

# Package ‘OBIC’

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**Type** Package

**Title** Calculate the Open Bodem Index (OBI) Score

**Version** 3.0.2

**Description** The Open Bodem Index (OBI) is a method to evaluate the quality of soils of agricultural fields in The Netherlands and the sustainability of the current agricultural practices. The OBI score is based on four main criteria: chemical, physical, biological and management, which consist of more than 21 indicators. By providing results of a soil analysis and management info the 'OBIC' package can be use to calculate he scores, indicators and derivatives that are used by the OBI. More information about the Open Bodem Index can be found at <https://openbodemindex.nl/>.

**Depends** R (>= 3.5.0)

**Imports** checkmate, data.table

**License** GPL-3

**URL** <https://github.com/AgroCares/Open-Bodem-Index-Calculator>

**BugReports** <https://github.com/AgroCares/Open-Bodem-Index-Calculator/issues>

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add_management	<i>Estimate default values for management</i>
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## Description

This function adds default management input variables given soil type and land use

## Usage

```
add_management(
  ID,
  B_LU_BRP,
  B_SOILTYPE_AGR,
  M_GREEN = NA,
  M_NONBARE = NA,
  M_EARLYCROP = NA,
  M_COMPOST = NA_real_,
  M_SLEEPHOSE = NA,
  M_DRAIN = NA,
  M_DITCH = NA,
  M_UNDERSEED = NA,
  M_LIME = NA,
  M_NONINVTILL = NA,
  M_SSPM = NA,
  M_SOLIDMANURE = NA,
  M_STRAWRESIDUE = NA,
  M_MECHWEEDS = NA,
  M_PESTICIDES_DST = NA
)
```

**Arguments**

ID	(character) A field id
B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
M_GREEN	(boolean) A soil measure. Are catch crops sown after main crop (optional, option: yes or no)
M_NONBARE	(boolean) A soil measure. Is parcel for 80 percent of the year cultivated and 'green' (optional, option: yes or no)
M_EARLYCROP	(boolean) A soil measure. Use of early crop varieties to avoid late harvesting (optional, option: yes or no)
M_COMPOST	(numeric) The frequency that compost is applied (optional, every x years)
M_SLEEPHOSE	(boolean) A soil measure. Is sleepnose used for slurry application (optional, option: yes or no)
M_DRAIN	(boolean) A soil measure. Are under water drains installed in peaty soils (optional, option: yes or no)
M_DITCH	(boolean) A soil measure. Are ditched maintained carefully and silt applied on the land (optional, option: yes or no)
M_UNDERSEED	(boolean) A soil measure. Is grass used as second crop in between maize rows (optional, option: yes or no)
M_LIME	(boolean) measure. Has field been limed in last three years (option: yes or no)
M_NONINVTILL	(boolean) measure. Non inversion tillage (option: yes or no)
M_SSPM	(boolean) measure. Soil Structure Protection Measures, such as fixed driving lines, low pressure tires, and light weighted machinery (option: yes or no)
M_SOLIDMANURE	(boolean) measure. Use of solid manure (option: yes or no)
M_STRAWRESIDUE	(boolean) measure. Application of straw residues (option: yes or no)
M_MECHWEEDS	(boolean) measure. Use of mechanical weed protection (option: yes or no)
M_PESTICIDES_DST	(boolean) measure. Use of DST for pesticides (option: yes or no)

**Value**

A data.table with all default estimates for the management measures that are used for the Label Sustainable Soil Management. For each B\_LU\_BRP 15 management measures are given, all as boolean variables except for M\_COMPOST being a numeric value.

**Examples**

```
add_management(ID = 1, B_LU_BRP = 256, B_SOILTYPE_AGR = 'dekzand')
add_management(ID = 1, B_LU_BRP = c(256,1019), B_SOILTYPE_AGR = rep('dekzand',2))
```

binnenveld

*Example dataset for use in OBIC package***Description**

This table contains a series of agricultural fields with soil properties needed for illustration OBIC.

**Usage**

binnenveld

**Format**

An object of class `data.table` (inherits from `data.frame`) with 3251 rows and 55 columns.

**Details**

**ID** A field id (numeric)

**YEAR** The year that the crop is grown (integer)

**B\_LU\_BRP** A series with crop codes given the crop rotation plan (integer, source: the BRP)

**B\_SC\_WENR** The risk for subsoil compaction as derived from risk assessment study of Van den Akker (2006) (character).

**B\_GWL\_CLASS** The groundwater table class (character)

**B\_SOILTYPE\_AGR** The agricultural type of soil (character)

**B\_HELP\_WENR** The soil type abbreviation, derived from 1:50.000 soil map (character)

**B\_AER\_CBS** The agricultural economic region in the Netherlands (CBS, 2016) (character)

**A\_SOM\_LOI** The percentage organic matter in the soil (%) (numeric)

**A\_CLAY\_MI** The clay content of the soil (%) (numeric)

**A\_SAND\_MI** The sand content of the soil (%) (numeric)

**A\_SILT\_MI** The silt content of the soil (%) (numeric)

**A\_PH\_CC** The acidity of the soil, measured in 0.01M CaCl<sub>2</sub> (-) (numeric)

**A\_CACO3\_IF** The carbonate content of the soil (%) (numeric)

**A\_N\_RT** The organic nitrogen content of the soil in mg N / kg (numeric)

**A\_CN\_FR** The carbon to nitrogen ratio (-) (numeric)

**A\_COM\_FR** The carbon fraction of soil organic matter (%) (numeric)

**A\_S\_RT** The total Sulfur content of the soil (in mg S per kg) (numeric)

**A\_N\_PMN** The potentially mineralizable N pool (mg N / kg soil) (numeric)

**A\_P\_AL** The P-AL content of the soil (numeric)

**A\_P\_CC** The plant available P content, extracted with 0.01M CaCl<sub>2</sub> (mg / kg) (numeric)

**A\_P\_WA** The P-content of the soil extracted with water (mg P<sub>2</sub>O<sub>5</sub> / 100 ml soil) (numeric)

- A\_CEC\_CO** The cation exchange capacity of the soil (mmol+ / kg), analysed via Cobalt-hexamine extraction (numeric)
- A\_CA\_CO\_PO** The The occupation of the CEC with Ca (%) (numeric)
- A\_MG\_CO\_PO** The The occupation of the CEC with Mg (%) (numeric)
- A\_K\_CO\_PO** The occupation of the CEC with K (%) (numeric)
- A\_K\_CC** The plant available K content, extracted with 0.01M CaCl<sub>2</sub> (mg / kg) (numeric)
- A\_MG\_CC** The plant available Mg content, extracted with 0.01M CaCl<sub>2</sub> (ug / kg) (numeric)
- A\_MN\_CC** The plant available Mn content, extracted with 0.01M CaCl<sub>2</sub> (ug / kg) (numeric)
- A\_ZN\_CC** The plant available Zn content, extracted with 0.01M CaCl<sub>2</sub> (ug / kg) (numeric)
- A\_CU\_CC** The plant available Cu content, extracted with 0.01M CaCl<sub>2</sub> (ug / kg) (numeric)
- A\_EW\_BCS** The presence of earth worms (optional, score 0-1-2, numeric)
- A\_SC\_BCS** The presence of compaction of subsoil (optional, score 0-1-2, numeric)
- A\_GS\_BCS** The presence of waterlogged conditions, gley spots (optional, score 0-1-2, numeric)
- A\_P\_BCS** The presence / occurrence of water puddles on the land, ponding (optional, score 0-1-2, numeric)
- A\_C\_BCS** The presence of visible cracks in the top layer (optional, score 0-1-2, numeric)
- A\_RT\_BCS** The presence of visible tracks / rutting or trampling on the land (optional, score 0-1-2, numeric)
- A\_RD\_BCS** The rooting depth (optional, score 0-1-2, numeric)
- A\_SS\_BCS** The soil structure (optional, score 0-1-2, numeric)
- A\_CC\_BCS** he crop cover on the surface (optional, score 0-1-2, numeric)
- M\_COMPOST** The frequency that compost is applied (optional, every x years, numeric)
- M\_GREEN** A soil measure. Are catch crops sown after main crop (optional, option: yes or no, boolean)
- M\_NONBARE** A soil measure. Is parcel for 80 percent of the year cultivated and 'green' (optional, option: yes or no, boolean)
- M\_EARLYCROP** A soil measure. Use of early crop varieties to avoid late harvesting (optional, option: yes or no, boolean)
- M\_SLEEPOUSE** A soil measure. Is sleepouse used for slurry application (optional, option: yes or no, boolean)
- M\_DRAIN** A soil measure. Are under water drains installed in peaty soils (optional, option: yes or no, boolean)
- M\_DITCH** A soil measure. Are ditched maintained carefully and slib applied on the land (optional, option: yes or no, boolean)
- M\_UNDERSEED** A soil measure. Is grass used as second crop in between maize rows (optional, option: yes or no, boolean)
- M\_LIME** A soil measure. Has field been limed in last three years (option: yes or no, boolean)
- M\_NONINVTILL** A soil measure. Non inversion tillage (option: yes or no, boolean)
- M\_SSPM** A soil measure. Soil Structure Protection Measures, such as fixed driving lines, low pressure tires, and light weighted machinery (option: yes or no, boolean)

**M\_SOLIDMANURE** A soil measure. Use of solid manure (option: yes or no, boolean)

**M\_STRAWRESIDUE** A soil measure. Application of straw residues (option: yes or no, boolean)

**M\_MECHWEEDS** A soil measure. Use of mechanical weed protection (option: yes or no, boolean)

**M\_PESTICIDES\_DST** A soil measure. Use of DST for pesticides (option: yes or no, boolean)

---

bouwsteen\_tb

*Table with water retention properties of 'bouwstenen'*

---

### Description

This table contains water retention curve parameters and typical mineral composition of 18 'bouwstenen'

### Usage

bouwsteen\_tb

### Format

An object of class `data.table` (inherits from `data.frame`) with 36 rows and 14 columns.

### Details

**bouwsteen** soil type bouwsteen

**omschrijving** description of 'bouwsteen'

**thres** residual water content (cm<sup>3</sup>/cm<sup>3</sup>). Table 3 of Wosten 2001

**thsat** water content at saturation (cm<sup>3</sup>/cm<sup>3</sup>). Table 3 of Wosten 2001

**Ks** saturated hydraulic conductivity (cm/d). Table 3 of Wosten 2001

**alpha** parameter alpha of pF curve (1/cm) Table 3 of Wosten 2001

**l** parameter l of pF curve (-). Table 3 of Wosten 2001

**n** parameter n of pF curve (-). Table 3 of Wosten 2001

**sand%** sand content (%) within soil mineral parts. Middle value of Table 1 of Wosten 2001

**silt%** silt content (%) within soil mineral parts. Middle value of Table 1 of Wosten 2001

**clay%** clay content (%) within soil mineral parts. Middle value of Table 1 of Wosten 2001

**OM%** organic matter content (%). Middle value of Table 1 of Wosten 2001

**bulkdensity** soil bulk density (g/cm<sup>3</sup>). Middle value of Table 2 of Wosten 2001

**M50** size of sand particles (um). Middle value of Table 2 of Wosten 2001



---

`calc_aggregatestability`*Calculate aggregate stability index based on occupation CEC*

---

## Description

This function calculates an aggregate stability index given the CEC and its occupation with major cations.

## Usage

```
calc_aggregatestability(  
  B_SOILTYPE_AGR,  
  A_SOM_LOI,  
  A_K_CO_PO,  
  A_CA_CO_PO,  
  A_MG_CO_PO  
)
```

## Arguments

`B_SOILTYPE_AGR` (character) The type of soil  
`A_SOM_LOI` (numeric) The organic matter content of soil in percentage  
`A_K_CO_PO` (numeric) The occupation of the CEC with K (%)  
`A_CA_CO_PO` (numeric) The occupation of the CEC with Ca (%)  
`A_MG_CO_PO` (numeric) The occupation of the CEC with Mg (%)

## Value

The aggregate stability index of a soil given the Cation Exchange Capacity and its composition with major cations. A numeric value.

## Examples

```
calc_aggregatestability(B_SOILTYPE_AGR = 'dekzand', A_SOM_LOI = 3.5,  
  A_K_CO_PO = 6, A_CA_CO_PO = 83, A_MG_CO_PO = 9)  
calc_aggregatestability(B_SOILTYPE_AGR = c('dekzand', 'rivierklei'), A_SOM_LOI = c(3.5, 6.5),  
  A_K_CO_PO = c(6, 9), A_CA_CO_PO = c(83, 75), A_MG_CO_PO = c(9, 4))
```

calc\_bcs

*Calculate the BodemConditieScore***Description**

This function calculates the BodemConditieScore given input from manual observations made in the field. The individual parameters are scored in three classes: poor (0), neutral (1) or good (2) More information on this test can be found [here](#)

**Usage**

```
calc_bcs(
  B_LU_BRP,
  B_SOILTYPE_AGR,
  A_SOM_LOI,
  D_PH_DELTA,
  A_EW_BCS = NA,
  A_SC_BCS = NA,
  A_GS_BCS = NA,
  A_P_BCS = NA,
  A_C_BCS = NA,
  A_RT_BCS = NA,
  A_RD_BCS = NA,
  A_SS_BCS = NA,
  A_CC_BCS = NA,
  type = "score"
)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
A_SOM_LOI	(numeric) The percentage organic matter in the soil (%)
D_PH_DELTA	(numeric) The pH difference with the optimal pH.
A_EW_BCS	(numeric) The presence of earth worms (score 0-1-2)
A_SC_BCS	(numeric) The presence of compaction of subsoil (score 0-1-2)
A_GS_BCS	(numeric) The presence of waterlogged conditions, gley spots (score 0-1-2)
A_P_BCS	(numeric) The presence / occurrence of water puddles on the land, ponding (score 0-1-2)
A_C_BCS	(numeric) The presence of visible cracks in the top layer (score 0-1-2)
A_RT_BCS	(numeric) The presence of visible tracks / rutting or trampling on the land (score 0-1-2)
A_RD_BCS	(integer) The rooting depth (score 0-1-2)
A_SS_BCS	(integer) The soil structure (score 0-1-2)

A\_CC\_BCS (integer) The crop cover on the surface (score 0-1-2)  
 type (character) Define output of the function. Options: score (integrated score) and indicator (score per indicator)

### Value

A visual soil assessment score derived from field observations driven by organic matter content and soil structure properties. Returns a numeric value.

### References

[mijnbodemconditie.nl](http://mijnbodemconditie.nl)

### Examples

```
calc_bcs(B_LU_BRP = 265, B_SOILTYPE_AGR = 'dekzand', A_SOM_LOI = 3.5, D_PH_DELTA = 0.4,
A_EW_BCS = 1, A_SC_BCS = 1, A_GS_BCS = 1, A_P_BCS = 1, A_C_BCS = 1, A_RT_BCS = 1, A_RD_BCS = 1,
A_SS_BCS = 1, A_CC_BCS = 1)
```

---

calc\_bulk\_density      *Calculate the bulk density*

---

### Description

This function calculates the bulk density of the soil based on texture and organic matter

### Usage

```
calc_bulk_density(B_SOILTYPE_AGR, A_SOM_LOI, A_CLAY_MI = NULL)
```

### Arguments

B\_SOILTYPE\_AGR (character) The agricultural type of soil  
 A\_SOM\_LOI (numeric) The percentage organic matter in the soil (%)  
 A\_CLAY\_MI (numeric) The clay content of the soil (%)

### Value

The bulk density of an arable soil (kg / m3). A numeric value.

### Examples

```
calc_bulk_density(B_SOILTYPE_AGR = 'zeeklei', A_SOM_LOI = 6.5, A_CLAY_MI = 28)
calc_bulk_density(B_SOILTYPE_AGR = 'dekzand', A_SOM_LOI = 3.5)
calc_bulk_density(B_SOILTYPE_AGR = c('dekzand','rivierklei'), A_SOM_LOI = c(3.5,8.5))
```

---

calc_cec	<i>Calculate a soil fertility index based on the CEC</i>
----------	--

---

**Description**

This function calculates the capacity of the soil to buffer cations

**Usage**

```
calc_cec(A_CEC_CO)
```

**Arguments**

A\_CEC\_CO            (numeric) The cation exchange capacity (mmol+ / kg)

**Value**

The capacity of the soil to buffer cations. A numeric value.

**Examples**

```
calc_cec(A_CEC_CO = 85)  
calc_cec(A_CEC_CO = c(85,125,326))
```

---

calc_copper_availability	<i>Calculate the availability of the metal Cu</i>
--------------------------	---

---

**Description**

This function calculates the availability of Cu for plant uptake

**Usage**

```
calc_copper_availability(  
  B_LU_BRP,  
  A_SOM_LOI,  
  A_CLAY_MI,  
  A_K_CC,  
  A_MN_CC,  
  A_CU_CC  
)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
A_SOM_LOI	(numeric) The organic matter content of the soil (%)
A_CLAY_MI	(numeric) The clay content of the soil (%)
A_K_CC	(numeric) The plant available potassium, extracted with 0.01M CaCl <sub>2</sub> (mg / kg),
A_MN_CC	(numeric) The plant available Mn content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)
A_CU_CC	(numeric) The plant available Cu content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)

**Value**

The function of the soil to supply Copper. A numeric value.

