

Future storylines of the 2012 soybean failure event

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Presentation summary

Objectives of this work:

Link 2012 crop failure to meteorological conditions

Explore future counterfactuals under global warming

Outline:

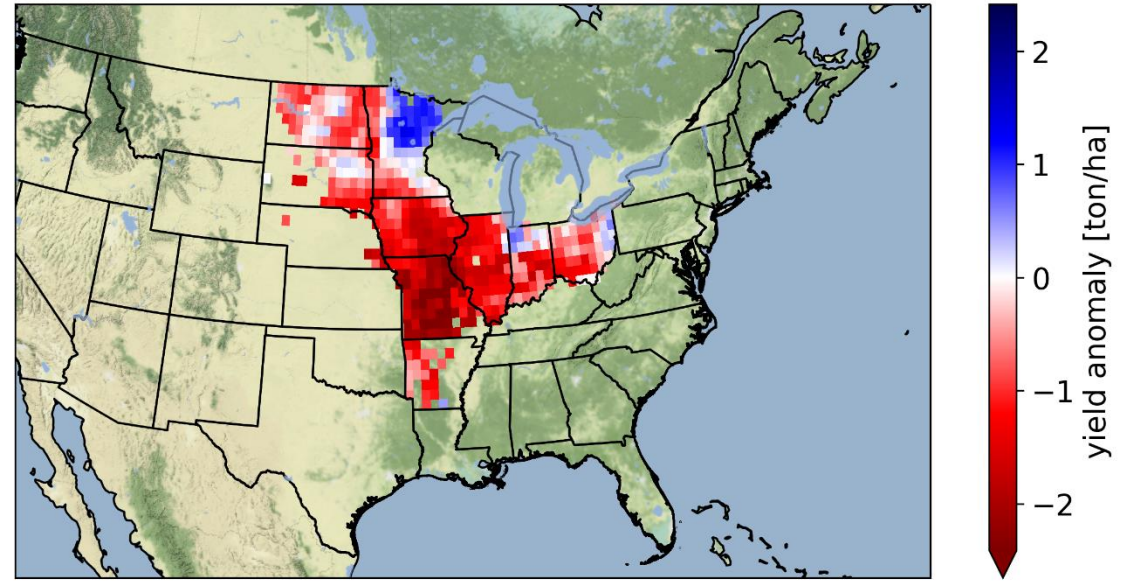
1. What happened in 2012?
2. Why does this event matter?
3. Linking crop failures to weather;
4. Methods;
5. Results.

I) What happened in 2012?

- Soybean prices reached a historical peak;
- Main US producing sites had crop failures.
- **Was it associated to weather conditions?**



Yield anomaly for 2012 soybean season



2) Why are soybeans important? (*Soybean importance*)

- Soybeans are main global source of protein for animal feed worldwide;
- Second most consumed type of vegetable oil;
- Important for human consumption;
- Most traded crop in the world;
- Concentrated production in few countries;
- Environmental issues (deforestation).

3) Methods

- Link crop failures to meteorological conditions;
- Explain historical cases and explore future counterfactuals.

