry deposition. The dry deposition is a load (kg/ha/year). The wet deposition is a load (kg/ha/year) in the statistical database but a concentration (mg/l) in the SOILNDB input database. The wet deposition is recalculated

using a yearly mean value of precipitation calculated from the climate database. The precipitation is corrected using the preca0 value in the climate database, Tab. 8. If the air temperature is below 0 degrees the preca0 (rain) value and the preca1 (snow) value is used.

Second harvest of leys

The ley has a second harvest. Only the date for harvest is given as input. The given harvest is divided in 2 parst, ⅔ of the total harvest is the first harvest and ⅓ is the second harvest.

Output

The output from the CSMG is two databases. The SOILNDB input database is the primary output. This database is used for input when running simulations in SOILNDB. The other output is the crop sequence database that is used to save the randomized crop sequence for later use.

The SOILNDB input database contains 7 tables, Tab. 4, detailed description in Appendix III.

Tab. 4. The tables in the SOILNDB input database.

CatchCrop	Statistical information about the catch crop
Cropping system	The crop sequence and management
Deposition	Atmospheric deposition of nitrogen
Extra	Some extra information about used databases
Hydrology	Hydrological model settings
ID number	Dataset number and used climate database
Soil data	Soil class and organic matter content

The crop sequence database is a MS Access database with 3 tables, se Tab. 5 for short description and Appendix IV for details.

Tab. 5. The tables in the crop sequence database

CatchCrop	Catch crop statistics
Inställningar	The settings for the randomization
slump	The randomized crop sequence, including catch crops

Minimum requirements

The Crop Sequence and Management Generator is written in MS Visual Basic.NET 2003. Minimum requirements are Windows 98, Windows 2000, Windows XP or higher, 128 Mb memory and a display with a resolution of 1024 * 768 pixels.

The Average Discharge Calculator 1.0 (ADC)

The average discharge calculator is a program for calibrating the simulated water discharge to the discharge given as input to NLeCCS. It also calculates the concentration of nitrogen in the precipitation, from the nitrogen load and amount of precipitation. This is necessary as the discharge is calibrated with the precipitation correction constant.

In the ADC it is possible to include or exclude the surface runoff from the total discharge that is compared to the target discharge. The total discharge is area dependent. It is calculated from all the simulated soils discharge multiplied with each soils relative area and then summed up.

The program automatically calculates a suggestion of a new value for preca0, Eqn 1. But the user can enter any value.

*New preca0 = old preca0 + (target discharge - discharge) * 0.002* *Eqn. 1.*

The wet deposition is a load (kg/ha/year) in the statistical database but a concentration (mg/l) in the SOILNDB input database. The wet deposition is recalculated using a yearly mean value of precipitation calculated from the climate database. The precipitation is corrected using the preca0 value, if the air temperature is below 0 degrees the preca1 (snow correction factor) value is also used.

The ADC also writes a log file that makes it possible to see all the changes made to the databases.

Minimum requirements

The average discharge calculator is written in MS Visual Basic.NET 2003.
Minimum requirements are Windows 98, Windows 2000, Windows XP or higher, 128 Mb memory and a display with a resolution of 1024 * 768 pixels.

Average calculations

The results from the simulations are further compiled with a MS Excel macro. Averages are calculated for a number of parameters, se Appendix VI for complete list. The averages are calculated for the individual crops, for all crops and for all crops excluding ley and fallow.

Appendix I

The climate text file.

The climate text file is an ASCII text, with 8 columns separated by white spaces (space, tab), Tab. 6. The columns are: Year, Month, Day, Relative humidity, Cloudiness, Wind, Precipitation and Temperature. It is not possible to have extra carriage returns at the end of the file this will result in a read error.

Tab. 6. The columns in a climate text file: Year, Month, Day, Relative humidity, Cloudiness, Wind, Precipitation, and Temperature.

1981	1	1	78.6	3.6	18.9	2.42872	5.85847
1981	1	2	79.3	4.2	12.1	9.67172	5.24882
1981	1	3	92.8	7.5	5.8	3.54336	4.09963
1981	1	4	87.0	6.6	8.4	3.81187	2.47866
1981	1	5	81.8	4.0	6.1	0.83875	-1.08870
1981	1	6	82.8	1.2	3.6	0.00175	-6.52032
1981	1	7	78.8	1.3	7.9	0.01978	-5.51680
1981	1	8	85.8	6.2	10.0	3.41349	-1.11222
…	…	…	…	…	…	…	…

Relative humidity is between 0 and 100.
Cloudiness is expressed in fractions of 8, Where 8 is total cloud cover and 0 no clouds.
Wind is expressed in m/s.
Precipitation is expressed in mm.
Temperature is expressed in degrees Celsius.

The SOILNDB climate MS Access database.

The SOILNDB climate database is an MS Access database. It contains a table with metadata (Coupling) for all the climates, Tab. 7, Tab. 8 and separate tables for the climate data Tab. 9.

Tab. 7. Example of the Coupling table in the climate database

station	latitud	preca0	preca1	c_upet2	ley_ upst1	ley_ upet3	ley_i upet3	w_wheat upst1	w_wheat upet3	w_rye upst1	w_rye upet3	w_barley upst1	w_barley_ upet3	w_rape upst1	w_rape upet3	comments
RCA2-E-A2	33	1	0.14	357	10	357	357	10	357	10	357	10	357	10	357	
RCA2-E-A23	33	1	0.14	357	10	357	357	10	357	10	357	10	357	10	357	
RCA2-E-A25	33	1	0.14	357	10	357	357	10	357	10	357	10	357	10	357	
RCA1-E	4	1	0.14	357	60	357	357	60	357	60	357	60	357	60	357	
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

Tab. 8. The columns in the coupling table

	Meaning
station	Name of the climate station, same as the name of corresponding climate table.
latitud	Latitude of the climate station.
preca0	Precipitation correction.
preca1	Snow fall correction, added to preca0 at times of snowfall.
c_upet2	End of plant uptake period.
ley_upst1	Start of ley uptake period.
ley_upet3	End of ley uptake period.
ley_i_upet3	
w_wheat_upst1	Start of winter wheat uptake period.
w_wheat_upet3	End of winter wheat uptake period.
w_rye_upst1	Start of rye uptake period.
w_rye_upet3	End of rye uptake period.
w_barley_upst1	Start of winter barley uptake period.
w_barley_upet3	End of winter barley uptake period.
w_rape_upst1	Start of winter rape uptake period.
w_rape_upet3	End of winter rape uptake period.
comments	Comments.