**Examples**

```
calc_copper_availability(B_LU_BRP = 265, A_SOM_LOI = 3.5, A_CLAY_MI = 4, A_K_CC = 65,
A_MN_CC = 110, A_CU_CC = 250)
calc_copper_availability(B_LU_BRP = 265, 3.5, 4, 65, 110, 250)
calc_copper_availability(B_LU_BRP = c(1019,265), c(3.5,5), c(4,8),c(65,95), c(110,250), c(250,315))
```

---

calc\_cropclass      *Determine classification rules for crops used to prepare crops.obic*

---

**Description**

This function determines crop classes given crop response to P, K and S fertilizers

**Usage**

```
calc_cropclass(B_LU_BRP, B_SOILTYPE_AGR, nutrient)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
nutrient	(character) The nutrient for which crop classification is needed. Options include P, K and S.

**Value**

The crop class representing its sensitivity for P, K or S deficiency. A character value.

**References**

CBAV (2022) Handboek Bodem en Bemesting, <https://www.handboekbodemenbemesting.nl/>

**Examples**

```
calc_cropclass(B_LU_BRP = 256, B_SOILTYPE_AGR = 'dekzand', nutrient = 'P')
calc_cropclass(B_LU_BRP = c(256,1027), B_SOILTYPE_AGR = c('dekzand','rivierklei'), nutrient = 'P')
```

---

calc\_crumbleability     *Calculate the crumbleability*

---

**Description**

This function calculates the crumbleability. This value can be evaluated by [ind\\_crumbleability](#)

**Usage**

```
calc_crumbleability(A_SOM_LOI, A_CLAY_MI, A_PH_CC)
```

**Arguments**

A\_SOM\_LOI        (numeric) The organic matter content of soil (%)  
A\_CLAY\_MI        (numeric) The clay content of the soil (%)  
A\_PH\_CC          (numeric) The pH of the soil, measured in 0.01M CaCl2

**Value**

The crumbleability index of a soil, a measure for a physical soil property. A numeric value.

**Examples**

```
calc_crumbleability(A_SOM_LOI = 3.5, A_CLAY_MI = 12, A_PH_CC = 5.4)
calc_crumbleability(A_SOM_LOI = c(3.5,12), A_CLAY_MI = c(4,12), A_PH_CC = c(5.4, 7.1))
```

---

calc\_grass\_age        *Calculate the average age of the grass*

---

**Description**

This function calculates the average age of the grass

**Usage**

```
calc_grass_age(ID, B_LU_BRP)
```

**Arguments**

ID (numeric) The ID of the field  
 B\_LU\_BRP (numeric) The crop code (gewascode) from the BRP

**Details**

The function assumes that the order of crop codes are descending, so the latest year is on top.

**Value**

The age of the grassland within a crop rotation plan. A numeric value.

**Examples**

```
calc_grass_age(ID = rep(1,5), B_LU_BRP = c(1091,265,256,256,1091))
calc_grass_age(ID = rep(1,5), B_LU_BRP = c(265,265,265,265,1091))
```

---

calc\_magnesium\_availability

*Calculate the capacity of soils to supply Magnesium*

---

**Description**

This function calculates an index for the availability of Magnesium in soil

**Usage**

```
calc_magnesium_availability(  
  B_LU_BRP,  
  B_SOILTYPE_AGR,  
  A_SOM_LOI,  
  A_CLAY_MI,  
  A_PH_CC,  
  A_CEC_CO,  
  A_K_CO_PO,  
  A_MG_CC,  
  A_K_CC  
)
```

**Arguments**

B\_LU\_BRP (numeric) The crop code from the BRP  
 B\_SOILTYPE\_AGR (character) The agricultural type of soil  
 A\_SOM\_LOI (numeric) The percentage organic matter in the soil (%)  
 A\_CLAY\_MI (numeric) The clay content of the soil (%)

A_PH_CC	(numeric) The acidity of the soil, measured in 0.01M CaCl <sub>2</sub> (-)
A_CEC_CO	(numeric) The cation exchange capacity of the soil (mmol+ per kg), analyzed via Cobalt-hexamine extraction
A_K_CO_PO	(numeric) The occupation of the CEC with potassium (%)
A_MG_CC	(numeric) The plant available content of Mg in the soil (mg Mg per kg) extracted by 0.01M CaCl <sub>2</sub>
A_K_CC	(numeric) The plant available potassium, extracted with 0.01M CaCl <sub>2</sub> (mg per kg),

**Value**

An index representing the availability of Magnesium in a soil. A numeric value.

**Examples**

```
calc_magnesium_availability(B_LU_BRP = 265, B_SOILTYPE_AGR = 'dekzand',
A_SOM_LOI = 3.5,A_CLAY_MI = 8.5,A_PH_CC = 5.4,
A_CEC_CO = 185,A_K_CO_PO = 4.5,A_MG_CC = 125,A_K_CC = 65)
```

---

calc\_makkink

*Add Makkink correction factors and crop cover to crop rotation table*

---

**Description**

This function adds Makkink correction factors for ET and crop cover to the crop rotation table

**Usage**

```
calc_makkink(B_LU_BRP)
```

**Arguments**

B\_LU\_BRP           (numeric) The crop code from the BRP

**Value**

A datatable with the crop dependent Makkink correction factor per month. Output is a single data.table with for each B\_LU\_BRP code the monthly correction factor. Columns of the data.table are: crop\_makkink, month, year, mcf and crop\_cover.

**Examples**

```
calc_makkink(B_LU_BRP = 265)
calc_makkink(B_LU_BRP = c(265,1019))
```



---

calc_management	<i>Calculate the 'performance' of sustainable soil management</i>
-----------------	---

---

### Description

This function evaluates the contribution of sustainable soil management following the Label Sustainable Soil Management.

### Usage

```
calc_management(
  A_SOM_LOI,
  B_LU_BRP,
  B_SOILTYPE_AGR,
  B_GWL_CLASS,
  D_SOM_BAL,
  D_CP_GRASS,
  D_CP_POTATO,
  D_CP_RUST,
  D_CP_RUSTDEEP,
  D_GA,
  M_COMPOST,
  M_GREEN,
  M_NONBARE,
  M_EARLYCROP,
  M_SLEEPHOSE,
  M_DRAIN,
  M_DITCH,
  M_UNDERSEED,
  M_LIME,
  M_NONINVTILL,
  M_SSPM,
  M_SOLIDMANURE,
  M_STRAWRESIDUE,
  M_MECHWEEDS,
  M_PESTICIDES_DST
)
```

### Arguments

A_SOM_LOI	(numeric) The percentage organic matter in the soil (%)
B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
B_GWL_CLASS	(character) The groundwater table class
D_SOM_BAL	(numeric) The organic matter balance of the soil (in kg EOS per ha)

D_CP_GRASS	(numeric) The fraction grassland in crop rotation
D_CP_POTATO	(numeric) The fraction potato crops in crop rotation
D_CP_RUST	(numeric) The fraction rustgewassen in crop rotation
D_CP_RUSTDEEP	(numeric) The fraction diepe rustgewassen in crop rotation (-)
D_GA	(numeric) The age of the grassland (years)
M_COMPOST	(numeric) The frequency that compost is applied (optional, every x years)
M_GREEN	(boolean) measure. are catch crops sown after main crop (option: yes or no)
M_NONBARE	(boolean) measure. is parcel for 80 percent of the year cultivated and 'green' (option: yes or no)
M_EARLYCROP	(boolean) measure. use of early crop varieties to avoid late harvesting (option: yes or no)
M_SLEEPHOSE	(boolean) measure. is sleepslangbemester used for slurry application (option: yes or no)
M_DRAIN	(boolean) measure. are under water drains installed in peaty soils (option: yes or no)
M_DITCH	(boolean) measure. are ditched maintained carefully and slib applied on the land (option: yes or no)
M_UNDERSEED	(boolean) measure. is maize grown with grass underseeded (option: yes or no)
M_LIME	(boolean) measure. Has field been limed in last three years (option: yes or no)
M_NONINVTILL	(boolean) measure. Non inversion tillage (option: yes or no)
M_SSPM	(boolean) measure. Soil Structure Protection Measures, such as fixed driving lines, low pressure tires, and light weighted machinery (option: yes or no)
M_SOLIDMANURE	(boolean) measure. Use of solid manure (option: yes or no)
M_STRAWRESIDUE	(boolean) measure. Application of straw residues (option: yes or no)
M_MECHWEEDS	(boolean) measure. Use of mechanical weed protection (option: yes or no)
M_PESTICIDES_DST	(boolean) measure. Use of DST for pesticides (option: yes or no)

### Value

The evaluated soil management score according to the Label Sustainable Soil Management. A numeric value.

### Examples

```
calc_management(A_SOM_LOI = 4.5, B_LU_BRP = 3732, B_SOILTYPE_AGR = 'dekzand',
B_GWL_CLASS = 'GtIV', D_SOM_BAL = 1115, D_CP_GRASS = 0.2, D_CP_POTATO = 0.5,
D_CP_RUST = 0.3, D_CP_RUSTDEEP = 0.2, D_GA = 0, M_COMPOST = rep(25, 1),
M_GREEN = TRUE, M_NONBARE = TRUE, M_EARLYCROP = TRUE, M_SLEEPHOSE = TRUE,
M_DRAIN = TRUE, M_DITCH = TRUE, M_UNDERSEED = TRUE, M_LIME = TRUE,
M_NONINVTILL = TRUE, M_SSPM = TRUE, M_SOLIDMANURE = TRUE, M_STRAWRESIDUE = TRUE,
M_MECHWEEDS = TRUE, M_PESTICIDES_DST = TRUE)
```

---

calc_man_ess	<i>Calculate the 'performance' of sustainable soil management given a required ecosystem service</i>
--------------	--

---

### Description

This function evaluates the contribution of sustainable soil management for a given ecosystem service

### Usage

```
calc_man_ess(
  A_SOM_LOI,
  B_LU_BRP,
  B_SOILTYPE_AGR,
  B_GWL_CLASS,
  D_SOM_BAL,
  D_CP_GRASS,
  D_CP_POTATO,
  D_CP_RUST,
  D_CP_RUSTDEEP,
  D_GA,
  M_COMPOST,
  M_GREEN,
  M_NONBARE,
  M_EARLYCROP,
  M_SLEEPHOSE,
  M_DRAIN,
  M_DITCH,
  M_UNDERSEED,
  M_LIME,
  M_NONINVTILL,
  M_SSPM,
  M_SOLIDMANURE,
  M_STRAWRESIDUE,
  M_MECHWEEDS,
  M_PESTICIDES_DST,
  type
)
```

### Arguments

A_SOM_LOI	(numeric)	The percentage organic matter in the soil (%)
B_LU_BRP	(numeric)	The crop code from the BRP
B_SOILTYPE_AGR	(character)	The agricultural type of soil
B_GWL_CLASS	(character)	The groundwater table class

D_SOM_BAL	(numeric) The organic matter balance of the soil (in kg EOS per ha)
D_CP_GRASS	(numeric) The fraction grassland in crop rotation
D_CP_POTATO	(numeric) The fraction potato crops in crop rotation
D_CP_RUST	(numeric) The fraction rustgewassen in crop rotation
D_CP_RUSTDEEP	(numeric) The fraction diepe rustgewassen in crop rotation (-)
D_GA	(numeric) The age of the grassland (years)
M_COMPOST	(numeric) The frequency that compost is applied (optional, every x years)
M_GREEN	(boolean) measure. are catch crops sown after main crop (option: yes or no)
M_NONBARE	(boolean) measure. is parcel for 80 percent of the year cultivated and 'green' (option: yes or no)
M_EARLYCROP	(boolean) measure. use of early crop varieties to avoid late harvesting (option: yes or no)
M_SLEEPHOSE	(boolean) measure. is sleepslangbemester used for slurry application (option: yes or no)
M_DRAIN	(boolean) measure. are under water drains installed in peaty soils (option: yes or no)
M_DITCH	(boolean) measure. are ditched maintained carefully and slib applied on the land (option: yes or no)
M_UNDERSEED	(boolean) measure. is maize grown with grass underseeded (option: yes or no)
M_LIME	(boolean) measure. Has field been limed in last three years (option: yes or no)
M_NONINVTILL	(boolean) measure. Non inversion tillage (option: yes or no)
M_SSPM	(boolean) measure. Soil Structure Protection Measures, such as fixed driving lines, low pressure tires, and light weighted machinery (option: yes or no)
M_SOLIDMANURE	(boolean) measure. Use of solid manure (option: yes or no)
M_STRAWRESIDUE	(boolean) measure. Application of straw residues (option: yes or no)
M_MECHWEEDS	(boolean) measure. Use of mechanical weed protection (option: yes or no)
M_PESTICIDES_DST	(boolean) measure. Use of DST for pesticides (option: yes or no)
type	(character) type of ecosystem service to evaluate the impact of soil management. Options: I_M_SOILFERTILITY, I_M_CLIMATE, I_M_WATERQUALITY, and I_M_BIODIVERSITY

### Value

The evaluated soil management score for multiple soil ecosystem services. This is done for the following ESS: I\_M\_SOILFERTILITY, I\_M\_CLIMATE, I\_M\_WATERQUALITY and I\_M\_BIODIVERSITY

### Examples

```
calc_man_ess(A_SOM_LOI = 4.5, B_LU_BRP = 3732, B_SOILTYPE_AGR = 'dekszand',
B_GWL_CLASS = 'GtIV', D_SOM_BAL = 1115, D_CP_GRASS = 0.2, D_CP_POTATO = 0.5,
D_CP_RUST = 0.3, D_CP_RUSTDEEP = 0.2, D_GA = 0, M_COMPOST = rep(25, 1),
M_GREEN = TRUE, M_NONBARE = TRUE, M_EARLYCROP = TRUE, M_SLEEPHOSE = TRUE,
M_DRAIN = TRUE, M_DITCH = TRUE, M_UNDERSEED = TRUE, M_LIME = TRUE,
M_NONINVTILL = TRUE, M_SSPM = TRUE, M_SOLIDMANURE = TRUE, M_STRAWRESIDUE = TRUE,
M_MECHWEEDS = TRUE, M_PESTICIDES_DST = TRUE, type="I_M_SOILFERTILITY")
```

---

calc_nleach	<i>Calculate the N leaching</i>
-------------	---------------------------------

---

### Description

This function calculates the potential N leaching of a soil.

### Usage

```
calc_nleach(  
  B_SOILTYPE_AGR,  
  B_LU_BRP,  
  B_GWL_CLASS,  
  D_NLV,  
  B_AER_CBS,  
  leaching_to  
)
```

### Arguments

B_SOILTYPE_AGR	(character)	The type of soil
B_LU_BRP	(numeric)	The crop code (gewascode) from the BRP
B_GWL_CLASS	(character)	The groundwater table class
D_NLV	(numeric)	The N supplying capacity of a soil (kg N ha-1 jr-1) calculated by <a href="#">calc_nlv</a>
B_AER_CBS	(character)	The agricultural economic region in the Netherlands (CBS, 2016)
leaching_to	(character)	whether it computes N leaching to groundwater ("gw") or to surface water ("ow")

### Value

The potential nitrogen leaching from the soil originating from soil nitrogen mineralization processes. A numeric value.

### Examples

```
calc_nleach('dekzand',265,'GtIII',145,'Zuidwest-Brabant','gw')  
calc_nleach('rivierklei',1019,'GtIV',145,'Rivierengebied','ow')
```

---

 calc\_nlv

*Calculate the NLV*


---

### Description

This function calculates the NLV (nitrogen producing capacity) for the soil

### Usage

