

Citizens science and the SDG



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“Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”

Mutual exchange of informations between the general public and professional science



Participatory in situ experiment



Real time data exchange



Round table



Dissemination activities



Let's put a 'game' on the table





SDG and natural resources

Current scenario (year 2016)

WATER

900 M without access to safe drinking water
2.5 B without access to sanitation

ENERGY

2.5 B without access to modern forms of energy
1.5 B without access to electricity

FOOD

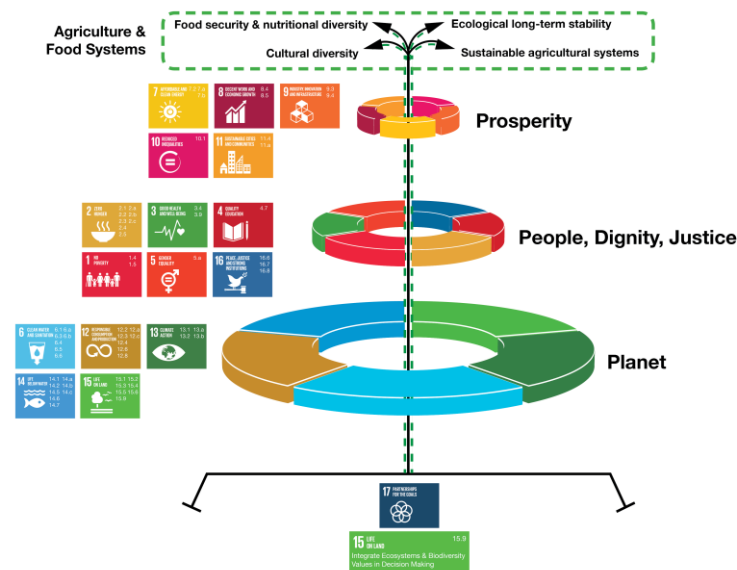
1.5 B suffering from hunger

Future scenario (year 2030)

Population growth, Changes in diet, Changes in energy policies ...



40% GAP in water resources
(availability vs demand)



<http://www.teebweb.org/sdg-agrifood/annex-1/>



How can we meet the increasing global demand for water for food?

Agricultural Intensification

Close the Yield Gap
(irrigation, fertilizers,...)

