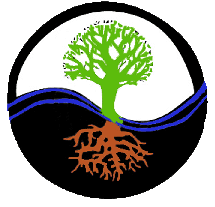
**Meta-Phenomics**

**Defining rules: Species**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Definition** | **Options** | **Remarks** |
|  |  |  |  |
| **Species** | Latin binomial name |  | no cultivar name |
| **Family** | Family system according to ?? |  |  |
| **Distribution** | Geographical distribution | Afr = Africa  Asi = Asia  Aus = Australia  Eur = Europa  NAm = North Amer  SAm = South Amer  MAm = Meso Amer |  |
| **Synonyms** | Other Latin names |  |  |
| **PClass** | Phylogenetic class | m = monocot  d = dicot  f = fern  g = gymnosperm | Bryophytes and Algae are not included |
| **LifeForm** |  | a = annual  ap = bi-annual  p = perennial |  |
| **StemForm** |  | h = herbaceous  hw = between herb. and woody  w = woody  s = succulent | Plants without stems are also categorized as herbaceous |
| **EcolPecu** | Ecological Peculiarities | e = epiphyte  h = hemi-parasite  p = parasite  v = vine  f = float. waterpl.  w = subm. waterpl. | Can be in various classes |
| **LeafHeight** | The maximum height that leaves are exposed. | h1 = < 25 cm  h2 = 25 cm << 80 cm  h3 = 80 cm << 2.5 m  h4 = 2.5 m << 8m  h5 = 8m << 25m  h6 = > 25m | Flower stalk with just a few small leaves (such as Arabidopsis) excluded. |
| **LeafHabit** | deciduous / evergreenness (for woody species) | d = deciduous  e = evergreen  de = mixed behavior | Some species are deciduous or evergreen depending on the exact climatic conditions |
| **PhotPath** | The primary photosynthetic pathway | C3 = C3  C4 = C4  CAM = CAM |  |
| **N2Fix** | Is the species in principle capable of N2-fixation | y = capable  n = not capable |  |
| **Other** | Other remarks, general |  |  |
| **Winterdeciduous** |  |  |  |
| **ShadeSun** | Ecological niche with respect to light | 1 = shade  2 = intermediate  3 = sun | Ülo: I am willing to make a thorough description for the scales, but here is the rough explanation. I have used the shade and drought scale in Niinemets and Valladares from 2006 Ecol Monogr and squeezed it to 3 level scale, exactly dividing 5 between 3 classes and then used this classification for other species. These scales are inversed compared with what you had defined, so at the end this generated the initial problem that 1 and 3 were mixed up for some species. 1: >3.66≤5 2: >2.33≤3.66 3: 1≤2.33  You can also interpret it as for instance for light: 1 = real shade species 2 = intermediate 3 = sun species |
| **InfFert** | Ecological niche with respect to nutrients | 1 = infertile  2 = intermediate  3 = fertile | In the case of N, it basically follows the Ellenberg Ellenberg for N 1-3 -> low (1) 4-6 -> medium (2) 7-9 -> high (3) |
| **DryWet** | Ecological niche with respect to water | 1 = dry  2 = intermediate  3 = wet |  |
| **ColdWarm** | Ecological niche with respect to temperature | 1 = low (boreal)  2 = intermediate  3 = high (tropical) | Temperature (approximately) 1 - tundra -cold temperate USDA zones 1-4 (sustains -20-30) 2- temperate - warm temperate- USDA zones 5-7 (sustains - 10-20) 3- subtropics, tropics, USDA zones 8-10 (above about -5-10 - in fact tolerates no true freezing)  USDA gives corresponding minimum temperatures, although as we have discussed in some cases this was somewhat difficult. |
