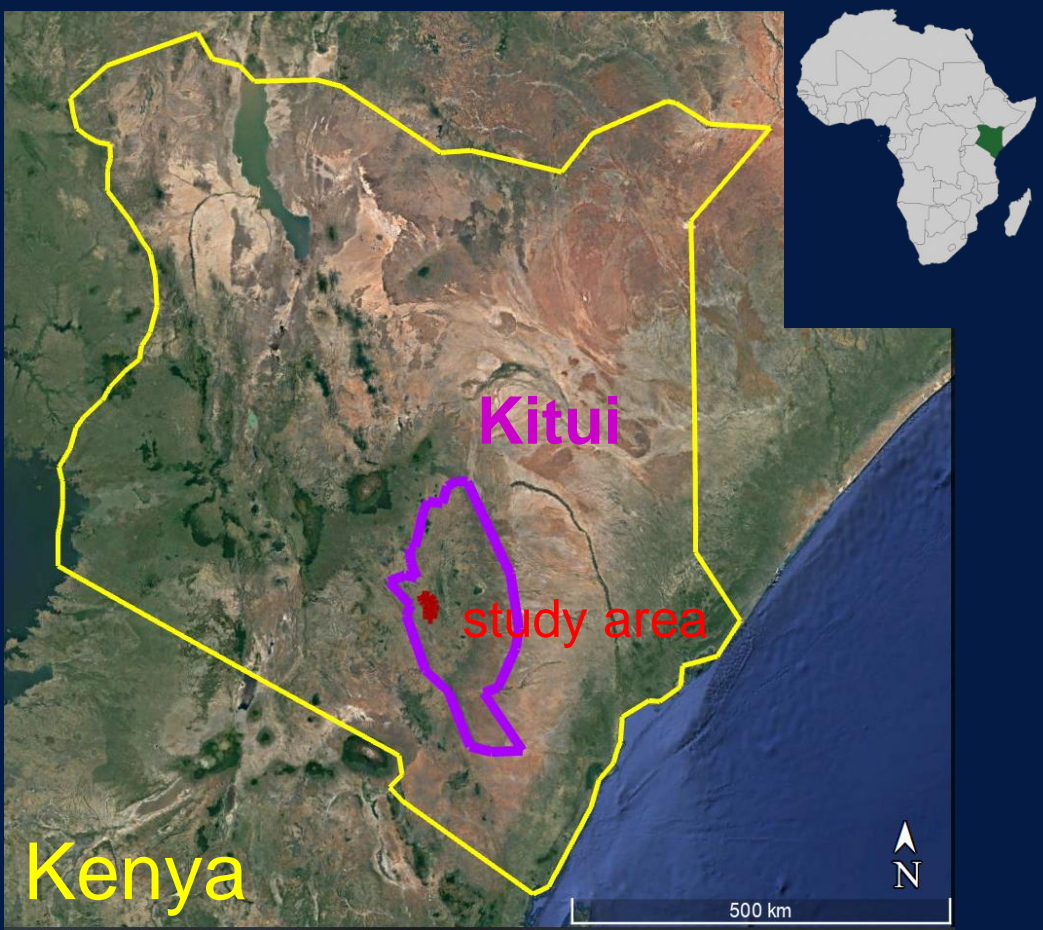
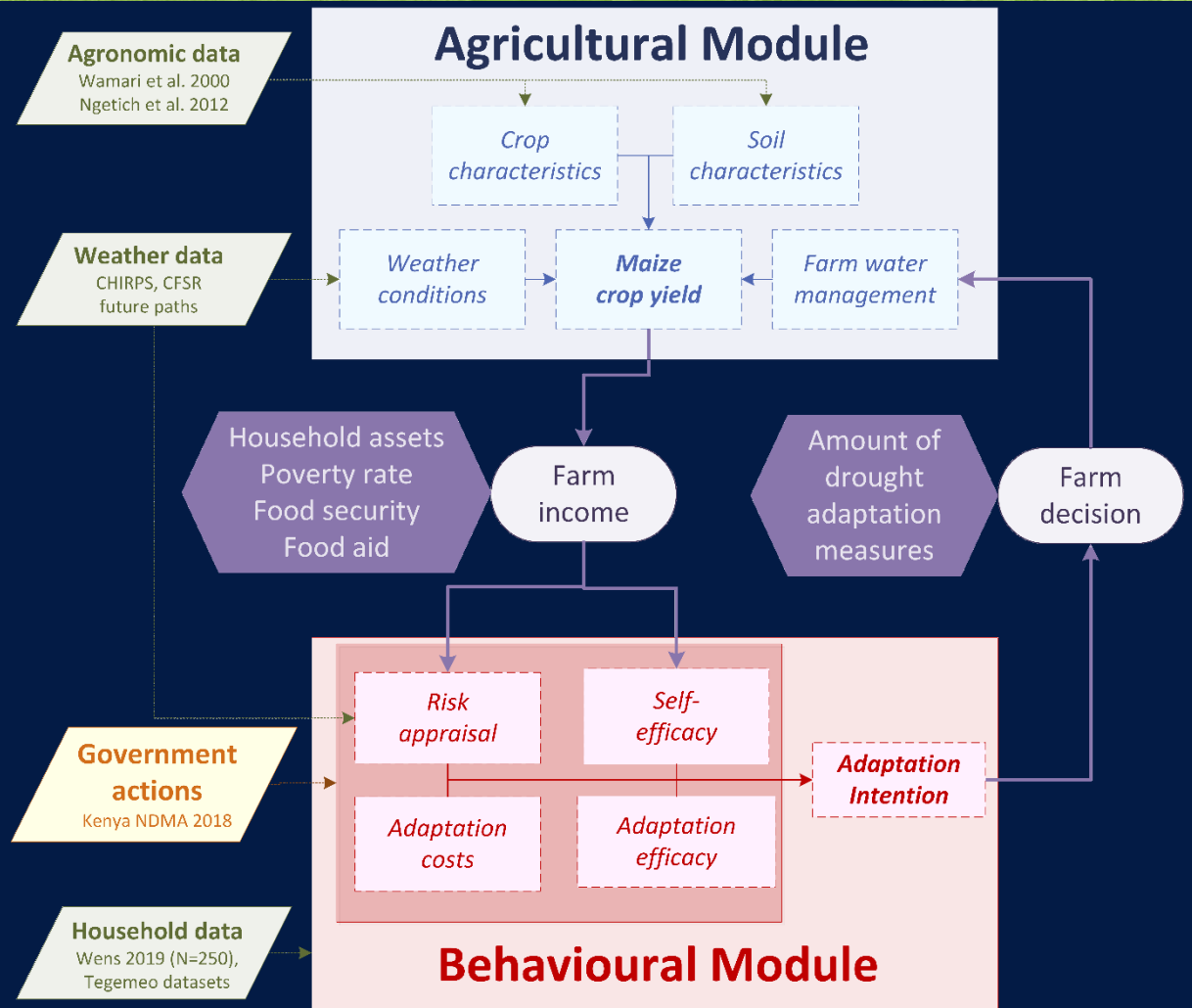