**Transition from
small scale to
Commercial
Agriculture**
- Loss of
livelihoods?

Agricultural Extensification

Expand the
cultivated area

Land Use
Change
Deforestation
Biodiversity
losses

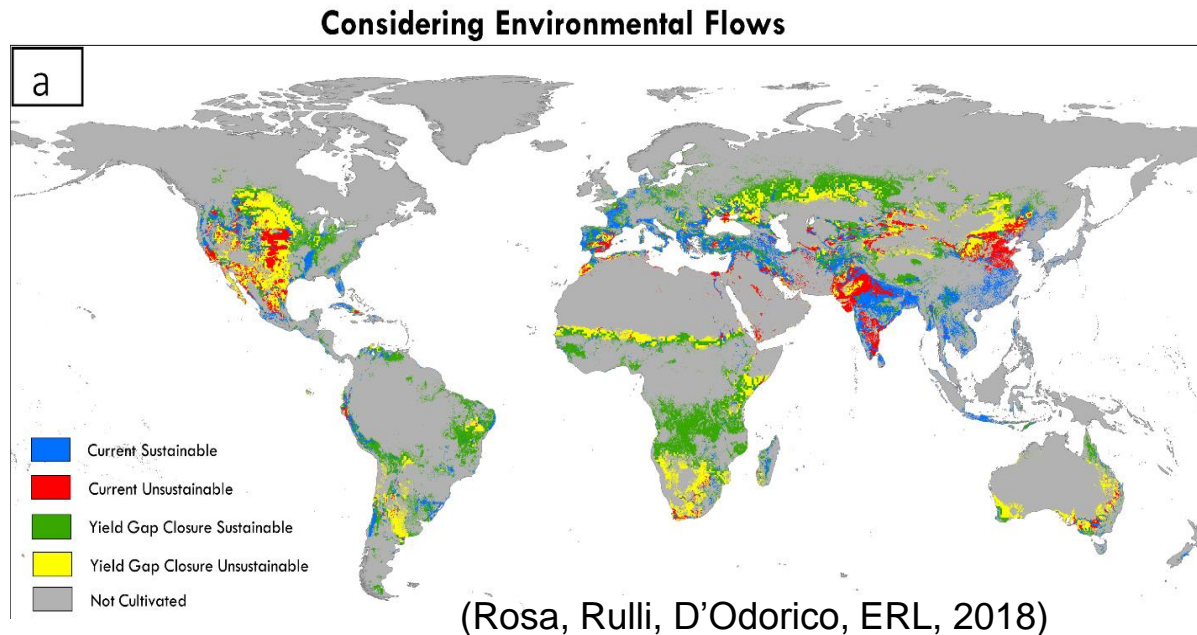
Sustainable Intensification

Improve Efficiency
Adopt More
Suitable Crops

**Increase
production
without
requiring more
land, water**

Agricultural Intensification: *how many people can we feed?*

We can feed 4Billion people if we close the yield gap

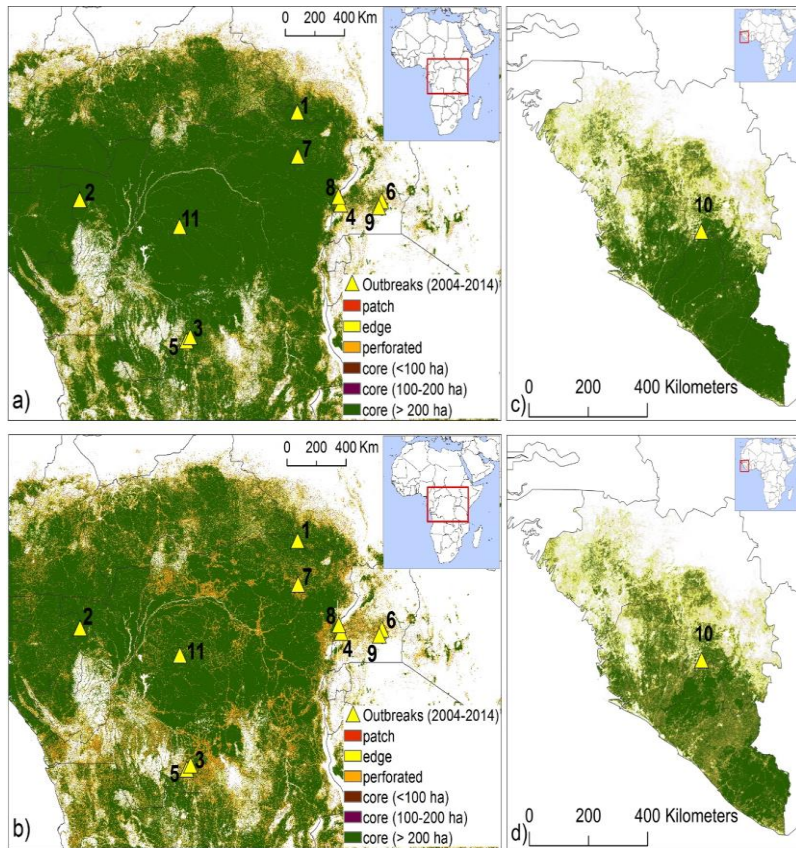


But, is there enough water to close the yield gap considering the environmental flows????



SDG and natural resources

Agricultural extensification: What about the direct and indirect consequences ?