1 - Crop-climate link

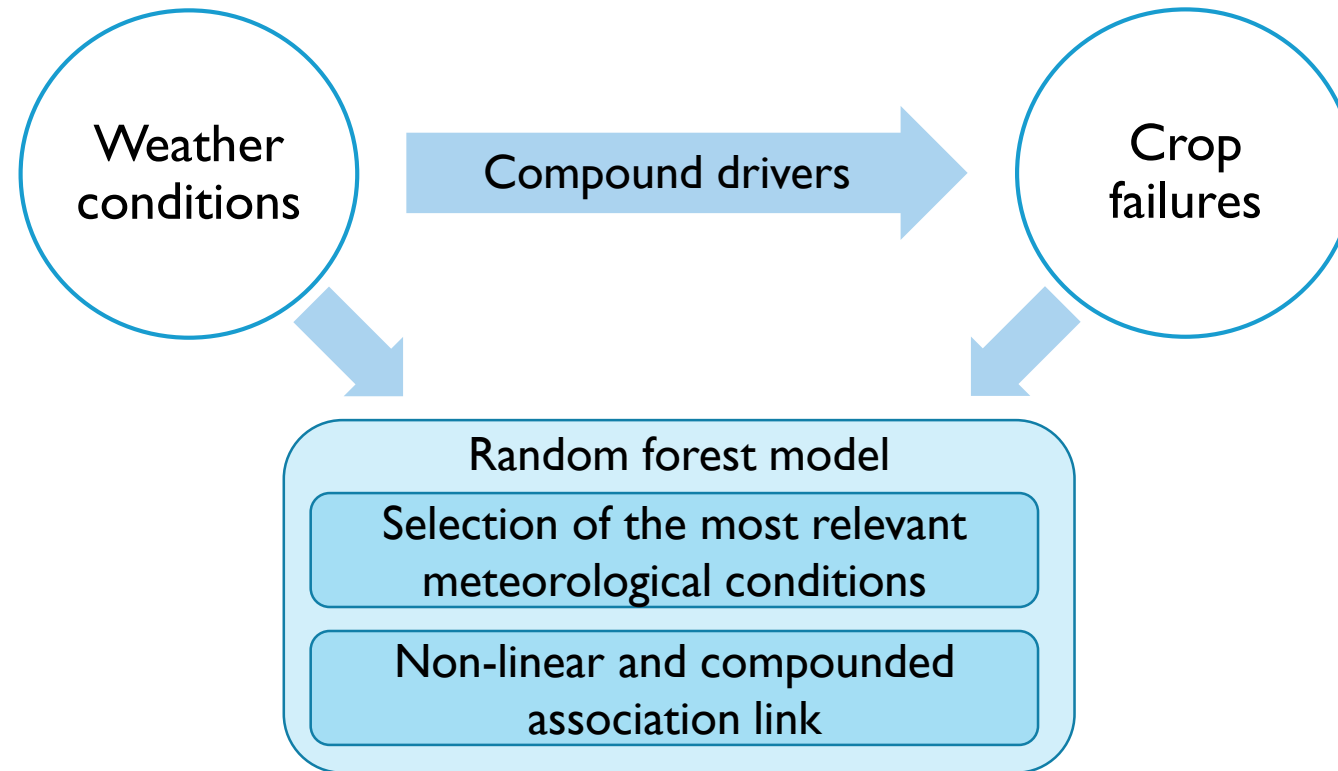
- Weather variables selection
 - Random forest