| **GlycoHalo** | Ecological niche with respect to salinity | 1 = glycophyte  2 = intermediate  3 = halophyte | Salinity: 1 G = Glycophyte 2 I = Intermediate 3 H = Halophyte Some horticultural studies provide measurements of salt solution conductivity, but in most cases what say said is 3 ended up 2 or 1 here, except perhaps Hippohae and Abies. I can work out the conductivity estimates at some point. |
|  |  |  |  |
| **OK** | Is the paper double checked? | ok = double checked  tobedone = data still have to be entered  notused = exp. did not meet the criteria |  |
| **pdf** | Location where the accompanying pdf is stored | 1 -12 = in H:\MP folder  31-39 = in H:\PDF folder  large = in Large pdf folder  n = no pdf  nn = no pdf exists |  |
| **Interaction** | Did the experiment consist of an interaction with other env. factors? | 0 = no  1 – 12 = env. fact. # |  |
| **Growth env.** | Growth environment | C = Climate chamber  G = Glasshouse  O = OTC or shelter  Y = outside in pots  Z = outside growing in local soil |  |
| **PotVol** | Volume of Pot used (L) | -11 = hydroponics |  |
| **RoVol** | Root Volume per plant used (L)  = PotVol/# of plants | -11 = hydroponics |  |

**Defining rules: Environment**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Definition** | **Options** | **Remarks** |
|  |  |  |  |
| **LevNum** | Level # of an env. Factor that is applied | Numeric | start with the lowest level: 1 |
| **Interaction** | Interaction with other environmental factor | 0 = no interaction  1 – 14 = env. Factor |  |
| **GrEnv** | Growth Environment | C = growth Chamber  G = Glasshouse  O = OTC or shelter  Y = outside in pots  Z = outside in soil |  |
| **Comp** | Presence of competitiors | 0 = individually grown  1 = 2 – 4 plants in pot  3 = intraspecific comp.  4 = interspecific comp. |  |
| **xLiPer** | Light period (h) | numeric | for growth chambers only (or glasshouses in case it is constant) |
| **xPpfd** | PPFD (µmol m-2 s-1) | numeric | for growth chambers only |
| **xDLI** | Daily Light Integral (mol m-2 day-1) | numeric | for all growing conditions with or without variable PPFD |
| **zDli** |  | text | Light intensity described in words as in publication |
| **xTmpDay** | Temperature at day (°C) | numeric | averaged over light period |
| **xTmpNight** | Temperature at night (°C) | numeric | averaged over night period |
| **xTMP** | Temperature (°C) | numeric | averaged over 24 h |
| **zTmp** |  | text | Temperature described in words as in publication |
| **xRFR** | Red:Far ratio (mol mol-1) | numeric | growth during the whole light period |
| **zRfr** |  | text | As described in words in the publication |
| **xUVB** | UV-B (mol m-2 day-1) | numeric | integrated over the day |
| **zUvb** |  | text | As described in words in the publication |
| **xCAD** | CO2 concentration (µmol mol-1) | numeric | averaged over the day period |
| **zCad** |  | text |  |
| **xOZO** | O3 concentration (nmol mol-1) | numeric | averaged over the day |
|  |  |  |  |
| **tNUT** | type of Nutrient stress | G = general, or NP  N = Nitrogen only  P = Phosphorus only  K = Potassium only  O = Other |  |
| **xNUT** | Nutrient level | defined by total dry weight |  |
| **zNut** |  | text |  |
| **xDRO** | Drought | defined by total dry weight |  |
| **zDro** |  | text |  |
| **xWAL** | Waterlogging | 0 = no waterlogging  1 = waterlogging |  |
| **zWal** |  | text |  |
| **xSUB** | Submergence | 0 = no submergence  1 = submergence |  |
| **xSub** |  | text |  |
| **xSAL** | Salinity (fraction) | fraction of seawater |  |
| **zSal** |  | text |  |
| **xCOM** | Soil compaction (g ml-1) |  |  |
| **zCom** |  | text |  |
