LE MODÈLE PDG LIGHT POUR SIMULER LA CROISSANCE FORESTIÈRE EN MÉLANGE À PARTIR DU MODÈLE À BASE ÉCO-PHYSIOLOGIQUE CASTANEA

Séminaire FOREM 2023 - Grenoble

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RÉPUBLIQUE FRANÇAISE
Liberté
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Fraternité

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ADEME
AGENCE DE LA TRANSITION ÉCOLOGIQUE

Office National des Forêts

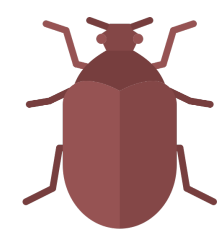
Mixed forest & biodiversity

Mixed forests seems to be ..

a better habitat for biodiversity
(Brockerhoff et al., 2017)

More productive
(Zhang et al. 2012)

More resilient to *some* perturbations
(Jactel et al. 2017)



› What about drought resistance ?

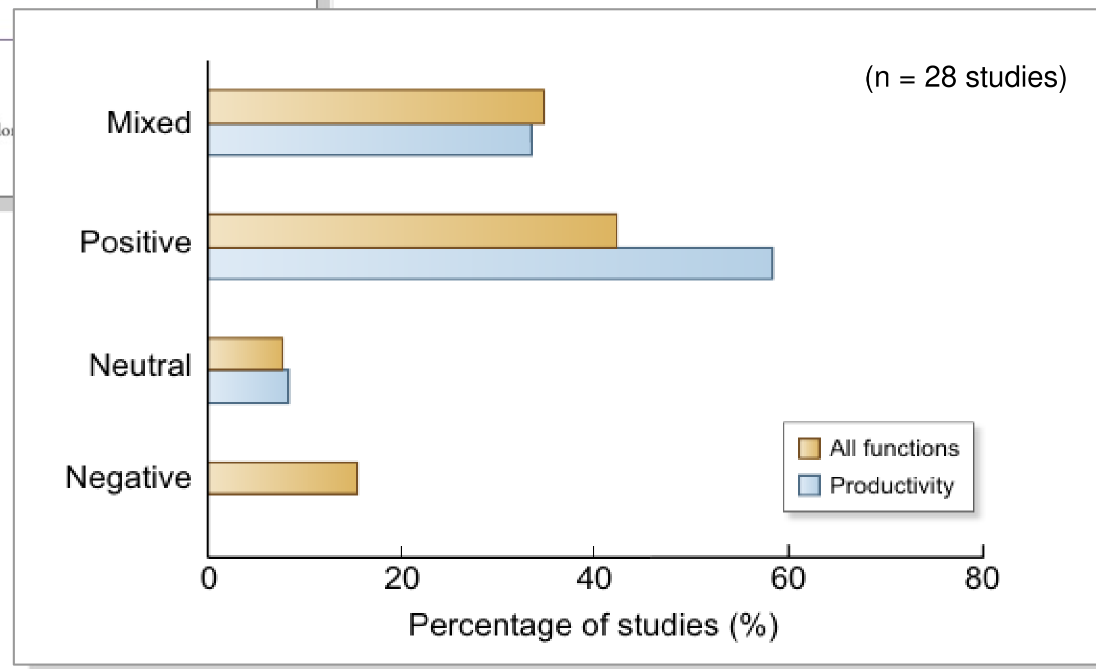
New Phytologist

Tansley insight

Having the right neighbors: how tree species diversity modulates drought impacts on forests

Charlotte Grossiord

Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Zürcherstrasse 111, Birmensdo



→ Evidence that forest tree diversity increases resistance to drought is unclear

Our understanding of mixed forest functioning

We need finer knowledge on the functioning of mixed forest (species-soil-climate combination)

+

It is costly & long to get data about forests

→ modeling of mixed forests

The modeling of mixed forests

Table 3
Forest growth models considered within this review and their spatial and temporal structure ([1] basic spatial unit; [2] shortest time step of

No	Name	Author(s)	Type	Spatial structure[1]	
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15	FINNFOR	Kellomäki and Vaisanen (1997), Kramer et al. (2002)	Process based	Cohort	
16	FORCLIM	Bugmann (1996)	Process based	Cohort	
17	FORCYTE	Kimmins and Scoullar (1989), Kimmins et al. (1990b)	Hybrid	Stand	
18	FORCYTE 11	Kimmins et al. (1990a)	Hybrid	Stand	
19	FORECAST	Kimmins et al. (1999)	Hybrid	Individual	
20	FOREST v5.1	Schwalm and Ek (2004)	Process based	Individual	
21	FOREST-BGC	Running and Coughlan (1988), Running and Gower (1991)	Process based	Stand	
22	FORGEM	Kramer et al. (2008)	Process based	Individual	Day
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43	PNET (-CN, -DAY)	Aber and Federer (1992), Aber et al. [illegible]	Process based	Stand	Month/Day
44	SECRETS	[illegible]	[illegible]	Stand	Hour
45	SILVA	Pretzsch et al. (2002)	Hybrid	Individual	5 Year
46	SIMWAL	[illegible]	[illegible]	[illegible]	Hour
47	[illegible]	[illegible]	[illegible]	[illegible]	5 Year
48	TRAGIC	[illegible]	[illegible]	[illegible]	Year
49	TREE-BGC	Korol et al. (1995)	Process based	Individual	Day
50	TREEDYN3	Bossel (1996), Kramer et al. (2002)	Process based	Stand	Day
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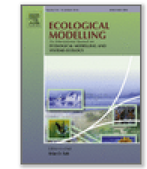

Review

Representation of species mixing in forest growth models. A review and perspective

Hans Pretzsch [a], David I. Forrester [b], Thomas Rötzer [a]

Review of 54 forest growth model

The modeling of mixed forests

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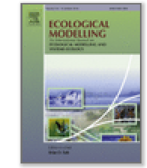
Review of
54 forest growth model

