Students Discussion

1/ Crops

- What is the impact of different management practices on the ability of the agriculture for carbon mitigation
- In particular what is the real potential of first generation of biofuel for carbon mitigation.
- What are the solutions to solve the trade off between increasing food demand and potential negative effect of climate change on agriculture
- What was the evolution of crops during the 20th century and is impact on the global carbon cycle.

What is the impact of different management practices on the ability of the agriculture for carbon mitigation

A

C gain resulting from the rebound of cultivation abandonment would be higher than in the control by 37% in the case of no former N fertilizer application.

B

10% of crop harvest residues are left in the field leads to a 15% lower value of △C than in the control (54 Tg C)
(Valentini et al., 2008)

C

Irrigation during the cultivatioin period leads to a decrease of soil C stocks because the negative impact of increasing soil moisture on soil C stocks is higher than the positive one of increasing root litter.

In particular what is the real potential of first generation of biofuel for carbon mitigation

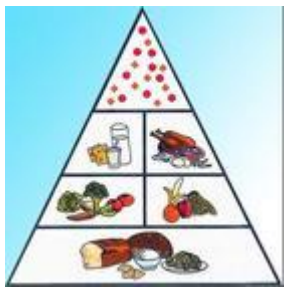
What are the solutions to solve the trade off between increasing food demand and potential negative effect of climate change on agriculture

To halt agricultural expansion

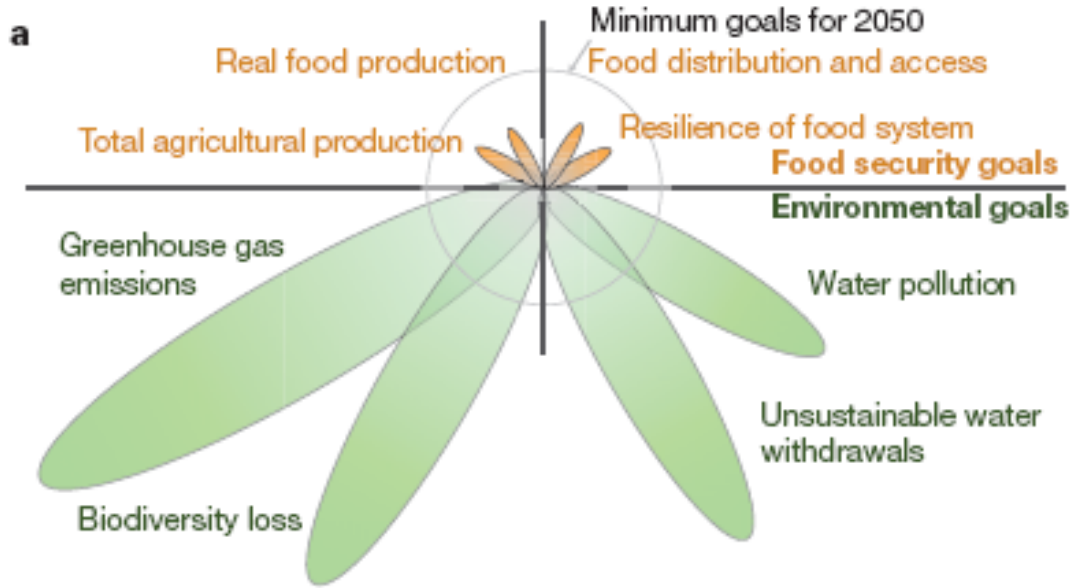
To close ‘yield gaps’ on underperforming lands

To increase cropping efficiency

To shift diets and reduce waste (Foley et al., 2011)



What was the evolution of crops during the 20th century and is impact on the global carbon cycle



Agriculture is the major contributor to climate change, and is responsible for 30-35% of global greenhouse gas emissions (Foley et al., 2011)

2/ Disturbances:

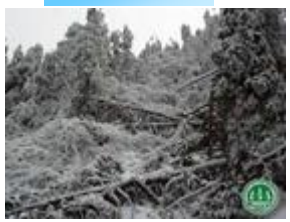
- - What are the most important forest disturbances with regards to the carbon cycle?
  - Are these disturbances similar in all biomes?
  - How important are disturbances for the global forest carbon cycle?

What are the most important forest disturbances with regards to the carbon cycle?

