Potential changes in agricultural net water needs and agroclimatic indicators in La Muga watershed under climate change conditions: A basin-level approach.

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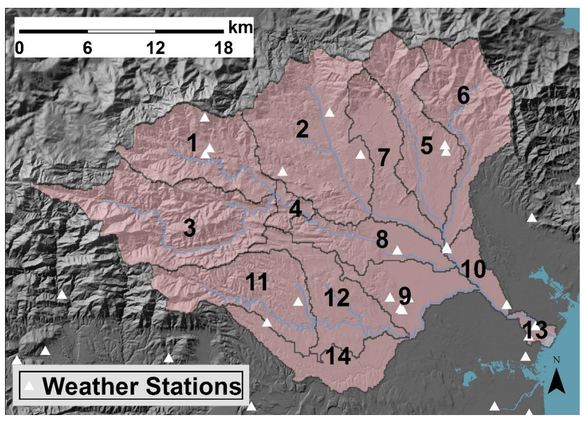
INTRODUCTION

To evaluate agriculture vulnerability to climate change under Mediterranean conditions, **crop net irrigation requirements (NIR)** and some **agroclimatic indicators** (related to crop phenology and growing cycle) in **La Muga watershed (Catalonia, NE Spain)** were estimated on the **2050 horizon** under RCP 4.5 climate change scenario.