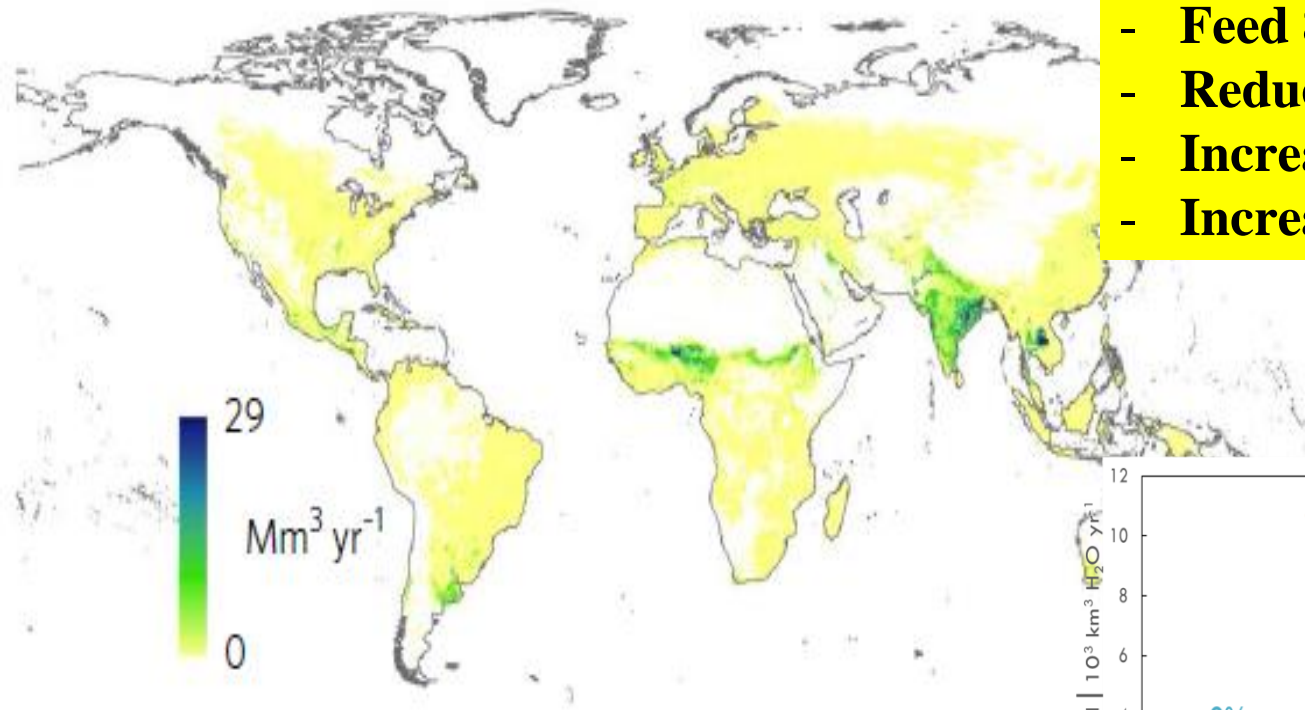


The nexus between forest fragmentation in Africa and Ebola virus disease outbreaks

(Rulli , Santini,Hyman, D'Odorico Scientific Reports 2017)

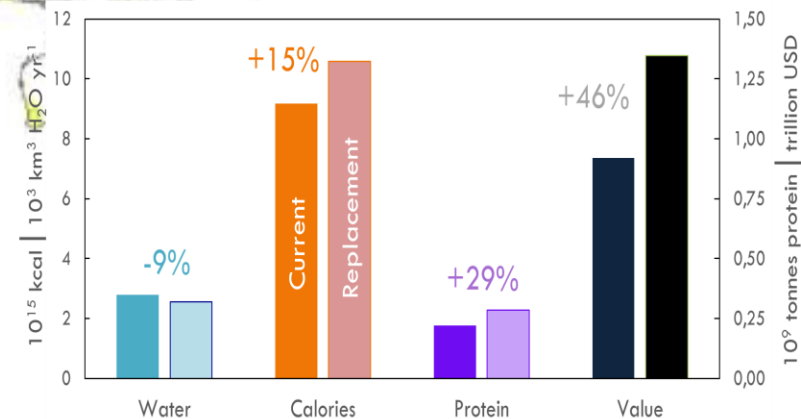
Forest fragmentation in Central and West Africa. Forest fragmentation in Central (panels a, and b) and West Africa (Panels c and d) in 2000 (top panels) and 2014 (bottom panels).

