



Crop and grassland responses to climate change factors: uncertainties and adaptation strategies

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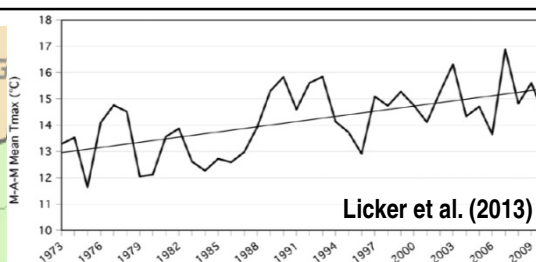
French National Institute for Agricultural Research (INRA)

Workshop “Climate change, agriculture and forestry”

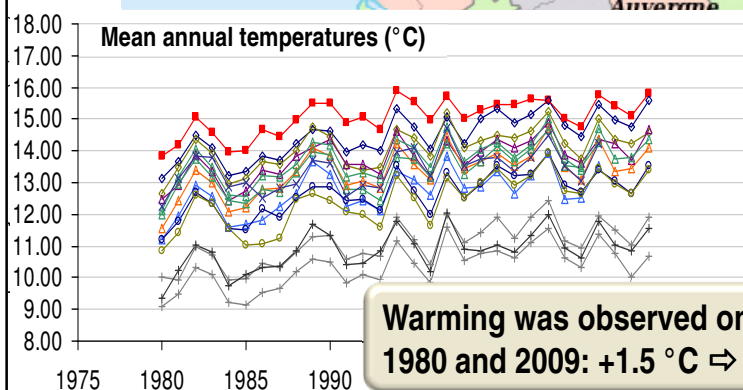
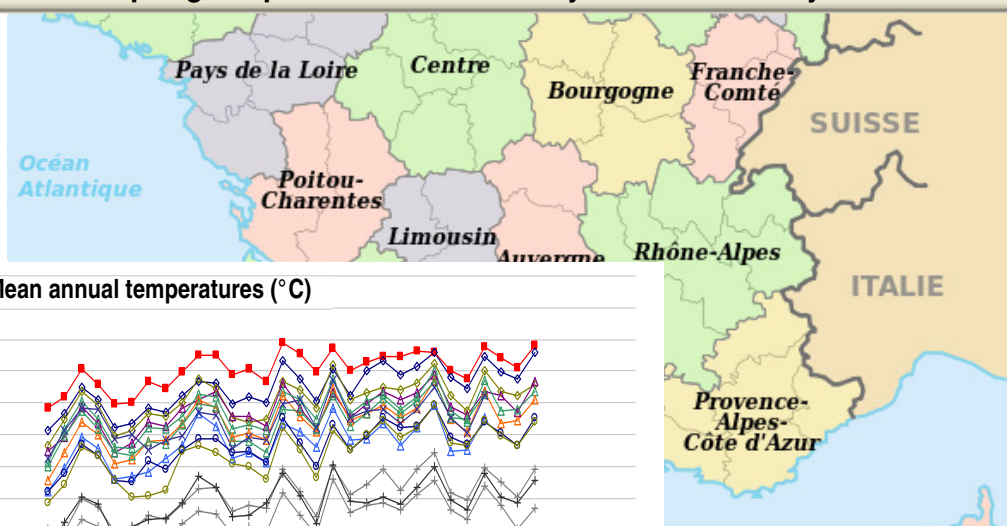
07 May 2014

Embassy of France, Berlin (Germany)

Climatic changes in France



Maximum spring temperatures increased by 2.4 °C in Picardie between 1973 and 2010



Warming was observed on 14 sites in southern France between 1980 and 2009: +1.5 °C \Rightarrow +0.5 °C / decade (Lelievre et al., 2011)