| **XLQQ** | Light Quantity & Quality |  | e.g. gaps in the forest, where DLI and R/FR change together |
| **zLQQ** |  | text |  |
|  |  |  |  |

**Defining rules: Trait data**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Definition** | **Options** | **Remarks** |
| ***1. Morphology / Anatomy*** |  |  |  |
| **LMA** | Leaf Mass per Area (g m-2) |  | leaf dry mass per unit leaf area |
| **LeTh** | Cross section leaf: Thickness (µm) | numeric | Total leaf thickness |
| **VfM** | Cross section leaf: Volumetric fraction of leaf in Mesophyl | 0 - 1 | Thickness mesophyll / total leaf thickness |
| **VfP** | Cross section leaf:  Volumetric Fraction of Mesophyl in Palisade Parenchyma | 0 - 1 | Thickness palisade mesophyll / total palisade plus spongy mesophyll |
| **NoPL** | Number of Palisade parenchyma Layers | > 0.5 | 1, 2, 3, 4 for well-developed layers, +0.5 for a palisade layer which either has no clear aligning adjacent cells, and/or is less than 2x long vs wide. Minimum value is 0.5. Grasses are not considered |
| **Ames/A** | Area of mesophyll adjacent to intercellular spaces relative to leaf area (m2 m-2) | numeric | Either Ames/A or Sm/S (no/yes only the area adjacent tioo intercellular spaces |
| **MeTh** | Mesophyl Thickness | numeric | Can be measured from photographs in publications |
| **StDen**  **(SDab)** | Stomatal density (# mm-2) | numeric | abaxial plus adaxial sensity, or abaxial if this is the only count given |
| **LeDe** | Leaf Density (g cm-3) | numeric | See also LDMC |
| **LDMC** | Leaf Dry Matter Content (%) | numeric | dry weight : fresh weight leaves  (overlaps with LD !) |
| **SDMC** | Stem Dry Matter Content (%) | numeric | dry weight : fresh weight stem |
| **RDMC** | Root Dry Matter Content (%) | numeric | dry weight : fresh weight root |
|  |  |  |  |
| **ILA** | Individual leaf area ( cm2) | numeric | Can be either of a specific leaf, or average over all leaves |
| **PlHe** | Plant Height (cm) | numeric | measured from ground level to the shoot apex or highest leaf tip |
| **StDia** | Stem diameter (mm) | numeric | Also include 'root collar diameter' |
| **SlInd** | Slenderness index (m/m) | numeric | Plant height / stem diameter |
| **SSL** | Specific Stem Length (m g-1) | numeric | stem length /stem mass |
| **InLe** | Internode Length (cm) | numeric | Length between 2 internodes |
| **NoBT**  **(NoT)** | Number of Branches/shoots or Tillers | numeric | Number of tillers in case of grasses or side shoots in case of dicots, including the main tiller/shoot |
| **PlInd** | Plastochron Index | numeric | Plastochron Index, or number of leaves in main stem when not yet mature |
| **SRL** | Specific Root Length (m g-1) | numeric |  |
| **VfC** | Volumetric fraction of Cortex | numeric |  |
| **DADadL** | Did Author Determine anatomical details Leaf? | text, indicate what has been measured |  |
|  |  |  |  |
| ***2. Chemical Composition*** |  |  |  |
| **NtotA** | [N total] Leaf per area (g m-2) | numeric | Total N, including nitrate |
| **NtotL** | [N total] Leaf (mg g-1) | numeric | Total N, including nitrate |
| **NtotS** | [N total] Stem (mg g-1) | numeric | Total N, including nitrate |
| **NtotR** | [N total] Root (mg g-1) | numeric | Total N, including nitrate |
| **NorgA** | [N organic] Leaf per area (g m-2) | numeric | Total N, excluding NO3 |
| **NorgL** | [N organic] Leaf (mg g-1) | numeric | Total N, excluding NO3 |
| **NorgS** | [N organic] Stem (mg g-1) | numeric | Total N, excluding NO3 |