Sustainable intensification



- Feed 825 million people more
- Reduce water use by 10%
- Increase calories by 15%
- Increase proteins by 29%

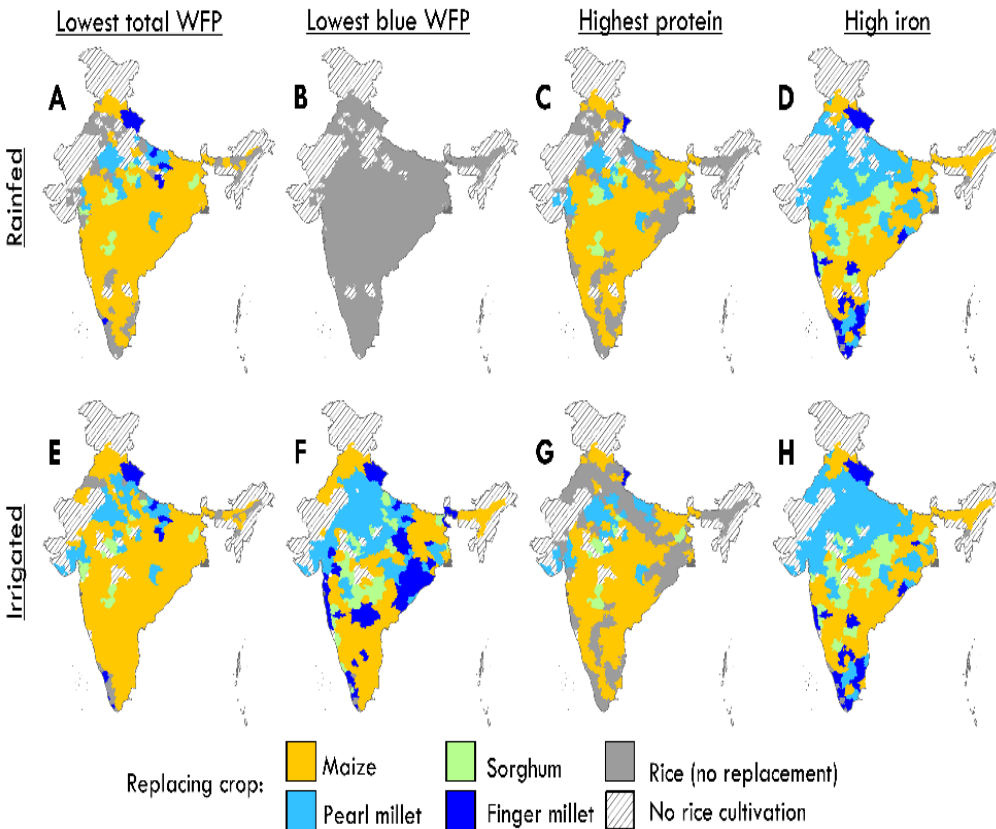
(Davis, Rulli, D'Odorico *Nature Geoscience*, 2017)