Forest disturbances
(Schelhaas et al. 2003)

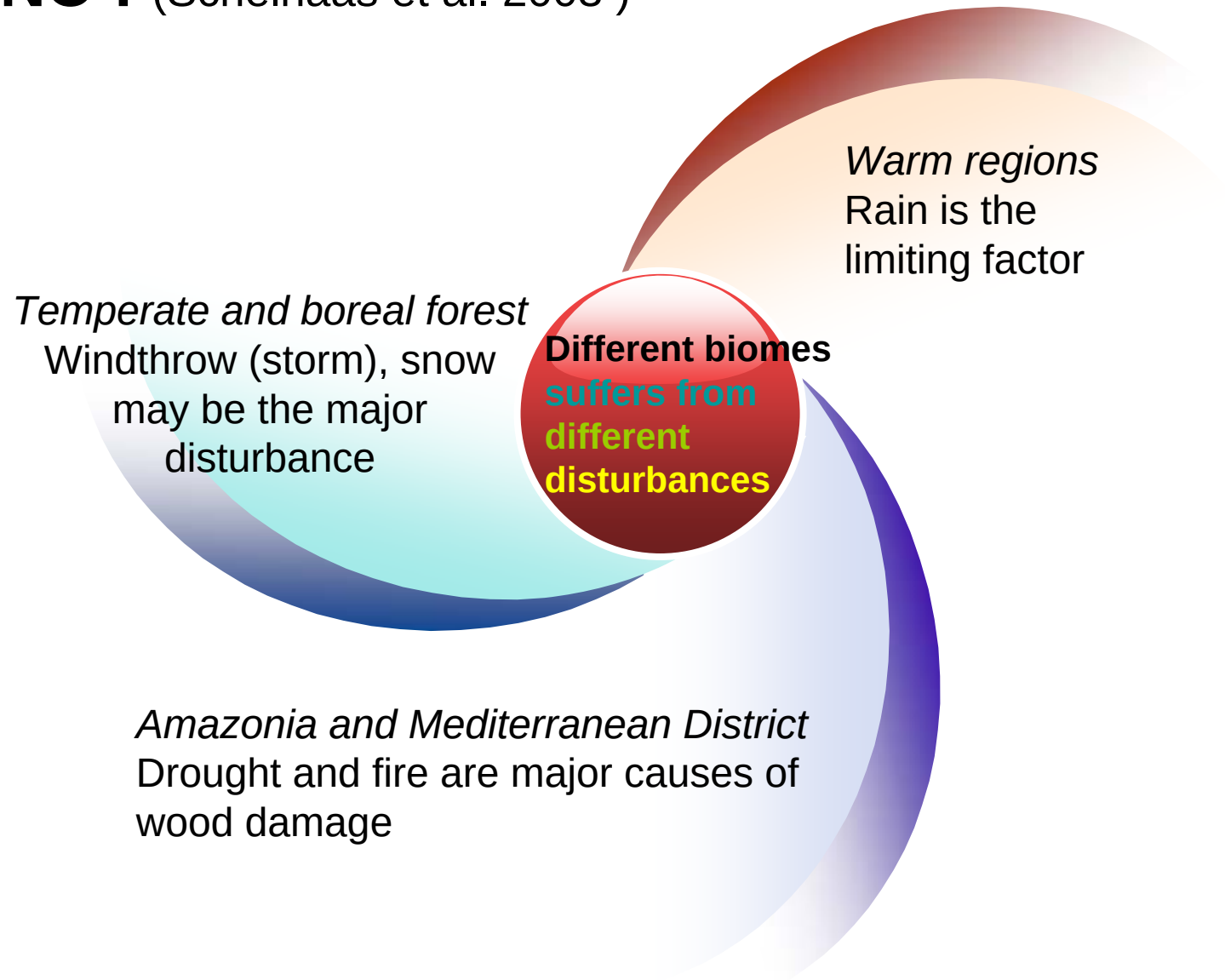
- Abiotic
  - Drought
  - Storm
  - Snow
  - Fire
- Biotic
  - Bark Beetles
  - Others






Are these disturbances similar in all biomes?

NO ! (Schelhaas et al. 2003)



How important are disturbances for the global forest carbon cycle?

- Difficulty to understand and model the mechanism of different disturbances
- Disturbances can lead to severe and lasting results:
  - 2010 Amazonia drought has reversed the carbon sink which has lasted for years.(Lewis et al. 2011). Likewise, Europe heatwave in 2003 led to similar results.
  - Disturbance causing tree mortality would cost many years to recover.

