

Community Dynamics Simulation

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3/25/2019

Run model

The Ecosystem Demography (ED2) model was run using the PEcAn VM in Virtualbox. The following settings were used:

- Host = pecan.vm
- Model = ED2.2 (git)
- Site Group = All Sites
- Site = EBI Energy farm
- PFTs
 1. ebifarm.c3grass
 2. ebifarm.c4crop
 3. ebifarm.forb
- Start Date = 2004/01/01
- End Date = 2009/12/31
- ED2.cohort = ebifarm.lat40.0lon-88.0.css
- ED2.patch = ebifarm.lat40lon-88.0.pss
- ED2.site = ebifarm. lat40.0lon88.0.site
- Ed.met_driver_header = ED_MET_DRIVER_HEADER 2004-2009
- Land use = Earth Land Surface
- Soil = FAO_
- Thermal sums = Earth Land Surface
- Vegetation = OGE2

The configuration file ED2IN was also edited by checking the “Edit config file” box. The following three sections were changed.

```
!-----!  
! ED2 File output.  For all the variables 0 means no output and 3 means HDF5 output.  !  
! !  
! IFOUTPUT -- Fast analysis.  These are mostly polygon-level averages, and the time  !  
! interval between files is determined by FRQANL  !  
! IDOUTPUT -- Daily means (one file per day)  !  
! IMOUTPUT -- Monthly means (one file per month)  !  
! IQOUTPUT -- Monthly means of the diurnal cycle (one file per month).  The number  !  
! of points for the diurnal cycle is 86400 / FRQANL  !  
! IYOUTPUT -- Annual output.  !  
! ITOUTPUT -- Instantaneous fluxes, mostly polygon-level variables, one file per year.  !  
! IOOUTPUT -- Observation time output. Equivalent to IFOUTPUT, except only at the  !  
! times specified in OBSTIME_DB.  !  
! ISOUTPUT -- restart file, for HISTORY runs.  The time interval between files is  !  
! determined by FRQHIS  !  
!-----!  
NL%IFOUTPUT = 0  
NL%IDOUTPUT = 0  
NL%IMOUTPUT = 3  
NL%IQOUTPUT = 0  
NL%IYOUTPUT = 0
```

```

NL%ITOUTPUT = 0
NL%IOOUTPUT = 0
NL%ISOUTPUT = 0
!-----!

!-----!
! ATTACH_METADATA -- Flag for attaching metadata to HDF datasets. Attaching metadata !
!                   will aid new users in quickly identifying dataset descriptions but !
!                   will compromise I/O performance significantly. !
!                   0 = no metadata, 1 = attach metadata !
!-----!
NL%ATTACH_METADATA = 1
!-----!

!-----!
! UNITFAST -- The following variables control the units for FRQFAST/OUTFAST, and !
! UNITSTATE FRQSTATE/OUTSTATE, respectively. Possible values are: !
!           0. Seconds; !
!           1. Days; !
!           2. Calendar months (variable) !
!           3. Calendar years (variable) !
! !
! N.B.: 1. In case OUTFAST/OUTSTATE are set to special flags (-1 or -2) !
!         UNITFAST/UNITSTATE will be ignored for them. !
!         2. In case IQOUTPUT is set to 3, then UNITFAST has to be 0. !
! !
!-----!
NL%UNITFAST = 1
NL%UNITSTATE = 1
!-----!

!-----!
! OUTFAST/OUTSTATE -- these control the number of times per file. !
!                   0. Each time gets its own file !
!                   -1. One file per day !
!                   -2. One file per month !
!                   > 0. Multiple timepoints can be recorded to a single file reducing !
!                       the number of files and i/o time in post-processing. !
!                       Multiple timepoints should not be used in the history files !
!                       if you intend to use these for HISTORY runs. !
!-----!
NL%OUTFAST = 0
NL%OUTSTATE = 0
!-----!

```

Visualize results

All the Output files of the format `analysis-E-***-00-000000-g01.h5` were downloaded by selecting them from the dropdown menu and selecting the “Show Output File” button.

There is one file per month. The data format for a single month for the variable `MMEAN_LAI_PY` is shown below. Each row is a PFT and each column is a cohort.

```
library(ncdf4)
single_nc <- nc_open("ed2_results/analysis-E-2004-01-00-000000-g01.h5")
single_nc_lai <- ncvar_get(single_nc, "MMEAN_LAI_PY")
single_nc_lai
```

```
##           [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11]
## [1,] 0.06157984  0  0  0  0  0  0  0  0  0  0.002042686
## [2,] 0.03313895  0  0  0  0  0  0  0  0  0  0.000000000
## [3,] 0.05085608  0  0  0  0  0  0  0  0  0  0.001686965
## [4,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [5,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [6,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [7,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [8,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [9,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [10,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [11,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [12,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [13,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [14,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [15,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [16,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
## [17,] 0.00000000  0  0  0  0  0  0  0  0  0  0.000000000
```

Each monthly LAI dataset is summed across cohort and only the rows for the three PFTs of interest are retained. All the monthly datasets are combined into one.

```
library(dplyr)
library(tibble)

extract_lai <- function(file_path){
  nc <- nc_open(file_path)
  lai <- ncvar_get(nc, "MMEAN_LAI_PY")
  lai_df <- data.frame(lai)
  clean_lai_df <- lai_df %>%
    transmute(LAI = rowMeans(.)) %>%
    slice(1:3) %>%
    add_column(PFT = c("c3grass", "c4crop", "forb"),
               date = substr(file_path, 24, 30)) %>%
    mutate(date = as.Date(paste0(date, "-01")))
}

nc_files <- list.files("ed2_results/", pattern = "*.h5")
nc_file_paths <- paste0("ed2_results/", nc_files)

all_lai <- lapply(nc_file_paths, extract_lai)
all_lai <- do.call(rbind, all_lai)
head(all_lai)
```

```
##           LAI      PFT      date
## 1 0.005783866 c3grass 2004-01-01
## 2 0.003012631 c4crop  2004-01-01
## 3 0.004776640 forb   2004-01-01
## 4 0.008135376 c3grass 2004-02-01
## 5 0.003429235 c4crop  2004-02-01
```

```
## 6 0.007496156    forb 2004-02-01
```

The LAI time series per PFT is plotted.

```
library(ggplot2)
```

```
ggplot(all_lai, aes(x = date, y = LAI, color = PFT)) +  
  geom_line()
```