Tab. 9. Example of a climate table

datum	Temperature	Humidity	Windspeed	Precipitation	Cloudiness
1981-01-01	78.6	3.6	18.9	2.42872	5.85847
1981-01-02	79.3	4.2	12.1	9.67172	5.24882
1981-01-03	92.8	7.5	5.8	3.54336	4.09963
1981-01-04	87	6.6	8.4	3.81187	2.47866
1981-01-05	81.8	4	6.1	0.83875	-1.0887
1981-01-06	82.8	1.2	3.6	0.00175	-6.52032
1981-01-07	78.8	1.3	7.9	0.01978	-5.5168
1981-01-08	85.8	6.2	10	3.41349	-1.11222
…	…	…	…	…	…

Observe that the date (datum) starts with a space.

Appendix II

Statistical database (Excel)

Each table corresponds to a sheet in the Excel workbook.

The cells with "…" indicates that the table can be expanded in that direction i.e. more crops or soils. It is of vital importance that all the tables are expanded at the same time, otherwise data will be missing and CSMG will fail to construct the SOILNDB-database.

Tab. 10. 'Områden'

Område
po1a
po1b
po2a
po2b
…

Område	The names of the different areas/regions in the database, used as key in many tables

Tab. 11. 'Grödor'

Gröda	Höst/vår	Engelskt namn	N-Fix	Max Skörd korr
vårkorn	vår	Spring barley	Nej	1.1
höstvete	höst	Winter wheat	Nej	1.1
vall	vall	Ley	Ja	1.1
sockerbetor	vår	Sugar beets	Nej	1.1
höstraps	höst	Winter rape	Nej	1.1
träda	vår	Fallow	Nej	1.1
havre	vår	Oats	Nej	1.1
vårvete	vår	Spring wheat	Nej	1.1
råg	höst	Winter rye	Nej	1.1
höstkorn	höst	Winter barley	Nej	1.1
vårraps	vår	Spring rape	Nej	1.1
potatis	vår	Potatoes	Nej	1.1
…	…	…	…	…

Gröda	Swedish names of the crops
Höst/vår	Spring (vår) or Autumnt (host) sown crops or Ley (vall)
Engelskt namn	English names of the crops
N-Fix	Ja = the crops can fixate nitrogen, Nej = non N fixating crop
Max Skörd korr	Correction factor for the harvest.

Tab. 12. 'N-fix i slåttervall'

Område	N kg/ha
po1a	40
po1b	40
po2a	32
po2b	32
…	…

Område	The names of the different areas/regions in the database
N kg/ha	Nitrogen fixated in leys (kg/year) this amount is added to the leys fertilization.

Tab. 13. 'N-dep'

Område	Våt dep (kg/ha/år)	Torr dep (kg/ha/år)
po1a	1.33	3
po1b	1.35	3
po2a	1.33	3
po2b	1.18	2
…	…	…

Område The names of the different areas/regions in the database
Våt dep (kg/ha/år) The wet nitrogen deposition (kg/ha/year)
Torr dep (kg/ha/år) The dry nitrogen deposition (kg/ha/year)

Tab. 14. 'Målavrinning'

Område	(mm)
po1a	288
po1b	445
po2a	312
po2b	190
…	…

Område The names of the different areas/regions in the database
(mm) The target discharge (mm)
This table is not used in this program.

Tab. 15. 'Jordarter'

Jord	Lera
Sand	nej
Loamy sand	nej
Sandy loam	nej
Clay	ja
…	…

Jord The names of the soils
Lera ja = clay soil, nej = non clay soil, affects the distribution of catch crops

Tab. 16. 'Jordartsfördelning'

Område	Sand	Loamy sand	Sandy loam	Loam	Silt loam	Silt	Sandy clay loam	Clay loam	Silty clay loam	Sandy clay	Silty clay	Clay	Oklassat	…
po1a	0.00	0.00	0.72	0.25	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	…
po1b	0.00	0.11	0.71	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	…
po2a	0.00	0.07	0.71	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	…
po2b	0.03	0.08	0.67	0.19	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område — The names of the different areas/regions in the database
Sand - Clay — The proportion of the soil class in the region
Oklassat — Unclassified soils

Tab. 17. 'OrganiskHalt'

Område	Sand	Sand	Loamy sand	Loamy sand	Sandy loam	…	Oklassat	Oklassat	…
	Topsoil	Subsoil	Topsoil	Subsoil	Topsoil	…	Topsoil	Subsoil	…
po1a	4.30	0.1	4.30	0.1	4.30	…	4.30	0.1	…
po1b	4.30	0.1	4.30	0.1	4.30	…	4.30	0.1	…
po2a	4.30	0.1	4.30	0.1	4.30	…	4.30	0.1	…
po2b	4.30	0.1	4.30	0.1	4.30	…	4.30	0.1	…
…	…	…	…	…	…	…			…

Område — The names of the different areas/regions in the database
Sand - Oklassat — The soil classes, as in table 'Jordartsfördelning'
Topsoil — The organic matter content in the upper soil layer
Subsoil — The organic matter content in the lower soil layer

Tab. 18. 'Grödoareal'

Område	Areal	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	235898	56036	48518	29559	31350	7560	19080	12913	11438	3888	5299	4572	5684	…
po1b	76177	18095	15668	9545	10124	2441	6161	4170	3694	1255	1711	1476	1836	…
po2a	111327	22928	12589	33607	7198	2157	9291	4084	3564	3540	4867	1262	6240	…
po2b	73514	15140	8313	22192	4753	1424	6135	2697	2354	2338	3214	833	4120	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Areal	Total area of crops (ha)
Vårkorn-potatis	Swedish names of the crops see table ‘Grödor’ for English translation. Area of each crop in the region (ha)

Tab. 19. ‘Såtid’

Område	**vårkorn**	**höstvete**	**vall**	**sockerbetor**	**höstraps**	**träda**	**havre**	**vårvete**	**råg**	**höstkorn**	**vårraps**	**potatis**	…
po1a	15-apr	22-sep	15-jun	20-apr	23-aug		15-apr	30-apr	22-sep	22-sep	30-apr	27-apr	…
po1b	15-apr	22-sep	15-jun	20-apr	23-aug		15-apr	30-apr	22-sep	22-sep	30-apr	27-apr	…
po2a	18-apr	23-sep	15-jun	20-apr	23-aug		18-apr	30-apr	23-sep	23-sep	30-apr	06-maj	…
po2b	18-apr	23-sep	15-jun	20-apr	23-aug		18-apr	30-apr	23-sep	23-sep	30-apr	06-maj	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Vårkorn-potatis	Swedish names of the crops see table ‘Grödor’ for English translation. Sowing date (formatted as date in excel)