```
calc_nlv(B_LU_BRP, B_SOILTYPE_AGR, A_N_RT, A_CN_FR, D_OC, D_BDS, D_GA)
```

### Arguments

B_LU_BRP	(numeric)	The crop code from the BRP
B_SOILTYPE_AGR	(character)	The agricultural type of soil
A_N_RT	(numeric)	The organic nitrogen content of the soil in mg N / kg
A_CN_FR	(numeric)	The carbon to nitrogen ratio
D_OC	(numeric)	The organic carbon content of the soil in kg C / ha
D_BDS	(numeric)	The bulk density of the soil in kg / m <sup>3</sup>
D_GA	(numeric)	The age of the grass if present

### Value

The capacity of the soil to supply nitrogen (kg N / ha / yr). A numeric value.

### Examples

```
calc_nlv(B_LU_BRP = 256, B_SOILTYPE_AGR = 'dekszand', A_N_RT = 2500,
A_CN_FR = 11, D_OC = 86000, D_BDS = 1300, D_GA = 4)
calc_nlv(1019, 'dekszand', 2315, 13, 86000, 1345, 0)
```

---

 calc\_n\_efficiency

*Calculate nitrogen use efficiency and leaching based on N surplus*


---

### Description

This function gives an indication of the nitrogen use efficiency, the function calculates the N surplus and the resulting N leaching

**Usage**

```
calc_n_efficiency(
  B_LU_BRP,
  B_SOILTYPE_AGR,
  B_GWL_CLASS,
  B_AER_CBS,
  A_SOM_LOI,
  A_CLAY_MI,
  D_PBI,
  D_K,
  D_PH_DELTA,
  leaching_to,
  M_GREEN = FALSE,
  B_FERT_NORM_FR = 1
)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soilBRP
B_GWL_CLASS	(character) The groundwater table class
B_AER_CBS	(character) The agricultural economic region in the Netherlands (CBS, 2016)
A_SOM_LOI	(numeric) The percentage organic matter in the soil (%)
A_CLAY_MI	(numeric) The clay content of the soil (%)
D_PBI	(numeric) The value of phosphate availability calculated by <a href="#">calc_phosphate_availability</a>
D_K	(numeric) The value of K-index calculated by <a href="#">calc_potassium_availability</a>
D_PH_DELTA	(numeric) The pH difference with the optimal pH.
leaching_to	(character) whether it computes N leaching to groundwater ("gw") or to surface water ("ow")
M_GREEN	(boolean) A soil measure. Are catch crops sown after main crop (optional, option: yes or no)
B_FERT_NORM_FR	(numeric) The fraction of the application norm utilized

**Value**

The estimated index for the nitrogen use efficiency, as being affected by soil properties. A numeric value.

**Examples**

```
calc_n_efficiency(1019, 'dekszand', 'GtIV', 'Zuidwest-Brabant', 4.5, 3.5, 0.8, 0.6, 0.2, 78, FALSE, 1)
calc_n_efficiency(256, 'veen', 'GtII', 'Centraal Veehouderijgebied', 4.5, 3.5, 0.8, 0.6, 0.2, 250, FALSE, 1)
```

---

calc\_organic\_carbon     *Calculate amount of organic carbon*

---

### Description

This function calculates the amount of organic carbon in the soil

### Usage

```
calc_organic_carbon(A_SOM_LOI, D_BDS, D_RD)
```

### Arguments

A_SOM_LOI	(numeric) The percentage organic matter in the soil
D_BDS	(numeric) The bulk density of the soil
D_RD	(numeric) The root depth of the crop

### Value

The total amount of Carbon in the soil (kg C / ha). A numeric value.

### Examples

```
calc_organic_carbon(A_SOM_LOI = 4.3, D_BDS = 1100, D_RD = 0.2)
calc_organic_carbon(A_SOM_LOI = c(1,4.3), D_BDS = c(1100,1300), D_RD = c(0.2,0.6))
```

---

calc\_permeability     *Calculate the permeability of the top soil*

---

### Description

This function calculates the permeability of the top soil

### Usage

```
calc_permeability(A_CLAY_MI, A_SAND_MI, A_SILT_MI, A_SOM_LOI)
```

### Arguments

A_CLAY_MI	(numeric) The clay content of the soil (%)
A_SAND_MI	(numeric) The sand content of the soil (%)
A_SILT_MI	(numeric) The silt content of the soil (%)
A_SOM_LOI	(numeric) The organic matter content of the soil (%)



---

 calc\_pesticide\_leaching

*Calculate risk of pesticide leaching*


---

### Description

This function calculates the risk of pesticide leaching from a soil. The risk is calculated by comparing the current leached fraction with a worst case scenario

### Usage

```
calc_pesticide_leaching(
  B_SOILTYPE_AGR,
  A_SOM_LOI,
  A_CLAY_MI,
  A_SAND_MI,
  A_SILT_MI,
  D_PSP,
  M_PESTICIDES_DST,
  M_MECHWEEDS
)
```

### Arguments

B_SOILTYPE_AGR	(character)	The agricultural type of soil
A_SOM_LOI	(numeric)	The percentage organic matter in the soil (%)
A_CLAY_MI	(numeric)	The clay content of the soil (%)
A_SAND_MI	(numeric)	The sand content of the soil (%)
A_SILT_MI	(numeric)	The silt content of the soil (%)
D_PSP	(numeric)	The precipitation surplus per crop calculated by <a href="#">calc_psp</a>
M_PESTICIDES_DST	(boolean)	measure. Use of DST for pesticides (option: TRUE or FALSE)
M_MECHWEEDS	(boolean)	measure. Use of mechanical weed protection (option: TRUE or FALSE)

### Value

The risk of pesticide leaching from soils. A numeric value.

### Examples

```
calc_pesticide_leaching(B_SOILTYPE_AGR = 'rivierklei', A_SOM_LOI = 4,
  A_CLAY_MI = 20, A_SAND_MI = 45, A_SILT_MI = 35,
  D_PSP = 225, M_PESTICIDES_DST = TRUE, M_MECHWEEDS = TRUE)
calc_pesticide_leaching('rivierklei', 4, 20, 45, 35, 225, TRUE, TRUE)
calc_pesticide_leaching('dekzand', 4.8, 4.2, 85, 10.8, 225, TRUE, TRUE)
```

---

calc\_phosphate\_availability  
*Calculate the phosphate availability (PBI)*

---

### Description

This function calculates the phosphate availability. This value can be evaluated by [ind\\_phosphate\\_availability](#)

### Usage

```
calc_phosphate_availability(  
  B_LU_BRP,  
  A_P_AL = NULL,  
  A_P_CC = NULL,  
  A_P_WA = NULL  
)
```

### Arguments

B_LU_BRP	(numeric) The crop code from the BRP
A_P_AL	(numeric) The P-AL content of the soil
A_P_CC	(numeric) The P-CaCl <sub>2</sub> content of the soil
A_P_WA	(numeric) The P-content of the soil extracted with water

### Value

The phosphate availability index estimated from extractable soil P fractions. A numeric value.

### Examples

```
calc_phosphate_availability(B_LU_BRP = 265, A_P_AL = 45, A_P_CC = 2.5)  
calc_phosphate_availability(c(265,1019),A_P_AL = c(35,54),A_P_CC = c(2.5,4.5), A_P_WA = c(35,65))
```

---

calc\_ph\_delta                    *Calculate the difference between pH and optimum*

---

### Description

This functions calculates the difference between the measured pH and the optimal pH according to the Bemestingsadvies

**Usage**

```
calc_ph_delta(
  B_LU_BRP,
  B_SOILTYPE_AGR,
  A_SOM_LOI,
  A_CLAY_MI,
  A_PH_CC,
  D_CP_STARCH,
  D_CP_POTATO,
  D_CP_SUGARBEET,
  D_CP_GRASS,
  D_CP_MAIS,
  D_CP_OTHER
)
```

**Arguments**

B_LU_BRP	(numeric)	The crop code from the BRP
B_SOILTYPE_AGR	(character)	The agricultural type of soil
A_SOM_LOI	(numeric)	The organic matter content of soil in percentage
A_CLAY_MI	(numeric)	The percentage A_CLAY_MI present in the soil
A_PH_CC	(numeric)	The pH-CaCl <sub>2</sub> of the soil
D_CP_STARCH	(numeric)	The fraction of starch potatoes in the crop plan
D_CP_POTATO	(numeric)	The fraction of potatoes (excluding starch potatoes) in the crop plan
D_CP_SUGARBEET	(numeric)	The fraction of sugar beets in the crop plan
D_CP_GRASS	(numeric)	The fraction of grass in the crop plan
D_CP_MAIS	(numeric)	The fraction of mais in the crop plan
D_CP_OTHER	(numeric)	The fraction of other crops in the crop plan

**Value**

The difference between the actual and desired optimum soil pH. A numeric value.

**References**

Handboek Bodem en Bemesting tabel 5.1, 5.2 en 5.3

**Examples**

```
calc_ph_delta(B_LU_BRP = 265, B_SOILTYPE_AGR = "rivierklei", A_SOM_LOI = 5,
  A_CLAY_MI = 20, A_PH_CC = 6, D_CP_STARCH = 0, D_CP_POTATO = 0.3, D_CP_SUGARBEET = 0.2,
  D_CP_GRASS = 0, D_CP_MAIS = 0.2, D_CP_OTHER = 0.3)
calc_ph_delta(265, "rivierklei", 5, 20, 6, 0, 0.3, 0.2, 0, 0.2, 0.3)
```

---

calc\_pmn *Calculate the index for the microbial biological activity*

---

### Description

This function assesses the microbial biological activity (of microbes and fungi) via the Potentially Mineralizable N pool, also called PMN (or SoilLife by Eurofins in the past).

### Usage

```
calc_pmn(B_LU_BRP, B_SOILTYPE_AGR, A_N_PMN)
```

### Arguments

B\_LU\_BRP (numeric) The crop code from the BRP  
 B\_SOILTYPE\_AGR (character) The agricultural type of soil  
 A\_N\_PMN (numeric) The potentially mineralizable N pool (mg N / kg soil)

### Value

the normalized potentially mineralizable Nitrogen pool (mg N / kg), a numeric value.

### Examples

```
calc_pmn(B_LU_BRP = 256, B_SOILTYPE_AGR = 'dekzand', A_N_PMN = 125)
calc_pmn(B_LU_BRP = c(256,1027), B_SOILTYPE_AGR = c('dekzand','rivierklei'), A_N_PMN = c(125,45))
```

---

calc\_potassium\_availability  
*Calculate the K availability*

---

### Description

This function calculates the K availability of a soil.

### Usage

```
calc_potassium_availability(
  B_LU_BRP,
  B_SOILTYPE_AGR,
  A_SOM_LOI,
  A_CLAY_MI,
  A_PH_CC,
  A_CEC_CO,
  A_K_CO_PO,
  A_K_CC
)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
A_SOM_LOI	(numeric) The organic matter content of the soil (%)
A_CLAY_MI	(numeric) The clay content of the soil (%)
A_PH_CC	(numeric) The acidity of the soil, measured in 0.01M CaCl <sub>2</sub> (-)
A_CEC_CO	(numeric) The cation exchange capacity of the soil (mmol+ / kg), analyzed via Cobalt-hexamine extraction
A_K_CO_PO	(numeric) The occupation of the CEC with potassium (%)
A_K_CC	(numeric) The plant available potassium, extracted with 0.01M CaCl <sub>2</sub> (mg / kg),

**Value**

The capacity of the soil to supply and buffer potassium. A numeric value.

**Examples**

```
calc_potassium_availability(B_LU_BRP = 265, B_SOILTYPE_AGR = 'dekzand',
A_SOM_LOI = 4, A_CLAY_MI = 11, A_PH_CC = 5.4, A_CEC_CO = 125,
A_K_CO_PO = 8.5, A_K_CC = 145)
calc_potassium_availability(265, 'dekzand', 4, 11, 5.4, 125, 8.5, 145)
calc_potassium_availability(c(265,1019), rep('dekzand',2), c(4,6), c(11,14),
c(5.4,5.6), c(125,145), c(8.5,3.5), c(145,180))
```

---

calc\_psp

*Calculate the precipitation surplus*

---

**Description**

This function calculates the precipitation surplus (in mm / ha) given the crop rotation plan.

**Usage**

```
calc_psp(B_LU_BRP, M_GREEN)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
M_GREEN	(boolean) A soil measure. Are catch crops sown after main crop (optional, options: TRUE, FALSE)

**Value**

The estimated precipitation surplus (in mm / ha) depending on averaged precipitation and evaporation. A numeric value.

**Examples**

```
calc_psp(B_LU_BRP = 265, M_GREEN = TRUE)
calc_psp(B_LU_BRP = c(265,1019,265,1019), M_GREEN = rep(TRUE,4))
```

---

calc_root_depth	<i>Determine the root depth of the soil for this crop</i>
-----------------	---

---

**Description**

This function determines the depth of the soil

**Usage**

```
calc_root_depth(B_LU_BRP)
```

**Arguments**

B\_LU\_BRP (numeric) The crop code (gewascode) from the BRP

**Details**

This is a helper function to estimate the rooting depth of crops, as being used for calculations for soil nutrient supplies. Be aware, this is not the real rooting depth; it rather represents the sampling depth of the soils collected for routine soil analysis.

**Value**

The root depth of a crop corresponding to the sampling depth analyzed by agricultural labs. A numeric value.

**Examples**

```
calc_root_depth(B_LU_BRP = 256)
calc_root_depth(B_LU_BRP = c(256,265,1019,992))
```

---

 calc\_rotation\_fraction

*Calculates the fraction in the crop rotation*


---

### Description

This function calculates the fraction present in the crop rotation

### Usage

```
calc_rotation_fraction(ID, B_LU_BRP, crop)
```

### Arguments

ID	(numeric) The ID of the field
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
crop	(character) The crop to check for. For relevant crop categories, see details.

### Details

This function calculates the fraction present in the crop rotation for specific crop categories. These categories include "starch", "potato", "sugarbeet", "grass", "mais", "alfalfa", "catchcrop", "cereal", "clover", 'nature', rapeseed', "other", "rustgewas", and "rustgewasdiep".

### Value

The fraction of specific crop types within the crop rotation sequence. A numeric value.

### Examples

```
calc_rotation_fraction(ID = rep(1,4), B_LU_BRP = c(265,1910,1935,1033),crop = 'potato')
calc_rotation_fraction(ID = rep(1,4), B_LU_BRP = c(265,1910,1935,1033),crop = 'grass')
```

---

 calc\_sbal\_arable

*Calculate the indicator for delta S-balance arable*


---

### Description

This function calculates the change in S-balance compared to averaged S-supply as given in fertilizer recommendation systems.

### Usage

```
calc_sbal_arable(D_SLV, B_LU_BRP, B_SOILTYPE_AGR, B_AER_CBS)
```

**Arguments**

D_SLV	(numeric)	The value of SLV calculated by <a href="#">calc_slv</a>
B_LU_BRP	(numeric)	The crop code (gewascode) from the BRP
B_SOILTYPE_AGR	(character)	The type of soil
B_AER_CBS	(character)	The agricultural economic region in the Netherlands (CBS, 2016)

**Value**

Estimated contribution of the soil to the S balance of arable fields. A numeric value.

**Examples**

```
calc_sbal_arable(D_SLV = 65, B_LU_BRP = 1019, B_SOILTYPE_AGR = 'dekszand',
B_AER_CBS = 'Rivierengebied')
```

---

calc_sealing_risk	<i>Calculate soil sealing risk</i>
-------------------	------------------------------------

---

**Description**

This function calculates the risks of soil sealing. This value can be evaluated by [ind\\_sealing](#)

**Usage**

```
calc_sealing_risk(A_SOM_LOI, A_CLAY_MI)
```

**Arguments**

A_SOM_LOI	(numeric)	The organic matter content of soil (%)
A_CLAY_MI	(numeric)	The clay content of the soil (%)

**Value**

The risk of soil sealing as affected by the soil organic matter and clay content. A numeric value.