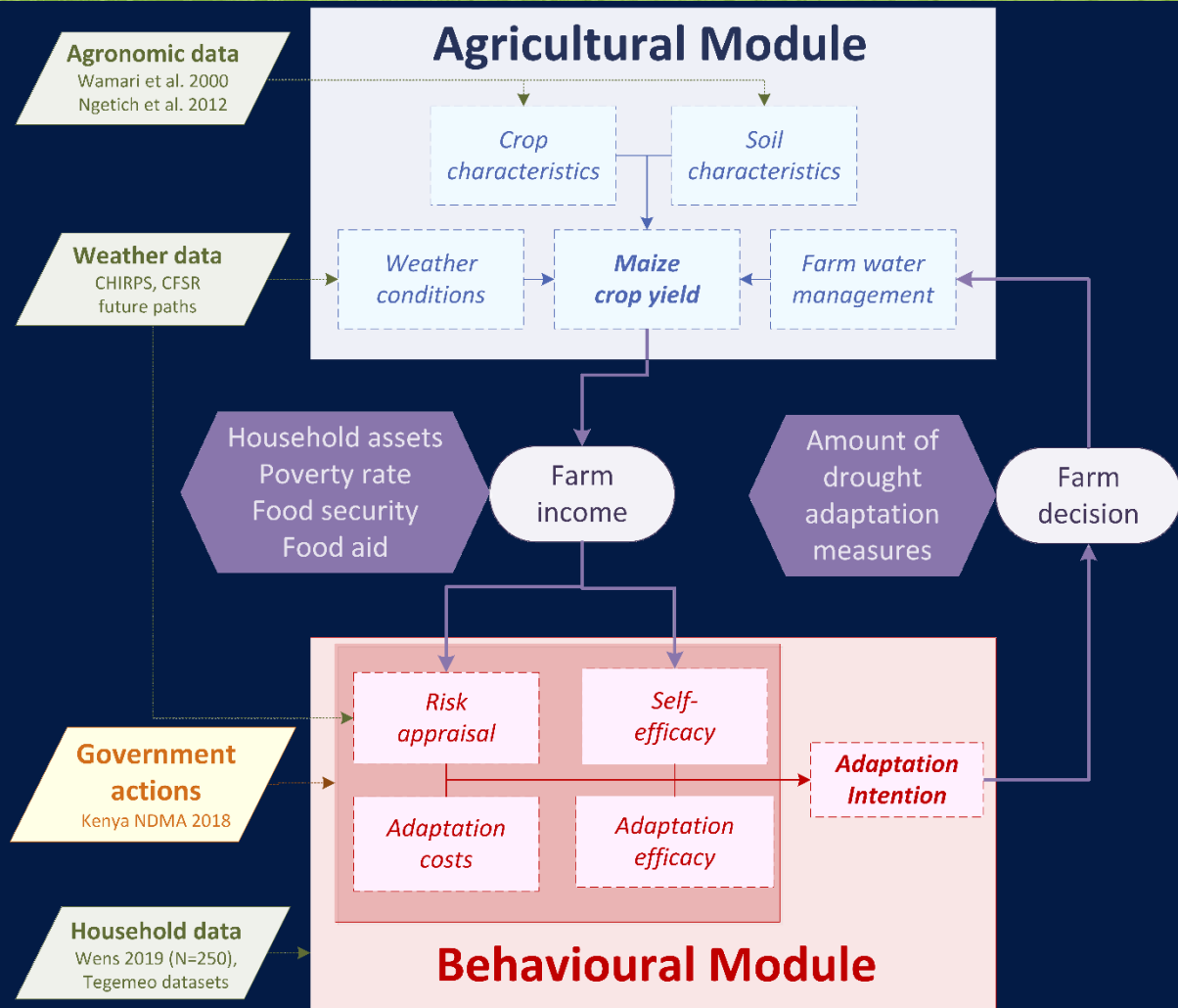
Integrating human adaptive behavior dynamics in agricultural drought risk assessments