Tab. 20. ‘Skördtid’

Område	**vårkorn**	**höstvete**	**vall**	**sockerbetor**	**höstraps**	**träda**	**havre**	**vårvete**	**råg**	**höstkorn**	**vårraps**	**potatis**	…
po1a	19-aug	01-sep	15-jun	01-nov	05-aug		19-aug	04-sep	20-aug	20-aug	04-sep	02-sep	…
po1b	19-aug	01-sep	15-jun	01-nov	05-aug		19-aug	04-sep	20-aug	20-aug	04-sep	02-sep	…
po2a	20-aug	25-aug	15-jun	01-nov	07-aug		20-aug	04-sep	16-aug	16-aug	04-sep	03-sep	…
po2b	20-aug	25-aug	15-jun	01-nov	07-aug		20-aug	04-sep	16-aug	16-aug	04-sep	03-sep	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Vårkorn-potatis	Swedish names of the crops see table ‘Grödor’ for English translation. Harvest date (formatted as date in excel)

Tab. 21. ‘Skördtid2’

Område	**vårkorn**	**höstvete**	**vall**	**sockerbetor**	**höstraps**	**träda**	**havre**	**vårvete**	**råg**	**höstkorn**	**vårraps**	**potatis**	…
po1a			15-aug										…
po1b			15-aug										…
po2a			15-aug										…
po2b			15-aug										…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database

Vårkorn-potatis Swedish names of the crops see table ‘Grödor’ for English translation. Second harvest date (formatted as date in excel)

Tab. 22. ‘Skörd’

Område	Areal	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	235898	5178	7650	8893	47248	2638		3785	5676	5103	5103	1630	36041	…
po1b	76177	5178	7650	8893	47248	2638		3785	5676	5103	5103	1630	36041	…
po2a	111327	4345	6747	9673	43171	2638		3785	5425	4696	5103	1657	38909	…
po2b	73514	4345	6747	9673	43171	2638		3785	5425	4696	5103	1657	38909	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Areal Total cultivated area in the region
Vårkorn-potatis Swedish names of the crops see table ‘Grödor’ for English translation. Harvest (kg/ha)
Harvest of ‘vall’ = ley is divided in two, 2/3 at first harvest and 1/3 at second harvest

Tab. 23. ‘KärnN’

Område	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	1.7	1.9	2	0.2	3.8		1.8	2.1	1.7	1.7	3.8	0.25	…
po1b	1.7	1.9	2	0.2	3.8		1.8	2.1	1.7	1.7	3.8	0.25	…
po2a	1.7	1.9	2	0.2	3.8		1.8	2.1	1.7	1.7	3.8	0.25	…
po2b	1.7	1.9	2	0.2	3.8		1.8	2.1	1.7	1.7	3.8	0.25	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn-potatis Swedish names of the crops see table ‘Grödor’ for English translation. Grain nitrogen content (g/kg)

Tab. 24. ‘Halmskördad areal %’

Område	vårkorn	höstvete	havre	vårvete	råg	höstkorn	…
po1a	59.00	65.00	63.00	80.00	71.00	63.00	…
po1b	59.00	65.00	63.00	80.00	71.00	63.00	…
po2a	26.00	44.00	55.00	50.00	38.00	27.00	…
po2b	26.00	44.00	55.00	50.00	38.00	27.00	…
…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database

Vårkorn-höstkorn Swedish names of the crops see table ‘Grödor’ for English translation. Area were straw is removed (%)
This table should only contain the crops that has straw removal.

Tab. 25. ‘Jordbearbetningstidpunkt’

Område	**vårkorn**	**vårkorn**	**höstvete**	**höstvete**	**vall**	**vall**	**sockerbetor**	**sockerbetor**	**höstraps**	**höstraps**	**träda**	**träda**	…
	höstsådd	**vårsådd**	**höstsådd**	**vårsådd**	**höstsådd**	**vårsådd**	**höstsådd**	**vårsådd**	**höstsådd**	**vårsådd**	**höstsådd**	**vårsådd**	…
po1a	22-aug	15-okt	15-sep	15-okt	22-aug	15-okt		08-nov	15-sep	15-okt	25-jul	25-okt	…
po1b	22-aug	15-okt	15-sep	15-okt	22-aug	15-okt		08-nov	15-sep	15-okt	25-jul	25-okt	…
po2a	22-aug	15-okt	16-sep	15-okt	22-aug	15-okt		08-nov	16-sep	15-okt	25-jul	25-okt	…
po2b	22-aug	15-okt	16-sep	15-okt	22-aug	15-okt		08-nov	16-sep	15-okt	25-jul	25-okt	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn-träda Swedish names of the crops see table ‘Grödor’ for English translation.
Dates for soil cultivation, formatted as date in excel.
Höstsådd This date applies if the next crop is autumn sown
Vårsådd This date applies if the next crop is spring sown

Tab. 26. ‘JordbearbettidpunktInförVall’

Område	**vårkorn**	**höstvete**	**vall**	**sockerbetor**	**höstraps**	**träda**	**havre**	**vårvete**	**råg**	**höstkorn**	**vårraps**	**potatis**	…
po1a	20-aug	02-sep			06-aug	01-dec	20-aug	05-sep	21-aug	21-aug	05-sep		…
po1b	20-aug	02-sep			06-aug	01-dec	20-aug	05-sep	21-aug	21-aug	05-sep		…
po2a	21-aug	26-aug		08-nov	08-aug	01-dec	21-aug	05-sep	17-aug	17-aug	05-sep		…
po2b	21-aug	26-aug		08-nov	08-aug	01-dec	21-aug	05-sep	17-aug	17-aug	05-sep		…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn- potatis Swedish names of the crops see table ‘Grödor’ for English translation.
Dates for soil cultivation if the next crop is a ley, formatted as date in excel.

Tab. 27. 'JordBearInförHöstBearbFånggröda'

Område	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	25-okt	25-okt			25-okt	25-okt	25-okt	25-okt	25-okt	25-okt	25-okt		…
po1b	25-okt	25-okt			25-okt	25-okt	25-okt	25-okt	25-okt	25-okt	25-okt		…
po2a	25-okt	25-okt			25-okt	25-okt	25-okt	25-okt	25-okt	25-okt	25-okt		…
po2b	25-okt	25-okt			25-okt	25-okt	25-okt	25-okt	25-okt	25-okt	25-okt		…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn-potatis Swedish names of the crops see table 'Grödor' for English translation.
Dates for soil cultivation if the crop has an autumn cultivated catch crop, formatted as date in excel.