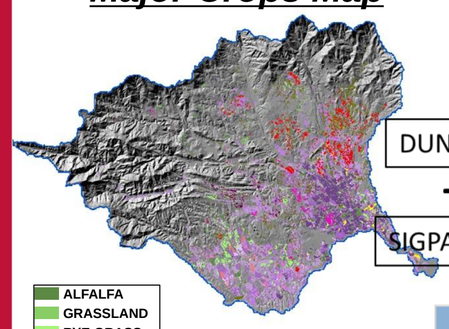
MATERIAL AND METHODS

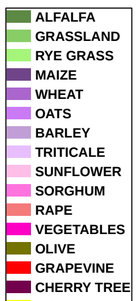
Location of La Muga basin

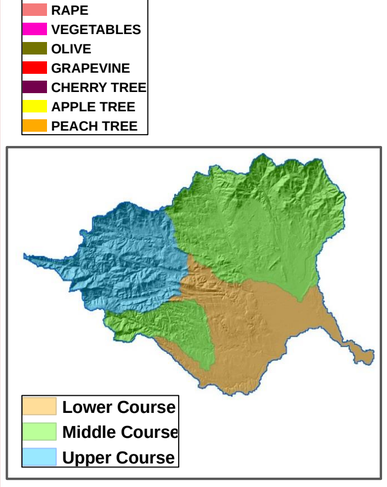
Regionalization at the subbasin level

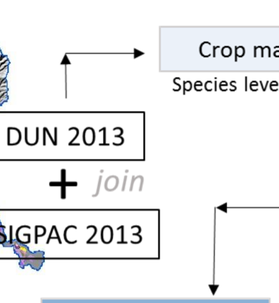


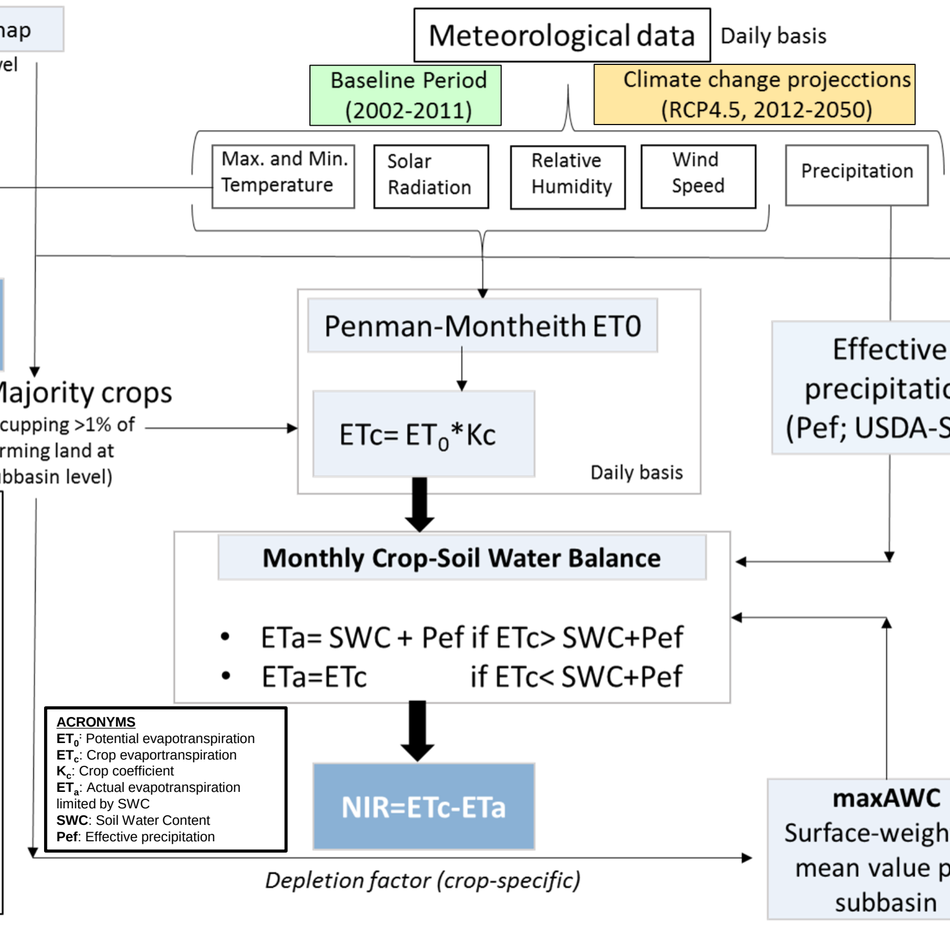
Major Crops Map

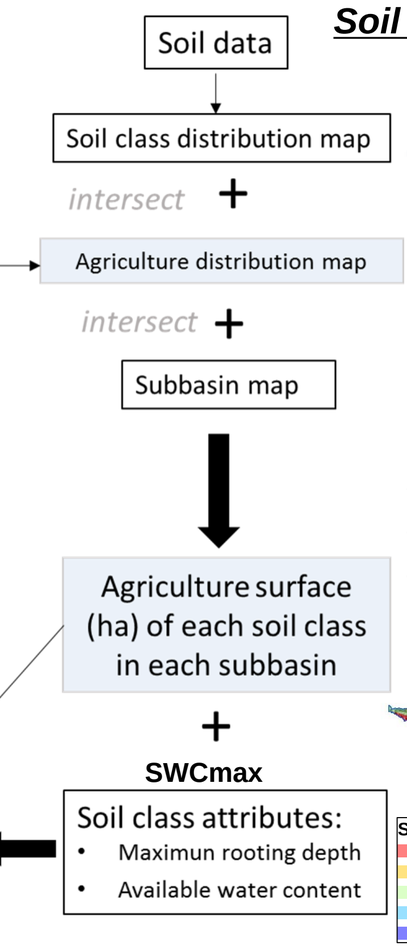




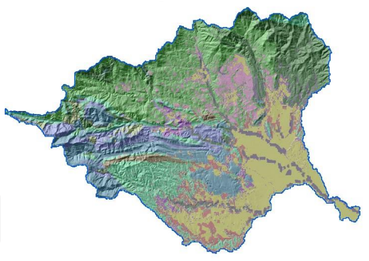




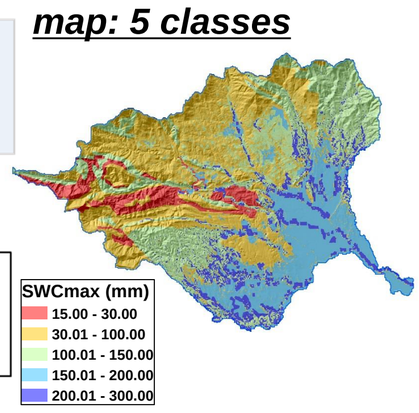




Soil class map:12 classes



Maximum Soil Water Capacity (SWCmax) map: 5 classes

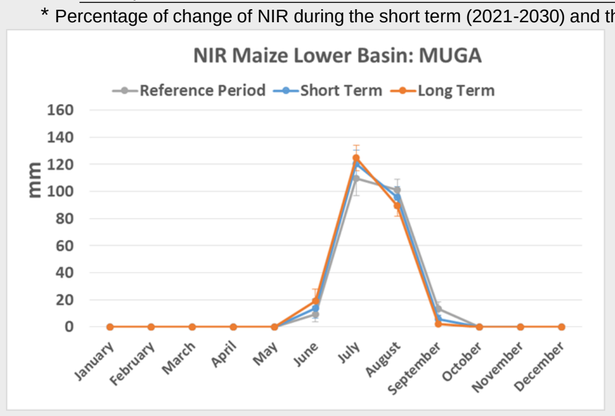


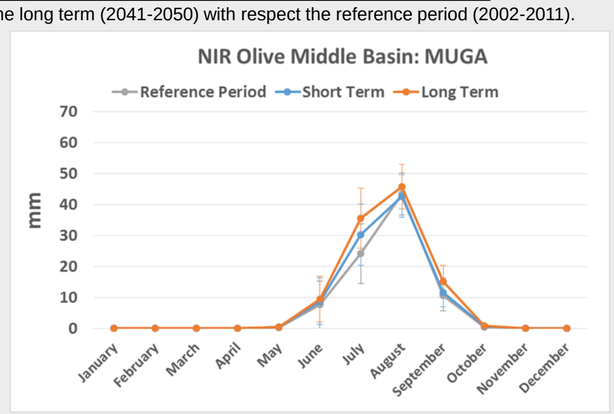
RESULTS

Increasing water needs (NIR) of some major crops

Crop	Basin Segment	Surface (ha)	ET_a (mm year^{-1}) Reference Period	ET_a Short term	ET_a Long term	NIR (mm year^{-1}) Reference period	NIR Short term	NIR Long term	% change* Short term	% change* Long term
Maize	Lower Course	1517	237.3	236.5	231.7	233.6	235.7	235.6	0.9	0.9
	Middle Course	387	253.2	249.6	241.4	219.7	224.1	228.3	2.0	3.9
Alfalfa	Lower Course	644	452.6	461.1	451.6	391.7	402.7	424.6	2.8	8.4
	Middle Course	363	497.8	503.4	493.5	306.7	313.9	340.6	2.3	11.1
	Upper Course	41	499.1	503.9	501.3	247.3	255.6	272.5	3.4	10.2
Wheat	Lower Course	1360	322.5	326.0	321.1	60.1	56.5	57.2	-6.0	-4.8
	Middle Course	294	342.8	348.0	337.9	51.0	47.8	51.5	-6.3	1.0
Grassland	Middle Course	1942	656.2	622.9	622.6	147.6	214.4	220.6	45.3	49.5
	Upper Course	5003	405.0	416.4	417.9	37.2	32.7	34.3	-12.1	-7.8
Olive	Lower Course	482	447.7	454.6	448.9	119.2	122.3	133.4	2.6	11.9
	Middle Course	981	473.2	475.9	469.1	86.4	94.4	107.3	9.3	24.2
Grapevine	Middle Course	857	263.8	268.0	268.5	7.3	7.8	8.0	6.8	9.6

