POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

FORMASAM stand-scale management scenarios in **ISIMIP2b** experiments using **4C**

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Leibniz Association

Objective

- test the **technical implementation of FORMASAM management** scenarios in **4C**
- investigate FORMASAM **stand scale management scenarios** for their **mitigation and adaptation effects**
- derive ecosystem **productivity response** to **climate change** and **CO2 fertilization** in **FORMASAM - 4C** simulations

Simulation set-up

- simulation setup following ISIMIP2b protocol
- simulation period: ini - 2100
- 60 - 75 experiments/runs per site
  - on PROFOUND sites: Bily-Kriz, Collelongo, Hyytiälä, Peitz, Solling-beech, Solling-Spruce, Sorø

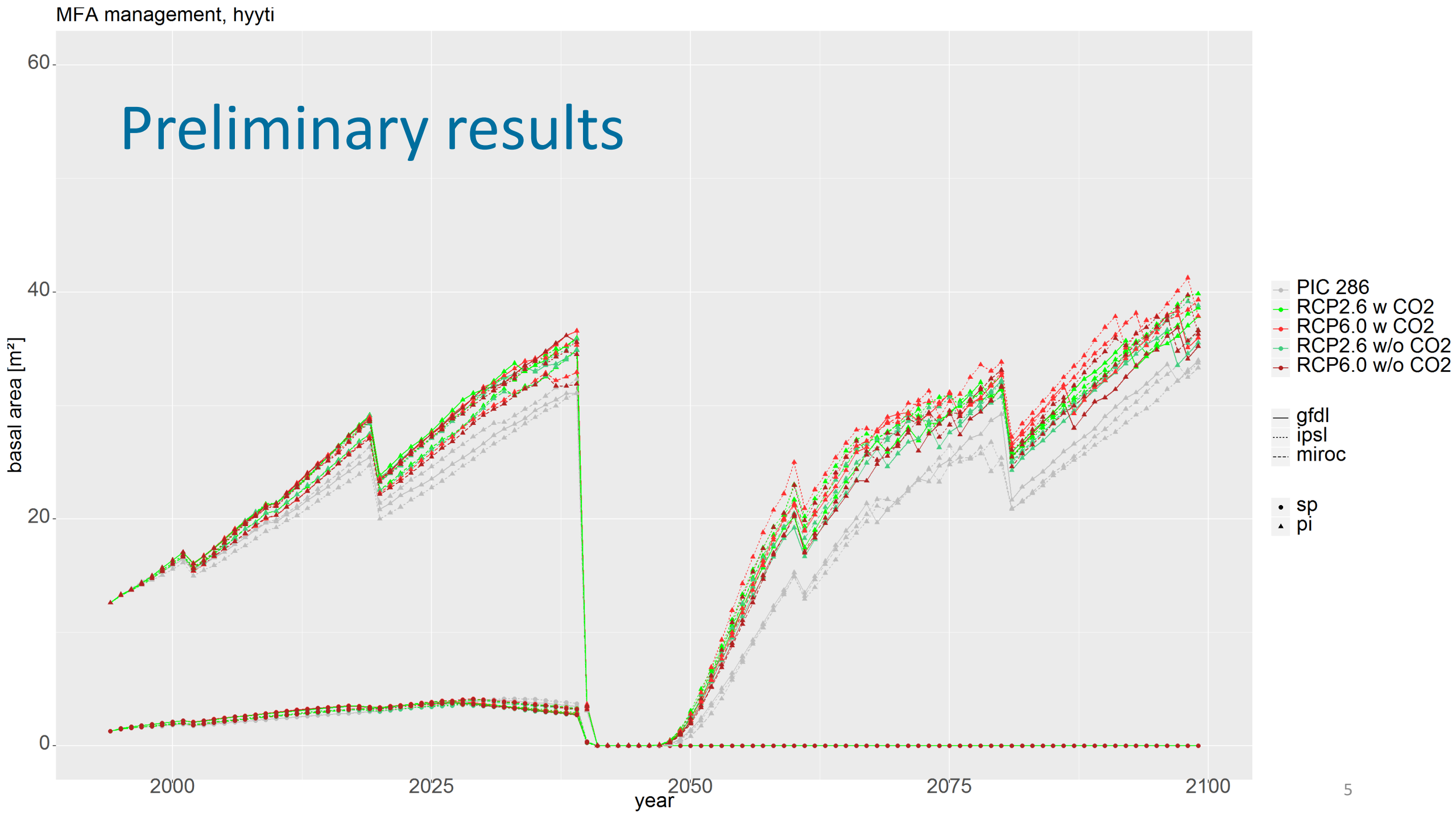
GCM	RCP	FORMASAM management
IPSL	**PIC** with CO2 fixed at 286 ppm	**o**: no management (control)
GFDL	**RCP 2.6** with CO2 fertilization (**w CO2**)	**CSS**: current site-specific (BAU)
MIROC5	**RCP 2.6** without CO2 fertilization (**w/o CO2**)	**BE**: bioenergy (mitigation)
	RCP 6.0 with CO2 fertilization (**w CO2**)	**HWP**: harvested wood products (mitigation)
	RCP 6.0 without CO2 fertilization (**w/o CO2**)	**MFA**: multifunctionally adapted (adaptation)