Climate change impacts in agriculture

Climatic & atmospheric changes



Impacts

CO₂ concentration



Photosynthesis



Water use efficiency



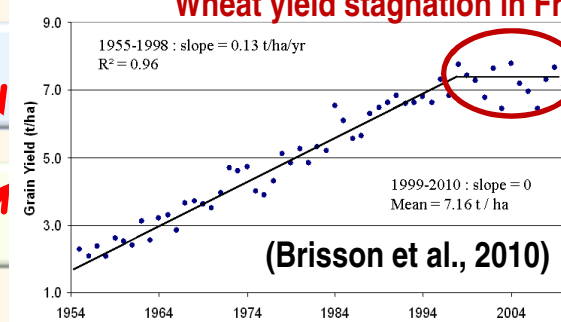
Precipitations



Temperatures



Wheat yield stagnation in France



Plant water status



Length of the cycle



Biotic interactions



Adaptations to climate change impacts / 1

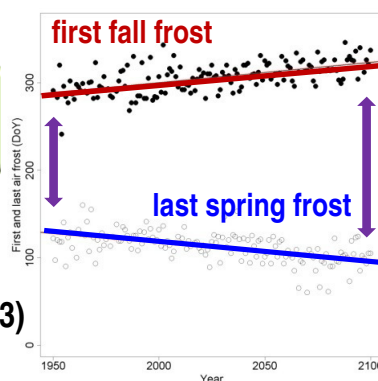
Impacts

Adaptations

Frost control

Plant protection

(Carrère and Bellocchi, 2013)

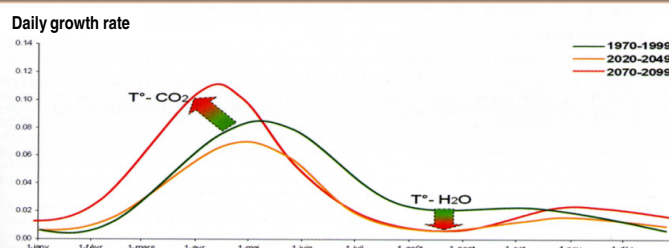


Start of grass growing season

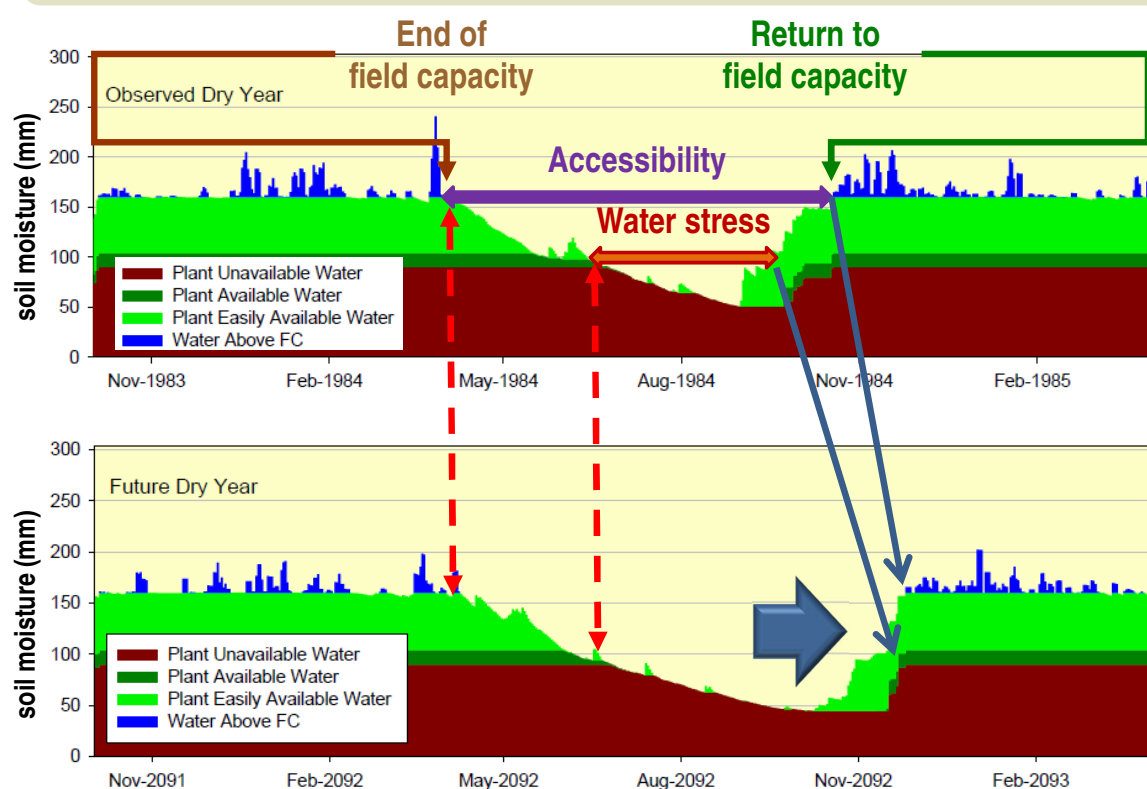
Nitrogen input

Evolution of yearly productivity of a grassland

(Durand et al., 2010)



