HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

CANDY Database organisation

Description of Background

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CANDY Version 2015

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Introduction

This document gives an overview about the organization of the CANDY database.

Database

All CANDY data are organized in a Microsoft Access database. The most important tables are shown in Figure 1.

The basic information of each simulation unit is stored in the table CDY_FXDAT. The definition of one simulation unit requires the attributes *fname*, *snr* and *utlg* which have to be unique in their combination. These attributes give the link to the management data in CDY_MADAT and the observation (measurement) data in CDY_MVDAT. The soil parameters of a simulation unit are linked via the *standort* attribute of the PROFILE table. PROFILE is linked to CNDHRZN, which contains the actual soil parameters of each horizon (*horiz_name* → *name*). The climate data is linked from the short name of a climate station in CDY_CLDAT (*wstat*) to the *wetter* attribute of CDY_FXDAT.

This data structure is convenient for the modelling of homogeneous units where one management is combined with one climate and homogeneous soil conditions. For the modelling of heterogeneous site conditions it is recommended to make use of the GIS mode in CANDY. In this case the simulation units are defined by the intersection of map layers containing the pattern for management units, soil units and climate units.

User specific data consist of fixed data (defining the plot), management, climate, and observation data. If required, data from regular slurry samplings may be added as well. As part of the model parameterization the soil parameters will usually be specified by the model user, as well. Furthermore, there are tables containing descriptions about specific management options, such as crop or fertilizer parameters.

The content of the single tables is described in more detail in the following paragraphs.