Tab. 28. 'PotentielltFånggrödeUpptag'

Område	Insådd vårbearbetning	Insådd vårbearbetning	Insådd höstbearbetning	Insådd höstbearbetning	Vårbearbetning utan insådd	Vårbearbetning utan insådd	…
	höstsådd	vårsådd	höstsådd	vårsådd	höstsådd	vårsådd	…
po1a	37	50	20	27	24	24	…
po1b	41	55	23	30	24	24	…
po2a	37	50	20	27	24	24	…
po2b	41	55	23	30	24	24	…
…	…	…	…	…	…	…	

Område The names of the different areas/regions in the database
Insådd vårbearbetning Catch crop sown with the crop, spring cultivated
Insådd höstbearbetning Catch crop sown with the crop, autumn cultivated
Vårbearbetning utan insådd No catch crop sown with the crop, spring cultivated
Höstsådd The crop is sown in autumn
Vårsådd The crop is sown in spring

Tab. 29. 'Fånggröda areal'

Område	vårkorn	vårkorn	vårkorn	höstvete	höstvete	höstvete	vall	vall	vall	…
	Insådd vårbearbetning	Insådd höstbearbetning	Vårbearbetning utan insådd	Insådd vårbearbetning	Insådd höstbearbetning	Vårbearbetning utan insådd	Insådd vårbearbetning	Insådd höstbearbetning	Vårbearbetning utan insådd	…
po1a	6164	4483	1121	2911	7278	485	0	0	0	…
po1b	1990	1448	362	940	2350	157	0	0	0	…
po2a	2522	1834	459	755	1888	126	0	0	0	…
po2b	1665	1211	303	499	1247	83	0	0	0	…
…	…	…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn-vall Swedish names of the crops see table 'Grödor' for English translation.
Insådd vårbearbetning Area of catch crop sown with the crop, spring cultivated
Insådd höstbearbetning Area of catch crop sown with the crop, autumn cultivated
Vårbearbetning utan insådd Area of catch no catch crop sown with the crop, spring cultivated

Tab. 30. 'stallgödselspridningstidpunkt'

Område	vårkorn	havre	vårvete	vårraps	sockerbetor	potatis	vall	…
po1a	21-okt	04-nov	02-okt	15-nov	15-nov	15-nov	27-okt	…
po1b	21-okt	04-nov	02-okt	15-nov	15-nov	15-nov	27-okt	…
po2a	21-okt	04-nov	02-okt	15-nov	15-nov	15-nov	27-okt	…
po2b	21-okt	04-nov	02-okt	15-nov	15-nov	15-nov	27-okt	…
…	…	…	…	…	…	…	…	…

Område The names of the different areas/regions in the database
Vårkorn-vall Swedish names of the crops see table 'Grödor' for English translation.
Manure application date, only applicable for spring sown crops.

Tab. 31. 'Stallgödsel höst %'

Område	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	7	96	10	24	91		0	20	94	79	7	6	…
po1b	7	96	10	24	91		0	20	94	79	7	6	…
po2a	6	77	14	24	91		12	20	94	80	7	6	…
po2b	6	77	14	24	91		12	20	94	80	7	6	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Vårkorn-potatis	Swedish names of the crops see table ‘Grödor’ for English translation.
	Manure applied in spring (%) the rest is applied in the autumn

Tab. 32. ‘Stallgödsel’

Område	**vårkorn**	**vårkorn**	**vårkorn**	**vårkorn**	**höstvete**	**höstvete**	**höstvete**	**höstvete**	…
	Areal %	NH4	OrgN	HandelsG	Areal %	NH4	OrgN	HandelsG	…
po1a	17	44	46	70	29	43	52	138	…
po1b	17	44	46	70	29	43	52	138	…
po2a	35	32	57	47	45	34	47	117	…
po2b	35	32	57	47	45	34	47	117	…
…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Vårkorn-höstvete	Swedish names of the crops see table ‘Grödor’ for English translation.
Areal %	The percentage of the crop area that receives manure (%)
NH4	The amount of ammonium nitrogen (kg/ha) with losses
OrgN	The amount of organic bound nitrogen (kg/ha) with losses
HandelsG	Complementary fertilizer (kg/ha)

Tab. 33. ‘Handelsgödsel’

Område	**vårkorn**	**höstvete**	**vall**	**sockerbetor**	**höstraps**	**träda**	**havre**	**vårvete**	**råg**	**höstkorn**	**vårraps**	**potatis**	…
po1a	99	157	141	113	168		74	157	89	84	111	103	…
po1b	99	157	141	113	168		74	157	89	84	111	103	…
po2a	88	134	137	124	163		74	116	98	85	113	103	…
po2b	88	134	137	124	163		74	116	98	85	113	103	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område	The names of the different areas/regions in the database
Vårkorn-potatis	Swedish names of the crops see table ‘Grödor’ for English translation.
	Applied fertilizer (kg/ha) when no manure are applied

Tab. 34. 'Manure Incorp höst'

Område	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	Ja	Ja	Nej	Ja	Ja		Ja	Ja	Ja	Ja	Ja	Ja	…
po1b	Ja	Ja	Nej	Ja	Ja		Ja	Ja	Ja	Ja	Ja	Ja	…
po2a	Ja	Ja	Nej	Ja	Ja		Ja	Ja	Ja	Ja	Ja	Ja	…
po2b	Ja	Ja	Nej	Ja	Ja		Ja	Ja	Ja	Ja	Ja	Ja	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område — The names of the different areas/regions in the database
Vårkorn-potatis — Swedish names of the crops see table 'Grödor' for English translation.
Ja = Manure incorporation when spread in autumn
Nej = No manure incorporation when spread in autumn

Tab. 35. 'Manure Incorp vår'

Område	vårkorn	höstvete	vall	sockerbetor	höstraps	träda	havre	vårvete	råg	höstkorn	vårraps	potatis	…
po1a	Ja	Nej	Nej	Ja	Nej		Ja	Ja	Nej	Nej	Ja	Ja	…
po1b	Ja	Nej	Nej	Ja	Nej		Ja	Ja	Nej	Nej	Ja	Ja	…
po2a	Ja	Nej	Nej	Ja	Ja		Ja	Ja	Nej	Nej	Ja	Ja	…
po2b	Ja	Nej	Nej	Ja	Ja		Ja	Ja	Nej	Nej	Ja	Ja	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…