Marthe Wens, Anne Van Loon, Ted Veldkamp, Jeroen Aerts etc

Here, we present you **ADOPT**, an agent-based, dynamic drought risk adaptation model for smallholder farmers, applied for Kitui



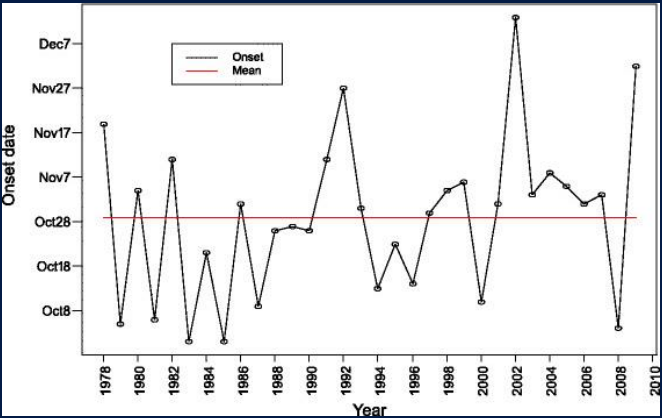
The adoption of four different local, drought-reducing farm water management measures are included in the ADOPT model



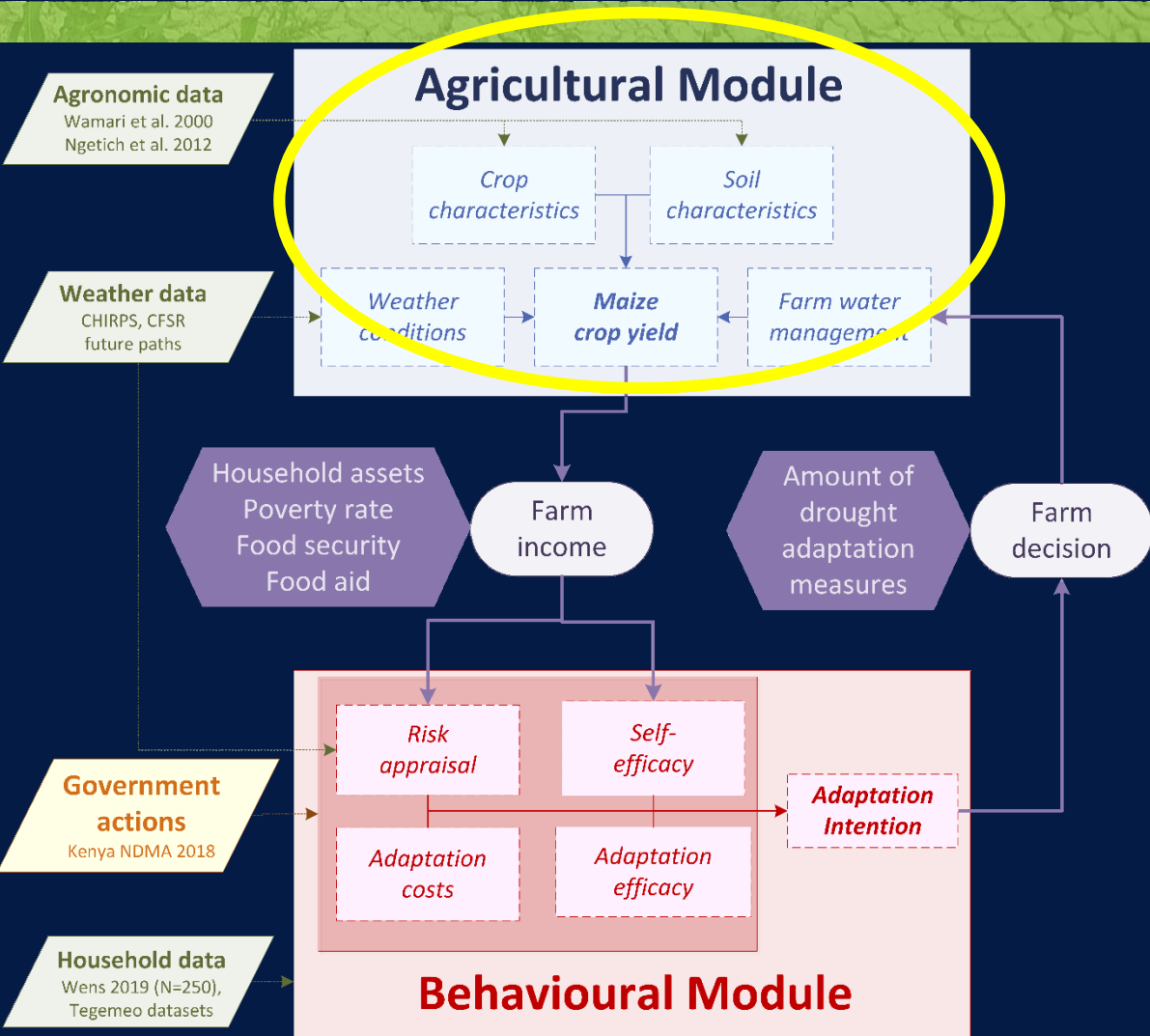
The **agricultural module** of ADOPT is represented by AquacropOS, simulating seasonal maize yield on individual farm scale