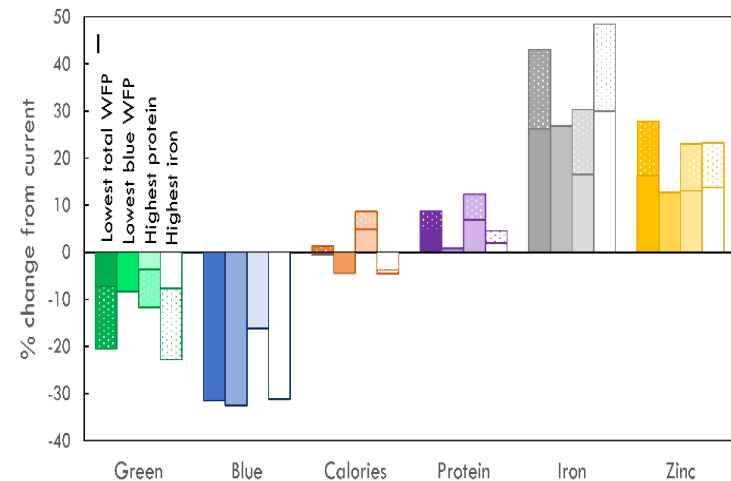


SDG and natural resources

Sustainable intensification



The potential nutritional and water use benefits of alternative cereals (i.e., maize, millets, and sorghum)



Davis, Rulli et al., (Science adv, 2018)

Outcomes of selected rice replacement scenarios



Mozambique current situation

Mozambique is a country with:

- a low gross domestic product GDP (116th on 186 (World Bank, 2016)),
- a high rate (29.7%) of malnourishment (FAOSTAT, 2010),
- the local diet exhibits an average food supply of 2,283 calories (2,178 cal from plant and 105 cal from animal products), mostly based on cassava and maize (30% and 20% of the average calorie supply, respectively) (FAOSTAT, 2010).



As scientist: Improve water and food condition



Water and food security assessment



Mozambique current situation

By combining:

- physically based equations,
- available information in datasets,
- computer programming Time,
- ...

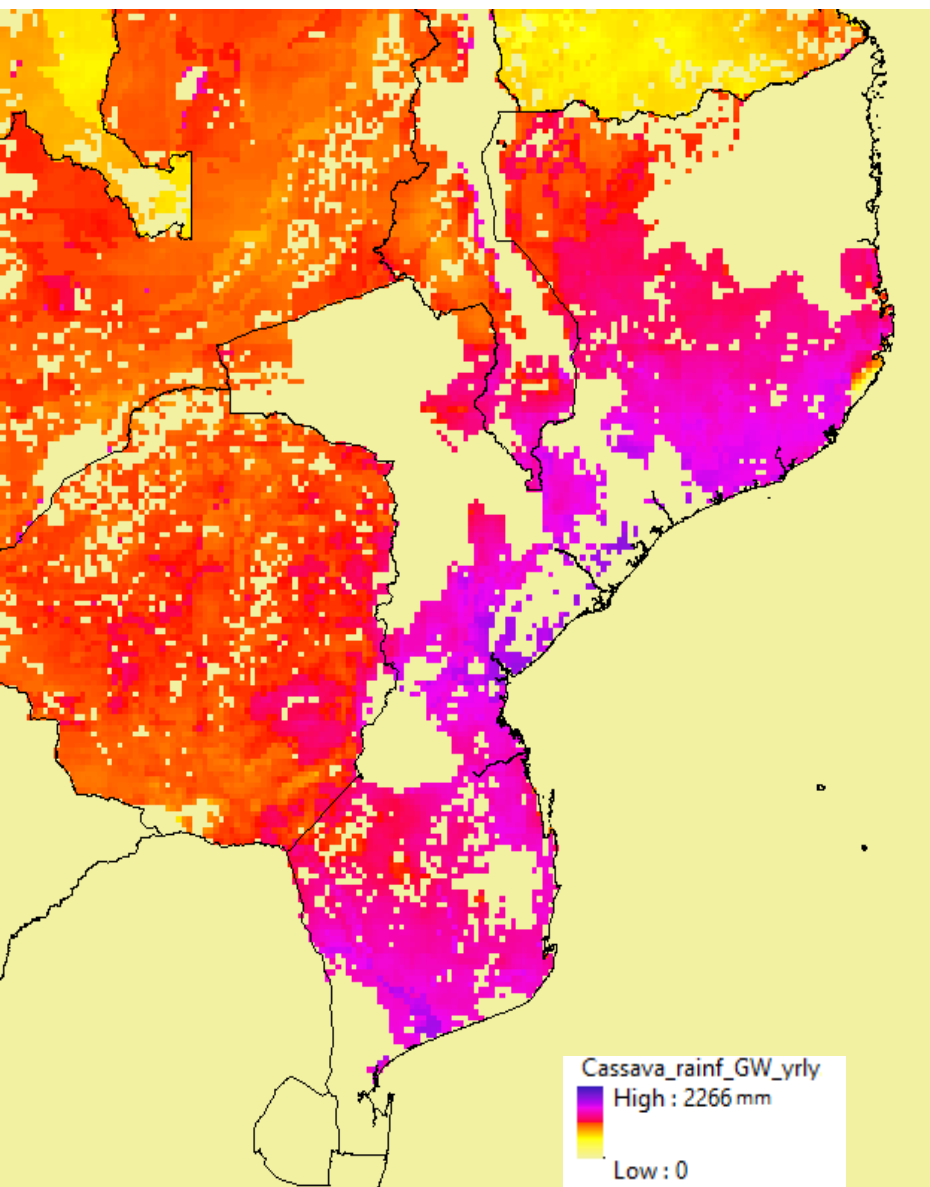
The screenshot shows a MATLAB editor window with the following details:

- Toolbar:** Includes buttons for PUBLISH, VIEW, and various execution options like Run, Run and Advance, Run Section, Advance, and Run and Time.
- File Path:** PROGETTI > ModelloCIRCO_CP > CropCalendar_RiceWheat >
- Editor Title Bar:** Editor - D:\mode5\Modello_FUNZIONA_global_Dataset_NEW2.m
- Tab Bar:** Modello_FUNZIONA_global_Dataset_NEW2.m, Elaborato_Mexico.m, cropcalendarSUPERATO.m
- Code Content:**

```
64 -   rwetdcoef = 0.5;
65 -   nday=[31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31];
66 -   day_zero = cumsum(nday) - nday;
67 -   last_day = cumsum(nday);
68 -   first_day = last_day - nday + 1;
69
70   %File di testo in input
71 -   common_input_data_path = importdata('..\input\txtfiles\InputSoilwatAIO_
72 -   output_soilwat_path = importdata('..\input\txtfiles\PercorsiOutputSoilw
73 -   output_soilwat_name = importdata('..\input\txtfiles\NomiOutputSoilwat.t
74 -   root_depletion = importdata('..\input\txtfiles\Root_Depletion.txt');
75 -   root_depletion = root_depletion.data;
76 -   crops_list = importdata('..\input\txtfiles\Crops_Mirca.txt');
77 -   country_list = importdata('..\input\admin2012.prn');
78 -   [country_list_id, country_list_name] = xlsread('..\input\txtfiles\Count
79 -   globcover_parts_path = importdata('..\input\txtfiles\Path_globcover_par
80 -   tempdatapath_land = importdata('..\input\txtfiles\Path_temp_land_class_
81 -   %tempdatapath_rprc = importdata('..\input\txtfiles\Path_temp_rprc.txt')
82
83   %Controlla definizione di nbatch & co
84 -   if rem(ny5mintot,nbatch)~=0
85 -       error('Scegli nbatch in modo che ny5mintot sia divisibile per esso
86 -   end
87
```