FORMASAM management scenarios

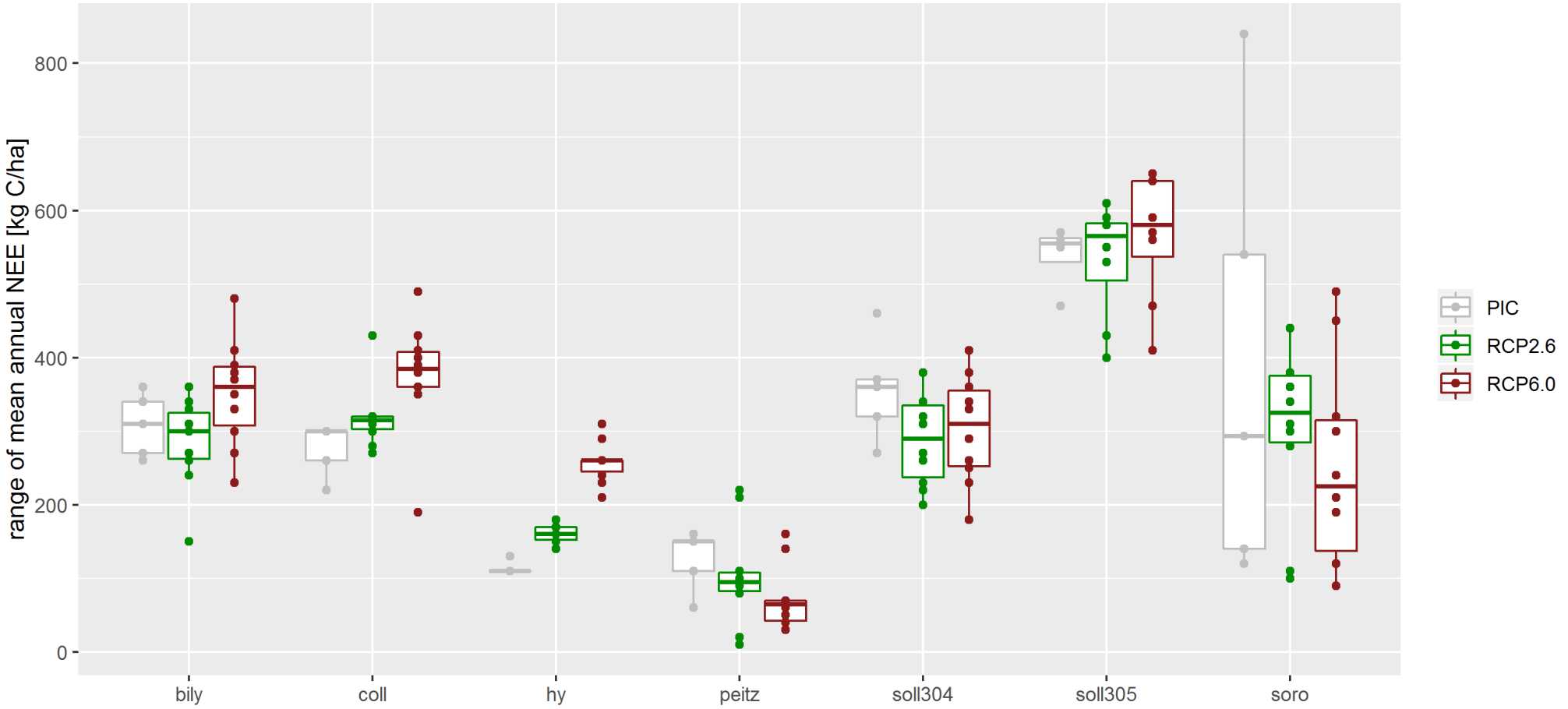
Table 7: Detailed FORMASAM management schedule for Hyytiälä