Soil water balance



(Rivington et al., 2013)

Adaptations to climate change impacts / 2

Impacts

Adaptations

Length of grass growing season

Length of grazing time

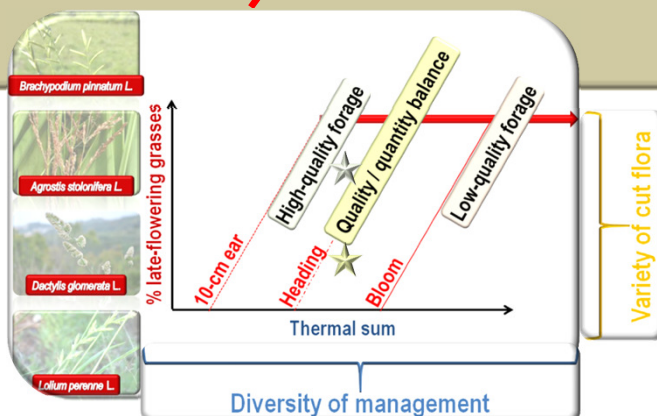
Number of cuts

Summer water deficit

Forage stocks

Irrigation requirements

Plant diversity

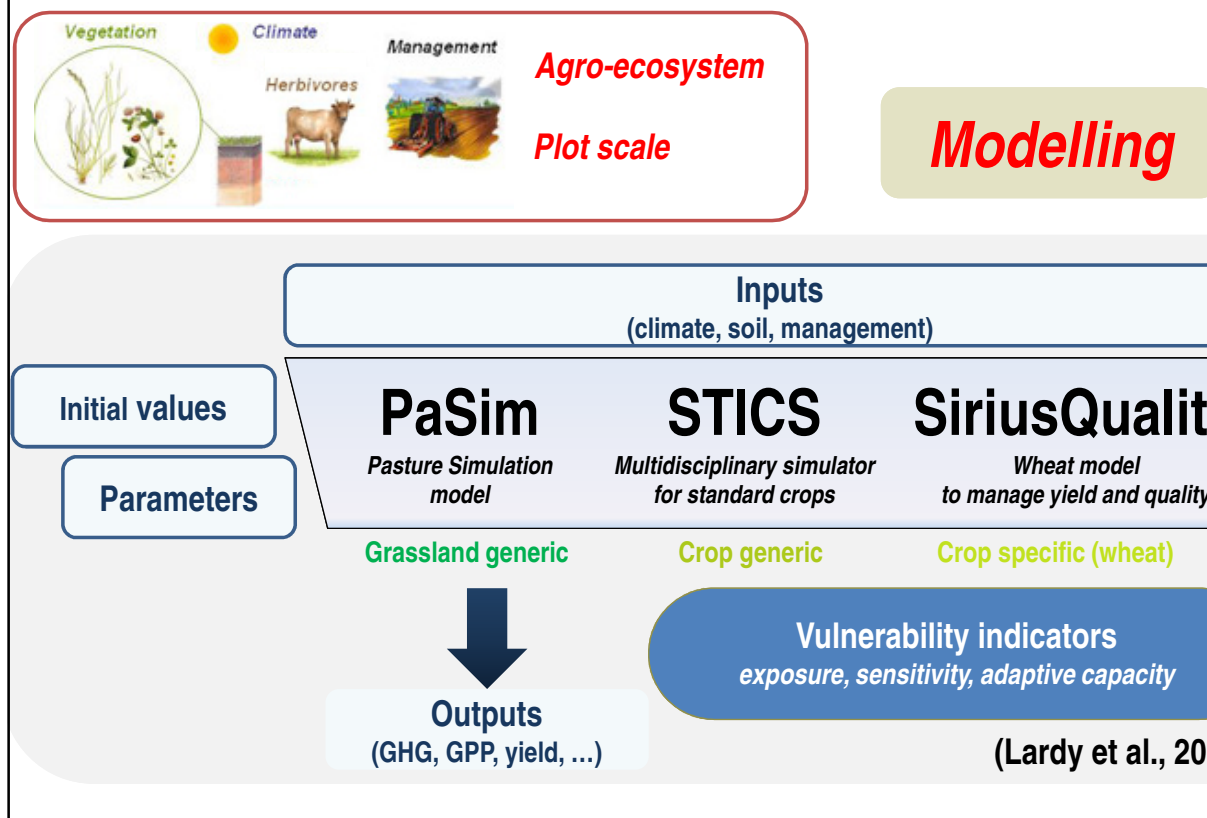


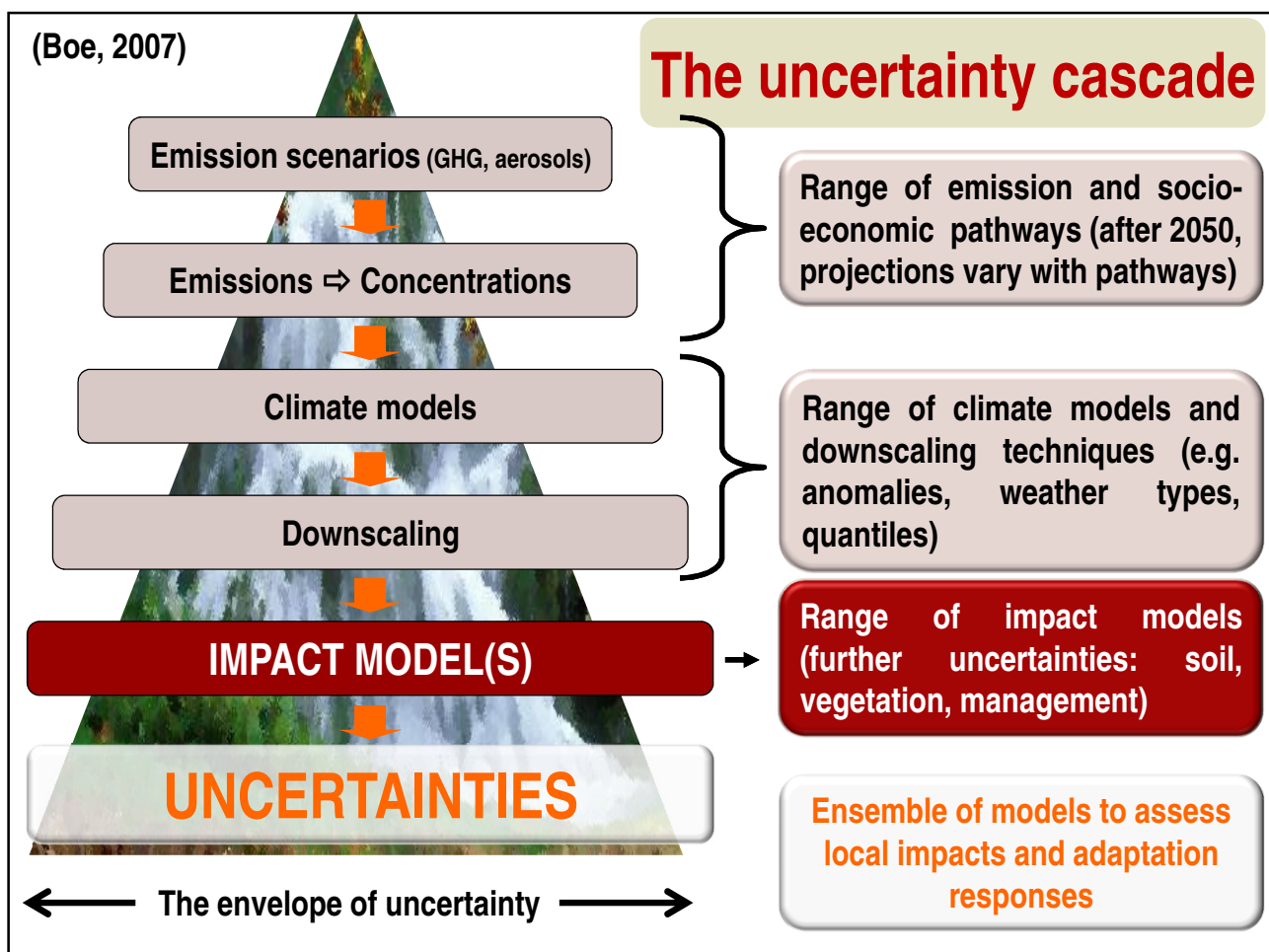
Variety of cut flora

(Theau et al., 2010)

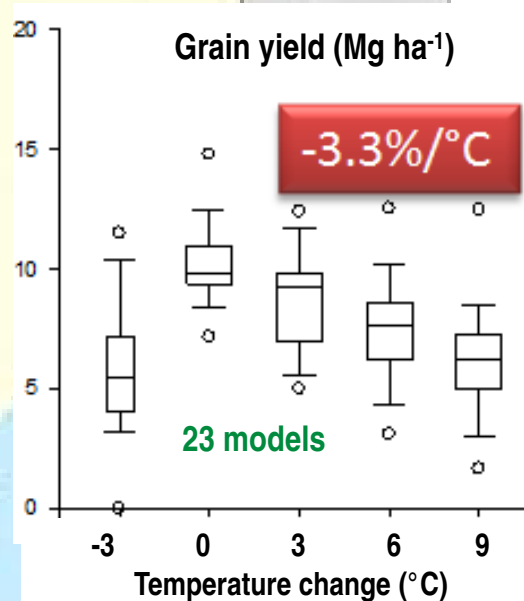
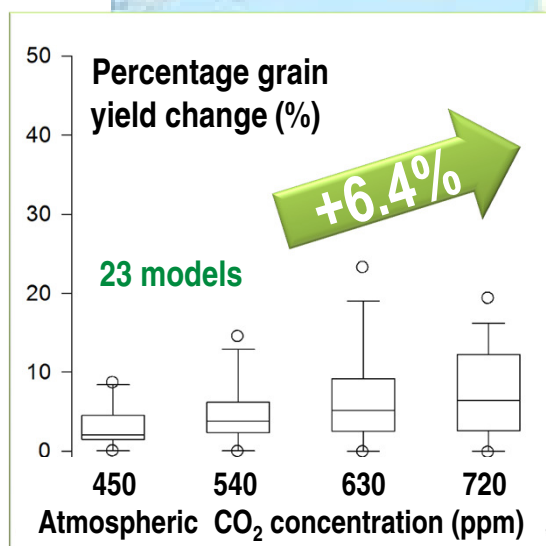
- + Lignin
- + Cellulose
- Crude protein
- Nonstructural carbohydrates

Systemic approach





