**BiomeE simulations for DBEN**

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**1. Model run setting:**

aCO2: 412 ppm

eCO2: 562 ppm

Disturbance: stand-replacing (resetting to initial conditions) and stochastic with mean frequency of:

0.01, 0.02, 0.04, 0.08, 0.20, 0.40 (corresponding to the file names: \_01, \_02, \_04, \_08, \_20, \_40)

DBHbins

[0, 1, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 150, 200, 9999]

**2. Output variables:**

**In “cohort\_yearly” files, the variables are description of the trees in this cohort. Since the trees are identical in a cohort, the description for one tree is for the whole cohort.**

yr: year

cNo. cohort sequential number (from tallest to shortest). The cohorts are sorted according to their height from the tallest to the shortest.

cID: cohort ID

PFT: PFT number (specific for each site)

Woody : 1 for woody, 0 for herbaceous

Layer: crown layer, 1 is the top layer

Density: number of trees in a hectare of land (10000 m2)

f\_L: the crown area fraction of this cohort. Adding up all cohorts is the crown area index of vegetation

dbh: Diameter (m)

height: Tree height (m)

Acrown: Crown area of a tree in this cohort (m2)

Aleaf: total leaf area of a tree in this cohort (m2)

bl: Leaf biomass of a tree in this cohort (kgC/tree)

br: Fine root biomass of a tree in this cohort (kgC/tree)

bSW: Sapwood biomass of a tree in this cohort (kgC/tree)

bHW: Heart wood biomass of a tree in this cohort (kgC/tree)

seed: total seed carbon of a tree in this cohort (kgC/tree)

nsc: non-structural carbon in a tree (kgC/tree)

GPP: Gross primary production of a tree (or a grass) (kgC/tree/year)

NPP: Net primary production of a tree (or a grass) (kgC/tree/year)

dDBH: Annual diameter growth of a tree in this cohort in this year (mm/year)

dBA: Annual basal area growth (m2/year)

Gtree: total growth of a tree (kgC/tree/year), including carbon allocated to seeds, leaves, fine roots, and wood (sapwood only because new wood is sapwood)

f\_sd: fraction of Gtree to seeds

f\_lf: fraction of Gtree to leaves

f\_fr: fraction of Gtree to fine roots

f\_wd: fraction of Gtree to wood

mu: mortality rate of this cohort in this year (by the way, Density is the number of trees in this cohort before mortality happens. We let the yearly mortality happens at the end of a year)

In “Ecosystem\_yearly”, the variables are land area normalized, which is a summary of ecosystem-level properties. I included carbon, nitrogen, and water stocks and fluxes, though the protocol only asks for heterotrophic respiration (Rh, kgC/m2/year).

**3. Site specific notes**

**Finland (FIN):** Lon 23.25°, Lat 62.25° Boreal: Pinus sylvestris - shade intolerant needleleaf (PFT1), Picea abies - shade tolerant needleleaf (PFT2), Betula pendula - shade intolerant broadleaf deciduous (PFT3), Grasses combined (PFT8).

BiomeE FIN PFTs:

|  |  |  |
| --- | --- | --- |
| PFT No. | Plant type | Protocol PFT No. |
| 1 | C3 Grass | PFT 8 |
| 2 | Shade intolerant evergreen | PFT 1 |
| 3 | Shade tolerant evergreen | PFT 2 |
| 4 | Shade intolerant deciduous | PFT 3 |

Specifically defined parameters (Species 1, 2, 3, and 4 are used):

envi\_fire\_prb = 0.4, ! 0.0, 0.01, 0.02, 0.04, 0.08, 0.2, 0.4

! species 0 1 2 3 4 5

lifeform = 0, 0, 1, 1, 1, 1, ! 0: grass; 1 Woody

phenotype = 0, 0, 1, 1, 0, 1, ! 0: Deciduous; 1 Evergreen

pt = 1, 0, 0, 0, 0, 0, ! 0: C3; 1: C4

tc\_crit\_on = 12., 8., 0.0, 0.0, 10., 15., ! degree C, converted to K in spdata

tc\_crit\_off = 15., 10., 0.0, 0.0, 12., 0.0, ! degree C, converted to K in spdata

gdd\_crit = 300., 50., 0.0, 0.0, 60., 0.0,

s0\_plant = 0.02, 0.005, 0.05, 0.05, 0.02, 0.05, ! initial size of seedlings

LMA = 0.02, 0.02, 0.08, 0.14, 0.025, 0.08, ! Leaf mass per unit area, 0.035

phiRL = 1.0, 1.0, 1.2, 1.5, 0.8, 1.2, ! Root/Leaf area ratio

rho\_wood = 120., 80., 320., 350., 320., 350.,

v\_seed = 0.4, 0.4, 0.1, 0.1, 0.1, 0.1, ! Seed allocation

LNbase = 0.6E-3, 1.0E-3, 0.6E-3, 0.5E-3, 0.8E-3, 0.5E-3, ! kgN m-2 leaf, Vmax = 0.03125\*LNbase (Unit: mol m-2 s-1)

m\_cond = 7.0, 7.0, 9.0, 9.0, 9.0, 9.0,

laimax = 2.0, 2.0, 3.2, 3.5, 3.0, 3.5, ! maximum crown LAI

phiCSA = 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, ! ratio of Asap/Acrown

r0mort\_c = 0.05, 0.05, 0.03, 0.01, 0.02, 0.02, ! canopy tree mortality rate, year-1

A\_sd = 4.0, 4.0, 9.0, 9.0, 9.0, 9.0, ! Seedling mortality parameter

AgeRepro = 0, 0, 5, 5, 5, 5

**Bialowieza (BIA)**: Lon 23.75°, Lat 52.75° Temperate; Picea abies - shade tolerant needleleaf (PFT2), Betula spp.- Shade intolerant broadleaf deciduous (PFT3), Carpinus betulus or Tilia cordata - (intermediate) shade tolerant broadleaf deciduous (PFT4), Grasses (PFT8).