Foster et al. (2017) AWM



Omoyo et al. (2015) AFS



Subsistence farmers grow **dry mid-altitude maize** varieties vulnerable to water shortage and temperature variability

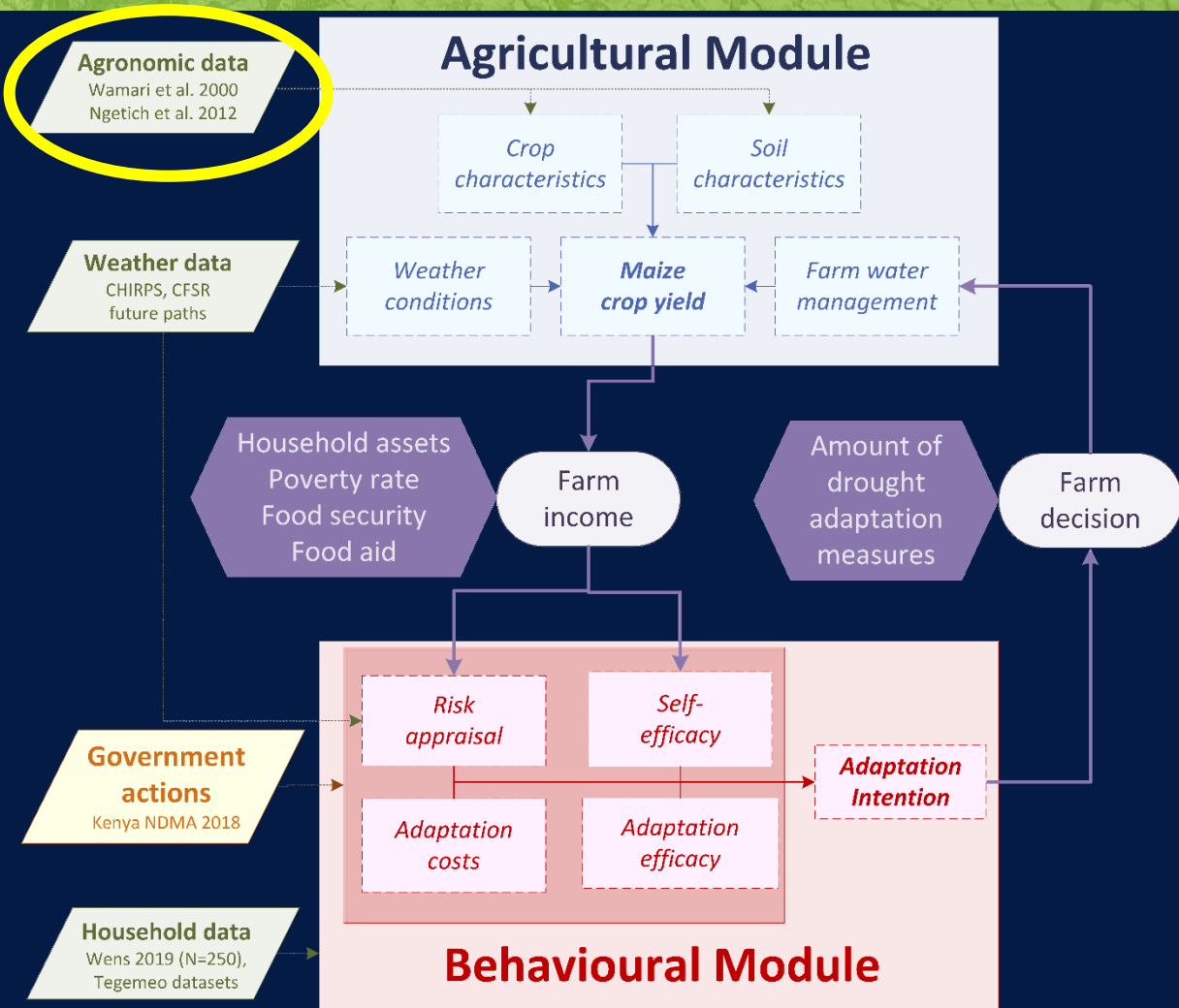
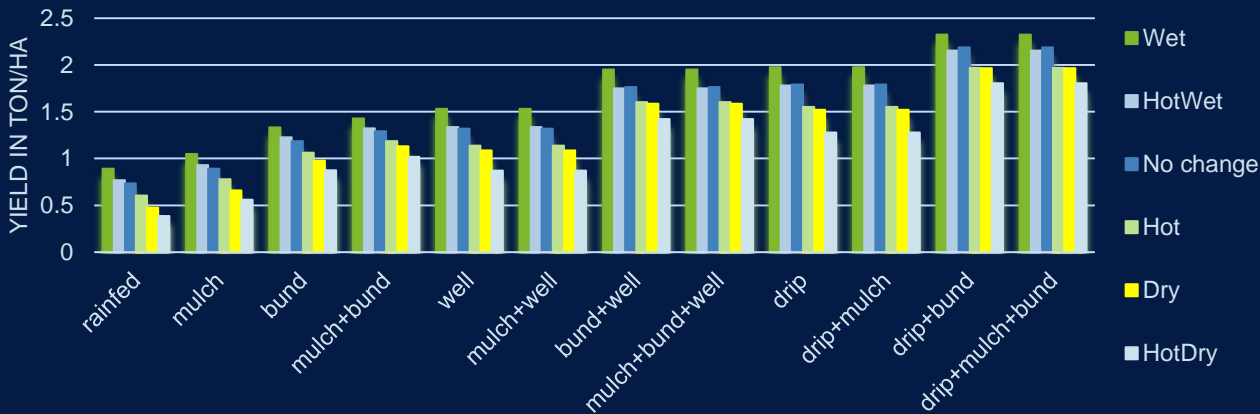
District	Lowest yields (kg/ha)	Highest yield (kg/ha)	Mean (kg/ha)	S.D (kg/ha)	CV (%)
Machakos	441.3 (1998)	4657.0 (1988)	1721.8	616.2	41.9
Makueni	323.2 (2005)	2750.0 (1993)	1270.1	660.0	52.0
Kitui	44.5 (1987)	4830.0 (1990)	1370.0	1072.0	78.3
Mwingi	240.8 (2005)	2475.0 (1993)	1030.0	612.0	59.4
Average	262.5	3677.5	1078.2	740.2	68.6