Name	Ini	HM	FM1	FM2	FM3	FM4	FM5	FM6	FM7	FM8	FM9	FM10	FM11	FM12	FM13	FM14	FM15	FM16	FM17	FM18	FM19	Remarks
Current Site-specific	1995	1996-2011	2031	2051	2052	2072	2102	2122	2142	2143	2163	2193	2213	2233	2234	2254	2284	2304				
		T	TA20	H	P	TB20	TB20	TA20	H	P	TB20	TB20	TA20	H	P	TB20	TB20	TA20				
Bioenergy	1995	1996-2011	2021	2022	2042	2082	2083	2103	2143	2144	2164	2204	2205	2225	2265	2266	2286	2326				
		T	H	P	TB25	H	P	TB25	H	P	TB25	H	P	TB25	H	P	TB25	H				
HWP	1995	1996-2011	2031	2071	2081	2082	2102	2132	2152	2192	2202	2203	2223	2253	2273	2313						
		T	TA10	TA10	H	P	TB10	TB10	TA10	TA10	H	P	TB10	TB10	TA10	TA10						
Multifunctional-Adapted	1995	1996-2011	2021	2041	2042	2062	2082	2102	2122	2123	2143	2163	2183	2203	2204	2224	2244	2264	2284	2285	2305	
		T	TA20	H	P	TB20	TB20	TA20	H	P	TB20	TB20	TA20	H	P	TB20	TB20	TA20	H	P	TB20	