ELSEVIER



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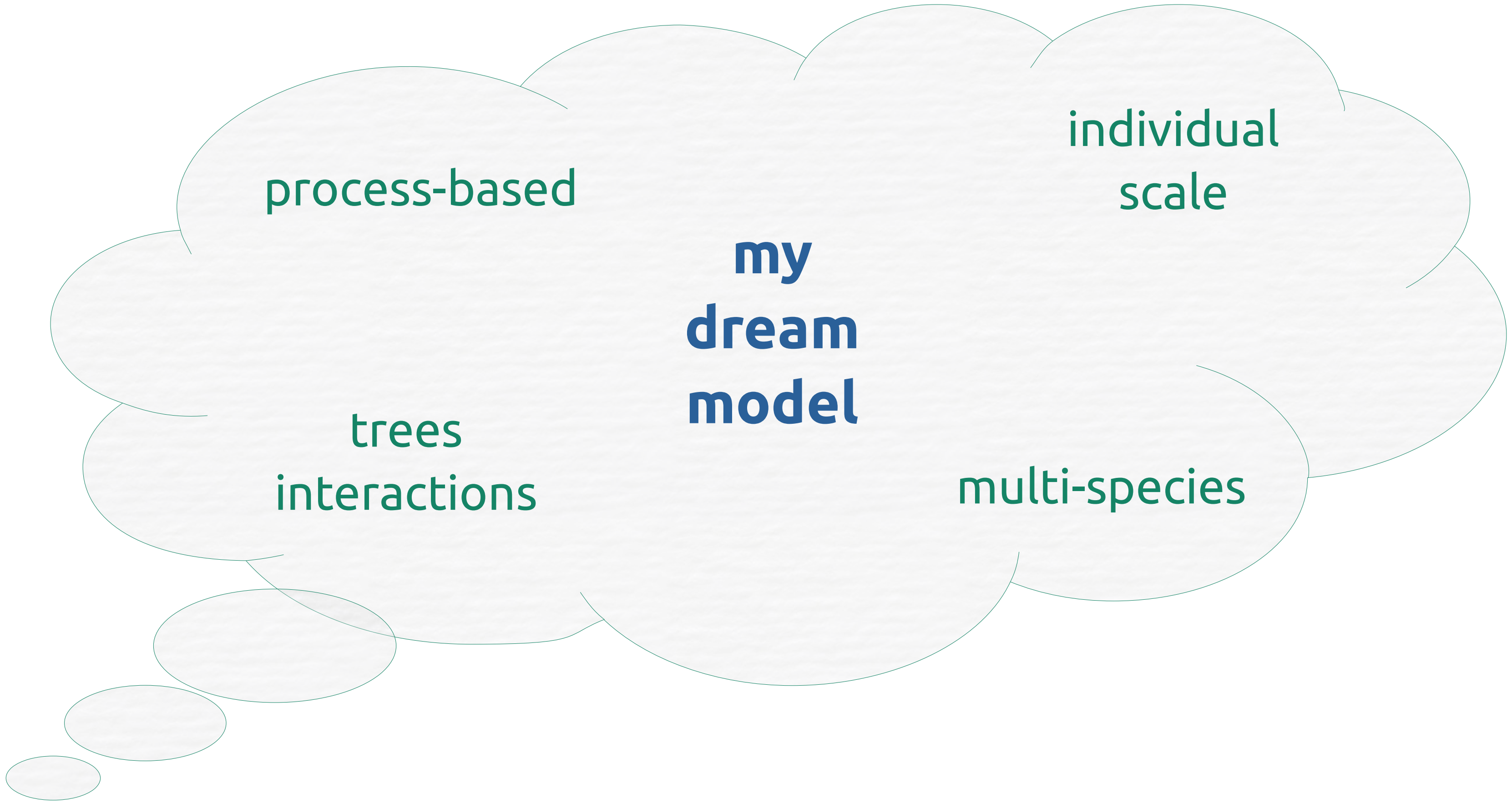
but, too few of them are :

- process-based
- at individual scale
- including tree interactions

› The modeling of mixed forests



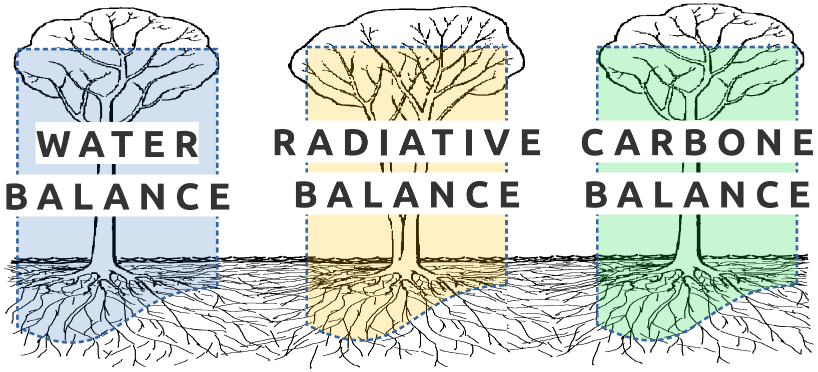
PDG Light: a new process-based model to study mixed forests

→ How are inter-specific interactions affected by climate, density and stand structure ?

PDG Light: a new process-based model to study mixed forests

CASTANEA :

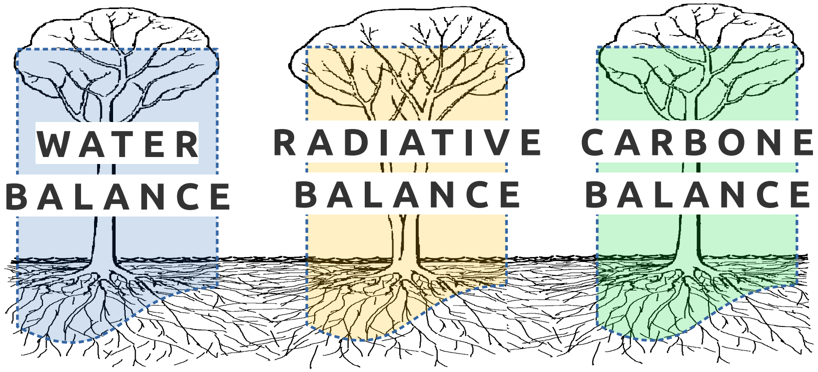
(Dufrêne et al., 2005)



STAND LEVEL

PDG Light: a new process-based model to study mixed forests

CASTANEA (Dufrêne et al., 2005) :



STAND LEVEL

PDG (Oddou-Muratorio and Davi, 2014) :

CASTANEA

+ DEMOGRAPHY AT INDIVIDUAL SCALE

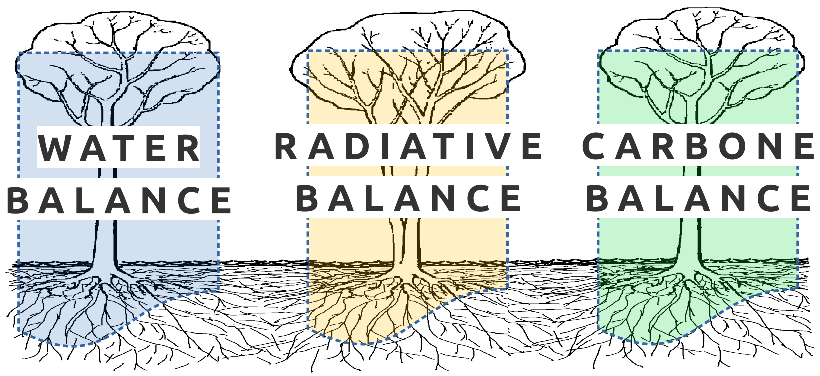
(+GENETICS DYNAMICS)

INDIVIDUAL LEVEL

PDG Light: a new process-based model to study mixed forests

CASTANEA :

(Dufrêne et al., 2005)



STAND LEVEL

PDG : **CASTANEA**

(Oddou-Muratorio and Davi, 2014)

+ DEMOGRAPHY AT INDIVIDUAL SCALE

(+GENETICS DYNAMICS)