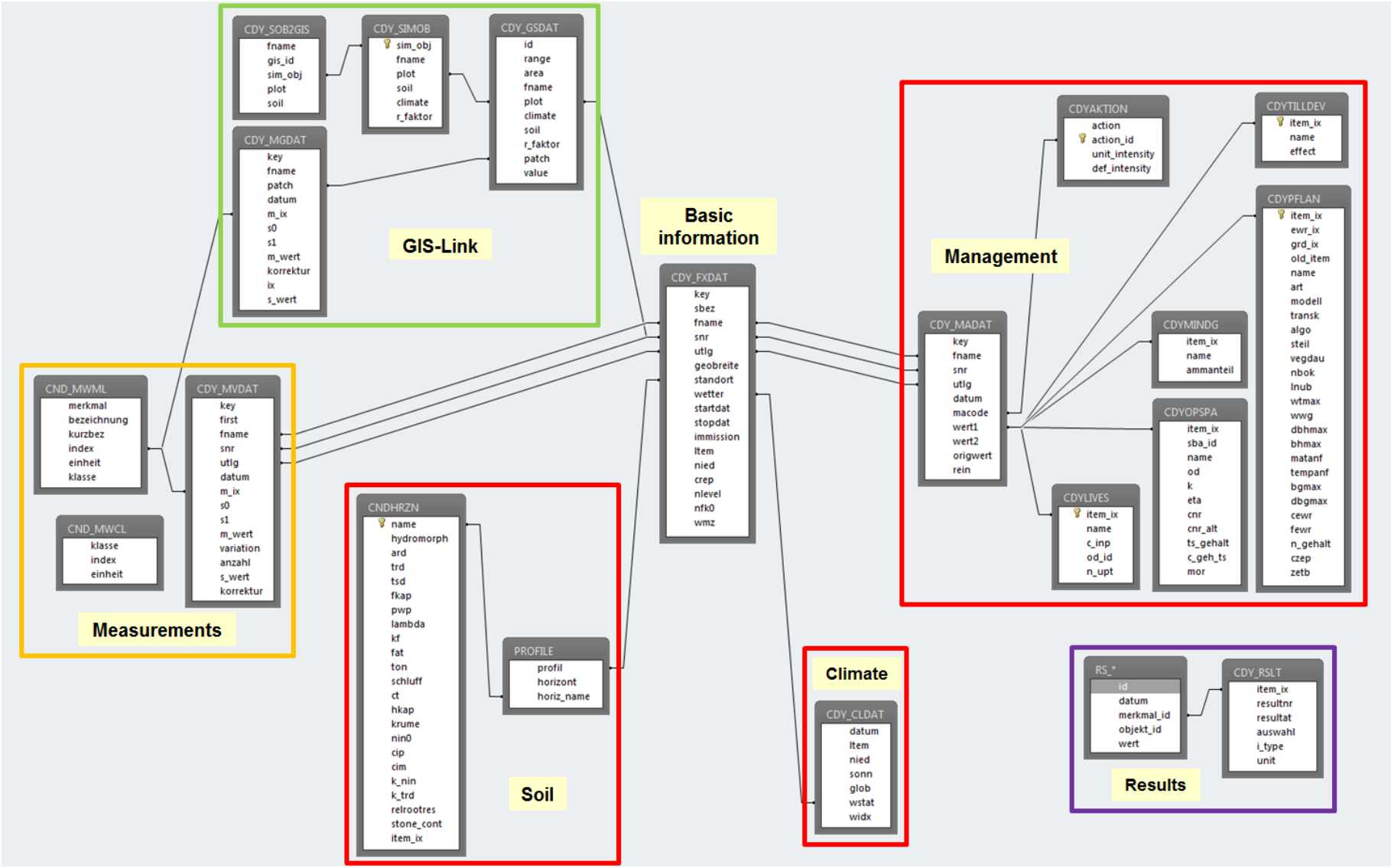

Figure 1: Schematic structure of the CANDY data model. In red boxes: user specific data (mandatory), orange box: recommended data, green box: optional extension, purple box: model output

Site information

CDY_FXDAT

Content

Basic information as fixed data with general description of each homogenous simulation object.

attribute	meaning	unit/type
sbez	plot name	string
fname	folder name	string (5)
snr	plot number 0..9999	number
utlg	subplot number 0..9 (optional, only if meaningful)	number
geobreite	geographic latitude; only used to transform sunshine duration into global radiation	[°]
standort	pointer to profil in PROFILE	string
wetter	pointer to wstat in CDY_CLDAT	string (3)
startdat	intended start of simulation	[dd.mm.yyyy]
stopdat	(written by the model)	[dd.mm.yyyy]
immission	annual atmospheric N deposition	[kg ha-1]
ltem	long term average of air temperature	[°C]
nied	long term average of annual rainfall	[mm]
crep	average annual flux of C reproduction, normal: 9 dt ha^{-1}	[dt ha-1]
nlevel	indicator of average N_{min} level: very low=1, low=2, normal=3, high=4	integer
nfk0	rough guess of the filling of plant available water capacity at start time	[%]
wmz	average BAT if known from other simulation runs; otherwise: -99	[d a^{-1}]

Remarks

The fixed data contain some information used to initialize the model:

- *nfk0* describes the relative filling of the water storage. If the starting point is in winter or early spring 100% is usually a good guess
- *nlevel* works together with the *nin0* and *k_nin* parameter of the soil data. The actual nitrate amount of a soil layer (1 dm) is set to *nin0+k_nin*(nlevel-3)*.
- *crep* describes the level of carbon reproduction before the simulation start. 9 dt ha-1 is a good guess for normal conditions. The resulting Corg value depends also on the BAT value
- *ltem*, *nied*, *wmz*: The BAT value of the pre-simulation time can be coded in the *wmz* column or will be estimated from the values of *ltem*, *nied* and soil texture.

These values are of course only rough estimates in order to make the model run. Much better tuning is possible using appropriate observation values to adapt the model to initial conditions.

Climate information

CDY_CLDAT

Content

Climate data in daily time steps.

attribute	meaning	unit/type
datum	date	[dd.mm.yyyy]
ltem	air temperature at 2 m	[°C]
nied	precipitation	[mm]
glob	global radiation	[J cm^{-2}]
sonn	sun shine duration (*)	[h]
wstat	acronym of climate station, link to CDY_FXDAT	string (3)
widx	weather index as [*wstat*] & "_" & Year([*datum*])	string

Remarks

glob and *sonn*: The model needs global radiation data only. If these are not available, they will be calculated from sunshine duration and latitude (*geobreite* in CDY_FXDAT) during simulation runs. If radiation data are presented in power units, the data need to be transformed taking into account that 1 Ws=1 J, 1 d=8.64 10^4 s, and 1 m^2= 10^4 cm^2; therefore 100 W m^{-2}=864 J cm^{-2}.