Ensemble modelling on maize



Bassu et al. (2014)

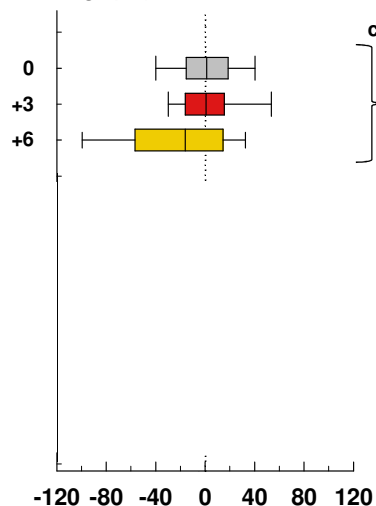
AgMIP The Agriculture Model Intercomparison and Improvement Project

Ensemble modelling on wheat

26 models

Australia

Temperature change (°C)



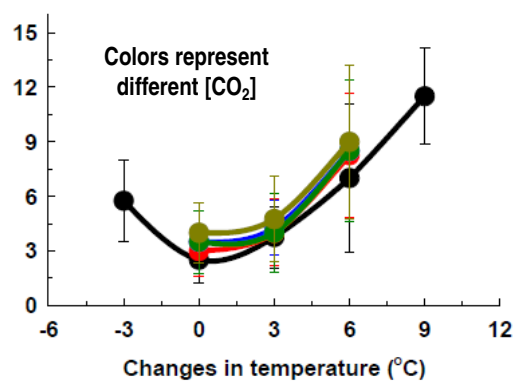
Simulated yield change (%)