INDIVIDUAL LEVEL

PDG Light : **PDG**

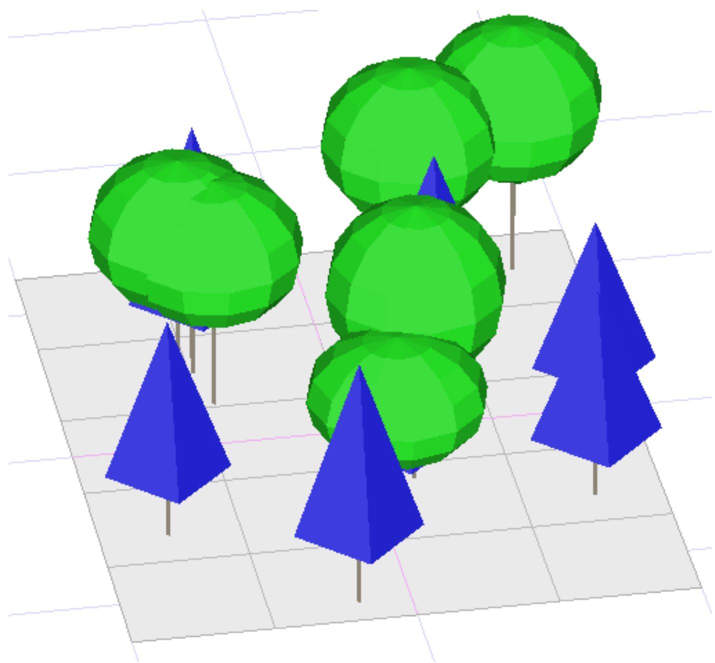
+

TREE INTERACTIONS

INDIVIDUAL LEVEL

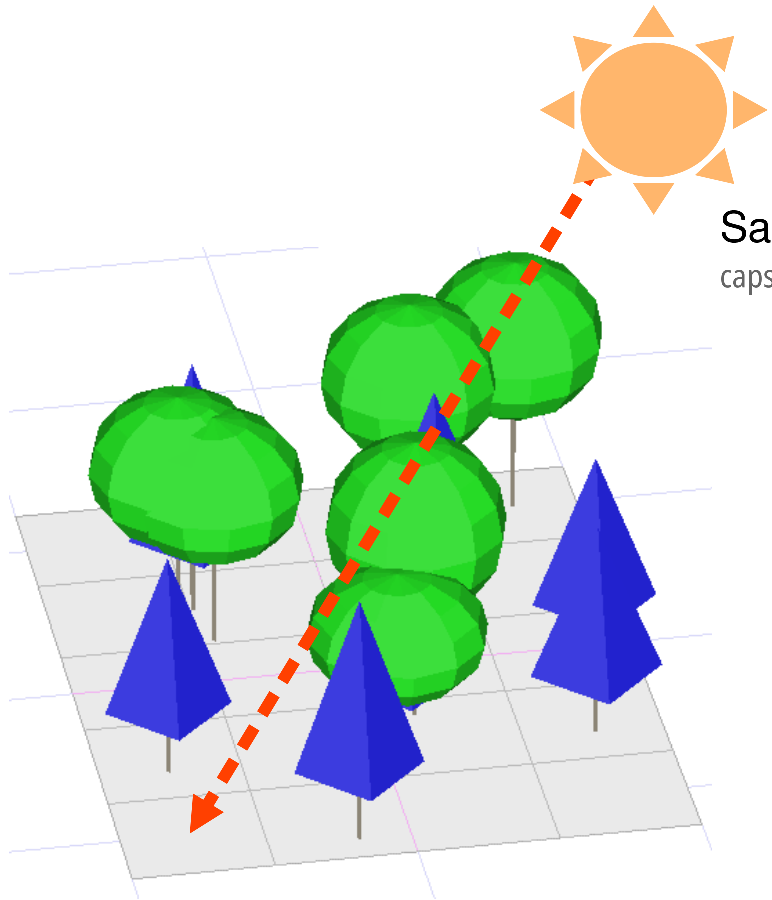
Modeling tree interactions in PDG Light

PDG Light



Modeling tree interactions in PDG Light

Competition for light



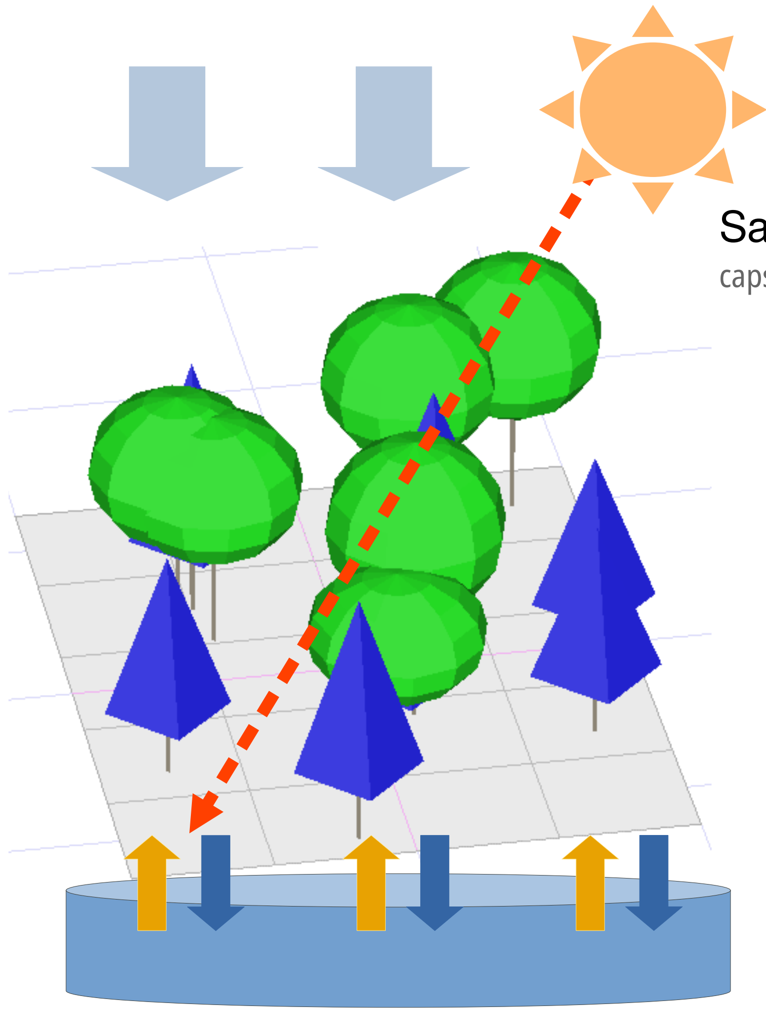
PDG Light

Samsara Light
capsis.cirad.fr/capsis/help_en/samsaralight

› Modeling tree interactions in PDG Light

PDG Light