**Examples**

```
calc_sealing_risk(A_SOM_LOI = 3.5, A_CLAY_MI = 7.5)
calc_sealing_risk(A_SOM_LOI = c(3.5,6.5), A_CLAY_MI = c(7.5,15))
```



---

calc_slv	<i>Calculate the SLV</i>
----------	--------------------------

---

**Description**

This function calculates a S-balance given the SLV (Sulfur supplying capacity) of a soil

**Usage**

```
calc_slv(B_LU_BRP, B_SOILTYPE_AGR, B_AER_CBS, A_SOM_LOI, A_S_RT, D_BDS)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The type of soil
B_AER_CBS	(character) The agricultural economic region in the Netherlands (CBS, 2016)
A_SOM_LOI	(numeric) The organic matter content of the soil (in percent)
A_S_RT	(numeric) The total Sulpher content of the soil (in mg S per kg)
D_BDS	(numeric) The bulk density of the soil (in kg per m3)

**Value**

The capacity of the soil to supply Sulfur (kg S / ha / yr). A numeric value.

**Examples**

```
calc_slv(B_LU_BRP = 1019, B_SOILTYPE_AGR = 'dekzand',
B_AER_CBS = 'Rivierengebied', A_SOM_LOI = 3.5, A_S_RT = 3500, D_BDS = 1400)
calc_slv(1019, 'dekzand', 'Rivierengebied', 3.5, 3500, 1400)
calc_slv(c(256, 1019), rep('dekzand', 2), rep('Rivierengebied', 2), c(6.5, 3.5),
c(3500, 7500), c(1400, 1100))
```

---

calc_sombalance	<i>Calculate simple organic matter balance</i>
-----------------	--

---

**Description**

This function calculates a simple organic matter balance, as currently used in agricultural practice in the Netherlands. For more details, see [www.os-balans.nl](http://www.os-balans.nl)

**Usage**

```
calc_sombalance(B_LU_BRP, A_SOM_LOI, A_P_AL, A_P_WA, M_COMPOST, M_GREEN)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
A_SOM_LOI	(numeric) The percentage organic matter in the soil (%)
A_P_AL	(numeric) The P-AL content of the soil (in mg P2O5 per 100g)
A_P_WA	(numeric) The P-water content of the soil (in mg P2O5 per Liter)
M_COMPOST	(numeric) The frequency that compost is applied (every x years)
M_GREEN	(boolean) measure. are catch crops sown after main crop (option: TRUE or FALSE)

**Value**

The estimated soil organic matter balance in kg EOS per ha per year. A numeric value.

**Examples**

```
calc_sombalance(B_LU_BRP = 1019,A_SOM_LOI = 4, A_P_AL = 35, A_P_WA = 40,
M_COMPOST = 4, M_GREEN = TRUE)
calc_sombalance(1019,4, 35, 40, 4, TRUE)
calc_sombalance(c(256,1024,1019),c(4,5,6), c(35,35,35), c(40,42,45), c(4,4,3), c(TRUE,FALSE,TRUE))
```

---

calc\_waterretention     *Calculate indicators for water retention in topsoil*

---

**Description**

This function calculates different kind of Water Retention Indices given the continuous pedotransferfunctions of Wosten et al. (2001) These include : 'wilting point', 'field capacity', 'water holding capacity', 'plant available water' and 'Ksat'

**Usage**

```
calc_waterretention(
  A_CLAY_MI,
  A_SAND_MI,
  A_SILT_MI,
  A_SOM_LOI,
  type = "plant available water",
  ptf = "Wosten1999"
)
```

**Arguments**

A_CLAY_MI	(numeric) The clay content of the soil (%)
A_SAND_MI	(numeric) The sand content of the soil (%)
A_SILT_MI	(numeric) The silt content of the soil (%)
A_SOM_LOI	(numeric) The organic matter content of the soil (%)
type	(character) The type of water retention index. Options include c('wilting point', 'field capacity', 'water holding capacity', 'plant available water', 'Ksat')
ptf	(character) Pedotransfer functions to calculate van Genuchten parameters. Options include c('Wosten1999', 'Wosten2001', 'Klasse')

**Value**

The function returns by default the amount of plant available water in the ploughing layer of the soil (in mm). A numeric value. If another type of output is selected, the function gives also the amount of water at 'wilting point' or 'field capacity' or 'water holding capacity'. Also the saturated permeability 'Ksat' can be selected. Units are always in mm, except for Water Holding Capacity (

**References**

Wosten et al. (2001) Pedotransfer functions: bridging the gap between available basic soil data and missing hydraulic characteristics. *Journal of Hydrology* 251, p123.

**Examples**

```
calc_waterretention(A_CLAY_MI = 20.5, A_SAND_MI = 65, A_SILT_MI = 14.5, A_SOM_LOI = 3.5)
calc_waterretention(A_CLAY_MI = 5, A_SAND_MI = 15, A_SILT_MI = 80, A_SOM_LOI = 6.5)
calc_waterretention(A_CLAY_MI = 5, A_SAND_MI = 15, A_SILT_MI = 80, A_SOM_LOI = 6.5,
type = 'water holding capacity')
```

---

calc\_waterstressindex *Calculate the Water Stress Index*

---

**Description**

This function calculates the Water Stress Index (estimating the yield depression as a function of water deficiency or surplus)

**Usage**

```
calc_waterstressindex(B_HELP_WENR, B_LU_BRP, B_GWL_CLASS, WSI = "waterstress")
```

**Arguments**

B_HELP_WENR	(character) The soil type abbreviation, derived from 1:50.000 soil map
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
B_GWL_CLASS	(character) The groundwater table class
WSI	(character) The type of Water Stress Index is required. Options: droughtstress, wetnessstress and the (combined) waterstress

**Value**

The yield depression (in %) through wetness or drought stress (depending on the WSI selected).  
Numeric value.

**References**

STOWA (2005) Uitbreiding en Actualisering van de HELP-tabellen ten behoeve van het Waterlood instrumentarium

**Examples**

```
calc_waterstressindex(B_HELP_WENR = 'ABkt', B_LU_BRP = 1019, B_GWL_CLASS = 'GtIV',
, WSI = 'droughtstress')
```

---

calc\_winderodibility *Calculate indicator for wind erodibility*

---

**Description**

This function calculates the risk for wind erodibility of soils, derived from Van Kerckhoven et al. (2009) and Ros & Bussink (2013)

**Usage**

```
calc_winderodibility(B_LU_BRP, A_CLAY_MI, A_SILT_MI)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
A_CLAY_MI	(numeric) The clay content of the soil (%)
A_SILT_MI	(numeric) The silt content of the soil (%)

**Value**

The vulnerability of the soil for wind erosion. A numeric value.

**Examples**

```
calc_winderodibility(B_LU_BRP = 265, A_CLAY_MI = 4, A_SILT_MI = 15)
calc_winderodibility(B_LU_BRP = c(265,1019), A_CLAY_MI = c(4,18), A_SILT_MI = c(15,65))
```

---

calc_workability	<i>Calculate indicator for workability</i>
------------------	--

---

**Description**

This function calculates the workability of soils, given as a value of relative season length between 0 and 1. A relative season length of 1 indicates that the water table is sufficiently low for the soil to be workable for the entire growing season required by the crop. The required ground water table for workability is determined by soil type and soil properties. Hydrological variables determine the groundwater table for each day of the year. The option calcyieldloss allows for calculation of yield loss based on the relative season length, differentiating in yield loss between six groups of crops Based on Huinink (2018)

**Usage**

```
calc_workability(
  A_CLAY_MI,
  A_SILT_MI,
  B_LU_BRP,
  B_SOILTYPE_AGR,
  B_GWL_GLG,
  B_GWL_GHG,
  B_GWL_ZCRIT,
  calcyieldloss = FALSE
)
```

**Arguments**

A_CLAY_MI	(numeric) The clay content of the soil (%)
A_SILT_MI	(numeric) The silt content of the soil (%)
B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
B_GWL_GLG	(numeric) The lowest groundwater level averaged over the most dry periods in 8 years in cm below ground level
B_GWL_GHG	(numeric) The highest groundwater level averaged over the most wet periods in 8 years in cm below ground level
B_GWL_ZCRIT	(numeric) The distance between ground level and groundwater level at which the groundwater can supply the soil surface with 2mm water per day (in cm)
calcyieldloss	(boolean) whether the function includes yield loss, options: TRUE or FALSE (default).

**Value**

The workability of a soil, expressed as a numeric value representing the relative season length that the soil can be managed by agricultural activities.

**References**

Huinink (2018) Bodem/perceel geschiktheidsbeoordeling voor Landbouw, Bosbouw en Recreatie. BodemConsult-Arnhem

**Examples**

```
calc_workability(A_CLAY_MI = 18,A_SILT_MI = 25,B_LU_BRP = 265,
B_SOILTYPE_AGR = 'dekzand',B_GWL_GLG = 145,B_GWL_GHG = 85,B_GWL_ZCRIT = 400,
calcyieldloss = FALSE)
calc_workability(18,25,265,'dekzand',145,85,400,FALSE)
```

---

calc\_zinc\_availability

*Calculate the availability of the metal Zinc*

---

**Description**

This function calculates the availability of Zn for plant uptake

**Usage**

```
calc_zinc_availability(B_LU_BRP, B_SOILTYPE_AGR, A_PH_CC, A_ZN_CC)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The agricultural type of soil
A_PH_CC	(numeric) The acidity of the soil, determined in 0.01M CaCl <sub>2</sub> (-)
A_ZN_CC	The plant available Zn content, extracted with 0.01M CaCl <sub>2</sub> (mg / kg)

**Value**

The function of the soil to supply zinc A numeric value.

**Examples**

```
calc_zinc_availability(B_LU_BRP = 265, B_SOILTYPE_AGR = 'dekzand',A_PH_CC = 4.5, A_ZN_CC = 3000)
calc_zinc_availability(B_LU_BRP = 265, 'dekzand',4,3500)
calc_zinc_availability(B_LU_BRP = c(1019,265), c('dekzand','rivierklei'),c(4.5,4.8),c(2500,4500))
```

---

cf\_ind\_importance      *Helper function to weight and correct the risk and scores*

---

**Description**

Helper function to weight and correct the risk and scores

**Usage**

```
cf_ind_importance(x)
```

**Arguments**

x                      The risk or score value to be weighted

**Value**

A transformed variable after applying a inverse weighing function so that lower values will gain more impact when applied in a weighed.mean function. A numeric value.

**Examples**

```
cf_ind_importance(x = 0.5)
cf_ind_importance(x = c(0.1,0.5,1.5))
```

---

column\_description.obic  
*Column description for the OBIC*

---

**Description**

This table defines the columns used in the OBIC and which unit is used

**Usage**

```
column_description.obic
```

**Format**

An object of class data.table (inherits from data.frame) with 216 rows and 6 columns.

**Details**

**column** The column name used in OBIC

**type** The type of column

**description\_nl** A description of the column in Dutch

**description\_en** A description of the column in English

**unit** The unit used for this column

**method** The method to measure/obtain the values for this column

---

crops.makkink	<i>Makkink correction factor table</i>
---------------	--

---

**Description**

This table contains the makkink correction factors for evapo-transpiration per month

**Usage**

crops.makkink

**Format**

An object of class `data.table` (inherits from `data.frame`) with 24 rows and 13 columns.

**Details**

**crop\_makkink** Makkink crop category

**1** Evapotranspiration correction factors for January

**2** Evapotranspiration correction factors for February

**3** Evapotranspiration correction factors for March

**4** Evapotranspiration correction factors for April

**5** Evapotranspiration correction factors for May

**6** Evapotranspiration correction factors for June

**7** Evapotranspiration correction factors for July

**8** Evapotranspiration correction factors for August

**9** Evapotranspiration correction factors for September

**10** Evapotranspiration correction factors for October

**11** Evapotranspiration correction factors for November

**12** Evapotranspiration correction factors for December



crops.obic

*Linking table between crops and different functions in OBIC***Description**

This table helps to link the different crops in the OBIC functions with the crops selected by the user

**Usage**

crops.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 511 rows and 22 columns.

**Details**

**crop\_code** The BRP gewascode of the crop

**crop\_name** The name of the crop, in lower case

**crop\_waterstress** Classification linking for linking crops to waterstress.obic

**crop\_intensity** Whether crop is root/tuber crop, rest crop, or other.

**crop\_eos** Effective soil organic matter produced by the crop in kg/ha

**crop\_eos\_residue** Effective soil organic matter from plant residues in kg/ha

**crop\_category** Classification of crop per land use type (arable, maize, grass, nature)

**crop\_rotation** Classification of crop to determine function within crop rotations

**crop\_crumbleability** The category for this crop at crumbleability

**crop\_phosphate** The category for this crop for evaluation phosphate availability

**crop\_sealing** The category for this crop at soil sealing

**crop\_n** The category for this crop for evaluation nitrogen

**crop\_k** The category for this crop for evaluation potassium

**crop\_measure** The category for this crop for evaluating measures

**nf\_clay** Allowed effective N dose on clay soils

**nf\_sand.other** Allowed effective N dose on sandy soils

**nf\_sand.south** Allowed effective N dose on sandy soils sensitive to leaching

**nf\_loess** Allowed effective N dose on loess soils

**nf\_peat** Allowed effective N dose on peat soils

**crop\_name\_scientific** All-lower-case scientific name of the crop species. When crop is not species specific the genus of the crop is given

**crop\_season** Crop category for length growing season

**crop\_makkink** Crop category for makkink correction factors

---

`eval.crumbleability`     *Coefficient table for evaluating crumbleability*

---

### Description

This table contains the coefficients for evaluating the crumbleability. This table is used internally in [ind\\_crumbleability](#)

### Usage

```
eval.crumbleability
```

### Format

An object of class `data.table` (inherits from `data.frame`) with 16 rows and 4 columns.

---

`evaluate_logistic`     *Evaluate using the general logistic function*

---

### Description

This function evaluates the calculated values from an indicator using a general logistic function

### Usage

```
evaluate_logistic(x, b, x0, v, increasing = TRUE)
```

### Arguments

<code>x</code>	(numeric) The values of a calc function to be converted to an evaluation
<code>b</code>	(numeric) The growth rate
<code>x0</code>	(numeric) The offset of the x-axis
<code>v</code>	(numeric) Affects the growth rate near the maximum
<code>increasing</code>	(boolean) Should the evaluation increase (TRUE) with x or decrease (FALSE)?

### Value

A transformed variable after applying a logistic evaluation function. A numeric value.

### References

[https://en.wikipedia.org/wiki/Generalised\\_logistic\\_function](https://en.wikipedia.org/wiki/Generalised_logistic_function)

### Examples

```
evaluate_logistic(x = 5, b = 2, x0 = 3, v = 2.6)
evaluate_logistic(x = c(0.1,0.5,1.5,3.5), b = 2, x0 = 3, v = 2.6)
```

---

evaluate_parabolic	<i>Evaluate using parabolic function with</i>
--------------------	---

---

**Description**

This function evaluates the calculated values from an indicator using a parabolic function. After the optimum is reached the it stays at its plateau.

**Usage**

```
evaluate_parabolic(x, x.top)
```

**Arguments**

x	(numeric) The values of a calc function to be converted to an evaluation
x.top	(numeric) The value at which x reaches the plateau

**Value**

A transformed variable after applying a parabolic evaluation function. A numeric value.

**Examples**

```
evaluate_parabolic(x = 5, x.top = 8)
evaluate_parabolic(x = c(0.1,0.5,1.5,3.5), x.top = 6.5)
```

---

format_aer	<i>Convert possible B_AER_CBS values to standardized values</i>
------------	---

---

**Description**

This function formats information of Agricultural Economic Region so it can be understood by other OBIC functions

**Usage**

```
format_aer(B_AER_CBS)
```

**Arguments**

B_AER_CBS	(character) The agricultural economic region in the Netherlands (CBS, 2016)
-----------	---

**Value**

A standardized B\_AER\_CBS value as required for the OBIC functions. A character string.

**Examples**

```
format_aer(c("LG13","LG12"))
format_aer(c("LG13","LG12",'Rivierengebied'))
```

---

format\_gwt                      *Convert possible B\_GWL\_CLASS values to standardized values*

---

**Description**

This function formats ground water table information so it can be understood by other OBIC functions

**Usage**

```
format_gwt(B_GWL_CLASS)
```

**Arguments**

B\_GWL\_CLASS      (character) Ground water table classes

**Value**

A standardized B\_GWL\_CLASS value as required for the OBIC functions. A character string.

**Examples**

```
format_gwt(c('sVII', 'sVI'))
format_gwt(c('sVII', 'sVI', 'GtII', 'GtI'))
```

---

format\_soilcompaction    *Convert possible B\_SC\_WENR values to standardized values*

---

**Description**

This function converts numeric values for B\_SC\_WENR to values used by other OBIC functions if numeric values are entered.