| **NorgR** | [N organic] Root (mg g-1) | numeric | Total N, excluding NO3 |
| **CarL** | Carbon concentration Leaf (mg g-1) | numeric |  |
| **CarS** | Carbon concentration Stem (mg g-1) | numeric |  |
| **CarR** | Carbon concentration Root (mg g-1) | numeric |  |
| **CNrL** | Carbon:Nitrogen ratio Leaf (g g-1) | numeric |  |
| **CNrS** | Carbon:Nitrogen ratio Stem (g g-1) | numeric |  |
| **CNrR** | Carbon:Nitrogen ratio Root (g g-1) | numeric |  |
| **PtotL** | [P total] Leaf (mg g-1) | numeric |  |
| **PtotS** | [P total] Stem (mg g-1) | numeric |  |
| **PtotR** | [P total] Root (mg g-1) | numeric |  |
| **NPrL** | N/P ratio Leaf (g g-1) |  |  |
| **NO3L** | [Nitrate] Leaf (mg g-1) | numeric |  |
| **NO3S** | [Nitrate] Stem (mg g-1) | numeric |  |
| **NO3R** | [Nitrate] Root (mg g-1) | numeric |  |
| **MinL** | [Minerals] Leaf (mg g-1) | numeric | minerals or ash |
| **MinS** | [Minerals] Stem (mg g-1) | numeric | minerals or ash |
| **MinR** | [Minerals] Root (mg g-1) | numeric | minerals or ash |
| **TncL** | [TNC] Leaf (mg g-1) | numeric |  |
| **TncS** | [TNC] Stem (mg g-1) | numeric |  |
| **TncR** | [TNC] Root (mg g-1) | numeric |  |
| **Ss/TncL** | fraction of TNC in Soluble Sugars in the Leaves |  |  |
| **Ss/TncR** | fraction of TNC in Soluble Sugars in the Roots | 0 – 1 |  |
| **ChlTo** | Chlorophyll content leaves (µmol m-2) | numeric |  |
| **ChlA/B** | Chlorophyll a:b ratio | 1 – 5 |  |
| **CHL/N** | Chlorophyl to N ratio (mmol mol-1) | numeric | preferably at a N-organic basis |
| **VAZc** | VAZ / Chlorophyll (mmol mol-1) | numeric |  |
| **SoPhL** | [Soluble Phenolics] Leaf (mg g-1) | numeric |  |
| **DADccS** | Did Author Determine the chemical composition of the Stem? | text, indicate what has been measured |  |
| **DADccR** | Did Author Determine the chemical composition of the Root? | text, indicate what has been measured |  |
|  |  |  |  |
| ***3. Physiology*** |  |  |  |
| **AbsL** | Absorptance Leaf (%) | 0 - 100 |  |
| **RefL** | Reflectance Leaf (%) | 0 - 100 |  |
| **TrmL** | Transmittance Leaf (%) | 0 - 100 |  |
| **EzRub** | Rubisco Enzyme per unit area  Expression is variable, how to solve? | numeric | only for leaves |
| **Vmax** | Vcmax derived from A-pi curves (µmol m-2 s-1) | numeric | at saturating light and CO2 |
| **Jmax/Vmax** | Ratio of Jmax / Vcmax | numeric |  |
| **AQY** | Apparent Quantum Yield (mmol CO2 mol-1 quanta) | numeric | Not QY of PSII ! |
| **Fv/Fmn** | Fv/Fm measured at nocturnal period (predawn) | 0 - 1 |  |
| **Fv/Fmd** | Fv / Fm measured during the diurnal period (midday) | 0 - 1 |  |
|  |  |  |  |
| **PSlom** | level of measurement (of PhotoSynthesis) | 1 = leaf  2 = whole plant |  |
| **PSasl** | PhotoSynthesis per unit leaf area measured at saturating light levels (µmol m-2 s-1) | numeric | saturating light, ambient CO2 |
| **PSmsl** | PhotoSynthesis per unit leaf mass measured at saturating light levels (nmol g-1 s-1) | numeric | saturating light, ambient CO2 |
| **PScsl** | PhotoSynthesis per unit chlorophyll measured at saturating light conditions (mmol mol-1 s-1) | numeric | saturating light, ambient CO2 |
| **PSagl** | PhotoSynthesis per unit leaf area measured at growth light conditions (nmol g-1 s-1) | numeric | growth light, ambient CO2 |
| **PSmgl** | PhotoSynthesis per unit leaf mass measured at growth light conditions (µmol m-2 s-1) | numeric | growth light, ambient CO2 |
| **PSngl** | Photosynthesis per uit leaf org. N at growth light conditions (PNUE)  (µmol mol-1 s-1) | numeric | growth light, ambient CO2 |