Competition for light



Samsara Light
capsis.cirad.fr/capsis/help_en/samsaralight

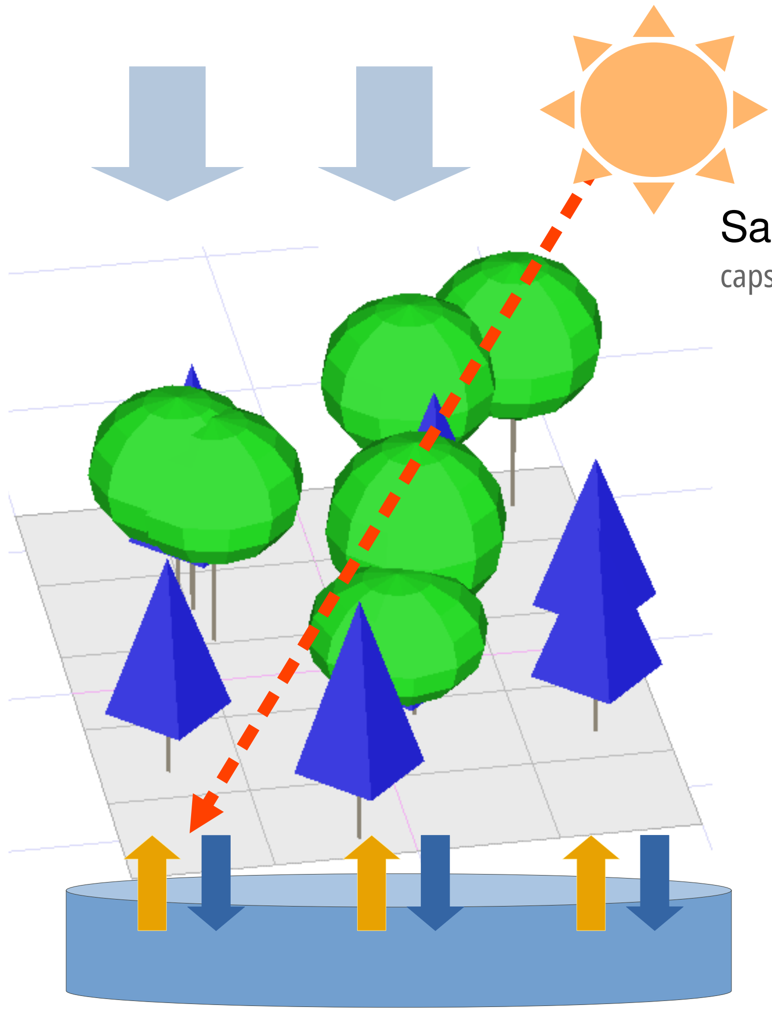
Competition for water

Modeling tree interactions in PDG Light

PDG Light

Competition for light

Complementarity in light use



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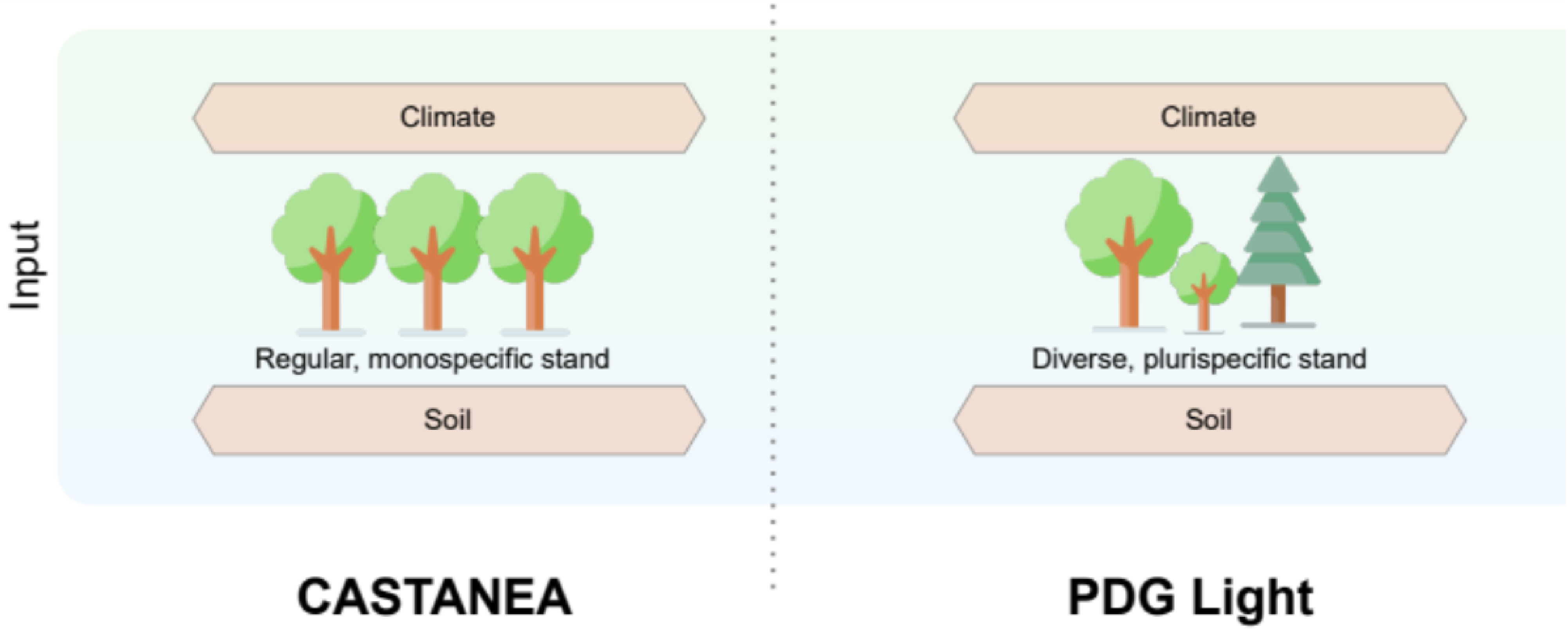
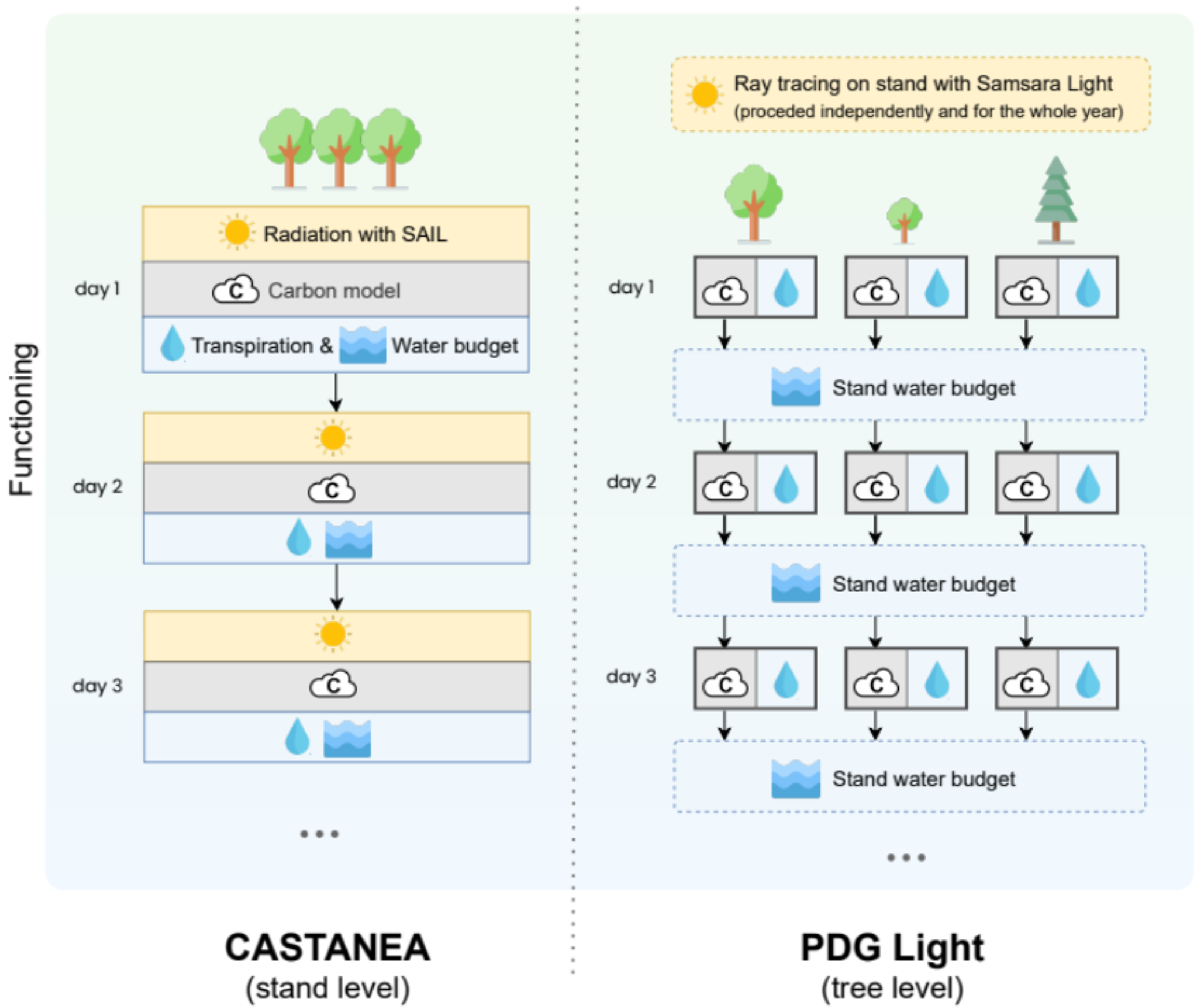
PDG Light: a new process-based model to study mixed forests