Getting information



crop calendar



search result for Mozambique

back

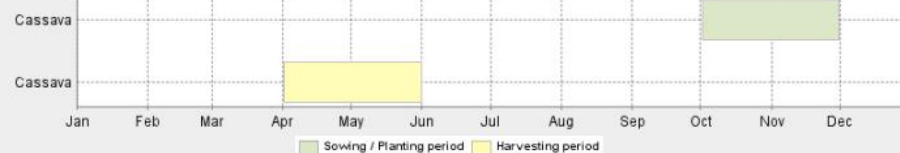


Click on the text in bold for more information about the zone

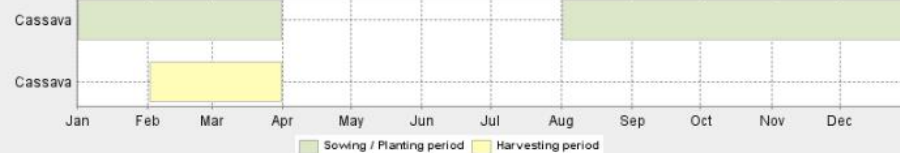


Click on the bars below for more information about the crop

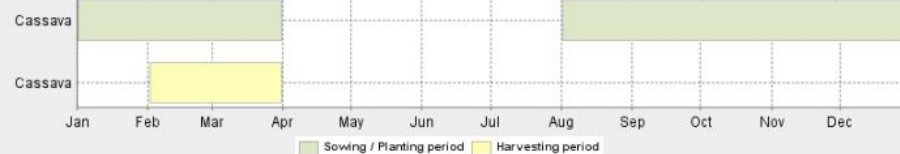
Agro-ecological zone : Region 08



Agro-ecological zone : Region 02



Agro-ecological zone : Region 01

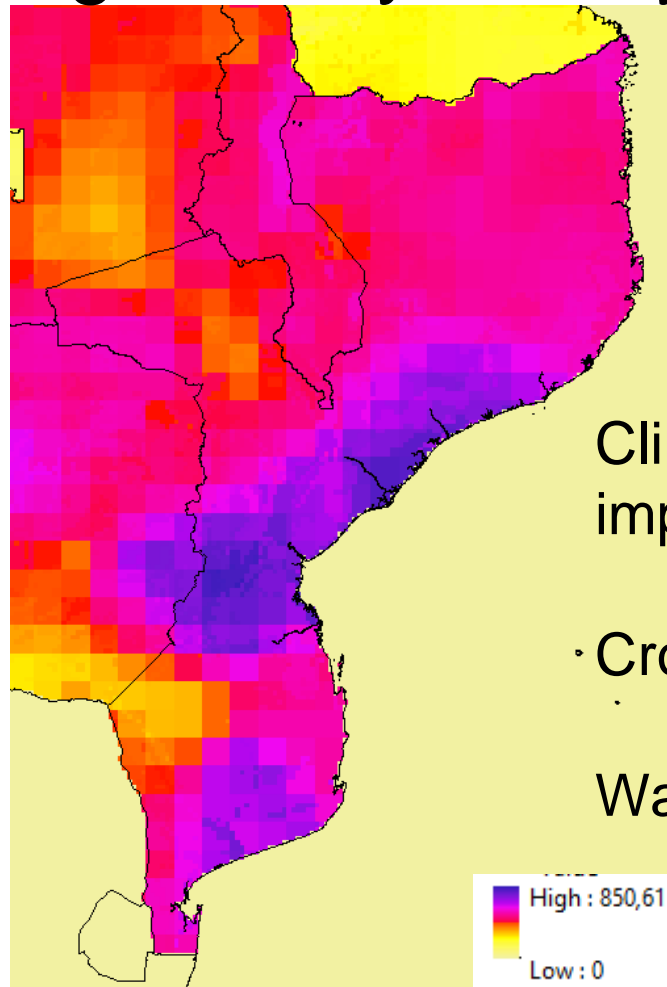
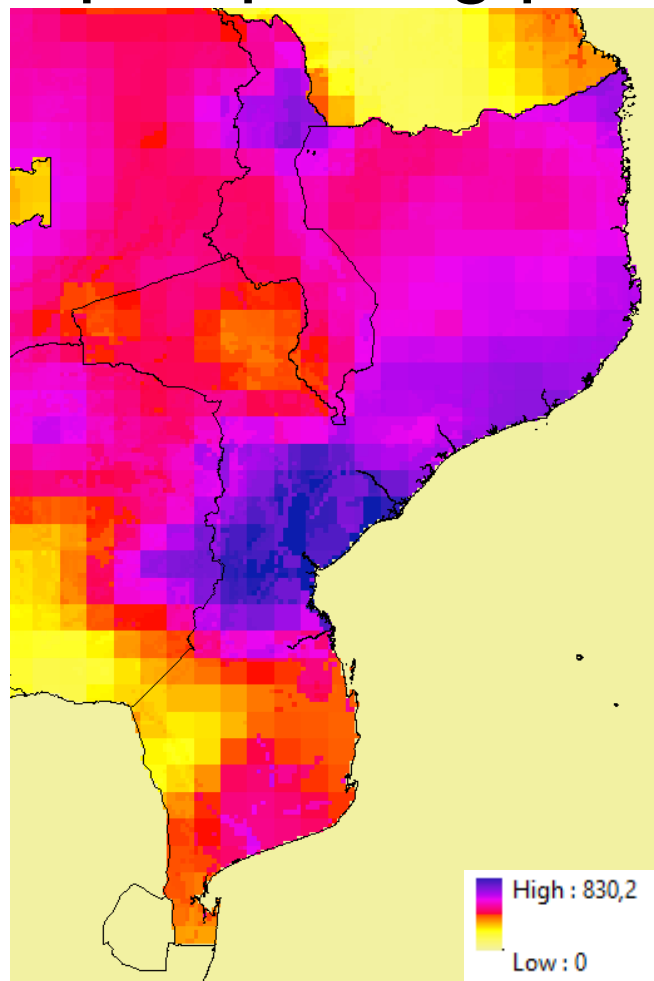