|  |  |  |  |
| **Trsp** | Transpiration rate per unit leaf area, measured under growth conditions | numeric | Exclude transpiration rates measured from a single leaf enclosed in a cuvette |
| **Gs** | stomatal conductance measured at growth conditions (mmol m-2 s-1) | numeric | Could be from a single leaf in a leaf chamber |
| **ci/ca (pi/pa)** | intercellular CO2 partial pressure at growth conditions (fraction) | 0 – 1 |  |
| **D13C** | Δ 13C (‰) | Numeric | Recalculate ð to Δ |
| **iWUE** | instantenous Water Use Efficiency (mmol CO2 mol-1 H2O) | numeric | Only A/gs ! Not A/E. |
| **WUEg** | Water Use Efficiency at growth level (g increase g H2O transpired) | numeric | Imclude both studies at the shoot and the whole plant level |
| **WsWPn**  **(WsWPp)** | Water Potential measured at nocturnal period (predawn) | numeric | any organ |
| **WsWPd**  **(WsWPl)** | Water Potential measured during the diurnal period | numeric | any organ |
| **WsOP** | Osmotic Potential | numeric | any organ |
| **WsTu** | Turgor | numeric | any organ |
| **RWCL** | Relative Water Content of the Leaves | numeric | relative to 100% |
|  |  |  |  |
| **LRlom** | level of measurement (of Leaf Respiration) | 4 = not reliable  5 = doubtful  6 = reliable |  |
| **LRa** | Leaf Respiration (µmol m-2 s-1) per unit leaf area | numeric | can be both on O2 or CO2 basis; generally single leaf |
| **LRm**  **(LR)** | Leaf Respiration (nmol g-1 s-1) per unit leaf mass | numeric | can be both on O2 or CO2 basis; generally single leaf |
| **ShR** | Shoot Respiration (nmol g-1 s-1) per unit shoot mass | numeric | can be both on O2 or CO2 basis; whole shoots |
| **RR** | Root Respiration (nmol g-1 s-1) per unit root mass | numeric | can be both on O2 or CO2 basis |
| **EzSuSy** | Sucrose synthase Enzyme | numeric | only for leaves |
| **EzAGP** | AGPase Enzyme | numeric | only for leaves |
| **EzNR** | Nitrate Reductase Enzyme | numeric | only for leaves |
| **DADez** | Did Author Determine other enzymes, or how did they determine the 4 enzymes listed? | text, indicate what has been measured | only for leaves |
|  |  |  |  |
| ***4. Growth and reproduction*** |  |  |  |
| **SoD** | Stage of development | 1 = vegetative  2 = flowering  3 = fruiting  13 = vegetative for RGR traits and physiology, but fruiting for generative traits |  |
|  |  |  |  |
| **RGR** | Relative Growth Rate (mg g-1 day-1) | numeric |  |
| **ULR** | Unit Leaf rate (g m-2 day-1) | numeric | increase in biomass per unit leaf area and time  also: NAR |
| **LAR** | Leaf Area Ratio (m2 kg-1) | numeric | leaf area / unit total plant weight |
| **SLA** | Specific Leaf Area (m2 kg-1) | numeric | leaf area per unit leaf dry mass. Averaged over the last part of a growing period with various harvests, or end of the growing period at 1 harvest |
| **LMF** | Leaf Mass Fraction (g g-1) | numeric | leaf dry mass per unit total vegetative plant mass |
| **SMF** | Stem Mass Fraction (g g-1) | numeric | stem dry mass per unit total vegetative plant mass |
| **RMF** | Root Mass Fraction (g g-1) | numeric | root dry mass per unit total vegetative plant mass |
|  |  |  |  |
| **CoCoL** | Construction Costs Leaf (g glucose g-1 DM) | numeric |  |
| **PBT** | PayBack Time of the leaves (days) | numeric | whole-plant PBT is excluded |
| **TDM** | Total Dry Mass of the plant (vegetative) (g) | numeric | reproductive structures excluded! |