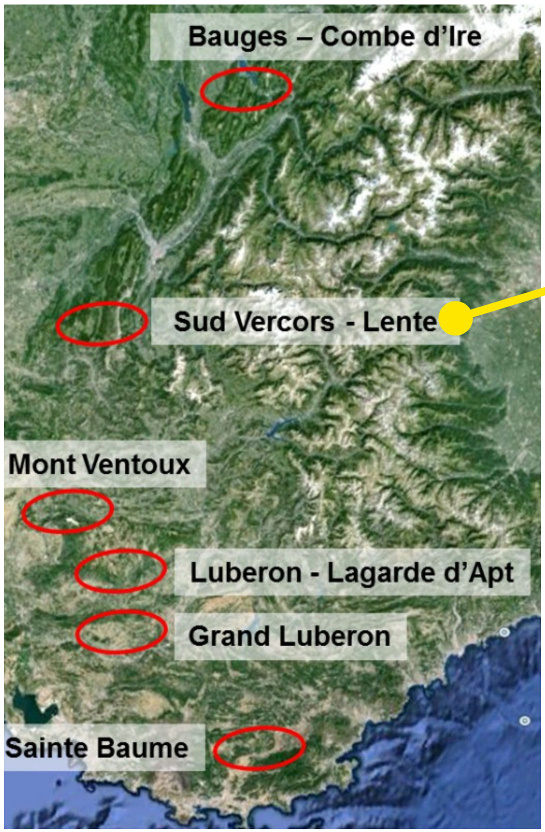


PDG Light: a new process-based model to study mixed forests

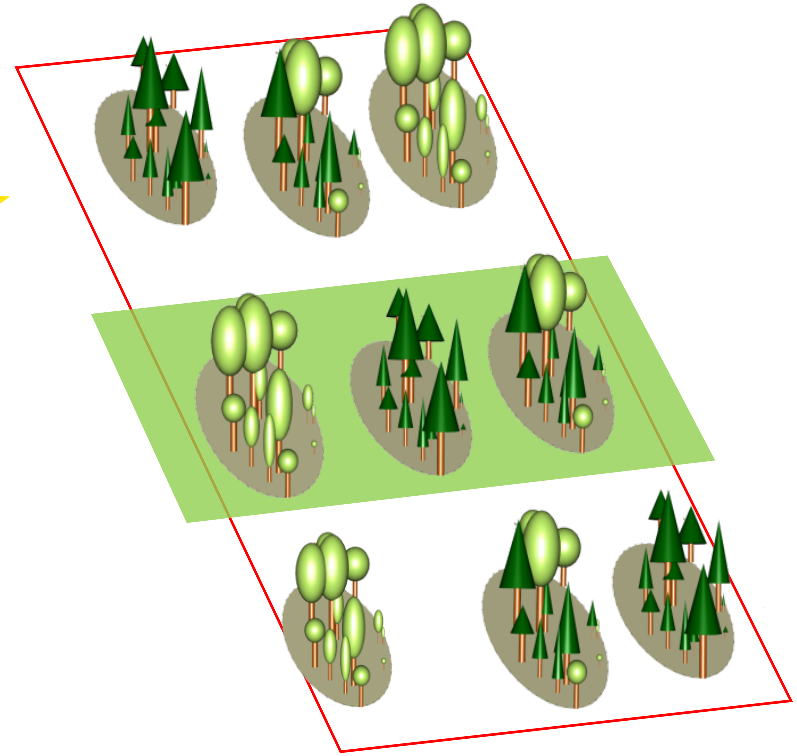


› The GMAP monitoring network for mixed forests

Sites from the French Alps to the Mediterranean Sea ...



… composed of triplets



- Beech plots
- Fir plots
- Beech and Fir mixed plots

Coordinator : *Xavier Morin, CNRS CEFE*

A demonstration of PDG Light simulation (1/2)

Productivity ? → **Gross Primary Production** (GPP)

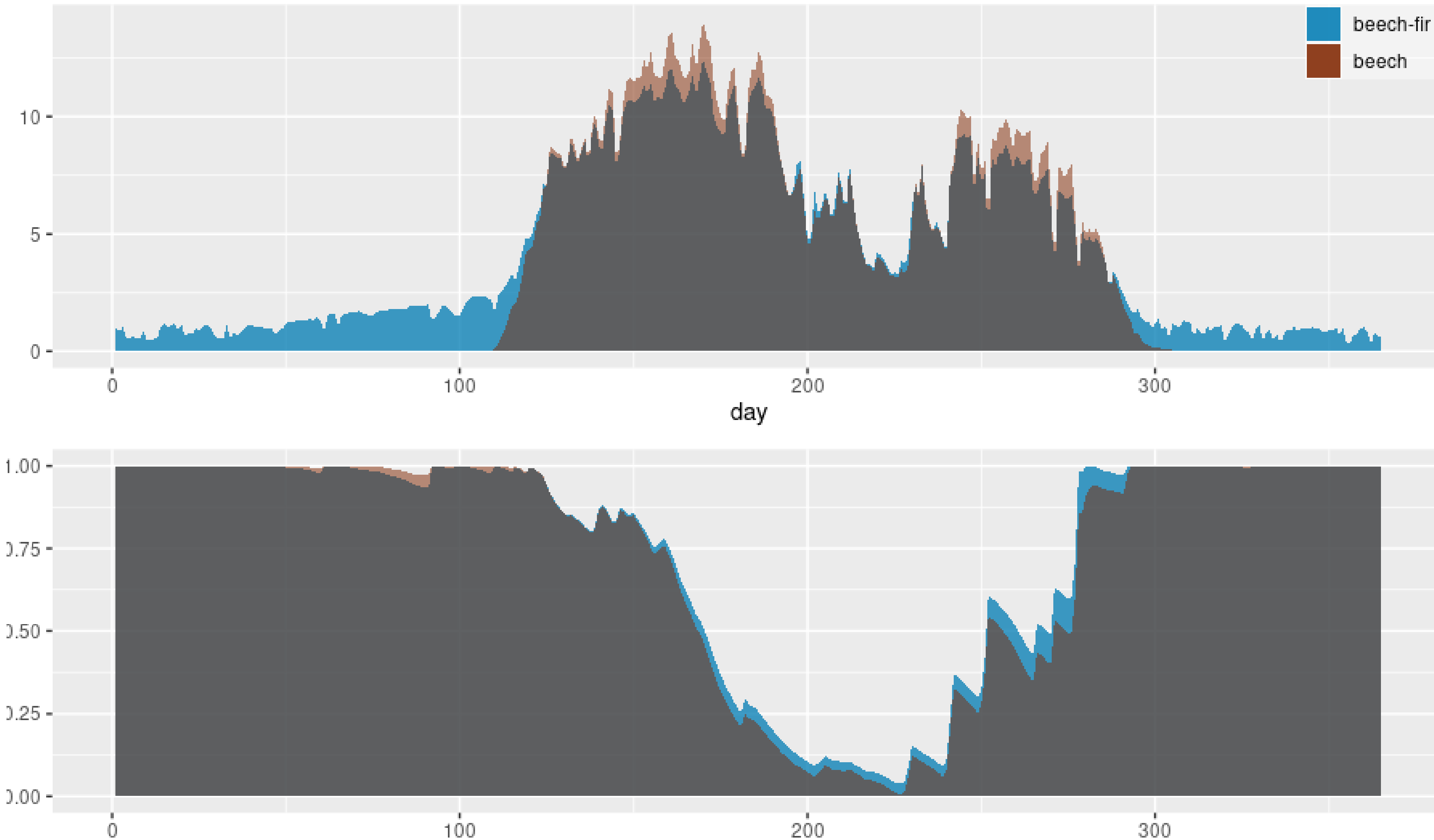
Sensibility to drought ? → minimal **Relative Extractable Water** (REW)

› A demonstration of PDG Light simulation (1/2)