Measurement values

CDY_MVDAT

Content

Data from observations (measurements).

attribute	meaning	unit/type
first	'*' start of a series; else ' '	
fname	folder name	string (5)
snr	plot number	number
utlg	subplot number	number
datum	sampling date	[dd.mm.yyyy]
m_ix	pointer to the property index in CDYPROP	
s0	upper soil layer of the sample	
s1	lower soil layer of the sample	
m_wert	measurement value	
variation	variance (not required)	
anzahl	number of replications (if any)	
s_wert	simulation result	
korrektur	'J' model adapts to observation; 'N' model writes S_WERT	

Remarks

The soil profile is segmented to single calculation layers that are numbered increasing with depth and starting from 1 of the topmost. Since each layer has a standard thickness of 1 dm, all state values (temperature, soil moisture, C_{org} etc.) are allocated to the middle of a calculation layer (0.5, 1.5, 2.5 etc. dm)

We have to consider two cases for the coding of observation values:

i) The observation relates to the middle of one calculation layer, for instance 1.5 dm. In that case, it corresponds to the state variable in calculation layer 2 and the input values are S0=1 and S1=2

ii) The observation is on the borderline between two calculation layers, for instance 3 dm. In that case it corresponds to the average of the state variables in layers 3 and 4 but the input values are S0=3 and S1=3

At runtime these inputs are used to calculate the output x from the modelled values m in the following way:

If S0=S1 then {h1:=S0-1; h2:=S1+1} else {h1:=S0; h2:=S1}

$$sx := \sum_{i=h1}^{i=h2} m[i]$$

i = number of the calculation layer

$x=sx/n$ (depending on the type of the state variable)

For including measurement values within your simulation runs you have to be aware of accessing the correct database table. Using the CANDY GUI, measurement values are permanently stored in the table CDY_MVDAT. For each simulation run the selected measurement values are temporarily stored in the table CDY_MSDAT. By working with the model via batch file calls, measurement values are retrieved only from the table CDY_MSDAT, which has to be created by the user. During batch mode simulations CDY_MSDAT remains permanent available (only simulated data are updated). The structure of the CDY_MSDAT corresponds to CDY_MVDAT, but contains the extra index field (*ix*). This index is composed as a string from site attributes:

In GIS mode, CANDY uses measurement values from the table CDY_MGDAT that has an additional field (*patch*) as described in the CANDY Handling document.

CDY_MSDAT / CDY_MGDAT

Content

Data from observations (measurements) either used for batch calls (CDY_MSDAT) or used within GIS mode (CDY_MGDAT).

attribute	meaning	unit/type
first	'*' start of a series; else ' '	
fname	folder name	string (5)
snr	plot number	number
utlg	subplot number	number
datum	sampling date	[dd.mm.yyyy]
m_ix	pointer to the property index in CND_MWML	
s0	upper soil layer of the sample	
s1	lower soil layer of the sample	
m_wert	measurement value	
variation	variance (not required)	
anzahl	number of replications (if any)	
s_wert	simulation result	
korrektur	'J' model adapts to observation; 'N' model writes S_WERT	
ix	internal index: <fname><*b*><snr><utlg><datum><*b*><m_ix><*b*><s0><*b*><s1> with <*b*>: blank	string
patch	replaces the combination of *snr* and *utlg* within the GIS mode	

Remarks

Be aware of handling the data within these tables in a date ordered way, otherwise there may occur errors or blank simulation values during the simulation run. For the structure of the index attribute (*ix*) the following sql statements may be used for CDY_MSDAT:

*update cdy_msdat set ix=fname+str(snr*10+utlg)+str(datum)+str(m_ix)+str(s0)+str(s1)*

or:

update cdy_msdat set ix = [fname] & " " & [snr] & [utlg] & [datum] & " " & [m_ix] & " " & [s0] & " " & [s1]