3/ Forest sink

- - Which are the different methods to estimate the forest sink?
  - What is the uncertainty and scale(s) associated with each method?
  - What are the strengths and weaknesses of each method?

(Peters et al., 2009)	Strengths	Weaknesses
Accounting methods	Tracking merchantable carbon products such as fuels, crops, and timber,	To describe growth of standing biomass and soil carbon accumulation
Ecosystem measurements (ANN artificial neural network Paple 2003)	Be useful at the single site level for optimizing the gap filling procedures. (*I think this measurement has a specific function, and could be improved continuously*)	*In my opinion, the measurement may be controlled by input data, and may change a lot when it is applied in different kinds of ecosystems.*
Processing modeling (Terrestrial carbon process models)	Combining climate, vegetation health, and carbon pool dynamics over larger spatiotemporal scales	Not include fossil fuels and struggle to include the recent land-use history
Satellite observations	*Researches based on satellite observations can breakthrough area restrictions. Be especially convenient for large scale estimation.*	*Uncertainty comes from the data structure, resolution and some other elements of the satellite*
Atmospheric trace gas monitoring	Integrating over all carbon sources and sinks and provide constraints on larger totals	Cannot break the information down to specific processes and regions, partly due to limitations in atmospheric transport modeling accuracy

What is the uncertainty and scale(s) associated with each method?

Phillips et al., 2000	Florida	Georgia	North Carolina	South Carolina	Virginia	Total	Total CV (%)	% of total variance
Growing-stock volume (10^3 m^3)	435 129	870 288	927 160	472 473	750 023	3 455 073		
% sampling error	1.65	1.16	1.13	1.51	1.14			
SE: Sampling	7180	10 095	10 477	7134	8550	19 678	0.57	98.7%
SE: Regression	650	1080	1117	715	1086	2128	0.06	1.2%
SE: Measurement — d.b.h.	34	57	58	38	54	110	0.00	0.0%
SE: Measurement — height	191	317	337	219	311	629	0.02	0.1%
SE: total	7212	10 158	10 542	7174	8625	19 803	0.57	100.0%
GSV net growth (10^3 m^3/yr)	19 652	36 094	32 836	14 877	24 024	127 483		
% sampling error	1.72	1.17	1.23	4.14	1.29			
SE: Sampling	338	422	404	616	310	965	0.76	89.6%
SE: Regression	97	156	172	118	173	327	0.26	10.3%
SE: Measurement — d.b.h.	3	4	3	3	3	7	0.01	0.0%
SE: Measurement — height	14	16	14	19	12	35	0.03	0.1%
SE: total	352	451	439	627	355	1020	0.80	100.0%
GSV removals (10^3 m^3/yr)	15 856	36 856	26 596	20 602	16 957	116 867		
% sampling error	3.59	2.58	3.68	3.63	4.65			
SE: Sampling	569	951	979	748	789	1835	1.57	99.2%
SE: Regression	50	87	77	59	63	153	0.13	0.7%
SE: Measurement — d.b.h.	3	5	4	3	3	8	0.01	0.0%
SE: Measurement — height	14	26	24	19	19	47	0.04	0.1%
SE: total	572	955	982	750	791	1842	1.58	100.0%
GSV change (10^3 m^3/yr)	3797	−762	6240	−5725	7067	10 616		
SE: Sampling	662	1040	1059	969	847	2073	19.53	97.0%
SE: Regression	109	179	188	132	184	361	3.40	2.9%
SE: Measurement — d.b.h.	4	6	5	5	4	11	0.10	0.0%
SE: Measurement — height	20	31	28	27	23	58	0.55	0.1%
SE: total	671	1056	1076	978	867	2105	19.83	100.0%

- first generation of biofuel 的定义是：'First-generation' or conventional biofuels are biofuels made from sugar, starch, and vegetable oil.For example: bioalcohols, biodiesel, green diesel, vegetable oil, bioethers, biogas, syngas, solid biofuels.（from wiki）
-
- 我自己感觉the real potential of first generation of biofuel就是一般biofuel是利用农业的废弃物用来生产燃料，因此一方面对环境的污染少、另一方面是提高了对农作物的能量利用效率（meet future food production needs and environmental challenges）。
-
- 不过那篇nature文章里面提到了crops to bioenergy, 作者的观点觉得这个东西不好，但是我感觉biofuel和这篇文章说的crops to bioenergy不是一个概念. crops to bioenergy应该是那种专门用来生产燃料的作物。