Omyo et al. (2015) AFS



Katumani maize

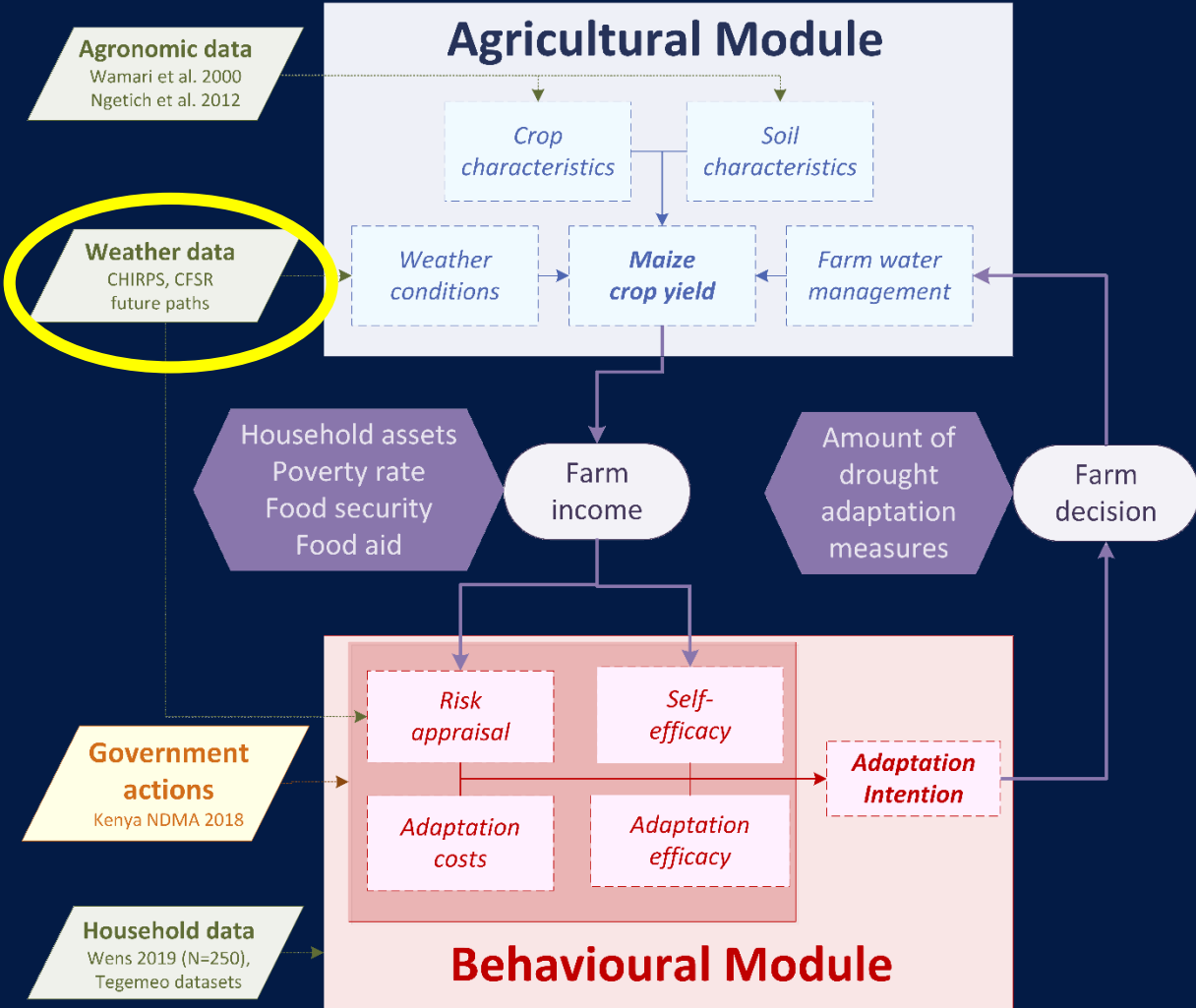
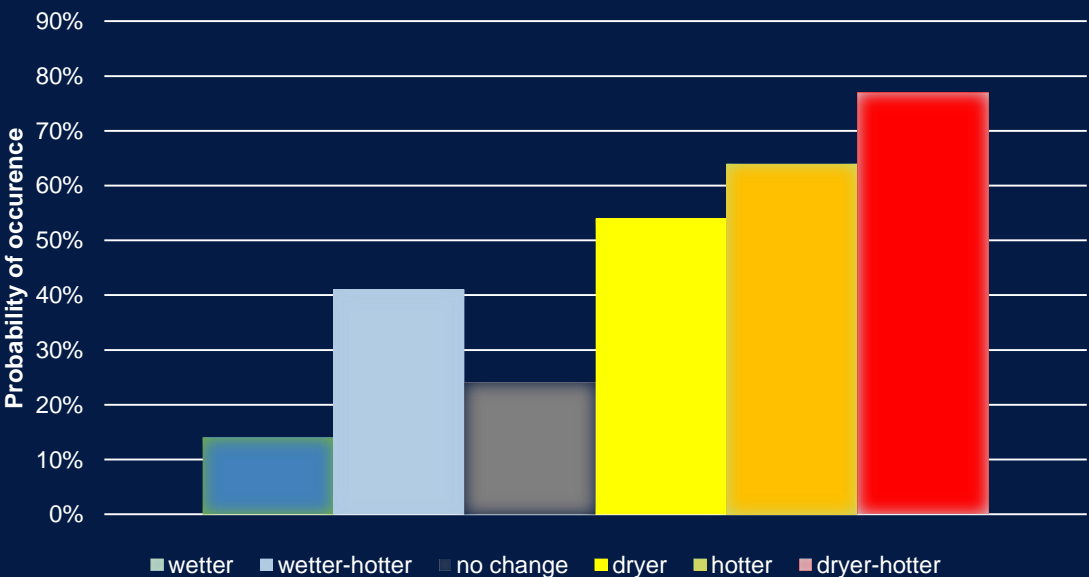
FUTURE MAIZE YIELD UNDER DIFFERENT MANAGEMENT AND CLIMATE SCENARIOS