**Usage**

```
format_soilcompaction(B_SC_WENR)
```

**Arguments**

B\_SC\_WENR            (numeric and/or character) Data on soil compaction risk that may have to be converted to string

**Value**

A standardized B\_GWL\_CLASS value as required for the OBIC functions. A character string.

**Examples**

```
format_soilcompaction(c('10', '11'))  
format_soilcompaction(c('2', '3', "Matig", "Groot"))
```

---

ind\_aggregatestability

*Calculate the indicator aggregate stability*

---

**Description**

This function calculates the indicator for the the aggregate stability of the soil by using the index calculated by [calc\\_aggregatestability](#)

**Usage**

```
ind_aggregatestability(D_AS)
```

**Arguments**

D\_AS (numeric) The value of aggregate stability calculated by [calc\\_aggregatestability](#)

**Value**

The evaluated score for the soil function aggregate stability. A numeric value between 0 and 1.

**Examples**

```
ind_aggregatestability(D_AS = 0.3)  
ind_aggregatestability(D_AS = c(0.3,0.6,0.9))
```

---

ind_bcs	<i>Calculate the indicator for BodemConditieScore</i>
---------	---

---

**Description**

This function calculates the final score for the BodemConditieScore by using the scores calculated by [calc\\_bcs](#)

**Usage**

```
ind_bcs(D_BCS)
```

**Arguments**

D\_BCS (numeric) The value of BCS calculated by [calc\\_bcs](#)

**Value**

The evaluated score for the Visual Soil Assessment. A numeric value between 0 and 50.

**Examples**

```
ind_bcs(D_BCS = 12)
ind_bcs(D_BCS = c(12, 18, 26, 30))
```

---

ind_cec	<i>Calculate the indicator for soil fertility given the CEC</i>
---------	---

---

**Description**

This function estimate how much cations can be buffer by soil, being calculated by [calc\\_cec](#)

**Usage**

```
ind_cec(D_CEC)
```

**Arguments**

D\_CEC (numeric) The value of CEC calculated by [calc\\_cec](#)

**Value**

The evaluated score for the soil function to buffer cations. A numeric value between 0 and 1.

**Examples**

```
ind_cec(D_CEC = 85)
ind_cec(D_CEC = c(85,135,385))
```

---

ind_compaction	<i>Calculate indicator for subsoil compaction</i>
----------------	---

---

**Description**

This function calculates the indicator for the risk for soil compaction of the subsoil. derived from van den Akker et al. (2013) Risico op ondergrondverdichting in het landelijk gebied in kaart, Alterra-rapport 2409, Alterra, Wageningen University and Research Centre,

**Usage**

```
ind_compaction(B_SC_WENR)
```

**Arguments**

B\_SC\_WENR (character) The risk for subsoil compaction as derived from risk assessment study of Van den Akker (2006)

**Value**

The evaluated score for the soil function for subsoil compaction. A numeric value between 0 and 1.

**References**

Akker et al. (2013) Risico op ondergrondverdichting in het landelijk gebied in kaart, Alterra-rapport 2409, Alterra, Wageningen University and Research Centre.

**Examples**

```
ind_compaction(B_SC_WENR = 'Zeer groot')
ind_compaction(B_SC_WENR = c('Zeer groot', 'Van nature dicht'))
```

---

ind_copper	<i>Calculate the indicator for Cu-availability</i>
------------	--

---

**Description**

This function calculates the indicator for the the Cu availability in soil by using the Cu-index as calculated by [calc\\_copper\\_availability](#)

**Usage**

```
ind_copper(D_CU, B_LU_BRP)
```

**Arguments**

D_CU	(numeric) The value of Cu-index calculated by <a href="#">calc_copper_availability</a>
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP

**Value**

The evaluated score for the soil function to supply copper for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_copper(D_CU = 125, B_LU_BRP = 265)  
ind_copper(D_CU = c(125,335), B_LU_BRP = c(1019,256))
```

---

ind_crumbleability	<i>Calculate the indicator for crumbleability</i>
--------------------	---

---

**Description**

This function calculates the indicator for crumbleability. The crumbleability is calculated by [calc\\_crumbleability](#)

**Usage**

```
ind_crumbleability(D_CR, B_LU_BRP)
```

**Arguments**

D_CR	(numeric) The value of crumbleability calculated by <a href="#">calc_crumbleability</a>
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP



**Value**

The evaluated score for the soil function crumbleability. A numeric value between 0 and 1.

**Examples**

```
ind_crumbleability(D_CR = 3, B_LU_BRP = 1910)
ind_crumbleability(D_CR = c(2,6), B_LU_BRP = c(1910,1910))
```

---

ind_gw_recharge	<i>Calculate groundwater recharge of a soil</i>
-----------------	---

---

**Description**

This function calculates an index score for groundwater storage based on precipitation surplus, infiltration at saturation, sealing risk, drainage and subsoil compaction

**Usage**

```
ind_gw_recharge(B_LU_BRP, D_PSP, D_WRI_K, I_P_SE, I_P_CO, B_DRAIN, B_GWL_CLASS)
```

**Arguments**

B_LU_BRP	(numeric) The crop code from the BRP
D_PSP	(numeric) The precipitation surplus per crop calculated by <a href="#">calc_psp</a>
D_WRI_K	(numeric) The value for top soil permeability (cm/d) as calculated by <a href="#">calc_permeability</a>
I_P_SE	(numeric) The indicator value for soil sealing
I_P_CO	(numeric) The indicator value for occurrence of subsoil compaction
B_DRAIN	(boolean) Are drains installed to drain the field (options: yes or no)
B_GWL_CLASS	(character) The groundwater table class

**Value**

The evaluated score for the soil function to improve groundwater recharge. A numeric value between 0 and 1.

**Examples**

```
ind_gw_recharge(B_LU_BRP = 265, D_PSP = 200, D_WRI_K = 10, I_P_SE = 0.6, I_P_CO = 0.9,
B_DRAIN = FALSE, B_GWL_CLASS = 'GtV')
ind_gw_recharge(B_LU_BRP = 233, D_PSP = 400, D_WRI_K = 10, I_P_SE = 0.4, I_P_CO = 0.2,
B_DRAIN = TRUE, B_GWL_CLASS = 'GtII')
```

---

ind_magnesium	<i>Calculate the indicator for Magnesium</i>
---------------	--

---

### Description

This function calculates the indicator for the the Magnesium content of the soil by using the Mg-availability calculated by [calc\\_magnesium\\_availability](#)

### Usage

```
ind_magnesium(D_MG, B_LU_BRP, B_SOILTYPE_AGR)
```

### Arguments

D_MG	(numeric) The value of Mg calculated by <a href="#">calc_magnesium_availability</a>
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
B_SOILTYPE_AGR	(character) The type of soil

### Value

The evaluated score for the soil function to supply magnesium for crop uptake. A numeric value.

### Examples

```
ind_magnesium(D_MG = 125, B_LU_BRP = 265, B_SOILTYPE_AGR = 'dekzand')
ind_magnesium(D_MG = c(125,35), B_LU_BRP = c(265,256), B_SOILTYPE_AGR = rep('dekzand',2))
```

---

ind_management	<i>Calculate the indicator for sustainable management</i>
----------------	---

---

### Description

This function calculates the the sustainability of strategic management options as calculated by [calc\\_management](#) The main source of this indicator is developed for Label Duurzaam Bodembeheer (Van der Wal, 2016)

### Usage

```
ind_management(D_MAN, B_LU_BRP, B_SOILTYPE_AGR)
```

### Arguments

D_MAN	(numeric) The value of Sustainable Management calculated by <a href="#">calc_management</a>
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
B_SOILTYPE_AGR	(character) The type of soil

**Details**

The current function allows a maximum score of 18 points for arable systems, 12 for maize and 10 for grass (non-peat), 17 for grass on peat, and 4 for nature.

**Value**

The evaluated score for the evaluated soil management given the Label Sustainable Soil Management. A numeric value between 0 and 1.

**Examples**

```
ind_management(D_MAN = 15, B_LU_BRP = 1019, B_SOILTYPE_AGR = 'dekzand')
ind_management(D_MAN = c(2,6,15), B_LU_BRP = c(1019,256,1019), B_SOILTYPE_AGR = rep('dekzand',3))
```

---

ind_man_ess	<i>Calculate the indicator for sustainable management given a required ecosystem service</i>
-------------	--

---

**Description**

This function calculates the the sustainability of strategic management options for a given ecosystem service as calculated by [calc\\_man\\_ess](#) The main source of this indicator is developed for Label Duurzaam Bodembeheer (Van der Wal, 2016)

**Usage**

```
ind_man_ess(D_MAN, B_LU_BRP, B_SOILTYPE_AGR, type)
```

**Arguments**

D_MAN	(numeric) The value of Sustainable Management calculated by <a href="#">calc_man_ess</a>
B_LU_BRP	(numeric) The crop code from the BRP
B_SOILTYPE_AGR	(character) The type of soil
type	(character) type of ecosystem service to evaluate the impact of soil management. Options: I_M_SOILFERTILITY, I_M_CLIMATE, I_M_WATERQUALITY, and I_M_BIODIVERSITY

**Value**

The evaluated score for the evaluated soil management for a specific ecosystem service. A numeric value between 0 and 1. This is done for the following ESS: I\_M\_SOILFERTILITY, I\_M\_CLIMATE, I\_M\_WATERQUALITY and I\_M\_BIODIVERSITY.

**Examples**

```
ind_man_ess(D_MAN = 3.5, B_LU_BRP = 1019, B_SOILTYPE_AGR = 'dekzand', type = 'I_M_SOILFERTILITY')
ind_man_ess(D_MAN = c(2,6,15), B_LU_BRP = c(1019,256,1019), B_SOILTYPE_AGR = rep('dekzand',3),
type = 'I_M_SOILFERTILITY')
```

ind\_nematodes

*Calculate indicator for plant parasitic nematodes***Description**

This function calculates the indicator for the presence of plant parasitic nematodes. If input values are not given, the number is assumed to be zero.

**Usage**

```
ind_nematodes(
  B_LU_BRP = B_LU_BRP,
  A_RLN_PR_TOT = 0,
  A_RLN_PR_CREM = 0,
  A_RLN_PR_NEG = 0,
  A_RLN_PR_PEN = 0,
  A_RLN_PR_PRA = 0,
  A_RLN_PR_THO = 0,
  A_RLN_PR_FLA = 0,
  A_RLN_PR_FAL = 0,
  A_RLN_PR_PIN = 0,
  A_RLN_PR_PSE = 0,
  A_RLN_PR_VUL = 0,
  A_RLN_PR_DUN = 0,
  A_RLN_PR_ZEA = 0,
  A_RKN_ME_TOT = 0,
  A_RKN_ME_HAP = 0,
  A_RKN_ME_CHIFAL = 0,
  A_RKN_ME_CHI = 0,
  A_RKN_ME_NAA = 0,
  A_RKN_ME_FAL = 0,
  A_RKN_ME_MIN = 0,
  A_RKN_ME_INC = 0,
  A_RKN_ME_JAV = 0,
  A_RKN_ME_ART = 0,
  A_RKN_ME_ARE = 0,
  A_RKN_ME_ARD = 0,
  A_DSN_TR_TOT = 0,
  A_DSN_TR_SIM = 0,
  A_DSN_TR_PRI = 0,
  A_DSN_TR_VIR = 0,
```

```

A_DSN_TR_SPA = 0,
A_DSN_TR_CYL = 0,
A_DSN_TR_HOO = 0,
A_DSN_PA_TER = 0,
A_DSN_PA_PAC = 0,
A_DSN_PA_ANE = 0,
A_DSN_PA_NAN = 0,
A_DSN_TY_TOT = 0,
A_DSN_RO_TOT = 0,
A_DSN_XI_TOT = 0,
A_DSN_LO_TOT = 0,
A_DSN_HEM_TOT = 0,
A_DSN_HEL_TOT = 0,
A_SN_DI_TOT = 0,
A_SN_DI_DIP = 0,
A_SN_DI_DES = 0,
A_OPN_PA_TOT = 0,
A_OPN_PA_BUK = 0,
A_OPN_CY_TOT = 0,
A_OPN_AP_TOT = 0,
A_OPN_AP_FRA = 0,
A_OPN_AP_RIT = 0,
A_OPN_AP_SUB = 0,
A_OPN_CR_TOT = 0,
A_OPN_SU_TOT = 0,
A_NPN_SA_TOT = 0
)

```

### Arguments

B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
A_RLN_PR_TOT	(numeric) Number of pratylenchus spp. (n / 100g)
A_RLN_PR_CREN	(numeric) Number of pratylenchus crenatus (n / 100g)
A_RLN_PR_NEG	(numeric) Number of pratylenchus neglectus (n / 100g)
A_RLN_PR_PEN	(numeric) Number of pratylenchus penetrans (n / 100g)
A_RLN_PR_PRA	(numeric) Number of pratylenchus pratensis (n / 100g)
A_RLN_PR_THO	(numeric) Number of pratylenchus thornei (n / 100g)
A_RLN_PR_FLA	(numeric) Number of pratylenchus flakkensis (n / 100g)
A_RLN_PR_FAL	(numeric) Number of pratylenchus fallax (n / 100g)
A_RLN_PR_PIN	(numeric) Number of pratylenchus pinguicaudatus (n / 100g)
A_RLN_PR_PSE	(numeric) Number of pratylenchus pseudopratensis (n / 100g)
A_RLN_PR_VUL	(numeric) Number of pratylenchus vulnus (n / 100g)
A_RLN_PR_DUN	(numeric) Number of pratylenchus dunensis (n / 100g)
A_RLN_PR_ZEA	(numeric) Number of pratylenchus zaeae (n / 100g)
A_RKN_ME_TOT	(numeric) Number of meloidogyne spp. (n / 100g)

A_RKN_ME_HAP	(numeric) Number of meloidogyne hapla (n / 100g)
A_RKN_ME_CHIFAL	(numeric) Number of meloidogyne chitwoodi/fallax (n / 100g)
A_RKN_ME_CHI	(numeric) Number of meloidogyne chitwoodi (n / 100g)
A_RKN_ME_NAA	(numeric) Number of meloidogyne naasi (n / 100g)
A_RKN_ME_FAL	(numeric) Number of meloidogyne fallax (n / 100g)
A_RKN_ME_MIN	(numeric) Number of meloidogyne minor (n / 100g)
A_RKN_ME_INC	(numeric) Number of meloidogyne incognita (n / 100g)
A_RKN_ME_JAV	(numeric) Number of meloidogyne javanica (n / 100g)
A_RKN_ME_ART	(numeric) Number of meloidogyne artiellia (n / 100g)
A_RKN_ME_ARE	(numeric) Number of meloidogyne arenaria (n / 100g)
A_RKN_ME_ARD	(numeric) Number of meloidogyne ardenensis (n / 100g)
A_DSN_TR_TOT	(numeric) Number of trichodoridae spp. (n / 100g)
A_DSN_TR_SIM	(numeric) Number of trichodorus similis (n / 100g)
A_DSN_TR_PRI	(numeric) Number of trichodorus primitivus (n / 100g)
A_DSN_TR_VIR	(numeric) Number of trichodorus viruliferus (n / 100g)
A_DSN_TR_SPA	(numeric) Number of trichodorus sparsus (n / 100g)
A_DSN_TR_CYL	(numeric) Number of trichodorus cylindricus (n / 100g)
A_DSN_TR_HOO	(numeric) Number of trichodorus hooperi (n / 100g)
A_DSN_PA_TER	(numeric) Number of paratrichodorus teres (n / 100g)
A_DSN_PA_PAC	(numeric) Number of paratrichodorus pachydermus (n / 100g)
A_DSN_PA_ANE	(numeric) Number of paratrichodorus anemones (n / 100g)
A_DSN_PA_NAN	(numeric) Number of paratrichodorus nanus (n / 100g)
A_DSN_TY_TOT	(numeric) Number of tylenchorhynchus spp. (n / 100g)
A_DSN_RO_TOT	(numeric) Number of rotylechus spp. (n / 100g)
A_DSN_XI_TOT	(numeric) Number of xiphinema spp. (n / 100g)
A_DSN_LO_TOT	(numeric) Number of longidorus spp. (n / 100g)
A_DSN_HEM_TOT	(numeric) Number of hemicycliophora spp. (n / 100g)
A_DSN_HEL_TOT	(numeric) Number of helicotylenchus spp. (n / 100g)
A_SN_DI_TOT	(numeric) Number of ditylenchus spp. (n / 100g)
A_SN_DI_DIP	(numeric) Number of ditylenchus dipsaci (n / 100g)
A_SN_DI_DES	(numeric) Number of ditylenchus destructor (n / 100g)
A_OPN_PA_TOT	(numeric) Number of paratylenchus spp. (n / 100g)
A_OPN_PA_BUK	(numeric) Number of paratylenchus bukowinensis (n / 100g)
A_OPN_CY_TOT	(numeric) Number of cysteaaltjes (n / 100g)
A_OPN_AP_TOT	(numeric) Number of aphelenchoides spp. (n / 100g)
A_OPN_AP_FRA	(numeric) Number of aphelenchoides fragariae (n / 100g)
A_OPN_AP_RIT	(numeric) Number of aphelenchoides ritzemabosi (n / 100g)
A_OPN_AP_SUB	(numeric) Number of aphelenchoides subtenuis (n / 100g)
A_OPN_CR_TOT	(numeric) Number of criconematidae spp. (n / 100g)
A_OPN_SU_TOT	(numeric) Number of subanguina spp. (n / 100g)
A_NPN_SA_TOT	(numeric) Number of saprofage en overige (n / 100g)

**Value**

The evaluated score for the soil function for nematode community. A numeric value between 0 and 1.

**Examples**