Område — The names of the different areas/regions in the database
Vårkorn-potatis — Swedish names of the crops see table 'Grödor' for English translation.
Ja = Manure incorporation when spread in spring
Nej = No manure incorporation when spread in spring

Appendix III

SOILNDB input database

Tab. 36. 'Catchcrop'

Crop	Pot_Catchcrop	Act_Catchcrop
havre	324	157
höstkorn	117	73
höstraps	202	0
höstvete	1270	591
potatis	144	0
råg	90	67
sockerbetor	1329	0
träda	447	0
vall	254	0
vårkorn	1380	651
vårraps	119	16
vårvete	304	209
…	…	…

Crop Swedish names of the crops see table 'Grödor' for English translation.
Pot_Catchcrop Maximum number of possible catch crop positions in the crop sequence, after that crop.
Act_Catchcrop Number of catch crops in the crop sequence, after that crop.

Tab. 37. 'Cropping system' part 1

ID_no	Year	Manure_ type_1	Manure_ amount_1	Ammonium_ cont_1	Org_N_ cont_1	C-N_ ratio_1	Manure_ time_1	Manure_ spread_1	Manure_ inc_1	Time_ inc_1	Ley_1	Applic_ loss_1
2	1988											
2	1989											
2	1990	Slurry, cattle	1	38	39	20	19900330	Broadc. spr.	Nej	0	Yes	0
2	1991	Slurry, cattle	1	38	39	20	19910330	Broadc. spr.	Nej	0	Yes	0
2	1992											
3	1973											
3	1974											
3	1975											
3	1976											
…	…	…	…	…	…	…	…	…	…	…	…	…

ID_no The number of the dataset, a dataset contains up to 20 years.
Year Simulation year, the climate is used for this year.
Manure_type_1 The type of manure applied, always Slurry, cattle
Manure_amount_1 The amount of manure, not used, set to 1 to activate the proper functions in SOILNDB.
Ammonium_cont_1 Amount of NH_4 (kg/ha)
Org_N_cont_1 Amount of organically bound nitrogen (kg/ha)
C-N_ratio_1 The ratio of C to N in the manure.
Manure_time_1 Spreading date
Manure_spread_1 Type of spreading used, always Broadc. spr.
Manure_inc_1 Whether or not the manure is incorporated after spreading
Time_inc_1 Hours between spreading and incorporation. Zero or one hour.
Ley_1 Whether or not the manure was spread on a ley.
Applic_loss_1 Losses during application of manure, set to 0 as the loss from applied amount of N is already calculated in the application amount.

The fields Manure_type_1 to Applic_loss_1 are repeated 3 times, Manure_type_2 to Applic_loss_2, Manure_type_3 to Applic_loss_3, allowing spreading of manure at 3 times per season. Only one spreading is used.

Tab. 38. 'Cropping system' part 2

Fert_1	Fert_ time_1	…	Fert_ time_4	Crop	Sowing_ timep	Harvest_ 1_yield	Harvest_ 1_time	Harvest_ 2_yield	Harvest_ 2_time	Inc_straw &tops	Soil_ cultiv	Soil_cultiv _time	c_ upa2	grain_ N_ content	remarks
99	19880414	…		Spring barley	19880415	5695.8	19880819	0		no	Yes	19881015		1.7	
0		…		Fallow		0		0		Yes	Yes	19891201			
184	19900331	…		Ley		6521.5	19900615	3260.7	19900815	Yes	No			2	
184	19910331	…		Ley		6521.5	19910615	3260.7	19910815	Yes	No			2	
181	19920330	…		Ley		6521.5	19920615	3260.7	19920815	Yes	Yes	19921015		2	
113	19730419	…		Sugar beets	19730420	51972.8	19731101	0		Yes	Yes	19731108		0.2	
113	19740419	…		Sugar beets	19740420	51972.8	19741101	0		Yes	Yes	19741108		0.2	
113	19750419	…		Sugar beets	19750420	51972.8	19751101	0		Yes	Yes	19751108		0.2	
99	19760414	…		Spring barley	19760415	5695.8	19760819	0		Yes	Yes	19760822		1.7	
84	19770331	…		Winter barley	19760922	5613.3	19770820	0		no	Yes	19771015		1.7	
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

Fert_1 Amount of fertilizer (kg/ha).
Fert_time_1 Date of fertilizer spreading.
Fert_x and Fert_time_x are repeated 4 times, allowing 4 spreading of fertilizer per year, x is 1 to 4. Only one spreading is used.
Crop The crop.
Sowing_timep Sowing date.
Harvest_1_yield The yield of the first harvest (kg/ha).
Harvest_1_time The date of the first harvest.
Harvest_2_yield The yield of the second harvest (kg/ha) only used for ley.
Harvest_2_time The date of the second harvest only used for ley.
Inc_Straw&tops Whether or not crop residuals are incorporated in the soil (yes) or removed from the field (no).
Soil_cultiv Whether or not the soil is cultivated.
Soil_cultiv_time The date of the soil cultivation.
C_upa2 The uptake of the catch crop in the autumn (kg/ha).
Grain_N_content The percentage of N in the harvested crop.
Remarks Commentaries.

Tab. 39. 'Deposition'

ID_no	County	Inorg_N	Dry_dep
1	Skåne	1.32	3
2	Skåne	1.32	3
3	Skåne	1.32	3
4	Skåne	1.32	3
5	Skåne	1.32	3
…	…	…	…

ID_no	Reference to the dataset number in "Cropping system" table.
County	If no data is given for the deposition then data from county are used. "Skåne" is used for all of Sweden as this parameter is not used but must have some content.
Inorg_N	Nitrogen deposited with precipitation (mg/l).
Dry_dep	Dry deposited nitrogen (kg/ha).

Tab. 40. 'Extra

Date	Name	Climate file	Indata	Region
2004-05-07	KP	C:\SoilNDB\database\Climate.mdb	C:\NLeCCS\målavrinning\indata.xls	po1a

Date	The day the database was created
Name	The name of the person who created the database, can also be used as a commentary field for the database.
Climate file	Filename and path of the climate database file used to create the database.
Indata	Filename and path of the input database file used to create the database.
Region	The region the database was created for.

The table Extra is used to save data about the database, in order to easily determine what data the database is created from.
The Region field is also used when the crop sequence is read from a SOILNDB database.