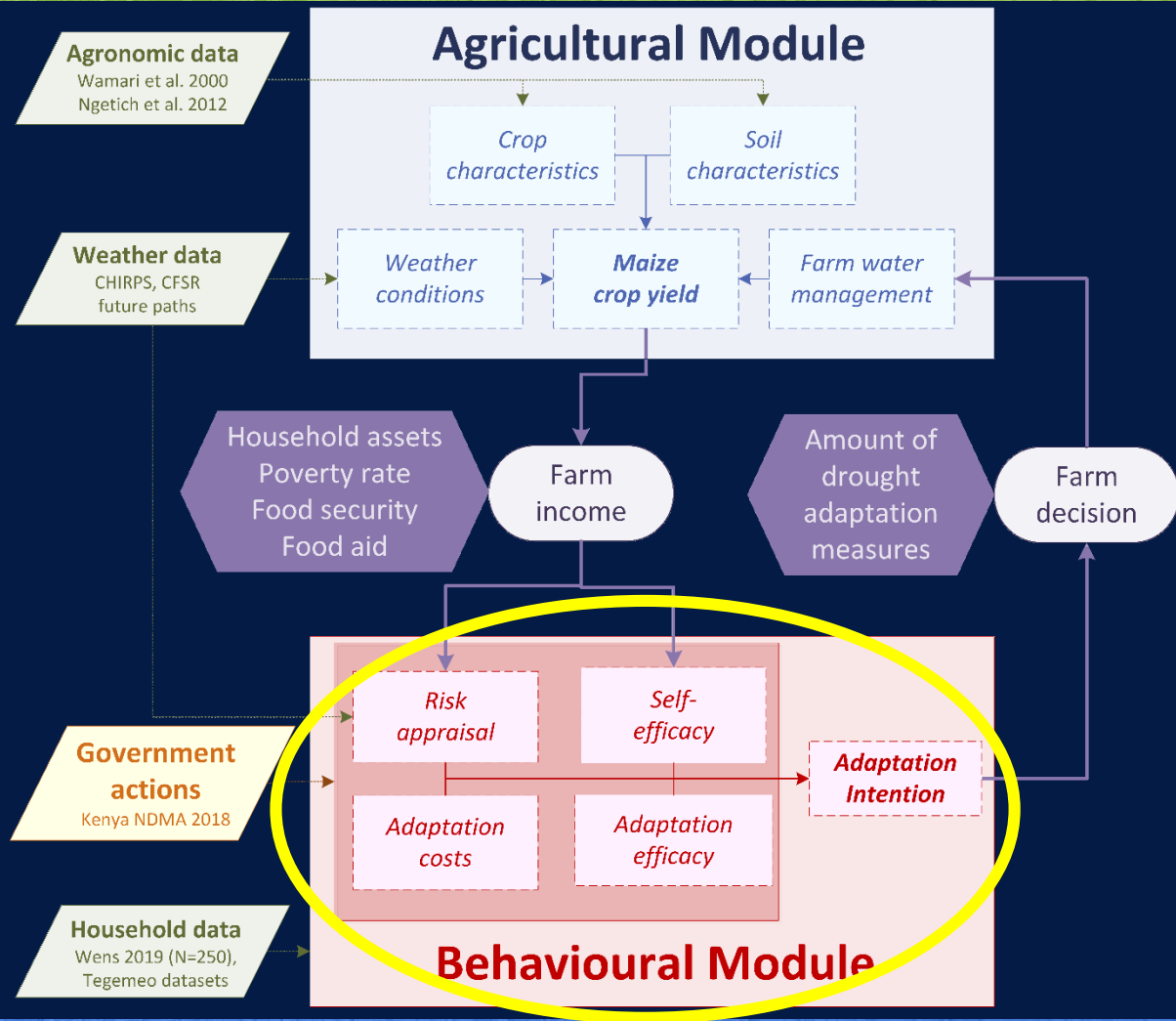
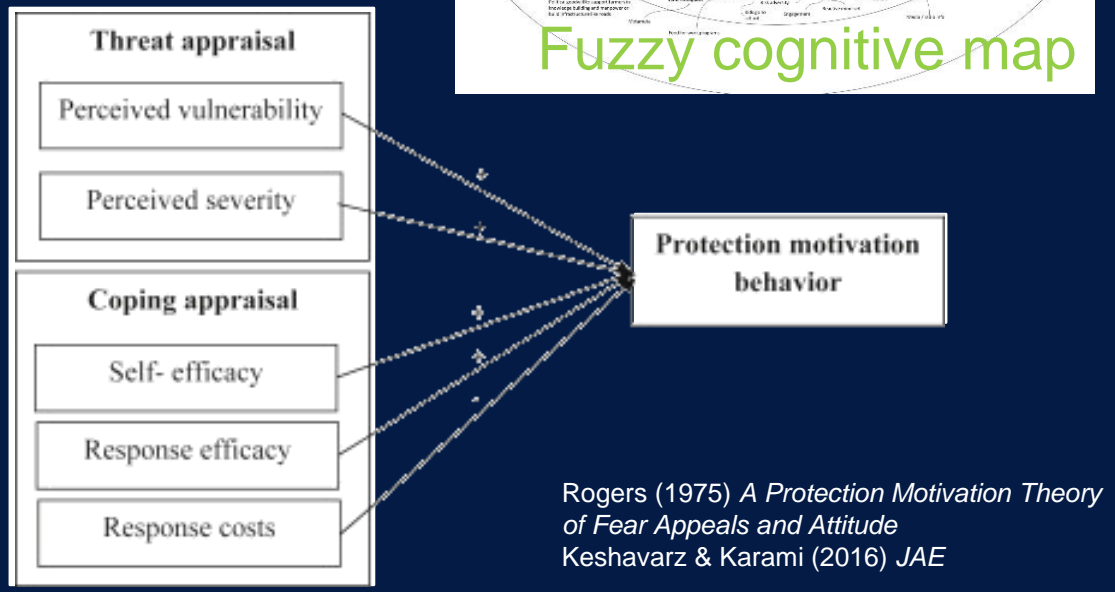
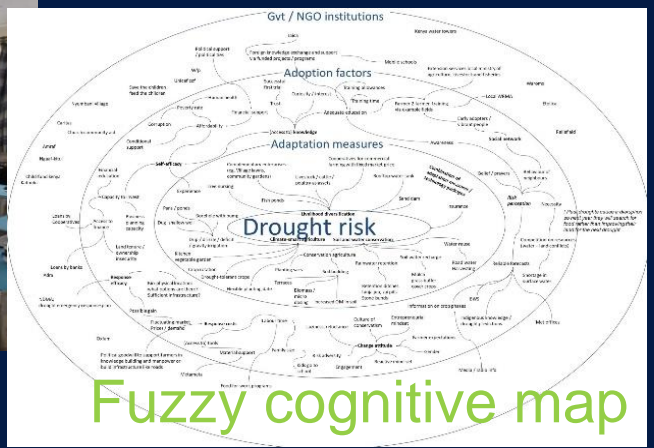
Future climate conditions are created based on current and projected **temperature** and **rainfall** trends