, respective for CDY_MGDAT:

update cdy_msdat set ix=fname+str(patch)+str(datum)+str(m_ix)+str(s0)+str(s1)

or:

update cdy_msdat set ix = [fname] & " " & [patch] & [datum] & " " & [m_ix] & " " & [s0] & " " & [s1]

CND_MWML (since v 3.20.17.xx no longer supported)

CND_MWCL (since v 3.20.17.xx no longer supported)

CDYPROP (please don't change this content)

Content

This table is re-written with each CANDY start to be consistent with the current development state of the program

attribute	**meaning**
propname	internal definition name (never change this)
shrtname	descriptive name
format	data format (internal meaning)
typ	aggregation: su sum; av: average; fx: flux; --: single value only
propunit	measurement unit
adaptbl	true/false shows if property can be used to change state variables

CDYPRCLASS

Content

Contains a definition of classes that can be selected to filter the possible properties for more convenience during data input

attribute	**meaning**
item_ix	key
classname	descriptive name

CDYCL2PR

Content

This maps the classes to the properties; can be edited on the *Properties* tab of the "*Parameters*" form

attribute	**meaning**
class_item	key (item_ix value) of CDYPRCLASS
prop_item	key (item_ix value) of CDYPROP

Management information

CDY_MADAT

Content

Field management data.

attribute	meaning	unit/type
fname	folder name	string (5)
snr	plot	number
utlg	subplot	number
datum	date of the action	[dd.mm.yyyy]
macode	pointer to *action_id* in CDYAKTION	[see **Fehler! Verweisquelle konnte nicht gefunden werden.**]
wert1	index as pointer to parameter table	[see **Fehler! Verweisquelle konnte nicht gefunden werden.**]
wert2	quantity value	[see **Fehler! Verweisquelle konnte nicht gefunden werden.**]
origwert	original value	[see **Fehler! Verweisquelle konnte nicht gefunden werden.**]
rein	priority of user values	[J/N]

Remarks

rein="N" – N uptakes and C inputs are calculated from model parameters

rein="J" – user values for N uptakes and C inputs will be used instead of model parameters

Table 1: Quantities and qualities of original value for different management codes

macode	activity	implementation	wert1	wert2	origwert
0	fallowing	crop growth stops, N in crop is returned to soil as OM indicated by the *grd_ix*	device index (*itemix* in CDYDEVPA)	tillage depth [dm]	tillage depth [cm]
1	emergence	CANDY_S initialisation point	crop index (*item_ix* in CDYPFLAN)	expected N uptake [kg ha^{-1}]	expected natural yield [dt ha^{-1}]
2	harvest (by-product **is** removed)	crop growths stops. Crop residues are added to soil	crop index	real N uptake [kg N ha^{-1}]	real yield [dt ha^{-1}]
3	organic matter application	according to parameters in CDYOPSPA the OM, water, and mineral nitrogen is added to calculation layer 1	OM index (*item_ix* in CDYOPSPA)	added amount of C [kg C ha^{-1}]	amount of added substrate [dt ha^{-1}]
4	mineral nitrogen application	NO_3-N and NH_4-N is added to calculation layer 1	fertilizer index (*item_ix* in CDYMINDG)	ammonium content [%]	total N input [kg N ha^{-1}]
5	soil tillage	state variables for water, temperature, nitrogen and all organic compounds are averaged over the tillage depth	device index	tillage depth [dm]	tillage depth [cm]
6	crop cutting	height and cover grade of crop is reduced	-	-	-
7	irrigation	water is added to calculation layer 1	-	water amount [mm]	water amount [mm]
8	pesticide application	chemical compound is added to first calculation layer	substrate index (*item_ix* in CDYAGCHM)	amount [kg ha^{-1}]	amount [kg ha^{-1}]
9	harvest (by-product **not** removed)	crop growths stops. Crop residues are added to soil, by product is added to soil as OM	crop index	real N uptake [kg N ha^{-1}]	real yield [dt ha^{-1}]
10	pasture start	animal count is increased	animal index (*item_ix* in CDYLIVES)	number of animals added to the management unit	-
11	pasture stop	animal count is decreased	animal index	number of animals withdrawn from the management	-

				unit	
12	sowing	crop module is initialized but not started	crop index	expected N uptake [kg ha^{-1}]	expected natural yield [dt ha^{-1}]