BiomeE BIA PFTs:

|  |  |  |
| --- | --- | --- |
| PFT No. | Plant type | Protocol PFT No. |
| 1 | C3 Grass | PFT 8 |
| 2 | Shade tolerant evergreen | PFT 2 |
| 3 | Shade intolerant deciduous | PFT 3 |
| 4 | Shade tolerant deciduous | PF T4 |

Specifically defined parameters (Species 1, 2, 3, and 4 are used):

! species 0 1 2 3 4 5

lifeform = 0, 0, 1, 1, 1, 1, ! 0: grass; 1 Woody

phenotype = 0, 0, 1, 0, 0, 1, ! 0: Deciduous; 1 Evergreen

pt = 1, 0, 0, 0, 0, 0, ! 0: C3; 1: C4

tc\_crit\_on = 12., 10., 0.0, 12., 12., 0., ! degree C, converted to K in spdata

tc\_crit\_off = 15., 12., 0.0, 15., 15., 0.0, ! degree C, converted to K in spdata

gdd\_crit = 300., 80., 0.0, 120., 120., 0.0,

s0\_plant = 0.02, 0.005, 0.06, 0.02, 0.02, 0.05, ! initial size of seedlings

LMA = 0.02, 0.02, 0.14, 0.025, 0.025, 0.08, ! Leaf mass per unit area, 0.035

phiRL = 1.0, 1.0, 1.5, 1.0, 1.1, 1.2, ! Root/Leaf area ratio

rho\_wood = 120., 80., 350., 300., 320., 350.,

v\_seed = 0.4, 0.4, 0.1, 0.1, 0.1, 0.1, ! Seed allocation

LNbase = 0.6E-3, 1.0E-3, 0.4E-3, 0.8E-3, 0.7E-3, 0.5E-3, ! kgN m-2 leaf, Vmax = 0.03125\*LNbase

m\_cond = 7.0, 7.0, 9.0, 9.0, 9.0, 9.0,

laimax = 2.0, 2.0, 3.5, 3.2, 3.3, 3.5, ! maximum crown LAI

Nfixrate0 = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ! 0.03 kgN kgRootC-1 yr-1

NfixCost0 = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ! N fixation carbon cost: 12 gC/gN

phiCSA = 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, ! ratio of Asap/Acrown

r0mort\_c = 0.05, 0.05, 0.01, 0.03, 0.02, 0.02, ! canopy tree mortality rate, year-1

A\_sd = 4.0, 4.0, 9.0, 9.0, 9.0, 9.0, ! Seedling mortality parameter

AgeRepro = 0, 0, 5, 5, 5, 5

**Barro Colorado Island (BCI):** Lon -79.75°, Lat 9.25° Tropical; Tropical broadleaf evergreen shade intolerant (PFT5) + Tropical broadleaf evergreen shade tolerant (PFT6) Tropical broadleaf deciduous (PFT7), Grasses (PFT8).

BiomeE BCI PFTs:

|  |  |  |
| --- | --- | --- |
| PFT No. | Plant type | Protocol PFT No. |
| 1 | C4 Grass | PFT 8 |
| 2 | Tropical broadleaf evergreen shade intolerant | PFT 5 |
| 3 | Tropical broadleaf evergreen shade tolerant | PFT 6 |
| 4 | Tropical broadleaf deciduous | PFT 7 |

Specifically defined parameters (Species 1, 2, 3, and 4 are used):

! species 0 1 2 3 4 5

lifeform = 0, 0, 1, 1, 1, 1, ! 0: grass; 1 Woody

phenotype = 0, 0, 1, 1, 0, 1, ! 0: Deciduous; 1 Evergreen

pt = 0, 1, 0, 0, 0, 0, ! 0: C3; 1: C4

s0\_plant = 0.02, 0.02, 0.05, 0.05, 0.05, 0.05, ! initial size of seedlings

LMA = 0.02, 0.02, 0.07, 0.12, 0.03, 0.08, ! Leaf mass per unit area, 0.035

phiRL = 1.5, 1.5, 1.5, 1.5, 1.2, 1.2, ! Root/Leaf area ratio

rho\_wood = 120., 80., 320., 350., 320., 400.,

v\_seed = 0.3, 0.3, 0.1, 0.1, 0.1, 0.1, ! Seed allocation

LNbase = 0.8E-3, 0.7E-3, 0.8E-3, 0.6E-3, 0.7E-3, 0.8E-3, ! kgN m-2 leaf, Vmax = 0.03125\*LNbase

laimax = 2.5, 2.5, 3.8, 4.0, 3.5, 3.5, ! maximum crown LAI

betaON = 0.2, 0.2, 0.0, 0.0, 0.9, 0.0, ! Critical soil moisture for PhenoON

betaOFF = 0.1, 0.1, 0.0, 0.0, 0.9, 0.0, ! Critical soil moisture for PhenoOFF

Nfixrate0 = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ! 0.03 kgN kgRootC-1 yr-1

NfixCost0 = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, ! N fixation carbon cost: 12 gC/gN

phiCSA = 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, 0.25E-4, ! ratio of Asap/Acrown

r0mort\_c = 0.2, 0.2, 0.04, 0.02, 0.02, 0.02, ! canopy tree mortality rate, year-1

m\_cond = 7.0, 7.0, 9.0, 9.0, 9.0, 9.0,

A\_sd = 4.0, 4.0, 9.0, 9.0, 9.0, 9.0, ! Seedling mortality parameter

AgeRepro = 0, 0, 5, 5, 5, 5

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