Warnings & disclaimers: *Currently not all studies included.... and I flip between counting papers at the start to looking more at rows, so you were forewarned on that.*

1 Current take home results

Out of 30 papers (we have currently 43 rows of data) 16 found evidence for GS x growth (any which way) and 9 found evidence for our definition of GS x growth. Those papers with any evidence are:

```
> sort(unique(eviany$paper_id))
```

```
 [1] "cuny2012"                 "delpierre2017"
 [3] "drew & downes 2018"       "etzold2021"
 [5] "francon2020"              "gao2022"
 [7] "grossiord2022"            "keenan et al 2014"
 [9] "mckown2016"               "michelot2012"
[11] "moser2019"                "oddi2022"
[13] "silvestro2023"            "soolananayakanahally2013"
[15] "wheeler2016"              "zhu2021"
```

And those papers with evidence of our definition are (side query: how come Zhang2021 is here, but not showing up above?):

```
> sort(unique(eviour$paper_id))
```

```
[1] "cuny2012"          "delpierre2017"     "drew & downes 2018"
[4] "grossiord2022"     "mckown2016"        "michelot2012"
[7] "oddi2022"          "silvestro2023"     "zhang2021"
```

and they cover both wood and plant vegetative studies:

```
> table(eviour$gsl)
```

```
plant vegetative phenology          satellite derived
                         5                          1
            wood phenology
                         5
```

Broadening beyond our definition includes studies where GS is not measured, or climate is used instead:

```
> table(eviour$gsl)
```

```
plant vegetative phenology          satellite derived
                         5                          1
            wood phenology
                         5
```

I have not checked whether that is different than random, but you can contrast that with the overall suite of GSL metrics and it looks representative to me on quick glance:

```
> table(d$gsl)

climate related to satellite phenology data
                                          1
                                       date
                                          1
                                not measured
                                          5
                     plant vegetative phenology
                                         15
                               satellite derived
                                          3
                     temperature or snow metric
                                          5
                                wood phenology
                                         12
```

They also cover a pretty wide diversity of growth metrics:

```
> table(eviany$growth) # any definition

                      annual core cell production (number of cells)
                                3                                 1
        dendrometer/circumference                  ecosystem fluxes
                                3                                 2
                           height    intra-annual core (xylogeneis)
                                4                                 3
                     photosynthesis                  root:shoot ratio
                                1                                 1
                       stem density
                                1

> table(eviour$growth) # our definition

cell production (number of cells)         dendrometer/circumference
                                1                                 2
                  ecosystem fluxes                            height
                                1                                 3
   intra-annual core (xylogeneis)                      photosynthesis
                                2                                 1
                  root:shoot ratio
                                1
```

Here's the full set of GS x growth that found it:

```
> table(eviany$gslxgrowth) # any definition

                                  not measured x annual core
                                                           1
              not measured x intra-annual core (xylogeneis)
                                                           1
                          plant vegetative phenology x height
                                                           4
plant vegetative phenology x intra-annual core (xylogeneis)
                                                           1
                 plant vegetative phenology x photosynthesis
                                                           1
              plant vegetative phenology x root:shoot ratio
                                                           1
                       satellite derived x ecosystem fluxes
                                                           2
                    temperature or snow metric x annual core
                                                           2
                   temperature or snow metric x stem density
                                                           1
         wood phenology x cell production (number of cells)
                                                           1
                  wood phenology x dendrometer/circumference
                                                           3
            wood phenology x intra-annual core (xylogeneis)
                                                           1

> table(eviour$gslxgrowth) # our definition

                plant vegetative phenology x height
                                                  3
       plant vegetative phenology x photosynthesis
                                                  1
     plant vegetative phenology x root:shoot ratio
                                                  1
              satellite derived x ecosystem fluxes
                                                  1
wood phenology x cell production (number of cells)
                                                  1
        wood phenology x dendrometer/circumference
                                                  2
   wood phenology x intra-annual core (xylogeneis)
                                                  2
```

To contrast, here's what studies that did NOT find evidence looked like:

```
> table(noeviany$gslxgrowth) # any definition

climate related to satellite phenology data x dendrometer/circumference
                                                                      1
                                                    date x annual core
                                                                      1
                                  plant vegetative phenology x annual core
                                                                      3
    plant vegetative phenology x annual core (simulated to intraannual)
                                                                      1
                                       plant vegetative phenology x biomass
                                                                      1
                                            satellite derived x annual core
                                                                      1
                                  temperature or snow metric x annual core
                                                                      1
                                wood phenology x dendrometer/circumference
                                                                      3
                           wood phenology x intra-annual core (xylogeneis)
                                                                      2

> table(noeviour$gslxgrowth) # our definition

       plant vegetative phenology x annual core
                                              3
           plant vegetative phenology x biomass
                                              1
     wood phenology x dendrometer/circumference
                                              1
wood phenology x intra-annual core (xylogeneis)
                                              1
```

2 Getting back to writing our paper

Reminder of what we expected the table we worked on since April to help us with ...

1. Section: Review three reasons for not growing
   (a) Overview paragraph of three reasons
      i. Measurement – see box/figure (include measurement only here or briefly so we move through it fast)
      ii. Resource limitation
      iii. Constraints

(b) Resource limitation, evidence for an against

i. Nutrients

ii. Water

iii. Is this more species-specific?

(c) Constraints, evidence for an against

i. Leaf life span

ii. Budset stuff ... (Zohner, Sool.)

iii. Evidence across species? Or which is species-specific

2. What do do next (The future! Is there a framework to our future directions? It would be nice if we found one)

Table will help us with this

Table will help us with this

This needs a total overhaul after the table; figure out the section headers

So, we hoped these studies would help with the prevalence of evidence for external and endogenous factors. I haven't got as far on this (and we did not consistently enter whether growth or GSL or both was limiting) but here's a quick look at the 21 papers that found evidence of external factors and 8 that found evidence of endogenous (in contrast to 6 papers that looked but did not find evidence of external or 17 endogenous factors).

For those that did, they looked at these GSL metrics:

```
> table(exoyes$gsl)

                      date                not measured
                         1                           4
plant vegetative phenology           satellite derived
                        13                           1
temperature or snow metric              wood phenology
                         4                           5
```

```
> table(endoyes$gsl)

              not measured plant vegetative phenology
                         1                           8
            wood phenology
                         4
```

And specifically:

```
> table(exoyes$gs_metric_used)

                start metric only                        start to end
                                 4                                  14
start to end (I think for SFGCC)                     suitable days
                                 1                                   1
```

```
       time with growth observed                           unsure
                               2                                2
```

```
> table(endoyes$gs_metric_used)
```

```
                     none         start metric only              start to end
                        1                         1                         8
time with growth observed                   unsure
                        1                         2
```

And these growth metrics (seems a bias towards annual core studies looking at external; we have 11 annual core results):

```
> table(exoyes$growth)
```

```
                        NDVI/greenness                              annual core
                                     1                                         8
annual core (simulated to intraannual)                                 biomass
                                     1                                         2
             dendrometer/circumference                          ecosystem fluxes
                                     3                                         2
                                height          intra-annual core (xylogeneis)
                                     5                                         3
                           photosynthesis                       root:shoot ratio
                                     2                                         1
                          stem density
                                     1
```

```
> table(endoyes$growth)
```

```
              annual core                   biomass dendrometer/circumference
                        1                         2                         4
         ecosystem fluxes          growth anomalies                    height
                        1                         1                         3
           photosynthesis          root:shoot ratio
                        1                         1
```