Beech-Fir mix vs pure Beech : 1 year simulation

GPP

REW

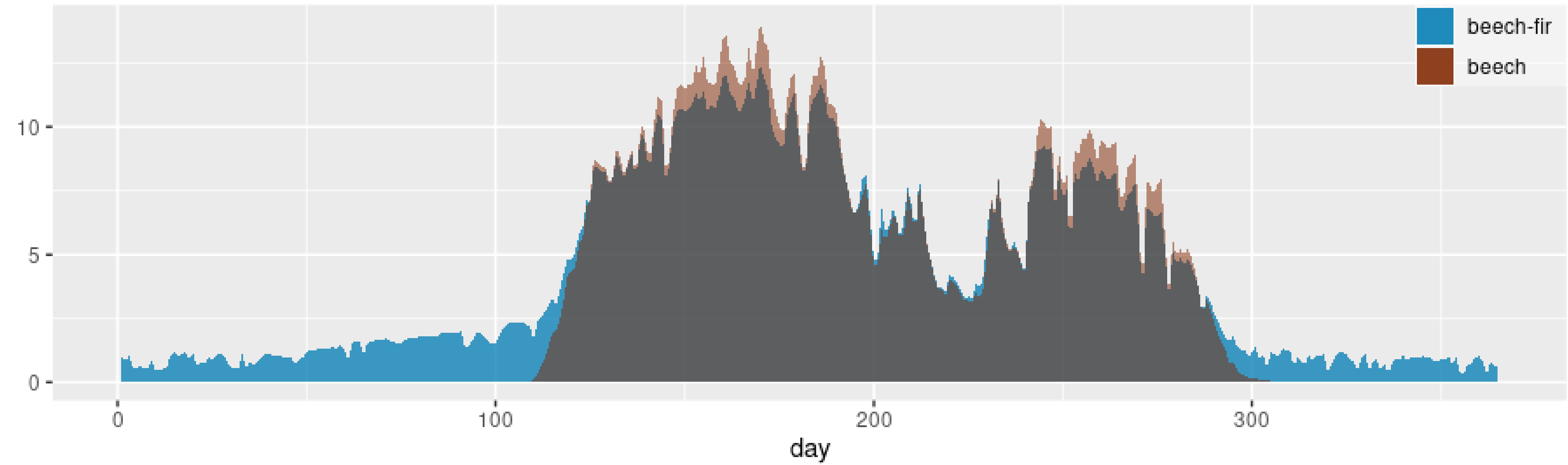


day of year

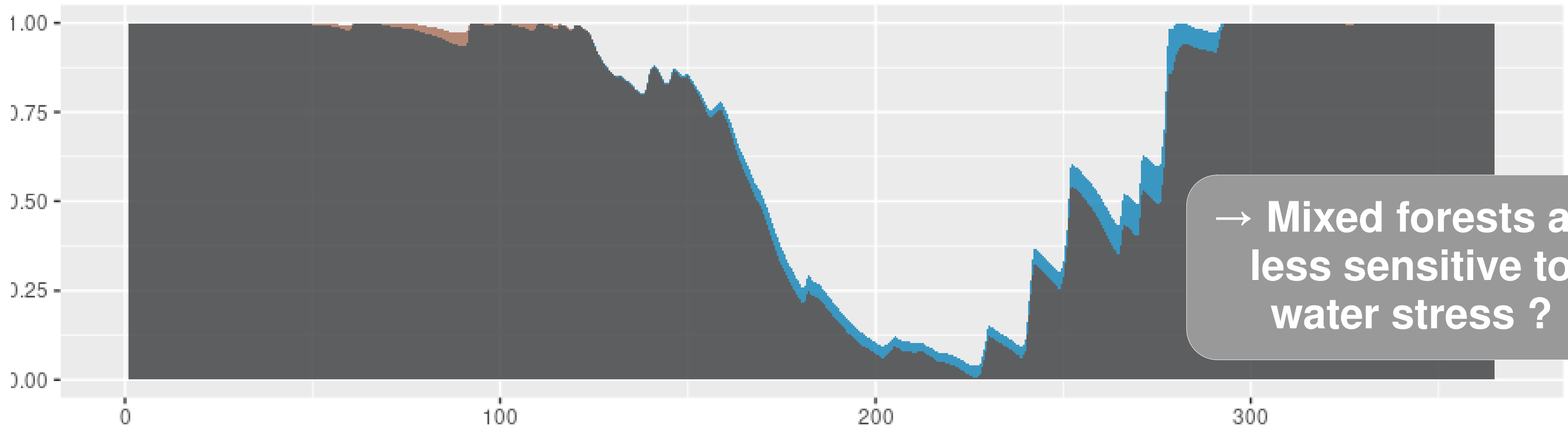
› A demonstration of PDG Light simulation (1/2)

Beech-Fir mix vs pure Beech : 1 year simulation

GPP



REW



→ **Mixed forests are less sensitive to water stress ?**

day of year

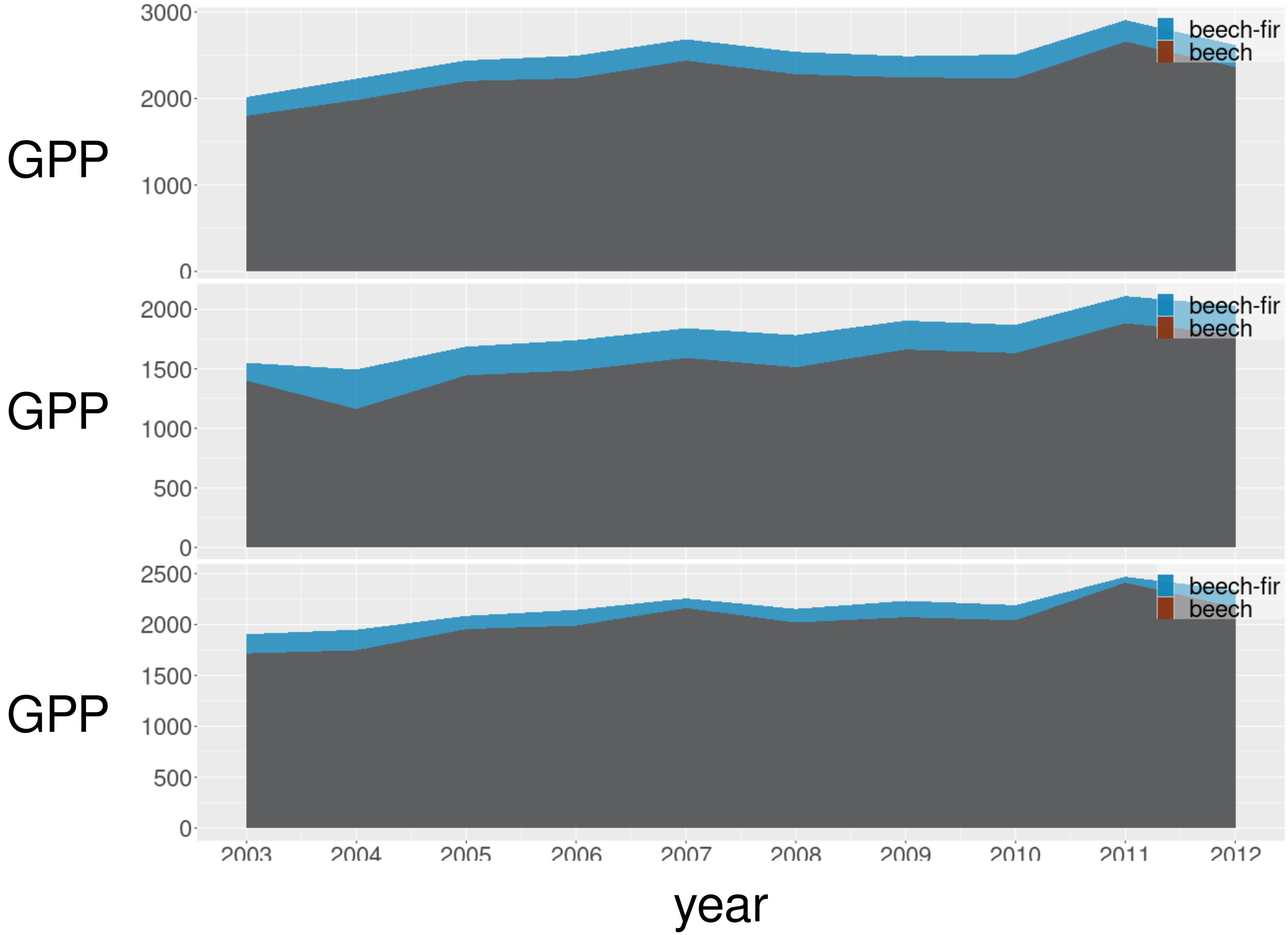
› A demonstration of PDG Light simulation (2/2)