2 - 2012 season

- Explain the event
- Similar events in the future

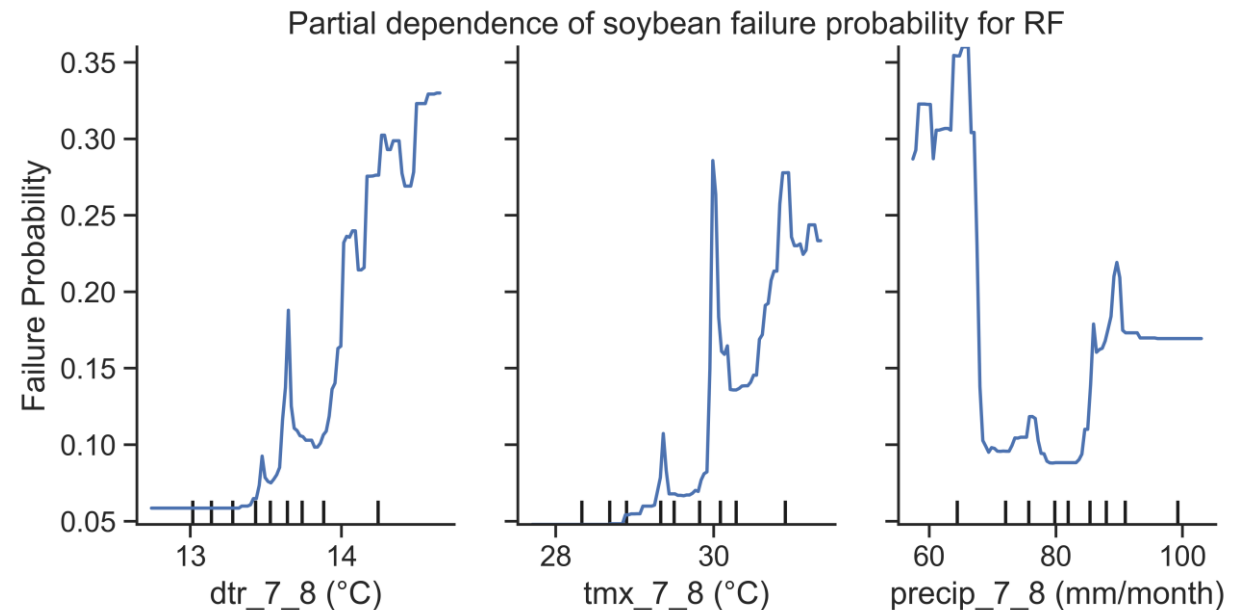
3-1) Methods: Crop-climate link



3-2) Results: Crop-climate link

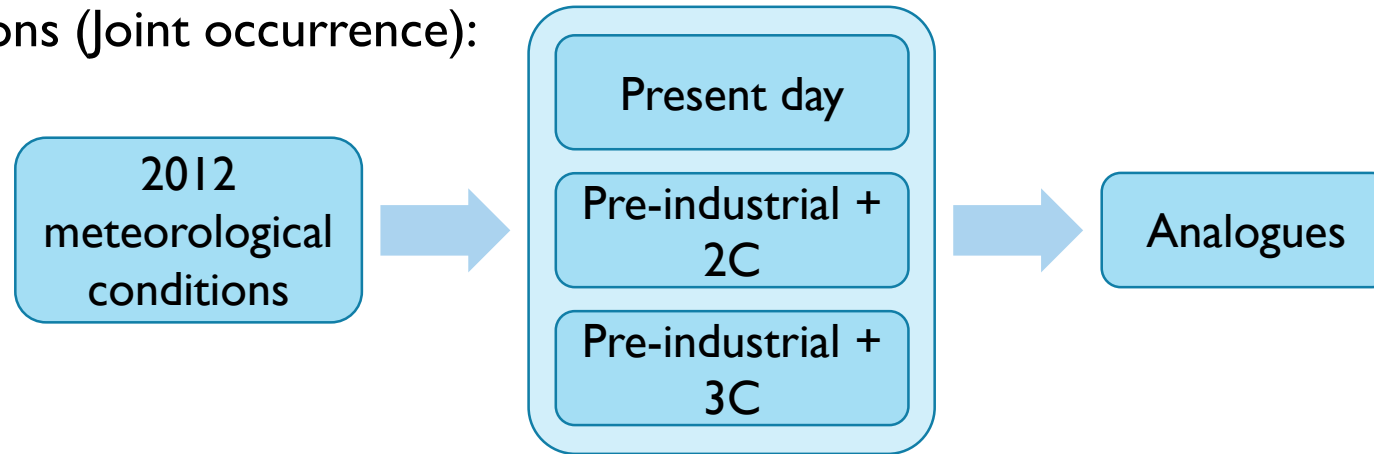
- Most important meteorological variables:
- Associations between crop failure probability and meteorological variables:
 - Higher Tmx and Dtr increase failure probability;
 - Lower Precip increase failure probability;
 - Non-linear links.

Variables	Months	Short
Maximum temperature	July and August	Tmx_7_8
Diurnal temperature range	July and August	Dtr_7_8
Precipitation	July and August	Precip_7_8

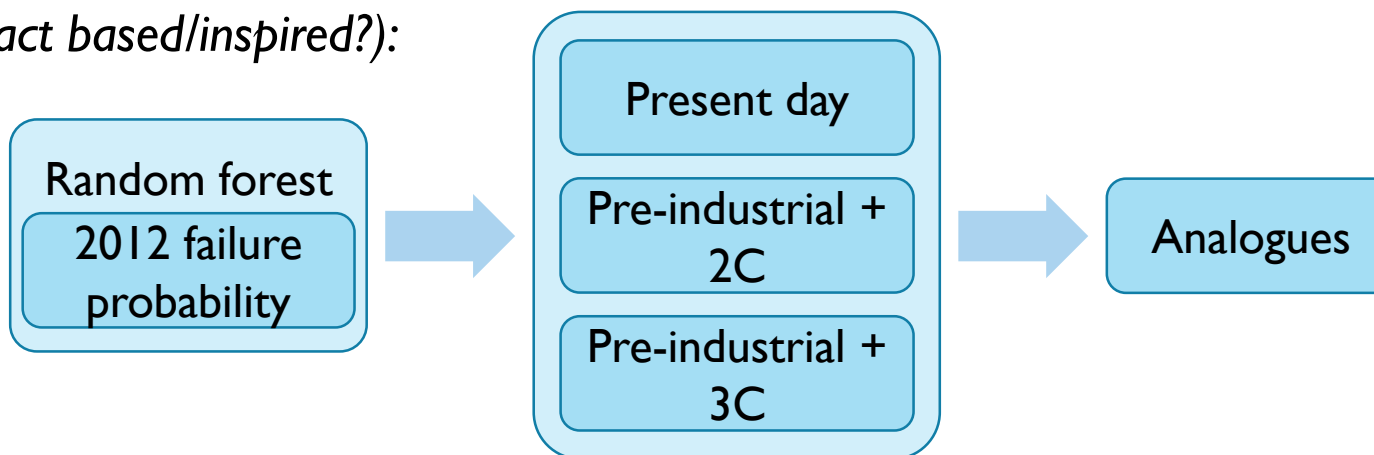


4-1) Methods: 2012 season – Two methods

a) Similar physical conditions (Joint occurrence):