```
ind_nematodes(B_LU_BRP = 1019)
ind_nematodes(B_LU_BRP = 1019,A_RLN_PR_TOT = 250,A_RLN_PR_ZEA = 400,A_SN_DI_DIP = 5)
```

---

ind\_nematodes\_list      *Calculate indicator for plant parasitic nematodes*

---

**Description**

This function calculates the indicator for the presence of plant parasitic nematodes. All nematodes present in a sample are used. A subset of nematodes is weighted in the set regardless of their presence.

**Usage**

```
ind_nematodes_list(A_NEMA)
```

**Arguments**

A\_NEMA                    (data.table) Long data table with the counted nematodes of a parcel.

**Value**

The evaluated score for the soil function for nematode community. A numeric value between 0 and 1.

**Examples**

```
## Not run:
ind_nematodes_list(data.table(species = 'Cysteaaltjes',count = 200))
ind_nematodes_list(data.table(species = c('Cysteaaltjes','Ditylenchus dipsaci'),
count = c(200,7)))

## End(Not run)
```

---

ind_nitrogen	<i>Calculate the indicator for NLV</i>
--------------	--

---

**Description**

This function calculates the indicator for the the nitrogen content of the soil by using the NLV calculated by [calc\\_nlv](#)

**Usage**

```
ind_nitrogen(D_NLV, B_LU_BRP)
```

**Arguments**

D_NLV	(numeric) The value of NLV calculated by <a href="#">calc_nlv</a>
B_LU_BRP	(numeric) The crop code from the BRP

**Value**

The evaluated score for the soil function to supply nitrogen for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_nitrogen(D_NLV = 85,B_LU_BRP = 256)
ind_nitrogen(D_NLV = c(150,65,35),B_LU_BRP = c(256,1019,1019))
```

---

ind_nretention	<i>Calculate the indicator for N retention for groundwater or surface water</i>
----------------	---

---

**Description**

This function calculates the indicator for the N retention of the soil by using the N leaching to groundwater or surface water calculated by [calc\\_nleach](#)

**Usage**

```
ind_nretention(D_NW, leaching_to)
```

**Arguments**

D_NW	(numeric) The value of N leaching calculated by <a href="#">calc_nleach</a>
leaching_to	(character) whether it evaluates N leaching to groundwater ("gw") or to surface water ("ow")



**Value**

The evaluated score for the soil function to supply nitrogen for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_nretention(D_NW = 15,leaching_to = 'gw')
ind_nretention(D_NW = c(.2,5.6,15.6),leaching_to = 'ow')
```

---

ind_n_efficiency	<i>Calculate an indicator value for nitrogen use efficiency and leaching based on N surplus</i>
------------------	---

---

**Description**

This function gives an indicator value for nitrogen use efficiency calculated by [calc\\_n\\_efficiency](#), this function makes use of [ind\\_nretention](#)

**Usage**

```
ind_n_efficiency(D_NLEACH, leaching_to = "gw")
```

**Arguments**

D_NLEACH	(numeric) The value of N leaching calculated by <a href="#">calc_n_efficiency</a>
leaching_to	(character) whether it evaluates N leaching to groundwater ("gw") or to surface water ("sw")

**Value**

The evaluated score for the soil function to enhance the nitrogen use efficiency. A numeric value between 0 and 1.

**Examples**

```
ind_n_efficiency(D_NLEACH = 50, leaching_to = 'gw')
ind_n_efficiency(D_NLEACH = c(5,15,25,75), leaching_to = 'sw')
```

---

ind_permeability	<i>Calculate the indicator score for the permeability of the top soil</i>
------------------	---

---

**Description**

This function calculates the indicator score for the permeability of the top soil

**Usage**

```
ind_permeability(D_WRI_K)
```

**Arguments**

D\_WRI\_K (numeric) The value for top soil permeability (cm/d) as calculated by [calc\\_permeability](#)

---

ind_pesticide_leaching	<i>Calculate an indicator score for pesticide leaching</i>
------------------------	--

---

**Description**

This function calculates the indicator value for pesticide leaching from a soil

**Usage**

```
ind_pesticide_leaching(D_PESTICIDE)
```

**Arguments**

D\_PESTICIDE The fraction of pesticide leached compared to the worst case scenario

**Value**

The evaluated score for the soil function to minimize pesticide leaching. A numeric value between 0 and 1.

**Examples**

```
ind_pesticide_leaching(D_PESTICIDE = 0.7)  
ind_pesticide_leaching(D_PESTICIDE = c(0.4,0.6,0.8,1))
```

---

ind_ph	<i>Calculate the indicator for pH</i>
--------	---------------------------------------

---

**Description**

This function calculates the indicator for the pH of the soil by the difference with the optimum pH. This is calculated in [calc\\_ph\\_delta](#).

**Usage**

```
ind_ph(D_PH_DELTA)
```

**Arguments**

D\_PH\_DELTA (numeric) The pH difference with the optimal pH.

**Value**

The evaluated score for the soil function to buffer pH within optimum range for crop growth. A numeric value between 0 and 1.

**Examples**

```
ind_ph(D_PH_DELTA = 0.8)
ind_ph(D_PH_DELTA = c(0.2, 0.6, 0.8, 1.5))
```

---

ind_phosphate_availability	<i>Calculate the indicator for the phosphate availability</i>
----------------------------	---

---

**Description**

This function calculates the indicator for the phosphate availability calculated by [calc\\_phosphate\\_availability](#)

**Usage**

```
ind_phosphate_availability(D_PBI)
```

**Arguments**

D\_PBI (numeric) The value of phosphate availability calculated by [calc\\_phosphate\\_availability](#)

**Value**

The evaluated score for the soil function to supply and buffer phosphorus for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_phosphate_availability(D_PBI = 3.5)
ind_phosphate_availability(D_PBI = c(0.5,0.8,2.5,5,15,35,75))
```

---

ind_pmn	<i>Calculate the indicator for microbial biological activity</i>
---------	--

---

**Description**

This function calculates the indicator that assess the microbial biological activity of the soil by using the PMN calculated by [calc\\_pmn](#)

**Usage**

```
ind_pmn(D_PMN)
```

**Arguments**

D\_PMN (numeric) The value of PMN calculated by [calc\\_pmn](#)

**Value**

The evaluated score for the soil function reflecting the microbial activity of a soil (specifically the potentially mineralizable N rate). A numeric value between 0 and 1.

**Examples**

```
ind_pmn(D_PMN = 24)
ind_pmn(D_PMN = c(54,265))
```

---

ind_potassium	<i>Calculate the indicator for Potassium Availability</i>
---------------	---

---

**Description**

This function calculates the indicator for the the Potassium Availability of the soil by using the K-availability calculated by [calc\\_potassium\\_availability](#)

**Usage**

```
ind_potassium(D_K, B_LU_BRP, B_SOILTYPE_AGR, A_SOM_LOI)
```

**Arguments**

D_K	(numeric)	The value of K-index calculated by <a href="#">calc_potassium_availability</a>
B_LU_BRP	(numeric)	The crop code from the BRP
B_SOILTYPE_AGR	(character)	The agricultural type of soil
A_SOM_LOI	(numeric)	The organic matter content of the soil (%)

**Value**

The evaluated score for the soil function to supply potassium for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_potassium(D_K = 4.5, B_LU_BRP = 256, B_SOILTYPE_AGR='dekzand', A_SOM_LOI=4)
ind_potassium(c(2.5, 3.5, 6.5), c(256, 1019, 1019), rep('dekzand', 3), c(3.5, 4.5, 7.5))
```

---

ind\_psp

---

*Calculate indicator for precipitation surplus*


---

**Description**

This function calculates the indicator value for precipitation surplus

**Usage**

```
ind_psp(D_PSP, B_LU_BRP)
```

**Arguments**

D_PSP	(numeric)	The precipitation surplus per crop calculated by <a href="#">calc_psp</a>
B_LU_BRP	(numeric)	The crop code from the BRP

---

ind_resistance	<i>Calculate indicator for soil resistance</i>
----------------	--

---

**Description**

This function calculates the indicator for the resistance of the soil against diseases and is indicated by the amount of soil life.

**Usage**

```
ind_resistance(A_SOM_LOI)
```

**Arguments**

A\_SOM\_LOI (numeric) The organic matter content of the soil in percentage

**Value**

The evaluated score for the soil function to resist diseases. A numeric value between 0 and 1.

**Examples**

```
ind_resistance(A_SOM_LOI = 3.5)
ind_resistance(A_SOM_LOI = c(3.5, 5.5, 15, 25))
```

---

ind_sealing	<i>Calculate the soil sealing indicator</i>
-------------	---

---

**Description**

This function calculates the indicator for the soil sealing calculated by [calc\\_sealing\\_risk](#)

**Usage**

```
ind_sealing(D_SE, B_LU_BRP)
```

**Arguments**

D\_SE (numeric) The value of soil sealing calculated by [calc\\_sealing\\_risk](#)  
B\_LU\_BRP (numeric) The crop code (gewascode) from the BRP

**Value**

The evaluated score for the soil function to avoid crop damage due to sealing of surface. A numeric value between 0 and 1.

**Examples**

```
ind_sealing(D_SE = 15,B_LU_BRP = 256)
ind_sealing(D_SE = c(5,15,35),B_LU_BRP = c(1019,1019,1019))
```

---

ind_sulfur	<i>Calculate the indicator for SLV</i>
------------	--

---

**Description**

This function calculates the indicator for the the S-index by using the SLV calculated by [calc\\_slv](#)

**Usage**

```
ind_sulfur(D_SLV, B_LU_BRP, B_SOILTYPE_AGR, B_AER_CBS)
```

**Arguments**

D\_SLV (numeric) The value of SLV calculated by [calc\\_slv](#)  
 B\_LU\_BRP (numeric) The crop code (gewascode) from the BRP  
 B\_SOILTYPE\_AGR (character) The type of soil  
 B\_AER\_CBS (character) The agricultural economic region in the Netherlands (CBS, 2016)

**Value**

The evaluated score for the soil function to supply sulfur for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_sulfur(D_SLV = 15,B_LU_BRP = 256,B_SOILTYPE_AGR = 'dekzand',B_AER_CBS = 'Rivierengebied')
ind_sulfur(c(10,15,35),c(256,1019,1019),rep('rivierklei',3),rep('Rivierengebied',3))
```

---

ind_sulpher	<i>Calculate the indicator for SLV (deprecated)</i>
-------------	---

---

**Description**

This function calculates the indicator for the the S-index by using the SLV calculated by [calc\\_slv](#)

**Usage**

```
ind_sulpher(D_SLV, B_LU_BRP, B_SOILTYPE_AGR, B_AER_CBS)
```

**Arguments**

D_SLV	(numeric) The value of SLV calculated by <a href="#">calc_slv</a>
B_LU_BRP	(numeric) The crop code (gewascode) from the BRP
B_SOILTYPE_AGR	(character) The type of soil
B_AER_CBS	(character) The agricultural economic region in the Netherlands (CBS, 2016)

**Details**

PI

**Value**

The evaluated score for the soil function to supply sulfur for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_sulpher(D_SLV = 15,B_LU_BRP = 256,B_SOILTYPE_AGR = 'dekzand',
B_AER_CBS = 'Rivierengebied')
ind_sulpher(c(10,15,35),c(256,1019,1019),rep('rivierklei',3),rep('Rivierengebied',3))
```

---

ind_waterretention	<i>Calculate indicator for Water Retention index</i>
--------------------	--

---

**Description**

This function evaluates different Water Retention Indices. These include : 'wilting point', 'field capacity', 'water holding capacity', 'plant available water' and 'Ksat'

**Usage**

```
ind_waterretention(D_P_WRI, type = "plant available water")
```

**Arguments**

D_P_WRI	(numeric) The value for Water Retention index (WRI) as calculated by <a href="#">calc_waterretention</a>
type	(character) The type of water retention index. Options include c('wilting point', 'field capacity', 'water holding capacity', 'plant available water', 'Ksat')

**Value**

The evaluated score for the soil function to retain and buffer water. Depending on the "type" chosen, the soil is evaluated for 'wilting point', 'field capacity', 'water holding capacity', 'plant available water' or 'Ksat'. Output is a numeric value varying between 0 and 1.



**Examples**

```
ind_waterretention(D_P_WRI = 75)
ind_waterretention(D_P_WRI = c(15,50,75,150))
ind_waterretention(D_P_WRI = c(0.1,0.2,0.5,0.8), type = 'water holding capacity')
```

---

ind\_waterstressindex    *Calculate the Water Stress Index*

---

**Description**

This function calculates the risk for yield depression due to drought, an excess of water or a combination of both. The WSI is calculated by [calc\\_waterstressindex](#)

**Usage**

```
ind_waterstressindex(D_WSI)
```

**Arguments**

D\_WSI                    (numeric) The value of WSI calculated by [calc\\_waterstressindex](#)

**Value**

The evaluated score for the soil function to resist drought or wetness stress by crops. A numeric value between 0 and 1.

**Examples**

```
ind_waterstressindex(D_WSI = 45)
ind_waterstressindex(D_WSI = c(5,15,25,35))
```

---

ind\_winderodibility    *Calculate indicator for wind erodibility*

---

**Description**

This function calculates the indicator for the resistance of the soil against wind erosion.

**Usage**

```
ind_winderodibility(D_P_DU)
```

**Arguments**

D\_P\_DU                    (numeric) The value for wind erodibility factor (WEF) as calculated by [calc\\_winderodibility](#)

**Value**

The evaluated score for the soil function to avoid soil damage due to wind erosion. A numeric value between 0 and 1.

**Examples**

```
ind_winderodibility(D_P_DU = 0.85)
ind_winderodibility(D_P_DU = c(0.15,0.6,0.9))
```

---

ind_workability	<i>Calculate indicator for workability</i>
-----------------	--

---

**Description**

This function calculates the indicator for the workability of the soil expressed as the period in which the soil can be worked without inflicting structural damage that cannot be restored by the regular management on the farm.

**Usage**

```
ind_workability(D_WO, B_LU_BRP)
```

**Arguments**

D_WO	(numeric) The value of the relative (workable) season length calculated by <a href="#">calc_workability</a>
B_LU_BRP	(numeric) The crop code from the BRP

**Value**

The evaluated score for the soil function to allow the soil to be managed by agricultural activities. A numeric value between 0 and 1.

**Examples**

```
ind_workability(D_WO = 0.85,B_LU_BRP = 256)
ind_workability(D_WO = c(0.15,0.6,0.9),B_LU_BRP = c(256,1019,1019))
```

---

ind_zinc	<i>Calculate the indicator for Zn-availability</i>
----------	--

---

**Description**

This function calculates the indicator for the the Zn availability in soil by using the Zn-index as calculated by [calc\\_zinc\\_availability](#)

**Usage**

```
ind_zinc(D_ZN)
```

**Arguments**

D\_ZN (numeric) The value of Zn-index calculated by [calc\\_zinc\\_availability](#)

**Value**

The evaluated score for the soil function to supply zinc for crop uptake. A numeric value between 0 and 1.

**Examples**