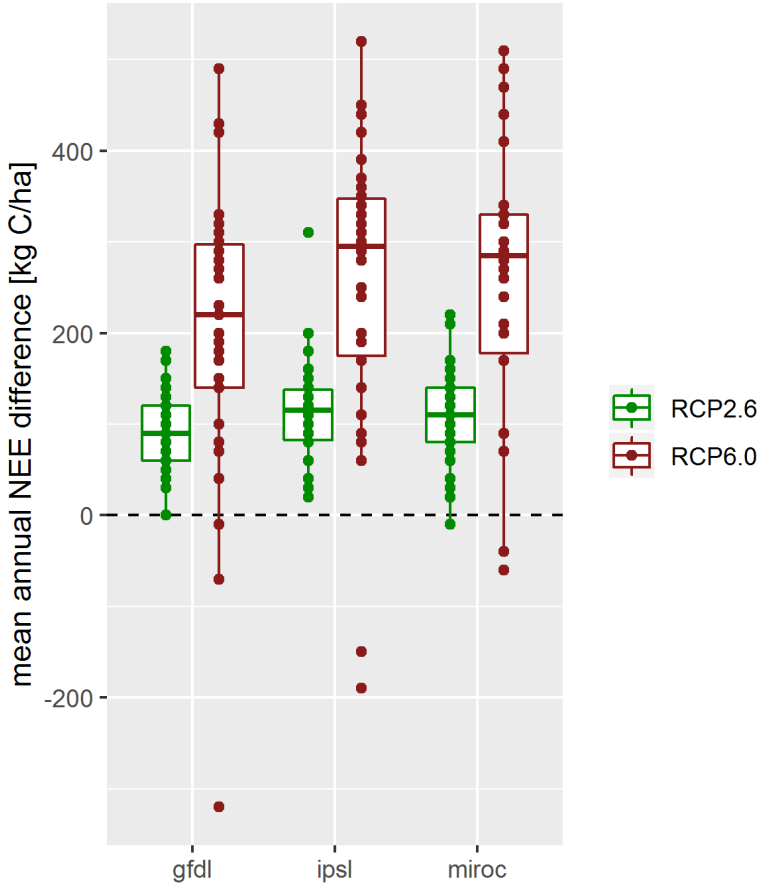
Preliminary results



GCM effect on ecosystem productivity

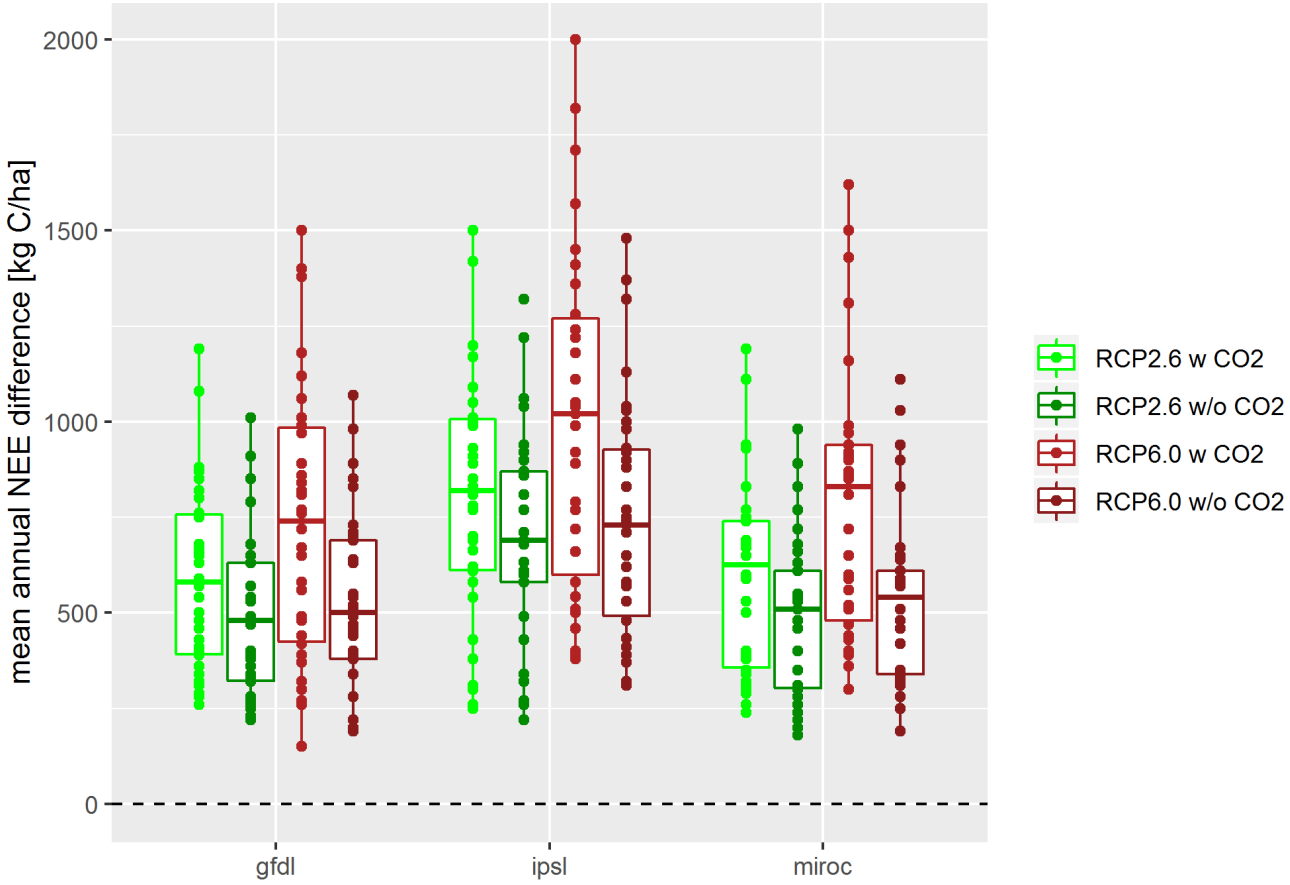


Ecosystem productivity response to full CO2 fertilization



- Comparison between associated w CO2 and w/o CO2 experiments
- **NEE response** to CO2 fertilization **mostly positive**