CDYAKTION

Content

Description of management actions, as used in CDY_MADAT.

attribute	meaning	unit/type
action	name of action	string
action_id	key	integer
unit_intensity	unit of the quantitative attribute	string
def_intensity	definition of the quantitative attribute	string

CDYTILLDEV

Content

Description of tillage devices, as used in CDY_MADAT.

attribute	meaning	unit/type
item_ix	key	integer
name	specification of tillage device	string
effect	loosening efficiency	number

CDYAGCHM

Content

Description of pesticide parameters.

attribute	meaning	unit/type
item_ix	index	integer
name	name of pesticide	string
index	unique number (e.g. CAS-registry number)	integer
h	Henry constant	[J mol^{-1}]
difair	diffusion coefficient of air	[cm^2 d^{-1}]
volgre	height of the borderline between soil surface and clean atmosphere	[cm]
dec_coef	decomposition coefficient	[d^{-1}]
temperature	reference temperature for DEC_COEF	[°C]
koc	KOC-value	[mg kg^{-1}]
frn	Freundlich exponent	number

CDYOPSPA

Content

Parameters for fresh organic matter turnover.

attribute	meaning	unit/type
item_ix	index	integer
name	name	string
sba_id	pointer to organic amendment in SBA	integer
od	organic matter for application (manure, slurry,…)	true/false
k	decomposition coefficient	[d^{-1}]
eta	synthesis coefficient	number
cnr_alt	total C/N-ratio $C_{org}/(N_{org}+N_{min})$	number
cnr	ratio in organic matter (C_{org}/N_{org})	number
ts_gehalt	dry matter content	[M. %]
c_geh_ts	C content in dry matter	[M. %]
mor	ratio of mineral and organic nitrogen N_{min}/N_{org}	number

CDYMINDG

Content

Parameters for mineral fertilizer.

attribute	meaning	unit/type
item_ix	index	integer
name	name of fertilizer	string
ammnanteil	part of NH_4-N from total N	[%]

CDYPFLAN

Content

Parameters for crops. Fehlt was? Algo, hi, kop_ix, ts1, ts2, sba_id

attribute	meaning	unit/type
item_ix	key	integer
ewr_ix	pointer to a record in CDYOPSPA to characterise harvest residues and roots	integer
grd_ix	pointer to a record in CDYOPSPA to characterise aboveground biomass after ploughing up	integer
name	name	string
art	plant characteristic: 1 = summer crop 2 = winter crop 3 = annual legume crop 4 = perennial legume crop 5 = perennial crop	integer
czep	specific interception capacity per mm plant height	[mm]

	(overwrites default in CDYAPARM)	
zetb	parameter of withdrawal function (overwrites default in CDYAPARM)	number
modell	model algorithm, default: CANDY_S	string
transk	transpiration coefficient (only used with V+ setting and CANDY_S model)	[kg N mm^{-1}]
vegdau	days from emergence to maturity	[d]
steil	parameter of N-uptake function	[kg N ha^{-1} d^{-1}]
nbok	for legumes: constant N uptake rate from soil	[0..1]
lnub	for legumes: part of N accumulated in deep soil	[0..1]
fewr	factor between N in harvest residues, roots and yield	[kg kg^{-1}]
cewr	N amount in harvest residues independent from yield	[kg N ha^{-1}]
wtmax	maximum rooting depth	[dm]
wwg	days for 10 cm root growth (depth)	[d]
dbhmax	days from emergence to maximum crop height	[d]
n_gehalt	N-concentration in yield	[kg N dt^{-1}]
dbgmax	days from emergence to maximum crop coverage	[d]
bhmax	maximum crop height	[cm]
matanf	days from starting maturity to harvest	[d]
bgmax	maximum crop coverage (0..1)	number
tempanf	days from emergence to beginning influence on soil temperature	[d]