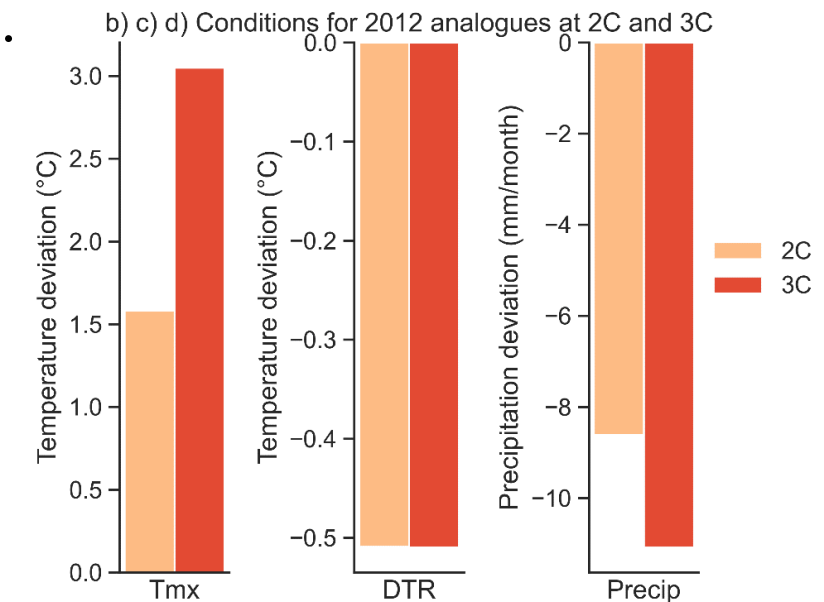
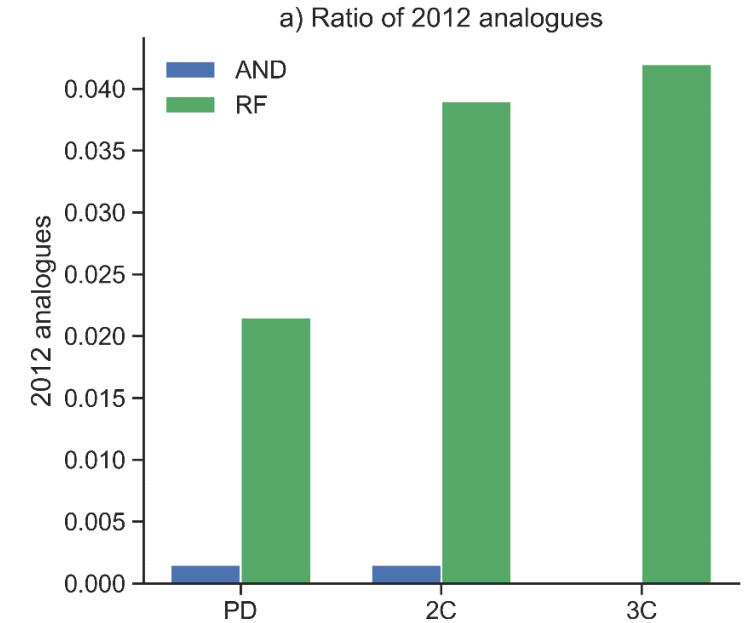
b) Failure probability (*Impact based/inspired?*):



4-2) Results: 2012 season

Comparison between the two approaches:

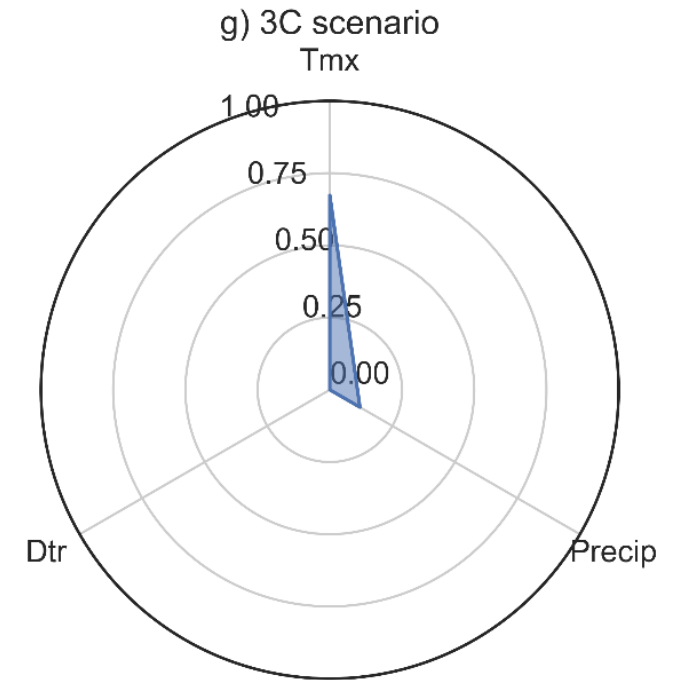
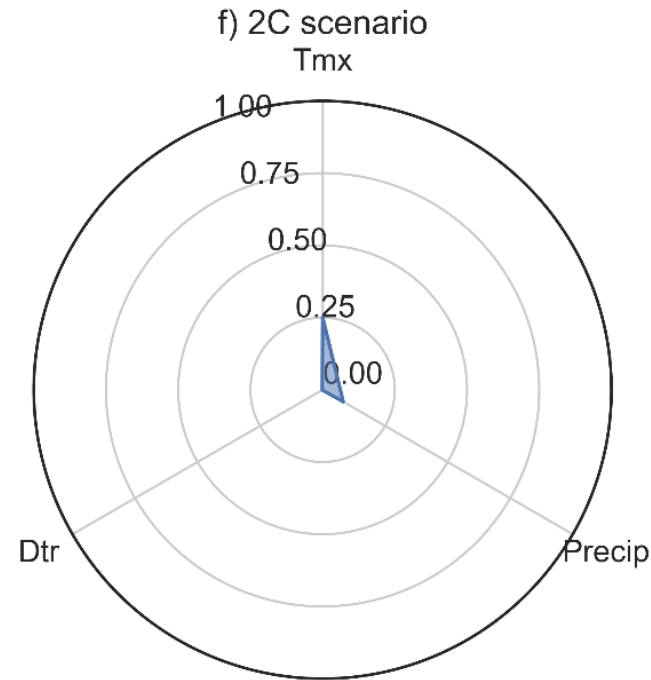
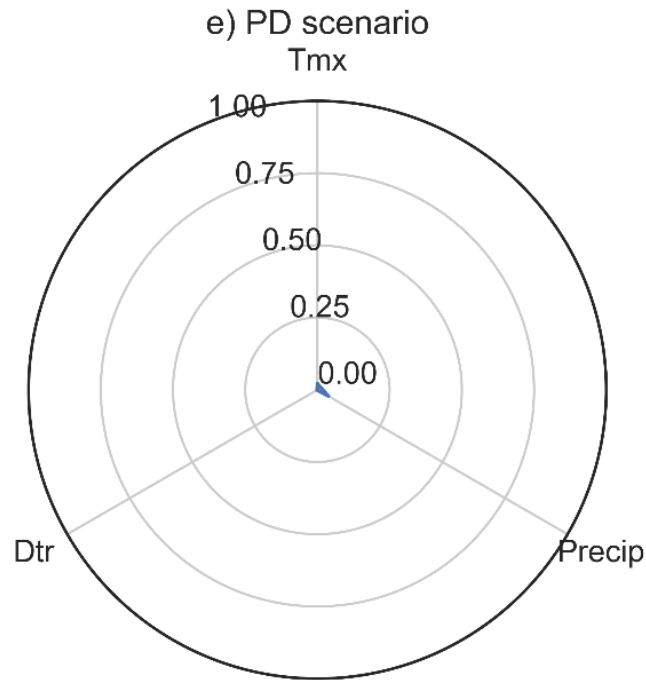
- Similar physical conditions do not increase with GW;
- *Events with similar failure probabilities show increase with GW;*
- Conditions change: Future events drier, warmer and lower Dtr values.



4-2) Results: 2012 season

Difference between approaches:

- 2012 Dtr values do not increase, but tmx and precip do:
 - Joint occurrence needs all three conditions for analogue definition;
 - *Events with similar failure probabilities* approach bypasses this limitation and captures increase in similar events.



5) Take-home messages

- Random forest capable of accounting for compound failure drivers and non-linear interactions;
- Crop failures expected to increase with higher GW levels;
- Reduction of the importance of compound failure drivers;
- 2012 joint occurrence of meteorological conditions are rare and do not escalate with GW due to DTR;
- *Events with similar failure probability of 2012* increase with GW;
- Future 2012 similar events to be warmer and drier, but lower DTR;

Thank you!

Paper coming soon.