Ecosystem productivity response to climate change

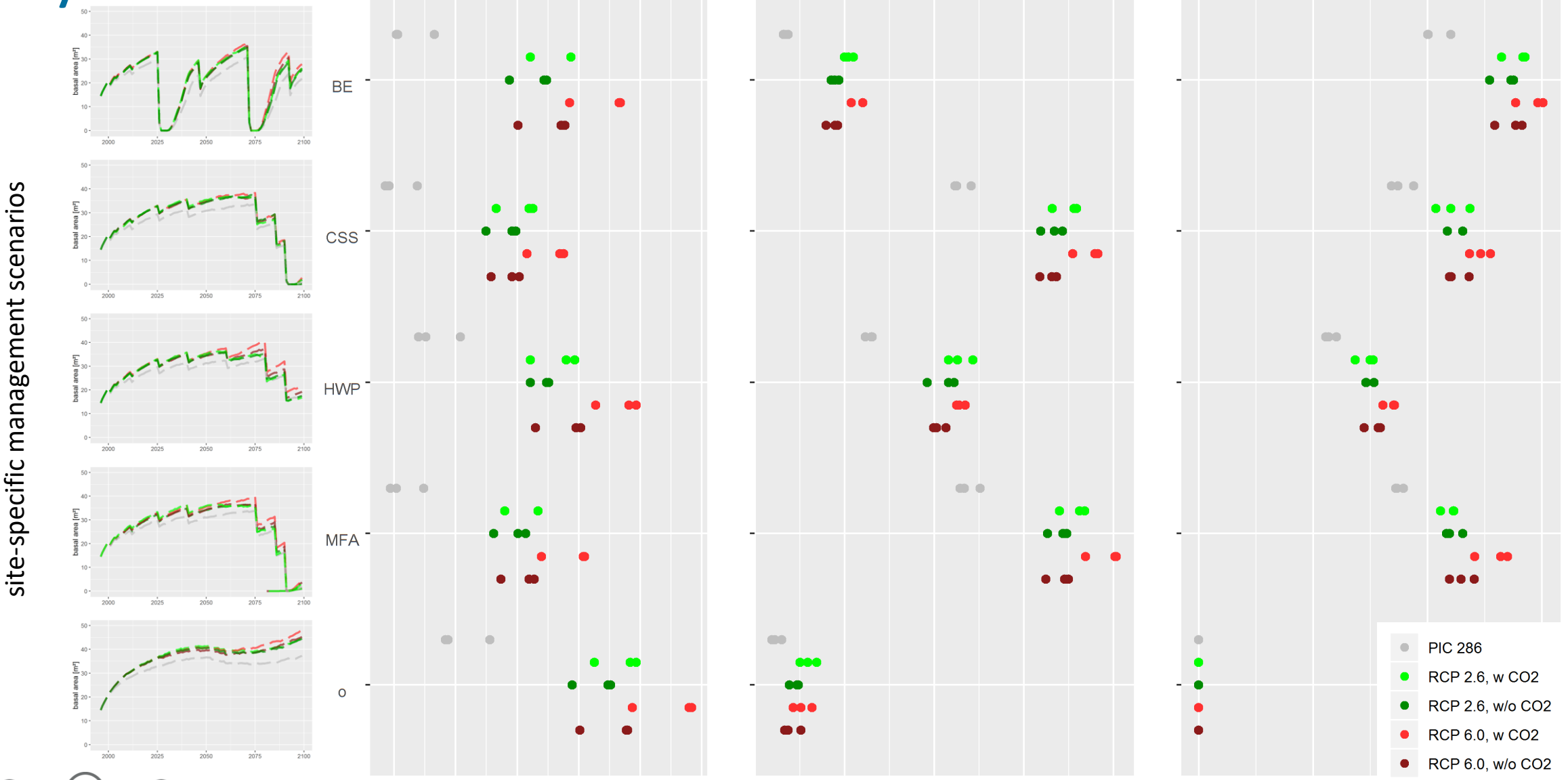


- comparison between associated climate change (RCPs) with pre-industrial control (PIC) scenarios
- **NEE response** to climate change is **always positive** and **stronger** for experiments **with full CO2 fertilization**