CDYGRAS

Content

Additional parameters for grassland vegetation.

attribute	**meaning**	**unit/type**
item_ix	key (identical to key in CDY_PFLAN	integer
name	name (German)	string
name_engl	English name	string
name_lat	botanic name (Latin)	string
ewr_ix	key to CDY_OPSPA (roots)	integer
grd_ix	key to CDY_OPSPA (leaves and stalks)	integer
transk	unreduced transpiration coefficient	[kg mm^{-1}]
tk_min	minimum value for transpiration coefficient	[kg mm^{-1}]
ts1	annual temperature sum for start of reduction of transpiration coefficient	number
ts2	annual temperature sum where reduction of transpiration coefficient is finished	number
sba_id	key to SBA crop parameters	integer
cewr	nitrogen flux to soil with root residues	[kg ha^{-1}]
vegdau	average annual vegetation time	[d]

Remarks

For *nbok*, *lnub*, *wtmax*, *bhmax*, *fewr*, *n_gehalt*, and *czep* see CDYPFLAN.

CDYLIVES

Content

Description of livestock.

attribute	meaning	unit/type
item_ix	key	integer
name	name	string
n_upt	daily nitrogen uptake with fodder	[kg ha^{-1} d^{-1}]
c_inp	daily carbon input to soil with excrements	[kg ha^{-1} d^{-1}]
od_id	key to CDYOPSPA to characterize excrements	integer

CDY_SLDAT

Content

Data from regular slurry samplings.

attribute	meaning	unit/type
rec_nr	table key	integer
stx	stable index	integer
fname	folder name	string (5)
datum	sampling date	[dd.mm.yyyy]
ts_gehalt	dry matter content (mandatory)	[M. %]
nt_gehalt	total N content (optional)	[M. %]
ct_gehalt	total C content (optional)	[M. %]
ops_id	link to basic record in CDY_OPSPA	integer

Remarks

The content of CDY_SLDAT may be used to adapt slurry parameters at runtime. The parameters in CDY_SLDAT will overwrite the standard parameters of the slurry type indicated by *ops_id*. To use this option it is required to change the name attribute in CDY_OPSPA to <*name*>#<*stx*>. CANDY will search the appropriate record in CDY_SLDAT looking for *ops_id*, *stx* and max (*datum*) ≤ application date. CANDY will adapt the dry matter content of the slurry and, depending on the given information, the carbon content and the part of mineral nitrogen (see *mor* in CDYOPSPA). The C/N ratio of the organic part will not be changed.

Soil parameters

PROFILE

Content

Includes all soil profiles of your database.

attribute	meaning	unit/type
profil	name (abbreviation) of the profile	string
horizont	depth (lower limit of the horizon)	[dm]
horiz_name	pointer to a record in CNDHRZN	string

CNDHRZN

Content

Detailed horizon description of the profiles.

attribute	meaning	unit/type
name	horizon name (refers to *horiz_name* in PROFILE)	string
hydromorph	for yes: horizon is always saturated with groundwater	(yes:1; no:0)
ard	soil aggregate density	[g cm^{-3}]
krume	switch : KRUME=1 means ploughed horizon	[1/0]
ct	reference value of C_{org} content (basis for dynamics of TRD, TSD, PWP and FKAP)	[M. %]
trd	bulk density	[g cm^{-3}]
k_trd	relative soil compaction	number
tsd	substrate density	[g cm^{-3}]
pwp	permanent wilting point	[Vol. %]
fkap	field capacity, good to estimate soil moisture in spring	[Vol. %]
kf	saturated conductivity	[mm d^{-1}]
lambda	seepage parameter after Glugla (facultative)	number
hkap	heat capacity (standard: 0.16)	number
ton	clay content (facultative)	[M. %]
schluff	silt content (facultative)	[M. %]
fat	clay and fine silt (particles ≤ 6.3 µm)	[M. %]
nin0	N_{min} standard per 1dm soil at normal N supply	[kg ha^{-1}]
k_nin	change of N_{min} standard per intensity level	[kg ha^{-1}]
relrootres	relative value describing rooting resistance	[0..1]
stone_cont	percentage of gravel and stones	[Vol. %]
item_ix	numeric table index	integer
cim	algorithm to estimate long term stabilized SOM pool	KO, RU, PS
cip	parameter for the KO approach to calculate C_{LTS}	number