* Percentage of change of NIR during the short term (2021-2030) and the long term (2041-2050) with respect the reference period (2002-2011).



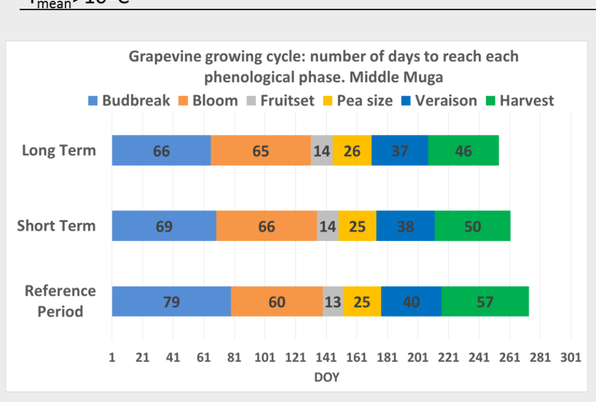


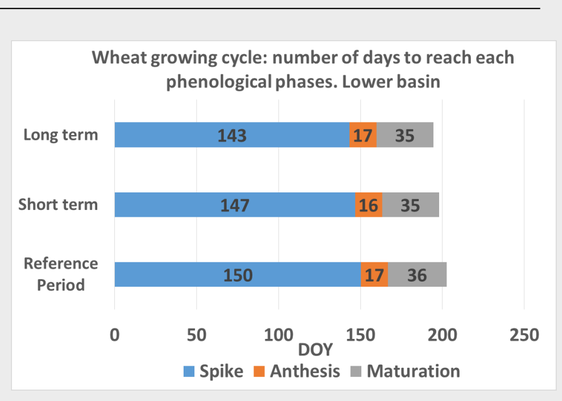
Theoretical total annual agricultural NIR for the whole basin were estimated in **15.58 hm³** for the reference period (2002-2011). Results show increases of:

- ✓ **0.1%** in the short term (**2021-2030**)
- ✓ **3.9%** in the mid term (**2041-2050**).
- ✓ NIR for **July and August** could increase **1.7%** in the short term and **3.7%** in the mid term.

Frost risk, growing cycle advancement and shortening and heat impacts affecting yield and quality

	Upper Basin Reference Period	Upper Basin Short term	Upper Basin Long term	Middle Basin Reference Period	Middle Basin Short term	Middle Basin Long term	Lower Basin Reference Period	Lower Basin Short term	Lower Basin Long term
Number of days T_{min}<0ºC									
March	8.4	7.4	6.3	2.7	2.7	2.6	1.7	1.6	1.3
April	1	0.7	0.4	0	0	0	0	0	0
Number of days T_{max}>30ºC									
July	9.0	11.1	12.9	12.9	14.8	16.8	13.8	16.4	17.7
August	5.5	7.3	9.2	11.0	13.2	15.6	11.8	14.5	16.4
Number of days T_{max}>35ºC									
July	0.4	0.8	1.3	0.5	1.0	1.4	1.2	1.6	2.2
August	0.5	0.9	1.05	1.3	1.5	2.0	1.0	1.8	2.5
Day of Year (DOY) T_{mean}>10ºC	107	106	102	79	74	69	70	63	58





CONCLUSION

Results suggest potential **problems in yield** related to temperature increase, **advancement and shortening** of growing cycle and **higher irrigation needs**, especially during summer, which may come into conflict with other water uses.

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