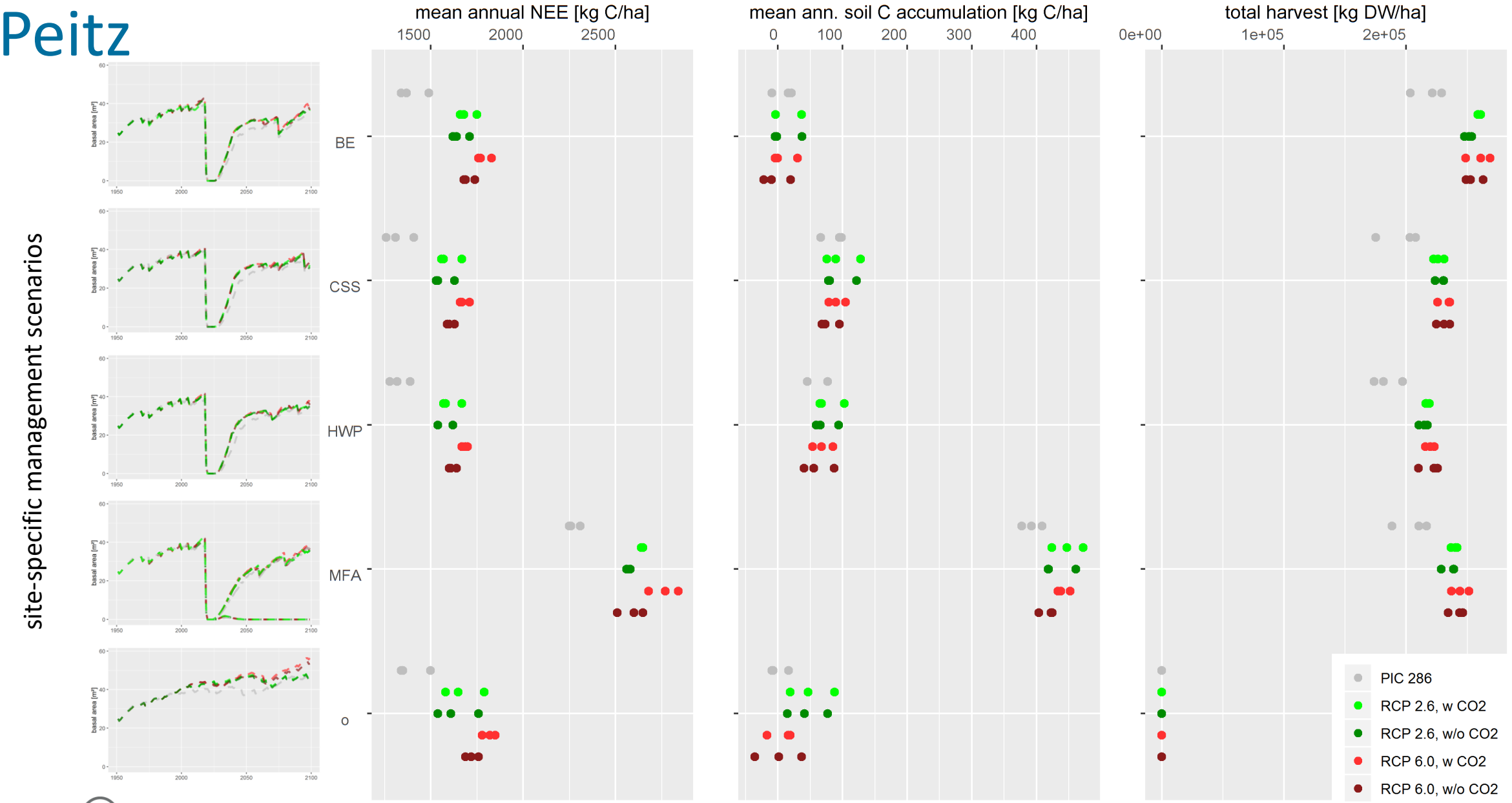

Bily-Kriz
Collelongo
Hyytiälä
Peitz
Solling beech
Solling spruce
Sorø
BE
CSS
HWP
MFA
o
basal area [m²]
CSS+HWP
CSS+HWP
MFA1
MFA2
be
pi
oa
sp
dg
bi
PIC 286
RCP2.6 w CO2
RCP2.6 w/o CO2
RCP6.0 w CO2
RCP6.0 w/o CO2