Atmospheric CO₂ concentration (ppm)

360 Required number of crop models to achieve
<13.5% simulated impact variability (-)

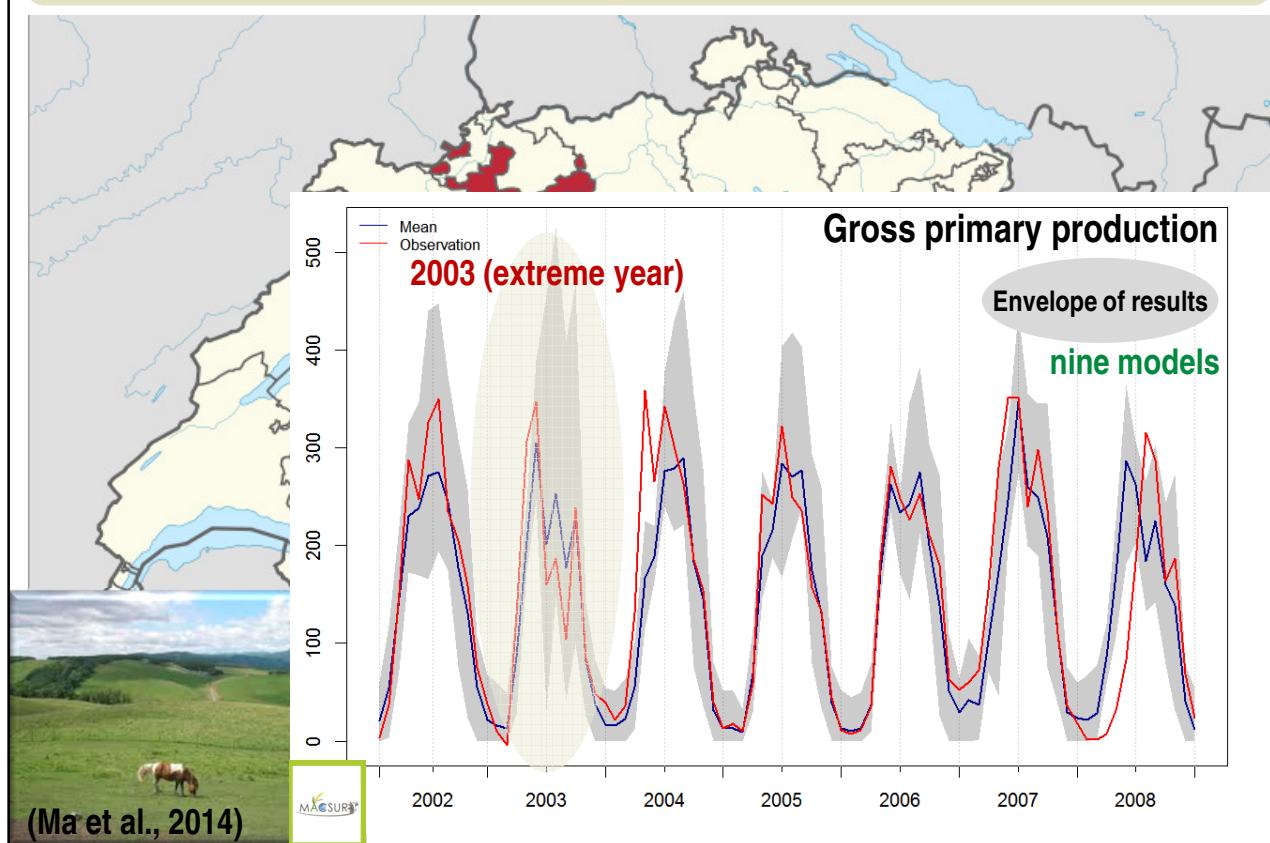
AgMIP The Agricultural Model Intercomparison and Improvement Project

Asseng et al. (2013)