Beech-Fir mix vs pure Beech : 10 year simulation

Plot vl_bas_3

Plot vl_haut_1

Plot vl_bas_4



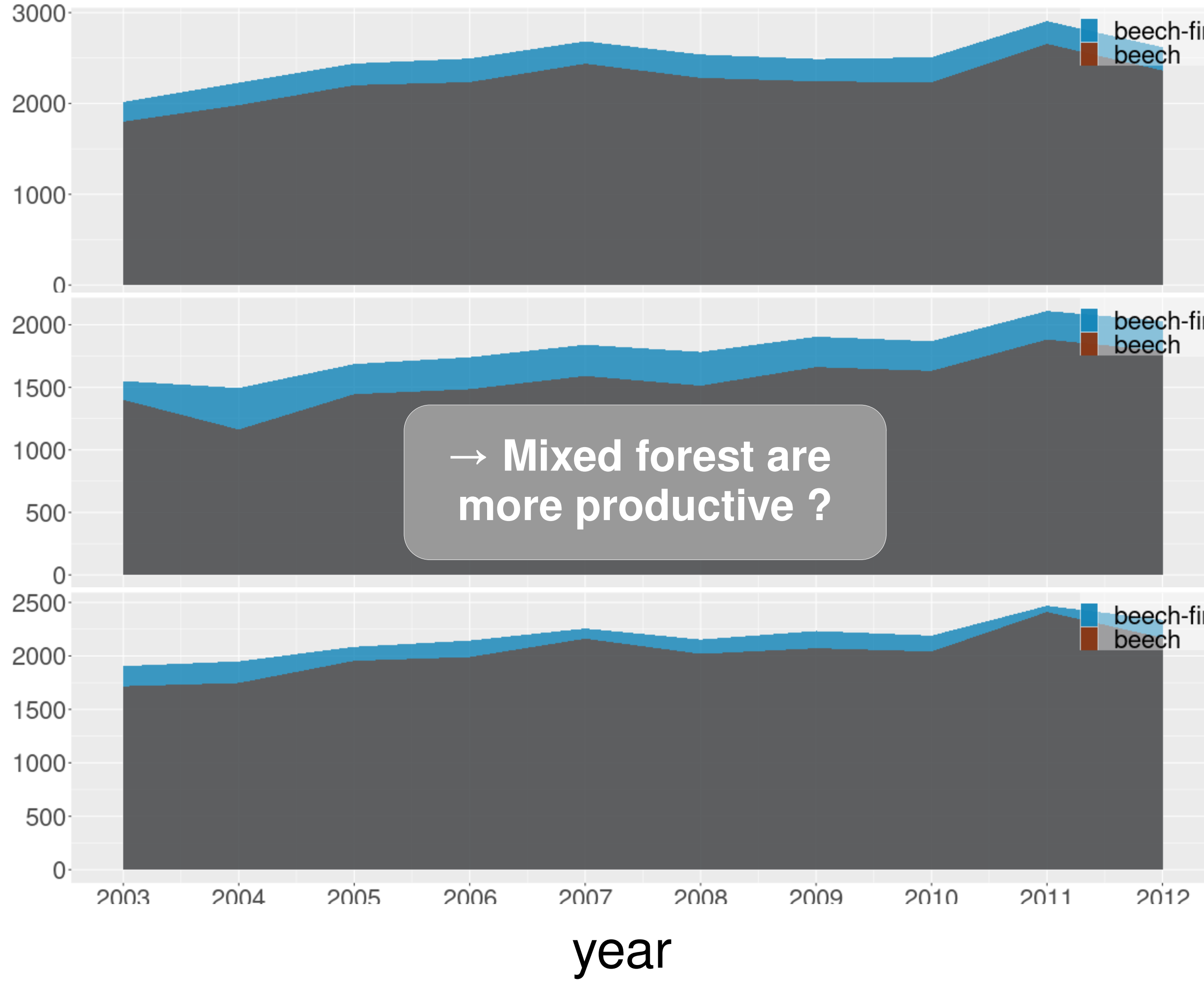
› A demonstration of PDG Light simulation (2/2)

Beech-Fir mix vs pure Beech : 10 year simulation

Plot vl_bas_3 GPP

Plot vl_haut_1 GPP

Plot vl_bas_4 GPP



Hypothesis testing with PDG Light

Productivity ? → **Gross Primary Production** (GPP)

Sensibility to drought ? → minimal **Relative Extractable Water** (REW)

Hypothesis testing with PDG Light

Productivity ? → **Gross Primary Production** (GPP)

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- Mixing effect

Hypothesis testing with PDG Light

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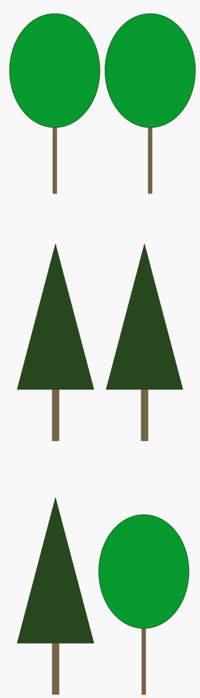
- Mixing effect



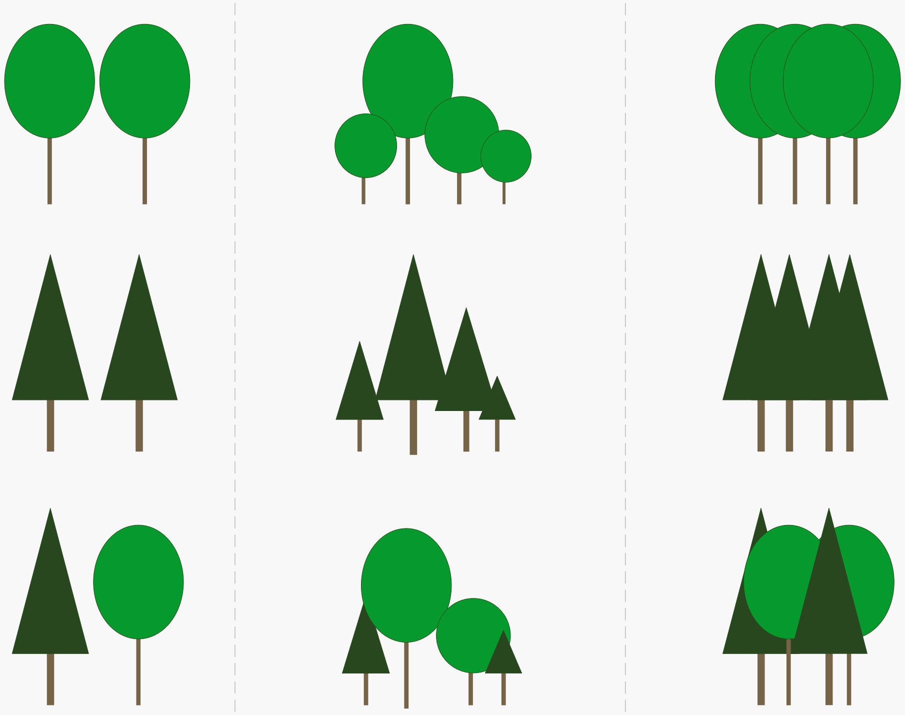
- Structure effect

Hypothesis testing with PDG Light

Productivity ? → **Gross Primary Production** (GPP)