```
ind_zinc(D_ZN = 45)
ind_zinc(D_ZN = c(12.5, 35, 65))
```

---

management.obic	<i>Relational table linking soil management measures to ecosystem services</i>
-----------------	--

---

**Description**

This table assigns which measures positively contribute to the ecosystem services included

**Usage**

```
management.obic
```

**Format**

An object of class `data.table` (inherits from `data.frame`) with 15 rows and 6 columns.

**Details**

**measure** The name of measure

**I\_M\_SOILFERTILITY** integrated soil management indicator for soil fertility

**I\_M\_CLIMATE** integrated soil management indicator for soil carbon sequestration

**I\_M\_WATERQUALITY** integrated soil management indicator for water quality

**I\_M\_BIODIVERSITY** Integrated soil management indicator for soil biodiversity

---

nema.crop.rot.obic      *Damage and reproduction of soil-borne pathogens and pests on crops*

---

**Description**

This table includes information from aaltjesschema (April 2021), a website where information is collected on the vulnerability of crops to plant parasitic nematodes and diseases that use nematodes as vector.

**Usage**

nema.crop.rot.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 7059 rows and 21 columns.

**Details**

**crop** crop as called in aaltjesschema

**name\_scientific** scientific name of nematode

**propagation** how easily a nematode can propagate on a crop given as strings with 5 classes

**damage** strings indicating how much damage a nematode can inflict on a crop, with 5 classes

**cultivar\_dependent** boolean whether there are differences in propagation between cultivars of the crop

**serotype\_dependant** boolean whether there are differences in propagation between serotypes of the pathogen

**dalgrond** boolean whether information is valid for soiltype 'dalgrond'

**klei** boolean whether information is valid for soiltype 'klei'

**loess** boolean whether information is valid for soiltype 'loess'

**zand** boolean whether information is valid for soiltype 'zand'

**zavel** boolean whether information is valid for soiltype 'zavel'

**info** string whether there is information on propagation, differentiating between none, yes, and some

**name\_common** string, common name of pathogen in Dutch, if no common name is available, scientific name is given

**nema\_name** string, full name of pathogen in aaltjesschema, includes common and scientific name

**grondsoort** string with letters indicating for which soil the information is valid

**groen\_br** boolean indicating that the crop is a green manure on fallow

**groen\_vs** boolean indicating that the crop is a green manure in early stubble

**groen\_od** boolean indicating that the crop is a green manure beneath cover crop

**groen\_ls** boolean indicating that the crop is a green manure in late stubble

**groen\_st** boolean indicating that the crop is a green manure as drifting deck

**crop\_name\_scientific** string, scientific name of crop species or genus

---

nema.obic

*Nematode table*


---

## Description

This table contains information uses for calculations on nematode species counts

## Usage

nema.obic

## Format

An object of class `data.table` (inherits from `data.frame`) with 78 rows and 7 columns.

## Details

**geel** The intermediate infestation severity count

**rood** The count at which a severe infestation is present

**species** The species or sometimes genera of the plant parasitic nematode

**standard** A boolean indicating whether the species should always be used in calculating the indicator score, regardless of the number of nematodes

**b** Growth rate (b) for the `evaluate_logistics` function

**v** v for the `evaluate_logistics` function, affects the growth rate near the maximum

---

nleach_table	<i>Table with fractions of excess N which runs off to groundwater and surface water</i>
--------------	---

---

### Description

This table contains the fractions of N overshoot which runs off to groundwater / surface water, per soil type, crop type, and groundwater table

### Usage

```
nleach_table
```

### Format

An object of class `data.table` (inherits from `data.frame`) with 198 rows and 7 columns.

### Details

**gewas** crop type

**bodem** soil type

**ghg** Lower value for groundwater table (cm-mv)

**glg** Upper value for groundwater table (cm-mv)

**B\_GT** grondwatertrap

**nf** Original values of N run-off fraction to surface water (kg N drain/ha/year per kg N overshoot/ha/year) or groundwater (mg NO<sub>3</sub>/L per kg N overshoot/ha/year)

**leaching\_to-set** Tells if leaching to ground water or surface water)

---

obic_evalmeasure	<i>Evaluate effects of measures</i>
------------------	-------------------------------------

---

### Description

This function quantifies the effects of 11 soil measures on the OBI score

### Usage

```
obic_evalmeasure(dt.score, extensive = FALSE)
```

### Arguments

`dt.score` (data.table) containing all indicators and scores of a single field

`extensive` (boolean) whether the output table includes evaluation scores of each measures (TRUE)

---

obic_farm	<i>Calculate the Open Bodem Index score for a series of fields belonging to a farm</i>
-----------	--

---

### Description

This functions wraps the functions of the OBIC into one main function to calculate the score for Open Bodem Index (OBI). In contrast to `obic_field`, this wrapper uses a `data.table` as input.

### Usage

```
obic_farm(dt)
```

### Arguments

`dt` (data.table) A `data.table` containing the data of the fields to calculate the OBI

### Details

The `data.table` should contain all required inputs for soil properties needed to calculate OBI score. Management information is optional as well as the observations from the visual soil assessment. The threshold values per category of soil functions need to have an equal length, with fractions defining the class boundaries in increasing order. The lowest boundary value (zero) is not needed.

### Value

The output of the Open Bodem Index Calculator for a series of agricultural fields belonging to a single farm. Depending on the output type, different output objects can be returned. These include the estimated OBI scores (both total and aggregated subscores), the value of the underling indicators as well the possible recommendations to improve the soil quality. The output is a list with field properties as well as aggregated farm properties

### Examples

```
## Not run:
obic_farm(dt = data.table(B_SOILTYPE_AGR = 'rivierklei', B_GWL_CLASS = "II",
  B_GWL_GLG = 75, B_GWL_GHG = 10,
  B_GWL_ZCRIT = 50, B_SC_WENR = '2', B_HELP_WENR = "Mob72", B_AER_CBS = 'LG01',
  B_LU_BRP = c( 1010, 1010, 263, 263, 263, 265, 265, 265), A_SOM_LOI = 3.91, A_SAND_MI = 66.3,
  A_SILT_MI = 22.8, A_CLAY_MI = 7.8, A_PH_CC = 5.4, A_N_RT = 1528.33, A_CN_FR = 13.02,
  A_S_RT = 321.26, A_N_PMN = 63.3, A_P_AL = 50.2, A_P_CC = 2.9, A_P_WA = 50.5,
  A_CEC_CO = 56.9, A_CA_CO_PO = 66.87, A_MG_CO_PO = 13.97, A_K_CO_PO = 3.06,
  A_K_CC = 58.6, A_MG_CC = 77.53, A_MN_CC = 7586.61, A_ZN_CC = 726.2, A_CU_CC = 68.8,
  A_C_BCS = 1, A_CC_BCS = 1, A_GS_BCS = 1, A_P_BCS = 1, A_RD_BCS = 1, A_EW_BCS = 1,
  A_SS_BCS = 1, A_RT_BCS = 1, A_SC_BCS = 1, M_COMPOST = 0, M_GREEN = FALSE, M_NONBARE = FALSE,
  M_EARLYCROP = FALSE, M_SLEEPOSE = FALSE, M_DRAIN = FALSE, M_DITCH = FALSE,
  M_UNDERSEED = FALSE, M_LIME = FALSE, M_MECHWEEDS = FALSE, M_NONINVTILL = FALSE,
  M_PESTICIDES_DST = FALSE, M_SOLIDMANURE = FALSE, M_SSPM = FALSE, M_STRAWRESIDUE = FALSE))
```

```
## End(Not run)
```

---

```
obic_field
```

```
Calculate the Open Bodem Index score for one field
```

---

### Description

This functions wraps the functions of the OBIC into one main function to calculate the score for Open Bodem Index (OBI) for a single field.

### Usage

```
obic_field(
  B_SOILTYPE_AGR,
  B_GWL_CLASS,
  B_SC_WENR,
  B_HELP_WENR,
  B_AER_CBS,
  B_GWL_GLG,
  B_GWL_GHG,
  B_GWL_ZCRIT,
  B_LU_BRP,
  A_SOM_LOI,
  A_SAND_MI,
  A_SILT_MI,
  A_CLAY_MI,
  A_PH_CC,
  A_N_RT,
  A_CN_FR,
  A_S_RT,
  A_N_PMN,
  A_P_AL,
  A_P_CC,
  A_P_WA,
  A_CEC_CO,
  A_CA_CO_PO,
  A_MG_CO_PO,
  A_K_CO_PO,
  A_K_CC,
  A_MG_CC,
  A_MN_CC,
  A_ZN_CC,
  A_CU_CC,
  A_C_BCS = NA,
  A_CC_BCS = NA,
```



```

A_GS_BCS = NA,
A_P_BCS = NA,
A_RD_BCS = NA,
A_EW_BCS = NA,
A_SS_BCS = NA,
A_RT_BCS = NA,
A_SC_BCS = NA,
B_DRAIN = FALSE,
B_FERT_NORM_FR = 1,
M_COMPOST = NA_real_,
M_GREEN = NA,
M_NONBARE = NA,
M_EARLYCROP = NA,
M_SLEEPHOSE = NA,
M_DRAIN = NA,
M_DITCH = NA,
M_UNDERSEED = NA,
M_LIME = NA,
M_NONINVTILL = NA,
M_SSPM = NA,
M_SOLIDMANURE = NA,
M_STRAWRESIDUE = NA,
M_MECHWEEDS = NA,
M_PESTICIDES_DST = NA,
ID = 1,
output = "all"
)

```

### Arguments

B_SOILTYPE_AGR	(character) The agricultural type of soil
B_GWL_CLASS	(character) The groundwater table class
B_SC_WENR	(character) The risk for subsoil compaction as derived from risk assessment study of Van den Akker (2006).
B_HELP_WENR	(character) The soil type abbreviation, derived from 1:50.000 soil map
B_AER_CBS	(character) The agricultural economic region in the Netherlands (CBS, 2016)
B_GWL_GLG	(numeric) The lowest groundwater level averaged over the most dry periods in 8 years in cm below ground level
B_GWL_GHG	(numeric) The highest groundwater level averaged over the most wet periods in 8 years in cm below ground level
B_GWL_ZCRIT	(numeric) The distance between ground level and groundwater level at which the groundwater can supply the soil surface with 2mm water per day (in cm)
B_LU_BRP	(numeric) a series with crop codes given the crop rotation plan (source: the BRP)
A_SOM_LOI	(numeric) The percentage organic matter in the soil (%)
A_SAND_MI	(numeric) The sand content of the soil (%)

A_SILT_MI	(numeric) The silt content of the soil (%)
A_CLAY_MI	(numeric) The clay content of the soil (%)
A_PH_CC	(numeric) The acidity of the soil, measured in 0.01M CaCl <sub>2</sub> (-)
A_N_RT	(numeric) The organic nitrogen content of the soil in mg N / kg
A_CN_FR	(numeric) The carbon to nitrogen ratio (-)
A_S_RT	(numeric) The total Sulfur content of the soil (in mg S per kg)
A_N_PMN	(numeric) The potentially mineralizable N pool (mg N / kg soil)
A_P_AL	(numeric) The P-AL content of the soil
A_P_CC	(numeric) The plant available P content, extracted with 0.01M CaCl <sub>2</sub> (mg / kg)
A_P_WA	(numeric) The P-content of the soil extracted with water (mg P <sub>2</sub> O <sub>5</sub> / 100 ml soil)
A_CEC_CO	(numeric) The cation exchange capacity of the soil (mmol+ / kg), analyzed via Cobalt-hexamine extraction
A_CA_CO_PO	(numeric) The The occupation of the CEC with Ca (%)
A_MG_CO_PO	(numeric) The The occupation of the CEC with Mg (%)
A_K_CO_PO	(numeric) The occupation of the CEC with K (%)
A_K_CC	(numeric) The plant available K content, extracted with 0.01M CaCl <sub>2</sub> (mg / kg)
A_MG_CC	(numeric) The plant available Mg content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)
A_MN_CC	(numeric) The plant available Mn content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)
A_ZN_CC	(numeric) The plant available Zn content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)
A_CU_CC	(numeric) The plant available Cu content, extracted with 0.01M CaCl <sub>2</sub> (ug / kg)
A_C_BCS	(numeric) The presence of visible cracks in the top layer (optional, score 0-1-2)
A_CC_BCS	(integer) The crop cover on the surface (optional, score 0-1-2)
A_GS_BCS	(numeric) The presence of waterlogged conditions, gley spots (optional, score 0-1-2)
A_P_BCS	(numeric) The presence / occurrence of water puddles on the land, ponding (optional, score 0-1-2)
A_RD_BCS	(integer) The rooting depth (optional, score 0-1-2)
A_EW_BCS	(numeric) The presence of earth worms (optional, score 0-1-2)
A_SS_BCS	(integer) The soil structure (optional, score 0-1-2)
A_RT_BCS	(numeric) The presence of visible tracks / rutting or trampling on the land (optional, score 0-1-2)
A_SC_BCS	(numeric) The presence of compaction of subsoil (optional, score 0-1-2)
B_DRAIN	(boolean) Are drains installed to drain the field (options: yes or no)
B_FERT_NORM_FR	(numeric) The fraction of the application norm utilized
M_COMPOST	(numeric) The frequency that compost is applied (optional, every x years)
M_GREEN	(boolean) A soil measure. Are catch crops sown after main crop (optional, option: yes or no)

M_NONBARE	(boolean) A soil measure. Is parcel for 80 percent of the year cultivated and 'green' (optional, option: yes or no)
M_EARLYCROP	(boolean) A soil measure. Use of early crop varieties to avoid late harvesting (optional, option: yes or no)
M_SLEEPHOSE	(boolean) A soil measure. Is sleep hose used for slurry application (optional, option: yes or no)
M_DRAIN	(boolean) A soil measure. Are under water drains installed in peaty soils (optional, option: yes or no)
M_DITCH	(boolean) A soil measure. Are ditched maintained carefully and silt applied on the land (optional, option: yes or no)
M_UNDERSEED	(boolean) A soil measure. Is grass used as second crop in between maize rows (optional, option: yes or no)
M_LIME	(boolean) measure. Has field been limed in last three years (option: yes or no)
M_NONINVTILL	(boolean) measure. Non inversion tillage (option: yes or no)
M_SSPM	(boolean) measure. Soil Structure Protection Measures, such as fixed driving lines, low pressure tires, and light weighted machinery (option: yes or no)
M_SOLIDMANURE	(boolean) measure. Use of solid manure (option: yes or no)
M_STRAWRESIDUE	(boolean) measure. Application of straw residues (option: yes or no)
M_MECHWEEDS	(boolean) measure. Use of mechanical weed protection (option: yes or no)
M_PESTICIDES_DST	(boolean) measure. Use of DST for pesticides (option: yes or no)
ID	(character) A field id
output	(character) An optional argument to select output: obic_score, scores, indicators, recommendations, or all. (default = all)

### Details

It is assumed that the crop series is a continuous series in decreasing order of years. So most recent year first, oldest year last.

### Value

The output of the Open Bodem Index Calculator for a specific agricultural field. Depending on the output type, different output objects can be returned. These include the estimated OBI scores (both total and aggregated subscores), the value of the underlying indicators as well the possible recommendations to improve the soil quality. The output is always a data.table.

### Examples

```
## Not run:
obic_field( B_SOILTYPE_AGR = 'rivierklei', B_GWL_CLASS = "II", B_GWL_GLG = 75, B_GWL_GHG = 10,
  B_GWL_ZCRIT = 50, B_SC_WENR = '2', B_HELP_WENR = "Mob72", B_AER_CBS = 'LG01',
  B_LU_BRP = c( 1010, 1010, 263, 263, 263, 265, 265, 265), A_SOM_LOI = 3.91, A_SAND_MI = 66.3,
  A_SILT_MI = 22.8, A_CLAY_MI = 7.8, A_PH_CC = 5.4, A_N_RT = 1528.33, A_CN_FR = 13.02,
```