Tab. 41. 'Hydrology'

ID_no	DDIST	DDRAIN	GFLOW1	LAYERS	GWFLOW
1	10	0.9	0	5	0
2	10	0.9	0	5	0
3	10	0.9	0	5	0
4	10	0.9	0	5	0
5	10	0.9	0	5	0
…	…	…	…	…	…

ID_no	The dataset number
DDIST	Distance between drainage pipes (m)
DDRAIN	Depth of drainage pipes (m)
GFLOW1	Amount of water that bypasses the drainage pipes to the ground water (mm/day)
LAYERS	Number of computational layers, 5 or 6
GWFLOW	Switch between free drainage (0) and drainage pipes (-1)

Tab. 42. 'ID number'

ID_no	dataset name	climate file	Area	comments
1	1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1a Skåne-Hallands slättbygd Skånedelen		
2	1a Skåne-Hallands slättbygd Skånedelen po1a 00002	1a Skåne-Hallands slättbygd Skånedelen		
3	1a Skåne-Hallands slättbygd Skånedelen po1a 00003	1a Skåne-Hallands slättbygd Skånedelen		
4	1a Skåne-Hallands slättbygd Skånedelen po1a 00004	1a Skåne-Hallands slättbygd Skånedelen		
5	1a Skåne-Hallands slättbygd Skånedelen po1a 00005	1a Skåne-Hallands slättbygd Skånedelen		
6	1a Skåne-Hallands slättbygd Skånedelen po1a 00006	1a Skåne-Hallands slättbygd Skånedelen		
…	…	…	…	…

ID_no	The dataset number
Dataset name	The name of the dataset, generally constructed from the climate name and the region name and the ID_no
Climate file	Name of the climate table in the climate file
Area	The size of the field, not used
Comments	Comments

Tab. 43. 'Soil data'

ID_no	Soil name	topsoil	subsoil	sub_SOM_Content	top_SOM_Content
1	Standard	Silty clay	Silty clay	0.1	4.3
2	Standard	Silty clay	Silty clay	0.1	4.3
3	Standard	Silty clay	Silty clay	0.1	4.3
4	Standard	Silty clay	Silty clay	0.1	4.3
5	Standard	Silty clay	Silty clay	0.1	4.3
6	Standard	Silty clay	Silty clay	0.1	4.3
7	Standard	Silty clay	Silty clay	0.1	4.3
8	Standard	Silty clay	Silty clay	0.1	4.3
9	Standard	Silty clay	Silty clay	0.1	4.3
10	Standard	Silty clay	Silty clay	0.1	4.3
…	…	…	…	…	…

ID_no The dataset number
Soil name
Topsoil The soil in the upper layer
Subsoil The soil in the lower layer
Sub_SOM_Content Organic matter in subsoil
Top_SOM_Content Organic matter in topsoil

Appendix IV

Crop sequence database

Tab. 44. 'Catchcrop'

Crop	Pot_Catchcrop	Pot_CatchcropMod	Act_Catchcrop	Act_CatchcropMod	Act_CatchcropClay	Act_CatchcropClayMod
havre	331	331	120	157	44	57
höstkorn	130	130	56	73	18	23
höstraps	195	195	0	0	0	0
höstvete	1294	1294	453	591	309	403
potatis	135	135	0	0	0	0
råg	107	107	52	67	15	19
sockerbetor	1329	1329	0	0	0	0
träda	449	449	0	0	0	0
vall	251	251	0	0	0	0
vårkorn	1330	1330	499	651	190	248
vårraps	118	118	12	16	2	3
vårvete	312	312	161	209	78	101

Crop	The crop in Swedish
Pot_Catchcrop	The maximum amount of catch crop that can be fitted into the crop sequence after each crop.
Pot_CatchcropMod	The maximum amount of catch crop that can be fitted into the crop sequence after each crop, should be the same as Pot_Catchcrop.
Act_Catchcrop	The actual number of catch crops in the crop sequence for each crop.
Act_CatchcropMod	The amount of catch crops on non clay soils when the spring cultivated catch crops on clay soils is redistributed.
Act_CatchcropClay	The amount of autumn cultivated catch crops on clay soils for each crop
Act_CatchcropClayMod	The amount of autumn cultivated catch crops on clay soils when the spring cultivated catch crops on clay soils is redistributed.

This table is purely informational; it is not used by any program.

Tab. 45. 'Slump'

NUMMER	GRÖDA	GÖDSELTYP	HÖSTVÅRSPRIDNING	VALLNR	STRAW_INCORP	FÅNGGRÖD	FÅNGGRÖDMOD
21	vall	Stallgödsel	Vårspridning	3001	Yes	0	0
22	vall	Stallgödsel	Vårspridning	3002	Yes	0	0
23	vall	Stallgödsel	Vårspridning	3003	Yes	0	0
24	höstvete	Handelsgödsel			Yes	0	0
25	vårkorn	Handelsgödsel			Yes	0	0
26	höstvete	Handelsgödsel			no	0	200
27	havre	Stallgödsel	Vårspridning		no	200	100
28	sockerbetor	Handelsgödsel			Yes	0	0
29	vårkorn	Handelsgödsel			Yes	0	200
30	vårvete	Handelsgödsel			Yes	0	0
…	…	…	…	…	…	…	…

NUMMER	Position in the crop sequence.
GRÖDA	Crop in Swedish.
GÖDSELTYP	Manure (stallgödsel) or fertilizer (handelsgödsel).
HÖSTVÅRSPRIDNING	Autumn (höstspridning) or spring (vårspridning) spreading of manure.
VALLNR	The leys are numbered in blocks to allow them to be moved in units during the randomization, nor really used here.
STRAW_INCORP	Incorporation of plant residuals.
FÅNGGRÖD	Catch crop 100 = Spring cultivated catch crop, 200 = autumn cultivated catch crop, 300 = Spring cultivation.
FÅNGGRÖDMOD	Catch crop 100 = Spring cultivated catch crop, 200 = autumn cultivated catch crop, 300 = Spring cultivation. A new randomization has to be used as the proportions between the different catch crops is different when a correction for spring cultivation on clay soils has been made.

Tab. 46. 'Inställningar'

Klimat	Region	StartÅr	Längd	Antal dataset
1a Skåne-Hallands slättbygd Skånedelen	po1a	1973	20	500

Klimat	The name of the climate table used in the randomization.
Region	The region for which the randomization was done.
Startår	The start year for the simulation.
Längd	Number of years in each dataset.
Antal dataset	Number of datasets.