Remarks

- KO: approach after Körschens (Equation 58 in the CANDY Manual)
- RU: approach after Rühlmann (Equation 59 in the CANDY Manual)
- PS: pore space approach after CIPS (Equation 60 - 62 in the CANDY Manual)

Results recording

RS_*

Content

During simulation runs user specific result sets can be recorded in time steps of 1, 5 or 10 days, monthly or annually. Results are stored in tables following the name convention RS_<user specific name>. The tables have the following structure.

attribute	meaning	unit/type
id	internal index	integer
datum	date in simulation scenario	[dd.mm.yyyy]
merkmal_id	result definition, link to *resultnr* in CDY_RSLT	integer
objekt_id	location (SNR in standard mode, patch in GIS mode)	integer
wert	result value	number

CDY_RSLT

Content

The definition of recordable result is given in the system table CDY_RSLT. The content of this table may depend on the CANDY version.

attribute	meaning
item_ix	internal index
resultnr	key attribute of the result
resultat	descriptive name of the result
auswahl	recording only if an asterisk (*) is specified
i_type	integration type: single value, average, sum to/at this date
unit	measurement unit

Remarks

- i_type: 0 = single value; 1 = sum; 2 = average

GIS support

CANDY supports the access to GIS data using ESRI-shape files (dbf, shp, shx). The filenames have to be composed of the prefix 'GIS' and the *fname* attribute (5 characters). If the management data are defined under the *fname* field you should have the files GISfield.dbf, GISfield.shp and GISfield.shx in your data directory.

In the GIS mode all observations are related to a specific patch and not to the whole plot. Therefore the measurement data are stored in CDY_MGDAT. This file is similar to CDY_MVDAT with the difference that CDY_MGDAT is linked to CDY_GSDAT over the *patch* attribute without a direct relation to CDY_FXDAT.

Depending on the geometry of the soil map it may happen that on the same management unit several soil patches with the same properties appear. By

experienced users this can be handled over the GIS software to reduce the number of resulting simulation objects. On the other hand during shape import you can choose the option for record reduction. For this reason there are two more tables:

GIS*.dbf

Content

GIS dbase specific content to link with CANDY.

attribute	meaning	unit/type
id	unique patch identifier, defined by the GIS system	integer
patch	unique patch identifier, used for result file name	string
flaeche	area of the patch	real [m²]
gebiet	name of the region = folder name in CANDY	string (5)
parzelle	plot name identical with *sbez* in CDY_FXDAT	string
boden	pointer to soil profile	string
wetter	pointer to climate station	string (3)
r_faktor	adaptation of local rainfall to observation at climate station	real
wert	template for results values after simulation	real

CDY_GSDAT

Content

With the import procedure the database table is updated.

attribute	meaning	unit/type
id	unique patch identifier as defined by the GIS system	integer
patch	unique patch identifier, used for result file name	string
area	area of the patch	[m²]
range	name of the CANDY folder	string (5)
plot	plot name identical with *sbez* in CDY_FXDAT	string
soil	pointer to soil profile	string
climate	pointer to climate station	string (3)
r_faktor	adaptation of local rainfall to observation at climate station	real
value	template for results values after simulation	real

CDY_SIMOB

Content

List of unique calculation patches for GIS usage.

attribute	meaning	unit/type
sim_obj	unique identifier	integer
fname	folder (link to CDY_FXDAT)	auto
plot	plot name identical with *sbez* in CDY_FXDAT	character (5)

soil	pointer to soil profile	character (25)
climate	pointer to climate station	character (12)
r_faktor	adaptation of local rainfall to observation at climate station	character (3)