```

A_S_RT = 321.26,A_N_PMN = 63.3,A_P_AL = 50.2,A_P_CC = 2.9,A_P_WA = 50.5,
A_CEC_CO = 56.9,A_CA_CO_PO = 66.87,A_MG_CO_PO = 13.97,A_K_CO_PO = 3.06,
A_K_CC = 58.6,A_MG_CC = 77.53,A_MN_CC = 7586.61,A_ZN_CC = 726.2,A_CU_CC = 68.8,
A_C_BCS = 1,A_CC_BCS = 1,A_GS_BCS = 1,A_P_BCS = 1,A_RD_BCS = 1,A_EW_BCS = 1,
A_SS_BCS = 1,A_RT_BCS = 1,A_SC_BCS = 1,M_COMPOST = 0,M_GREEN = FALSE,M_NONBARE =FALSE,
M_EARLYCROP = FALSE,M_SLEEPOSE = FALSE,M_DRAIN = FALSE,M_DITCH = FALSE,
M_UNDERSEED = FALSE,M_LIME = FALSE,M_MECHWEEDS = FALSE,M_NONINVTILL = FALSE,
M_PESTICIDES_DST = FALSE,M_SOLIDMANURE = FALSE,M_SSPM = FALSE,M_STRAWRESIDUE = FALSE)

## End(Not run)

```

---

obic\_field\_dt

*Calculate the Open Bodem Index score for a data table*

---

## Description

This functions wraps the functions of the OBIC into one main function to calculate the score for Open Bodem Index (OBI). In contrast to `obic_field`, this wrapper can handle a `data.table` as input. Multiple sites (distinguished in the column 'ID') can be simulated simultaneously.

## Usage

```
obic_field_dt(dt, output = "all")
```

## Arguments

<code>dt</code>	( <code>data.table</code> ) A <code>data.table</code> containing the data of the fields to calculate the OBI
<code>output</code>	(character) An optional argument to select output: <code>obic_score</code> , <code>scores</code> , <code>indicators</code> , <code>recommendations</code> , or <code>all</code> . (default = <code>all</code> )

## Value

The output of the Open Bodem Index Calculator for a specific agricultural field. Depending on the output type, different output objects can be returned. These include the estimated OBI scores (both total and aggregated subscores), the value of the underling indicators as well the possible recommendations to improve the soil quality. The output is always a `data.table`.

## Examples

```

## Not run:
obic_field_dt(data.table(B_SOILTYPE_AGR = 'rivierklei',B_GWL_CLASS = "II",
B_GWL_GLG = 75,B_GWL_GHG = 10,
B_GWL_ZCRIT = 50,B_SC_WENR = '2',B_HELP_WENR = "M0b72",B_AER_CBS = 'LG01',
B_LU_BRP = c( 1010, 1010,263,263, 263,265,265,265),A_SOM_LOI = 3.91,A_SAND_MI = 66.3,
A_SILT_MI = 22.8,A_CLAY_MI = 7.8,A_PH_CC = 5.4,A_N_RT = 1528.33,A_CN_FR = 13.02,
A_S_RT = 321.26,A_N_PMN = 63.3,A_P_AL = 50.2,A_P_CC = 2.9,A_P_WA = 50.5,
A_CEC_CO = 56.9,A_CA_CO_PO = 66.87,A_MG_CO_PO = 13.97,A_K_CO_PO = 3.06,

```

```

A_K_CC = 58.6,A_MG_CC = 77.53,A_MN_CC = 7586.61,A_ZN_CC = 726.2,A_CU_CC = 68.8,
A_C_BCS = 1,A_CC_BCS = 1,A_GS_BCS = 1,A_P_BCS = 1,A_RD_BCS = 1,A_EW_BCS = 1,
A_SS_BCS = 1,A_RT_BCS = 1,A_SC_BCS = 1,M_COMPOST = 0,M_GREEN = FALSE,M_NONBARE =FALSE,
M_EARLYCROP = FALSE,M_SLEEPOUSE = FALSE,M_DRAIN = FALSE,M_DITCH = FALSE,
M_UNDERSEED = FALSE,M_LIME = FALSE,M_MECHWEEDS = FALSE,M_NONINVTILL = FALSE,
M_PESTICIDES_DST = FALSE,M_SOLIDMANURE = FALSE,M_SSPM = FALSE,M_STRAWRESIDUE = FALSE))

## End(Not run)

```

---

obic\_recommendations    *Recommend measurements for better soil management*

---

### Description

This function gives recommendations better soil management based on the OBI score

### Usage

```
obic_recommendations(dt.recom)
```

### Arguments

dt.recom            (data.table) The results from [obic\\_evalmeasure](#)

---

obic\_recommendations\_bkp  
                          *Recommend measurements for better soil management*

---

### Description

This function returns a list of management recommendations based on OBI scores as part of BodemK-waliteitsPlan.

### Usage

```
obic_recommendations_bkp(dt.score, B_LU_BRP, B_SOILTYPE_AGR)
```

### Arguments

dt.score            (data.table) containing all OBI indicators and scores of a single field  
B\_LU\_BRP            (numeric) Cultivation code according to BRP  
B\_SOILTYPE\_AGR    (character) Agricultural soil type

---

pFpara\_class                      *Parameter estimation based on class of Staringreeks (Tabel 3, Wosten 2001)*

---

### Description

Parameter estimation based on class of Staringreeks (Tabel 3, Wosten 2001)

### Usage

```
pFpara_class(Pklei, Pleem, Psom, M50)
```

### Arguments

Pklei	(numeric) The clay (<2um) content of the soil (%)
Pleem	(numeric) The loam (<50um) content of the soil (%) Pleem > 0
Psom	(numeric) The organic matter content of the soil (%) Psom > 0
M50	(numeric) size of sand fraction (um)

### Value

a table with the following columns: ThetaR (numeric) residual water content (cm<sup>3</sup>/cm<sup>3</sup>) ThetaS (numeric) saturated water content (cm<sup>3</sup>/cm<sup>3</sup>) alfa (numeric) related to the inverse of the air entry suction, alfa > 0 (1/cm) n (numeric) a measure of the pore-size distribution, n>1, dimensionless ksat (numeric) saturated hydraulic conductivity (cm/d)

### Examples

```
pFpara_class(Pklei = 25, Pleem = 15, Psom = 4.5, M50 = 150)
pFpara_class(Pklei = 45, Pleem = 3, Psom = 4.5, M50 = 150)
```

---

pFpara\_ptf\_Wosten1999    *Estimate water retention curve parameters based on Wosten 1999*

---

### Description

This function estimates water retention curve parameters using Pedo transfer function of Wosten (1999) based on HYPRES

### Usage

```
pFpara_ptf_Wosten1999(Pklei, Psilt, Psom, Bovengrond)
```

**Arguments**

Pklei	(numeric) The clay content of the soil (%) within soil mineral part. Pklei > 0
Psilt	(numeric) The silt content of the soil (%) within soil mineral part. Psilt > 0
Psom	(numeric) The organic matter content of the soil (%). Psom > 0
Bovengrond	(boolean) whether topsoil (1) or not (0)

**Value**

a table with the following columns:

Dichtheid (numeric) soil bulk density (g/cm<sup>3</sup>) ThetaR (numeric) residual water content (cm<sup>3</sup>/cm<sup>3</sup>)  
 ThetaS (numeric) saturated water content (cm<sup>3</sup>/cm<sup>3</sup>) alfa (numeric) related to the inverse of the air  
 entry suction, alfa > 0 (1/cm) n (numeric) a measure of the pore-size distribution, n>1, dimension-  
 less ksat (numeric) saturated hydraulic conductivity (cm/d)

**References**

Wösten, J.H.M , Lilly, A., Nemes, A., Le Bas, C. (1999) Development and use of a database of hydraulic properties of European soils. Geoderma 90 (3-4): 169-185.

**Examples**

```
pFpara_ptf_Wosten1999(Pklei = 25, Psilt = 15, Psom = 4.5, Bovengrond = 1)
pFpara_ptf_Wosten1999(Pklei = 45, Psilt = 3, Psom = 4.5, Bovengrond = 1)
```

---

pFpara\_ptf\_Wosten2001 *Estimate water retention curve parameters based on Wosten 2001*

---

**Description**

This function estimates water retention curve parameters using Pedo transfer function of Wosten (2001)

**Usage**

```
pFpara_ptf_Wosten2001(Pklei, Pleem, Psom, M50, Bovengrond)
```

**Arguments**

Pklei	(numeric) The clay (<2um) content of the soil (%)
Pleem	(numeric) The loam (<50um) content of the soil (%) Pleem > 0
Psom	(numeric) The organic matter content of the soil (%) Psom > 0
M50	(numeric) size of sand fraction (um)
Bovengrond	(boolean) whether topsoil (1) or not (0)

**Value**

a table with the following columns: Dichtheid (numeric) soil bulk density (g/cm<sup>3</sup>) ThetaR (numeric) residual water content (cm<sup>3</sup>/cm<sup>3</sup>) ThetaS (numeric) saturated water content (cm<sup>3</sup>/cm<sup>3</sup>) alfa (numeric) related to the inverse of the air entry suction,  $\alpha > 0$  (1/cm) n (numeric) a measure of the pore-size distribution,  $n > 1$ , dimensionless ks<sub>sat</sub> (numeric) saturated hydraulic conductivity (cm/d) l (numeric) dimension parameter

**References**

Wösten, J. H. M., Veerman, G. ., de Groot, W. J., & Stolte, J. (2001). Waterretentie en doorlatendheidskarakteristieken van boven- en ondergronden in Nederland: de Staringreeks. Alterra Rapport, 153, 86. <https://doi.org/153>

**Examples**

```
pFpara_ptf_Wosten2001(Pklei = 25, Pleem = 15, Psom = 4.5, M50 = 150, Bovengrond = 1)
pFpara_ptf_Wosten2001(Pklei = 45, Pleem = 3, Psom = 4.5, M50 = 150, Bovengrond = 1)
```

---

pF\_curve

*Water retention curve*

---

**Description**

This function compute water content at given pressure head, using Van Genuchten water retention curve

**Usage**

```
pF_curve(head, thetaR, thetaS, alfa, n)
```

**Arguments**

head	(numeric) suction pressure ([L] or cm of water)
thetaR	(numeric) residual water content (cm <sup>3</sup> /cm <sup>3</sup> )
thetaS	(numeric) saturated water content (cm <sup>3</sup> /cm <sup>3</sup> )
alfa	(numeric) related to the inverse of the air entry suction, $\alpha > 0$ (1/cm)
n	(numeric) a measure of the pore-size distribution, $n > 1$ , dimensionless

**Value**

theta (numeric) water content (cm<sup>3</sup>/cm<sup>3</sup>)

The moisture content of a soil given a certain pressure head. A numeric value.



**Examples**

```
pF_curve(head = 2.2, thetaR = 0.01, thetaS = 0.35, alfa = 0.3, n = 1.6)
pF_curve(head = 4.2, thetaR = 0.01, thetaS = 0.35, alfa = 0.3, n = 1.6)
```

---

recom.obic	<i>Applicability range of measures, including literature based estimates, of effects on soil indicators</i>
------------	---

---

**Description**

This table defines the effects of 11 measures on soil indicators. This table is used internally in [obic\\_evalmeasure](#)

This table defines the effects of 11 measures on soil indicators

**Usage**

```
recom.obic
```

```
recom.obic
```

**Format**

An object of class `data.table` (inherits from `data.frame`) with 4048 rows and 11 columns.

An object of class `data.table` (inherits from `data.frame`) with 4048 rows and 11 columns.

**Details**

**m\_nr** The ID number of measure

**m\_description** The description of measure

**m\_prio** weighing factor for measure. This is not used in the script.

**m\_treshold** Threshold value of the indicator value. This is not used in the script.

**m\_order** Order of measures. When scores are tie, the measure with a smaller number is chosen.

**m\_soilfunction** description of the OBIC indicator variable

**indicator** Name of OBIC soil indicator variable

**m\_effect** Effect of measure on soil indicator. 3/2/1/0/-1

**m\_sector** type of agricultural sector: dairy/arable/vegetable/tree cultivation (in dutch)

**m\_soiltype** type of soil: sand/clay/peat/loess (in dutch)

**m\_applicability** is the measure applicable for combination of sector and soil (1/0)

---

recom.obic_bkp	<i>Effects of measures on soil indicators</i>
----------------	---

---

**Description**

This table defines the effects of 22 measures on soil indicators

**Usage**

recom.obic\_bkp

**Format**

A data.frame with 9152 rows and 11 columns:

**m\_nr** The ID number of measure

**m\_description** The description of measure

**m\_prio** weighing factor for measure. This is not used in the script.

**m\_treshold** Threshold value of the indicator value. This is not used in the script.

**m\_order** Order of measures. When scores are tie, the measure with a smaller number is chosen.

**m\_soilfunction** description of the OBIC indicator variable

**indicator** Name of OBIC soil indicator variable

**m\_effect** Effect of measure on soil indicator. 3/2/1/0/-1

**m\_sector** type of agricultural sector: dairy/arable/vegetable/tree cultivation (in dutch)

**m\_soiltype** type of soil: sand/clay/peat/loess (in dutch)

**m\_applicability** is the measure applicable for combination of sector and soil (1/0)

---

season.obic	<i>Desired growing season period for maximum yield</i>
-------------	--

---

**Description**

This table gives the required number of days before and after August 15 required for optimal yield or usability and has categories to determine yield loss having a shorter workable growing season based on Tabel 2 and several formulas from Huinink (2018)

**Usage**

season.obic

**Format**

An object of class data.table (inherits from data.frame) with 116 rows and 6 columns.

**Details**

- landuse** The name of the crop or landuse category, used to link to crops.obic\$crop\_season
- req\_days\_pre\_glg** Required number of workable days before August 15 assuming this coincides with GLG, lowest groundwater
- req\_days\_post\_glg** Required number of workable days after August 15 assuming this coincides with GLG, lowest groundwater
- total\_days** Total number of days required for optimal growth or use
- derving** Category to determine yield loss due to having a sub-optimal relative growing season length or RLG

soils.obic

*Linking table between soils and different functions in OBIC***Description**

This table helps to link the different crops in the OBIC functions with the crops selected by the user

**Usage**

soils.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 9 rows and 4 columns.

**Details**

- soiltype** The name of the soil type
- soiltype.ph** The category for this soil at pH
- soiltype.n** The category for this soil at nitrogen

tbl.ph.delta

*Table with optimal pH for different crop plans***Description**

This table contains the optimal pH for different crop plans and soil types

**Usage**

tbl.ph.delta

**Format**

An object of class `data.table` (inherits from `data.frame`) with 136 rows and 10 columns.

**Details**

**table** The original table from Handboek Bodem en Bemesting

**lutum.low** Lower value for A\_CLAY\_MI

**lutum.high** Upper value for A\_CLAY\_MI

**om.low** Lower value for organic matter

**om.high** Upper value for organic matter

**potato.low** Lower value for fraction potatoes in crop plan

**potato.high** Upper value for fraction potatoes in crop plan

**sugarbeet.low** Lower value for fraction potatoes in crop plan

**sugarbeet.high** Upper value for fraction potatoes in crop plan

**ph.optimum** The optimal pH (pH\_CaCl2) for this range

#' @references Handboek Bodem en Bemesting tabel 5.1, 5.2 en 5.3

---

waterstress.obic

*Linking table between crops, soils, groundwater tables and water induced stresses in OBIC*

---

**Description**

This table helps to link the different crops in the OBIC functions with the crops selected by the user

**Usage**

waterstress.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 393680 rows and 6 columns.

**Details**

**cropname** The name of the crop

**soilunit** The category for this soil, derived from 1:50.000 soil map

**gt** The class describing mean highest and lowest groundwater table, derived from 1:50.000 soil map

**droughtstress** The mean yield reduction due to drought (in percentage)

**wetnessstress** The mean yield reduction due to water surplus (in percentage)

**waterstress** The mean combined effect water stress (due to deficiency or excess of water)

---

weather.obic	<i>Weather table</i>
--------------	----------------------

---

**Description**

This table contains the climatic weather data of the Netherlands for the period 1990-2020

**Usage**

weather.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 12 rows and 4 columns.

**Details**

**month** Month of the year

**A\_TEMP\_MEAN** Mean monthly temperature

**A\_PREC\_MEAN** Mean monthly precipitation

**A\_ET\_MEAN** Mean monthly evapo-transpiration

---

weight.obic	<i>Weight of indicators to calculate integrated scores</i>
-------------	--

---

**Description**

This table defines the weighting factors (ranging between 0 and 1) of indicator values to calculate integrated scores.

**Usage**

weight.obic

**Format**

An object of class `data.table` (inherits from `data.frame`) with 196 rows and 5 columns.

**Details**

**var** The name of the weight

**weight** weighing factor

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