This table is used to set the prerequisites for the randomization to the same values as when the randomization was done.

Appendix V

SOILNDB result database

Tab. 47. Part 1 of the cropping system table

dataset	Year	Crop	Deposition	Fert	Org_N	NH4_N	Target	Simulated	Leaching	Denitr	Pot_Plant	Act_Plant
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1973	Spring wheat	10.95815	157	0	0	152.3438	131.7124	44.11644	0	250.015	216.4603
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1974	Spring barley	13.33118	99	0	0	115.7102	87.23167	102.8386	0	199.532	150.3941
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1975	Winter barley	9.084385	72	19	37	114.0342	73.75022	43.70861	0	184.2974	119.6296
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1976	Spring barley	13.63778	99	0	0	96.8286	62.31292	59.87926	0	199.532	128.465
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1977	Sugar beets	11.90394	113	0	0	103.9456	77.21513	30.83448	0	266.0164	197.9159
…	…	…	…	…	…	…	…	…	…	…	…	…

Dataset	Name of the dataset (usually contains 20 years)
Year	Year of simulation
Crop	The crop
Deposition	Total nitrogen deposition (kg/ha)
Fert	Fertilization (kg/ha)
Org_N	Organic nitrogen in manure (kg/ha)
NH4_N	Ammonium nitrogen in manure (kg/ha)
Target	The target the simulated nitrogen harvest should reach (kg/ha)
Simulated	Simulated nitrogen harvest (kg/ha)
Leaching	Leaching of nitrogen at 1.5 m depth (kg/ha)
Denitr	Denitrification (kg/ha)
Pot_plant	Potential plant uptake of nitrogen (kg/ha)
Act_plant	Simulated plant uptake of nitrogen (kg/ha)

Tab. 48. Part 2 of the cropping system table

Discharge	Surface_ runoff	Tile_ drains	Catchcrop_ Pot	Catchcrop_ Act	Leaching_ 1_m	Change_ Org_N	Change_ Mineral	Mineralisation	NO3_N Conc	Soil_Cultivation_ time
272.172	0	0	0	0	38.61342	18.37598	-143.7775	65.69138	16.20903	19731015
433.0955	0	0	0	0	110.695	-33.83984	6.444319	116.1631	23.74503	19740822
191.4011	0	0	0	0	40.61628	-13.23535	-3.842802	59.06223	22.83613	19751015
408.6501	0	0	0	0	57.12506	-20.16895	90.81413	87.18791	14.65294	19761015
312.1921	0	0	0	0	28.53441	70.83691	-89.47072	103.1555	9.876766	19771108
…	…	…	…	…	…	…	…	…	…	19781015

Discharge	Discharge to groundwater (mm)
Surface_runoff	Surface runoff (mm)
Tile_drains	Discharge to tile drains (mm)
Catchcrop_pot	Potential catch crop nitrogen uptake (kg/ha)
Catchcrop_act	Simulated catch crop nitrogen uptake (kg/ha)
Leaching_1_m	Nitrogen leaching at 1 m depth (kg/ha)
Change_Org_N	Change in organic nitrogen in the soil (kg/ha)
Change_mineral	Change in mineral nitrogen in the soil (kg/ha)
Mineralisation	Mineralization of nitrogen (kg/ha)
NO3_N_Conc	Concentration of nitrogen in the leachate to groundwater and tile drains
Soil_cultivation_time	Date for soil cultivation

Tab. 49. Part 3 of the cropping system table

följande_gröda	följande_ målskörd	följande_ simskörd	följande_ Fert	följande_ OrgN	följande_ NH4N	följande_ Leaching	följande_ Leaching1m	följande_ Potup	följande_ Actup	följande_år
Spring barley	115.7102	87.23167	99	0	0	102.8386	110.695	199.532	150.3941	1974
Winter barley	114.0342	73.75022	72	19	37	43.70861	40.61628	184.2974	119.6296	1975
Spring barley	96.8286	62.31292	99	0	0	59.87926	57.12506	199.532	128.465	1976
Sugar beets	103.9456	77.21513	113	0	0	30.83448	28.53441	266.0164	197.9159	1977
Oats	88.745	80.92201	54	53	29	83.49859	88.27232	151.0203	137.8146	1978
…	…	…	…	…	…	…	…	…	…	…

Följande_gröda	Next year's crop
Följande_målskörd	Next year's simulated harvest target (kg/ha)
Följande_simskörd	Next year's simulated harvest (kg/ha)

Följande_fert	Next year's fertilization (kg/ha)
Följande_OrgN	Next year's organic nitrogen application with manure (kg/ha)
Följande_NH4N	Next year's ammonium nitrogen application with manure (kg/ha)
Följande Leaching1m	Next year's leaching of nitrogen at 1.0 m depth (kg/ha)
Följande_potup	Next year's potential plant uptake (kg/ha)
Följande_actup	Next year's simulatet plant uptake (kg/ha)
Följande_år	Next year

Tab. 50. The hydrology table

Dataset	DDIST	DDRAIN	GFLOW1	LAYERS	GWFLOW
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	10	0.9	0	5	0
1a Skåne-Hallands slättbygd Skånedelen po1a 00002	10	0.9	0	5	0
1a Skåne-Hallands slättbygd Skånedelen po1a 00003	10	0.9	0	5	0
1a Skåne-Hallands slättbygd Skånedelen po1a 00004	10	0.9	0	5	0
1a Skåne-Hallands slättbygd Skånedelen po1a 00005	10	0.9	0	5	0
…	…	…	…	…	…

Dataset	Name of the dataset (usually contains 20 years)
DDIST	Distance between tile drains (m)
DDRAIN	Depth of tile drains (m)
GFLOW1	Amount of water that bypasses the drainage pipes to the ground water (mm/day)
LAYERS	Number of computational layers, 5 or 6
GWFLOW	Switch between free drainage (0) and drainage pipes (-1)