<http://www.fao.org/agriculture/seed/cropcalendar>



Best management of resources

Big variation in GW used by cassava only by postponing planting date by 15 days!



Climate change impacts?

• Crop management?

Water management?

...



Planting in Mozambique

Planting and harvesting in Mozambique



Planting and harvesting in the model

lat	long	crop	area_ha	Planting month	Harvesting month
41,54	2,38	11,00	0,45	3	7
41,54	2,46	11,00	1,34	11	6
41,54	2,46	11,00	1,18	3	7
41,54	9,21	11,00	0,00	11	6
41,54	9,21	11,00	0,01	5	9
41,54	12,63	11,00	24,75	4	9
41,54	12,63	11,00	27,10	11	5
41,54	12,71	11,00	21,89	4	9
41,54	12,71	11,00	36,47	11	5
41,54	12,79	11,00	33,93	4	9
41,54	12,79	11,00	48,04	11	5
41,54	12,88	11,00	27,80	4	9
41,54	12,88	11,00	38,48	11	5
41,54	12,96	11,00	21,88	4	9
41,54	12,96	11,00	35,31	11	5
41,54	13,04	11,00	0,29	4	9
41,54	13,04	11,00	2,28	11	5
41,54	13,13	11,00	0,71	4	9
41,54	13,13	11,00	0,82	11	5
41,54	13,21	11,00	0,71	4	9
41,54	13,21	11,00	0,88	11	5
41,54	13,29	11,00	2,31	4	9
41,54	13,29	11,00	2,55	11	5
41,54	13,38	11,00	9,41	4	9
41,54	13,38	11,00	9,86	11	5
41,54	13,46	11,00	6,67	4	9



Precious detailed data:

- > crop type
- > planting data
- > irrigation data
- > irrigation type
- ...



<https://unhabitat.org/mozambique/mozambique-projects/>



Sustainable development

Good environmental governance takes into account the role of all actors that impact the environment: governments, non-governmental organizations (NGOs), private sector, citizen groups

Cooperation between actors is important to achieving effective governance

Situation may not be well captured by targets or statistics designed for the mainstream population

Marginalized people need to be reached, heard and helped in order to achieve the universal SDG targets:

- People who live in certain geographic areas or living in non-favourable conditions, should be targeted to improve the representativeness of data collected
- **The data collected from these groups would provide rich and detailed information about their experiences and needs, that could not be assessed differently.**
- If the project topic has been decided at the local level, the results are more likely to be locally relevant.



Thank you for
your attention