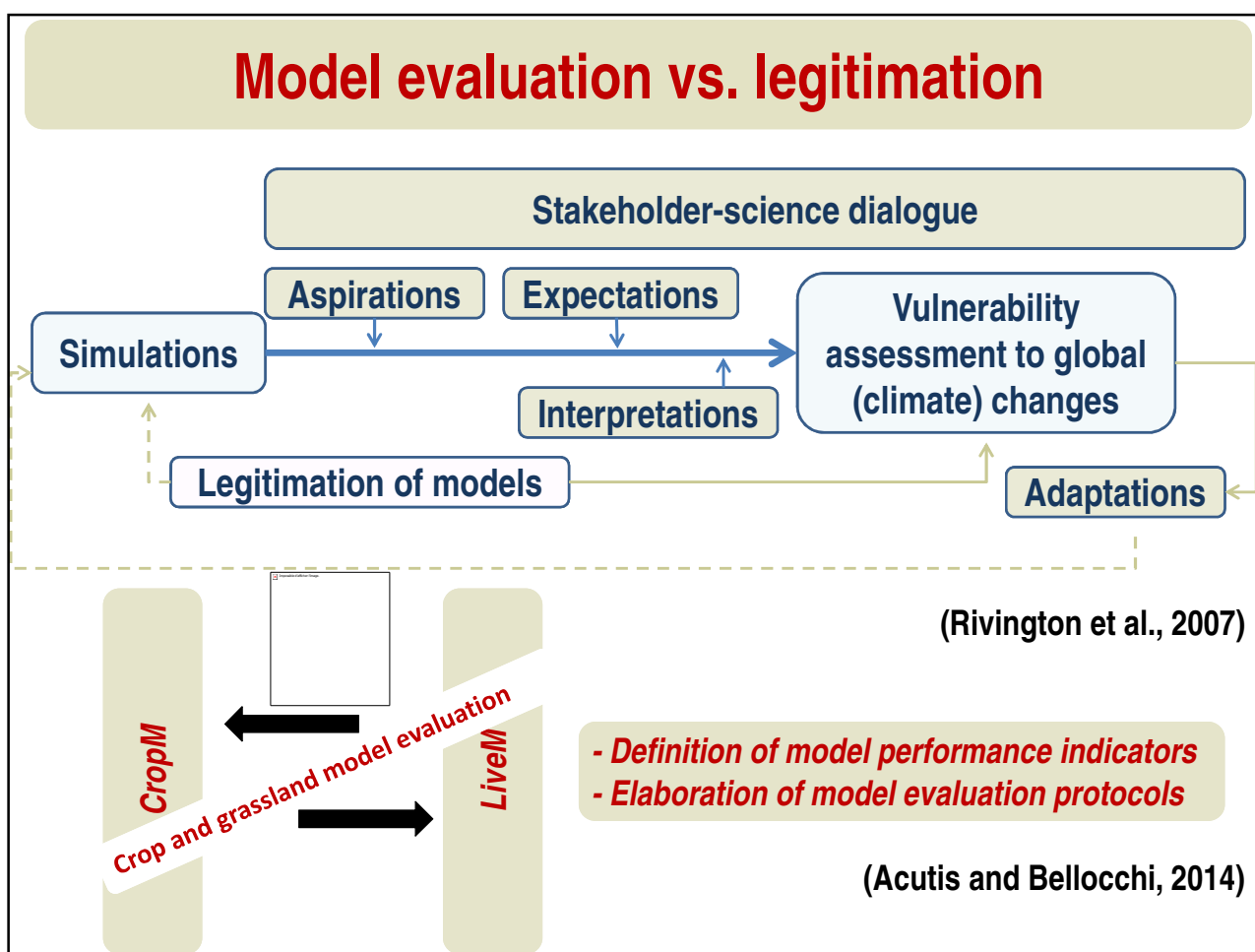


13.5% = mean experimental error (Taylor et al., 1999)

Ensemble modelling on grasslands



Model evaluation vs. legitimation





FACCEJPI Agriculture Food Security and Climate Change



www.faccejpi.com



The Agricultural Model Intercomparison and Improvement Project



modextreme
agriculture facing extreme climatic events




An integration of mitigation and adaptation options for sustainable livestock production under climate change





Agence Nationale de la Recherche




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Adaptation de l'agriculture et de la forêt au changement climatique