Tab. 51. The Soil_dep_mm table

Dataset	Klimatfil	Laen	Deposition	Soilname	Topsoil	Subsoil	Top_SOM_Content	Sub_SOM_Content
1a Skåne-Hallands slättbygd Skånedelen po1a 00001	1a Skåne-Hallands slättbygd Skånedelen	Skåne	3	standard	Sand	Sand	4.3	0.1
1a Skåne-Hallands slättbygd Skånedelen po1a 00002	1a Skåne-Hallands slättbygd Skånedelen	Skåne	3	standard	Sand	Sand	4.3	0.1
1a Skåne-Hallands slättbygd Skånedelen po1a 00003	1a Skåne-Hallands slättbygd Skånedelen	Skåne	3	standard	Sand	Sand	4.3	0.1
1a Skåne-Hallands slättbygd Skånedelen po1a 00004	1a Skåne-Hallands slättbygd Skånedelen	Skåne	3	standard	Sand	Sand	4.3	0.1
1a Skåne-Hallands slättbygd Skånedelen po1a 00005	1a Skåne-Hallands slättbygd Skånedelen	Skåne	3	standard	Sand	Sand	4.3	0.1
…	…	…	…	…	…	…	…	…

Dataset	Name of the dataset (usually contains 20 years)
Klimatefil	Name of the climate used for the simulation
Laen	The county from witch the nitrogen deposition data is taken if it is not specified in the input database
Deposition	Nitrogen deposition (kg/ha)
Soilname	The name of the soil, standard is a group of soil predefined in SOILNDB
Topsoil	Soilclass in the upper 50 cm
Subsoil	Soilclass in the lower 100 cm
Top_SOM_Content	Organic matter content in the upper 25 cm
Sub_SOM_Content	Organic matter content in the 25-50 cm layer

Appendix VI

Calculated averages

Tab. 52. Part 1 of the calculated averages table.

Year	crop	Deposition	Fert	Org_N	NH4_N	Mean target	Max target	Simulated	Leaching	Denitr	Pot_Plant	Act_Plant	Discharge
2257	Spring barley	11.7	94.1	7.8	7.5	98.1	107.9	97.1	18.9	22.1	199.5	179.7	273.6
1964	Winter wheat	11.7	151.5	15.1	12.5	160.2	176.2	157.0	13.8	17.7	297.6	265.7	233.8
1188	Ley	11.6	142.9	25.0	24.4	177.9	195.6	170.1	2.9	18.3	427.7	316.2	217.3
1266	Sugar beets	11.3	111.8	12.5	9.0	94.5	103.9	94.5	9.9	17.7	266.0	242.0	204.9
310	Winter rape	11.8	158.4	14.5	6.4	100.2	110.3	100.6	17.4	23.9	289.6	264.7	268.7
768	Ley	11.7	0.0	0.0	0.0	0.0	0.0	0.0	7.7	22.0	214.2	133.3	270.5
518	Oats	11.7	65.1	23.6	12.9	76.0	83.6	81.1	21.9	23.2	151.0	146.5	266.6
452	Spring wheat	11.5	155.7	1.1	0.7	134.5	147.9	142.4	17.9	19.5	250.0	241.0	245.2
162	Winter rye	11.8	86.2	8.6	6.7	97.5	107.3	102.3	21.6	20.1	184.1	176.3	267.8
213	Winter barley	11.5	78.8	8.2	16.0	97.4	107.1	102.0	20.6	19.6	184.1	175.9	239.3
174	Spring rape	11.6	106.8	5.9	5.8	61.9	68.1	63.5	20.3	21.6	206.0	192.0	256.6
228	Potatoes	11.6	90.9	21.3	14.6	90.1	99.1	93.5	23.2	25.6	209.7	198.6	259.3
supermedel		11.6	109.9	12.5	10.5	112.2	123.4	111.3	14.0	20.1	260.8	223.5	245.5
medel exkl. vall och träda			115.9	11.9	9.4	113.3	124.6	113.4	16.4	20.2	239.3	218.1	247.4

Year	Number of occurrences of the crop in the result database. Supermedel = average for all crops. Medel exkl. vall och träda = average for all crops excluding ley and fallow.
Crop	The crop
Deposition	Total nitrogen deposition (kg/ha)
Fert	Nitrogen fertilization including nitrogen fixation (kg/ha)
Org_N	Organic nitrogen applied (kg/ha)
NH4_N	Ammonium nitrogen applied (kg/ha)
Mean target	The target value for the nitrogen harvest (kg/ha)

Max target	The maximum value for nitrogen harvest (kg/ha)
Simulated	The simulated nitrogen harvest (kg/ha)
Leaching	The leaching of nitrogen at 1.5 m depth (kg/ha)
Denitr	Denitrification (kg/ha)
Pot_plant	The potential nitrogen uptake by the crop (kg/ha)
Act_plant	The actuall nitrogen uptake by the crop (kg/ha)
Discharge	The dischare of free draining water from the profile (mm)

Tab. 53. Part 2 of the calculated averages table.

Catchcrop_Pot	Catchcrop_Act	Leaching_1_m	Change_Org_N	Change_Mineral	Mineralisation	NO3_N_Conc	Surface_runoff	Tile_drains
0.0	0.0	22.2	-12.2	-2.9	110.6	6.8	42.3	0.0
0.0	0.0	12.4	14.1	4.7	104.4	6.2	40.6	0.0
0.0	0.0	6.6	-5.5	0.6	158.9	1.3	39.1	0.0
0.0	0.0	8.8	14.1	-7.1	149.4	4.8	40.7	0.0
0.0	0.0	20.6	24.6	14.2	138.2	6.6	43.7	0.0
0.0	0.0	15.4	3.7	-6.2	150.3	2.6	41.6	0.0
0.0	0.0	28.5	-16.9	-14.5	109.7	8.0	45.0	0.0
0.0	0.0	19.9	-1.3	5.6	109.7	6.9	39.2	0.0
0.0	0.0	24.5	3.0	-7.1	94.1	8.2	45.7	0.0
0.0	0.0	22.4	4.7	-10.8	93.4	8.8	41.4	0.0
0.0	0.0	23.8	3.7	8.6	130.1	7.5	42.3	0.0
0.0	0.0	31.7	-22.0	-25.3	161.6	8.5	41.9	0.0
		16.3	1.0	-2.0	125.5	5.6	41.4	0.0
0.0	0.0	18.0	1.8	-1.9	117.7	6.5	41.7	0.0

Catchcrop_pot	Potential nitrogen uptake by catch crops (kg/ha)
Catchcrop_act	Actual nitrogen uptake by catch crops (kg/ha)
Leaching_1_m	The nitrogen leaching at 1 m depth (kg/ha)
Change_Org_N	The change in the organic bound nitrogen in the soil (kg/ha)
Change_Mineral	The change in mineral nitrogen in the soil (kg/ha)
No3_N_Conc	The NO_3 concentraion in the leachate (mg/l)
Surface_runoff	The surface runoff of water (mm)
Tile_drains	The water discharge through drainage system (mm)