CDY_SOB2GIS

Content

Linking the simulation objects to GIS data.

attribute	**meaning**	**unit/type**
sim_obj	link to CDY_SIMOB	long integer
gis_id	link to CDY_GSDAT	long integer
fname	folder (link TO CDY_FXDAT)	character(5)
plot	plot name identical with *sbez* in CDY_FXDAT	character(25)
soil	pointer to soil profile	character (12)

Parameter tables for SBA

SBAMANURE

Content

Properties of organic manures used in SBA procedure.

attribute	**meaning**	**unit/type**
sba_om_id	link to SBAOMDEF	number
sba_crop_id	link to SBACROPS	number
crop	crop name	string
T1, T2	critical time interval	[d]
mdae_T1, mdae_T2	weighting factor for N from organic amendment	number

SBAOMDEF

Content

Properties of organic manures used in SBA procedure.

attribute	**meaning**
sba_om_id	key, link to SBAMANURE
name	SBA specific name of OM

SBASOIL

Content

Soil parameters in SBA procedure.

attribute	meaning	unit/type
profile	identifier of the soil profile	string
mdae00_30	weighting factor for mineral N in 0-30 cm	number
mdae30_60	weighting factor for mineral N in 30-60 cm	number
mdae60_90	weighting factor for mineral N in 60-90 cm	number

SBACROP

Content

Properties of crops used in SBA procedure.

attribute	meaning	unit/type
sba_crop_id	key	integer
sbacrop	SBA crop name	string
sample_depth	to calculate the N_{min} amount in soil	[cm]
yield_low, yield_high	class breaks of yield expectation	[dt ha^{-1}]
n_decrease	for low yield	[kg ha^{-1}]
n_increase	for high yield	[kg ha^{-1}]
minimal_n	least required N	[kg ha^{-1}]
n_p_crop_bp_left	correction if by-product was left from pre-crop	[kg ha^{-1}]
n_p_crop_bp_left	correction if by-product was removed	[kg ha^{-1}]
min_N_top	least required N in topsoil	[kg ha^{-1}]
max_N1	maximum application rate for the first event	[kg ha^{-1}]
N2	N application rate for the second event	[kg ha^{-1}]
N3_l, N3_m, N3_h	N application rate for the third event depending on yield expectation (l: low, m: medium, h: high yield)	[kg ha^{-1}]

General model parameters

CDYAPARM

Content

Additional ecological parameters implemented in CANDY.

attribute	meaning	unit/type
item_ix	index	integer
name	description of parameter set	string
parmsatz	short name of parameter set	string
bt_modell	index of soil temperature model	integer
n_im_som	adaptation of N immission during summer season	number
n_im_bew	adaptation of N immission for cropped soil	number
k_aos	max. decomposition coefficient (active OM)	[d^{-1}]
k_akt	max. activation coefficient (stabilised to active OM)	[d^{-1}]
k_stab	max. stabilisation coefficient (active to stabilised OM)	[d^{-1}]
k_deni	max. denitrification coefficient	[d^{-1}]

k_mulch	max. decomposition coefficient of mulch layer	[d^{-1}]
maxdeni	max. denitrification rate	[kg d^{-1}]
cnr_obs	C/N ratio of decomposable OM	number
czep	interception capacity of a crop per cm crop height	[mm cm^{-1}]
xsi	parameter of transpiration submodel	number
nunb	max. evaporation depth	[dm]
tbed	ratio PET/V_{Turc} for covered soil	number
tunb	ratio PET/V_{Turc} for bare soil	number
zetu	parameter of PET submodel (crop covered soil)	number
zetb	parameter of evapotranspiration submodel (bare soil)	number
disp_kf	weighing factor for dispersion effects; (0: no dispersion)	[0..1]
dng_eff	fertilizer effect (usual value : 1), all applications of mineral fertilizer N will be multiplied by this factor during simulation	[1/0]
f_bioturb	bioturbation parameter (not mandatory)	number