| **DMsh** | Dry Mass of the shoot (g) | numeric | reproductive structures excluded! |
| **DMro** | Dry Mass of the root (g) | numeric | reproductive structures excluded! |
| **OEPS** | Other Estimate of Plant Size (area, leaf number) | numeric | used for a relative assessment of size |
|  |  |  |  |
| **TtF** | Time to Flower (days) | numeric | From the start of the experimental treatment |
| **ISM** | Individual Seed Mass (g) | numeric |  |
| **NoSF** | Number of Seeds or Fruits per plant | numeric | Exclude complicated cases where species have fruits with many seeds (like tomato) |
| **HItb** | Harvest Index (or reproductive effort) of total plant (g g-1) | numeric | weight of economic part or reproductive part / total weight |
| **HIab** | Harvest Index (or reproductive effort) per aboveground (g g-1) | numeric | weight of economic part / aboveground weight |
| **DMgen** | Dry Mass of the generative parts (g) | numeric |  |
|  |  |  |  |

**Defining rules: Articles**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Definition** | **Options** | **Remarks** |
|  |  |  |  |
| **YearP** | Year of publication | numeric | (2222) in case of unpublished data |
| **Author** | Author(s) + year of publ. |  |  |
| **Source** | Journal or book |  |  |
| **OK** | Double-checked |  | Is the paper double- checked for growth conditions etc. |
| **PDF** | Is a pdf presently in store? | 1–14 = in H:\10-MP  gl = in general literature H:\  large = in D:\  n = not present,  nn = no pdf exists  r = present as reprint only |  |

**Defining rules: Housekeeping**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field Name** | **Definition** | **Options** | **Remarks** |
|  |  |  |  |
| **ExpNum** | Number of a specific experiment | numeric | one multi-factorial exp = 1 number; various independent exps in 1 paper = more than 1 number |
| **ObsSt** | Status of the Observation | 1 = single  2 = double  3 = with interactions | Some records are double in MPD because they belong to 2 or more dose-response curves |
| **ObsOp** | Is the observation the optimal condition? | 0 = sub-optimal  1 = optimal | within the experiment, for growth |

**Codes of filenames in MP-store**

|  |  |  |  |
| --- | --- | --- | --- |
| **Codes** | **Definition** |  |  |
|  |  |  |  |
| **--x123** | PDF data entered, x indicates letter of treatment folder in which the pdf file is stored |  |  |
| **--dnu** | Do not use these data, for reasons explained as annotation in the pdf |  |  |
| **No "--" mark yet** | File is only downloaded, not digitised and entered in the database |  |  |
|  |  |  |  |

PDF files: code

|  |  |  |  |
| --- | --- | --- | --- |
| **Environmental Factor** | **Abbreviation** | **File number** | **Explanation** |
|  |  |  |  |
| **1. Light** | LIRR | --a | Light; IRRadiance |
| **2. R:FR** | LIQU | --b | LIght QUality |
| **3. UV-B** | UVBR | --c | UV-B Radiation |
| **4. [CO2]** | CADI | --d | CArbon DIoxide |
| **5. [O3]** | OZON | --e | OZONe |
| **6. Nutrients** | NUTR | --f | NUTRients |
| **7. Drought** | DROU | --g | DROUght |
| **8. Waterlogging** | WALO | --h | WAter LOgging |
| **9. Submergence** | SUBM | --i | SUBMergence |
| **10. Temperature** | TEMP | --j | TEMPerature |
| **11. Salinity** | SALT | --k | SALiniTy |
| **12. Soil Compaction** | SOCO | --l | SOil COmpaction |
| **13. Light & R:FR** | LQ&Q | --m | Light Quantity & Quality |
| **14. Day length** | DALE | --n | DAy LEngth |
| **15. Humidity** | HUMI | --n | HUMIdity |