Sensibility to drought ? → minimal **Relative Extractable Water** (REW)

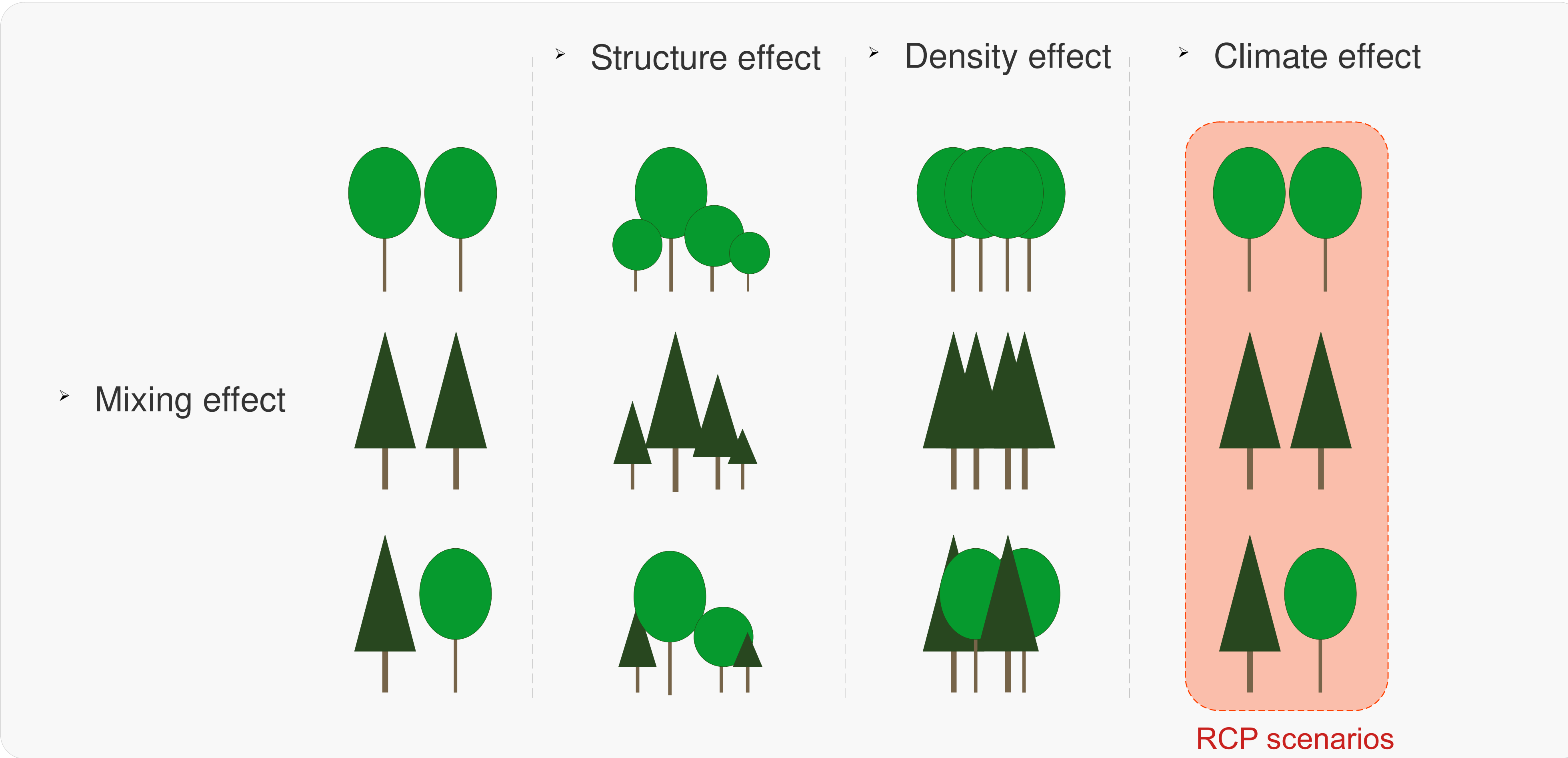
- Structure effect
- Density effect
- Mixing effect



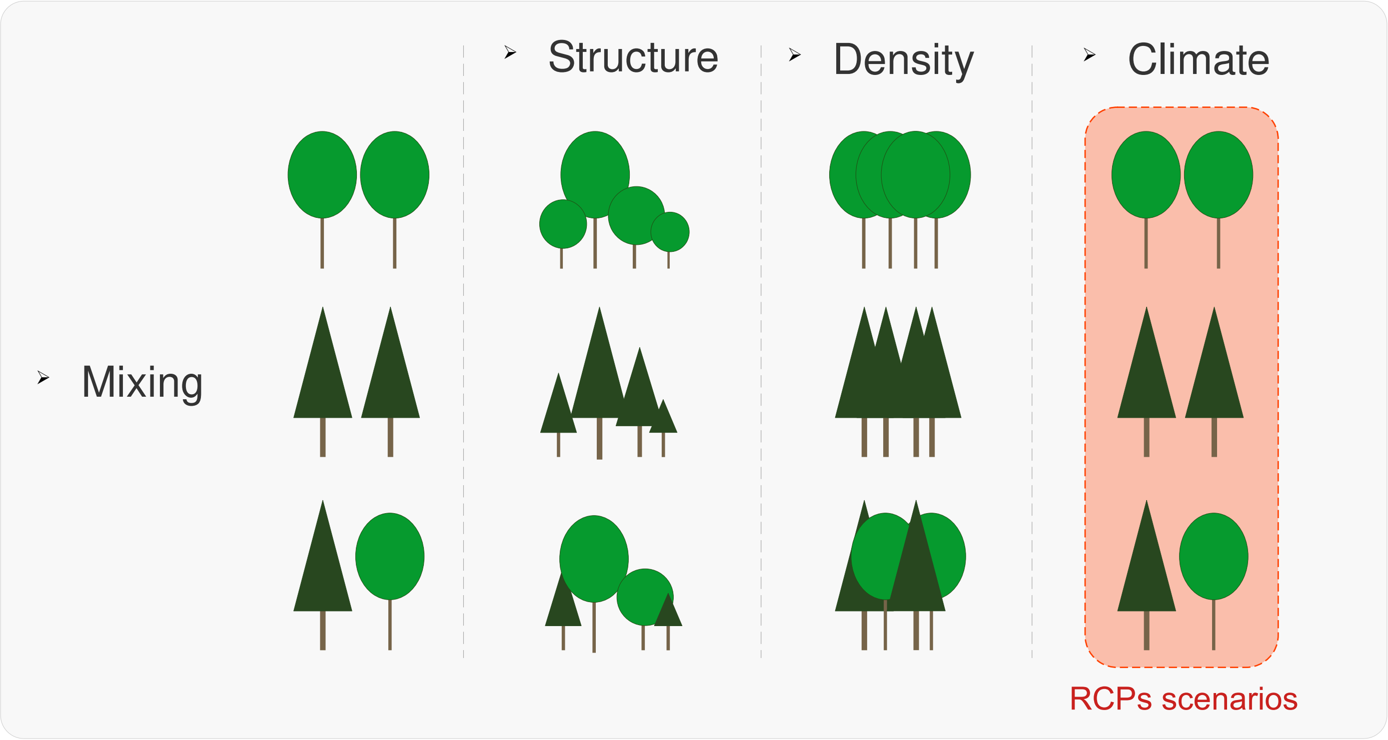
› Hypothesis testing with PDG Light

Productivity ? → **Gross Primary Production** (GPP)

Sensibility to drought ? → minimal **Relative Extractable Water** (REW)



In conclusion



Thank you for your attention !

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