basal area

Bily-kriz

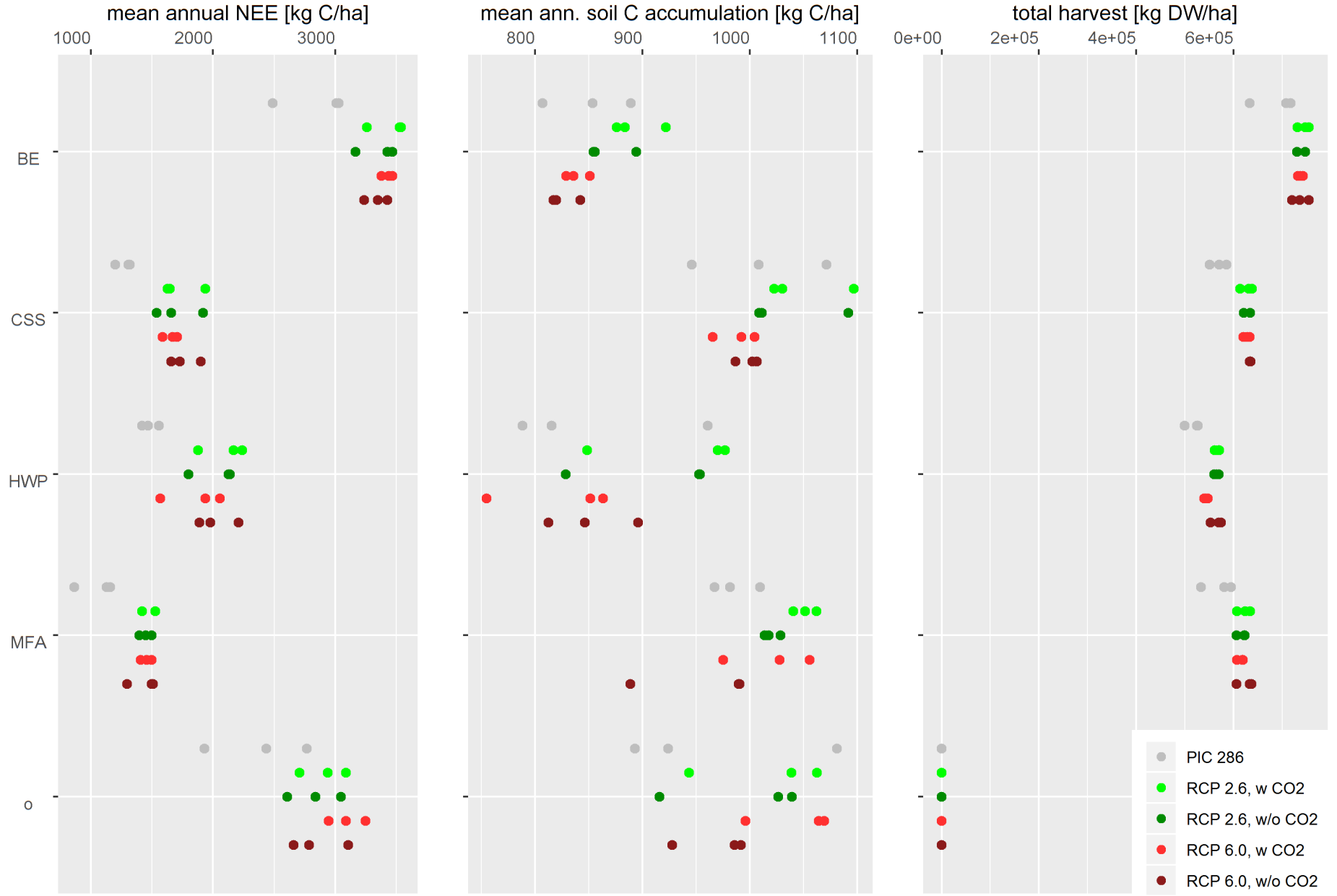

site-specific management scenarios
basal area [m²]
mean annual NEE [kg C/ha]
3000
3500
4000
4500
5000
5500
mean ann. soil C accumulation [kg C/ha]
500
750
1000
1250
1500
total harvest [kg DW/ha]
0e+00
2e+05
4e+05
6e+05
BE
CSS
HWP
MFA
o
2000
2025
2050
2075
2100
PIC 286
RCP 2.6, w CO2
RCP 2.6, w/o CO2
RCP 6.0, w CO2
RCP 6.0, w/o CO2

Peitz


site-specific management scenarios
mean annual NEE [kg C/ha]
1500
2000
2500
mean ann. soil C accumulation [kg C/ha]
0
100
200
300
400
total harvest [kg DW/ha]
0e+00
1e+05
2e+05
BE
CSS
HWP
MFA
o
basal area [m²]
1950
2000
2050
2100
PIC 286
RCP 2.6, w CO2
RCP 2.6, w/o CO2
RCP 6.0, w CO2
RCP 6.0, w/o CO2

Sorø

site-specific management scenarios



Conclusion

- simulation results seem reasonable (except for die-off in mixed stands)
- **deeper analysis** of different **management effects on mitigation and adaptation** needed

- discussion points
  - how to exclude the **effect of examined time period** in the analysis?
  - 4C issue: mixed stands and mixed planting

The End

thank you!