daily maximum temperature (*C)	daily minimum temperature (*C)	total annual precipitation (mm)	annual reference evaporation (mm)
16.3 (+- 0.8)	26.9 (+- 0.9)	888 (+-319)	1547 (+-298)

FUTURE DROUGHT CHARACTERISTICS



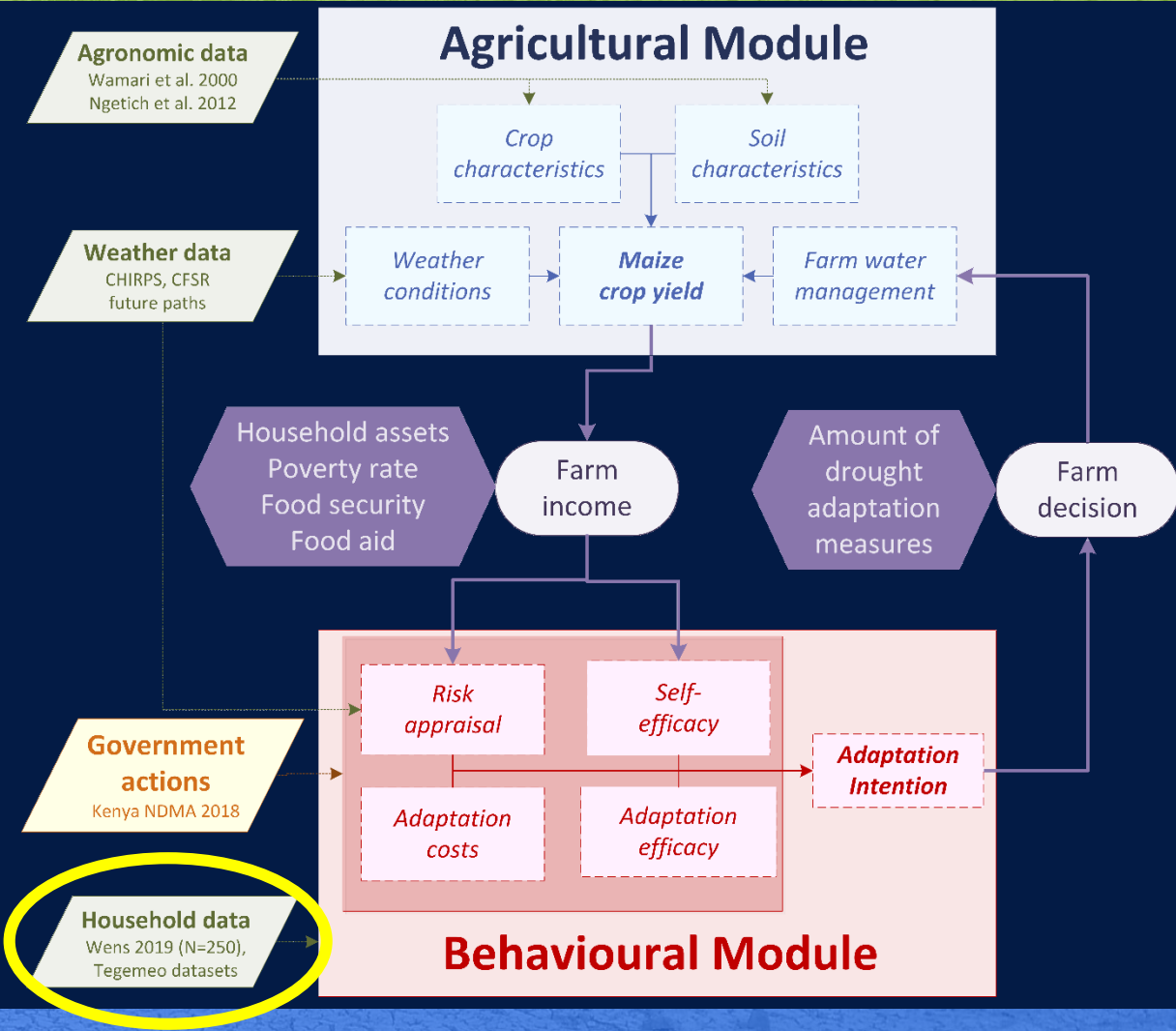
Interviews and existing theories are used to describe adaptation decisions of individual farm households in the behavioural module



Semi-structured questionnaires are used to characterize farm households and calibrate their adaptive behaviour



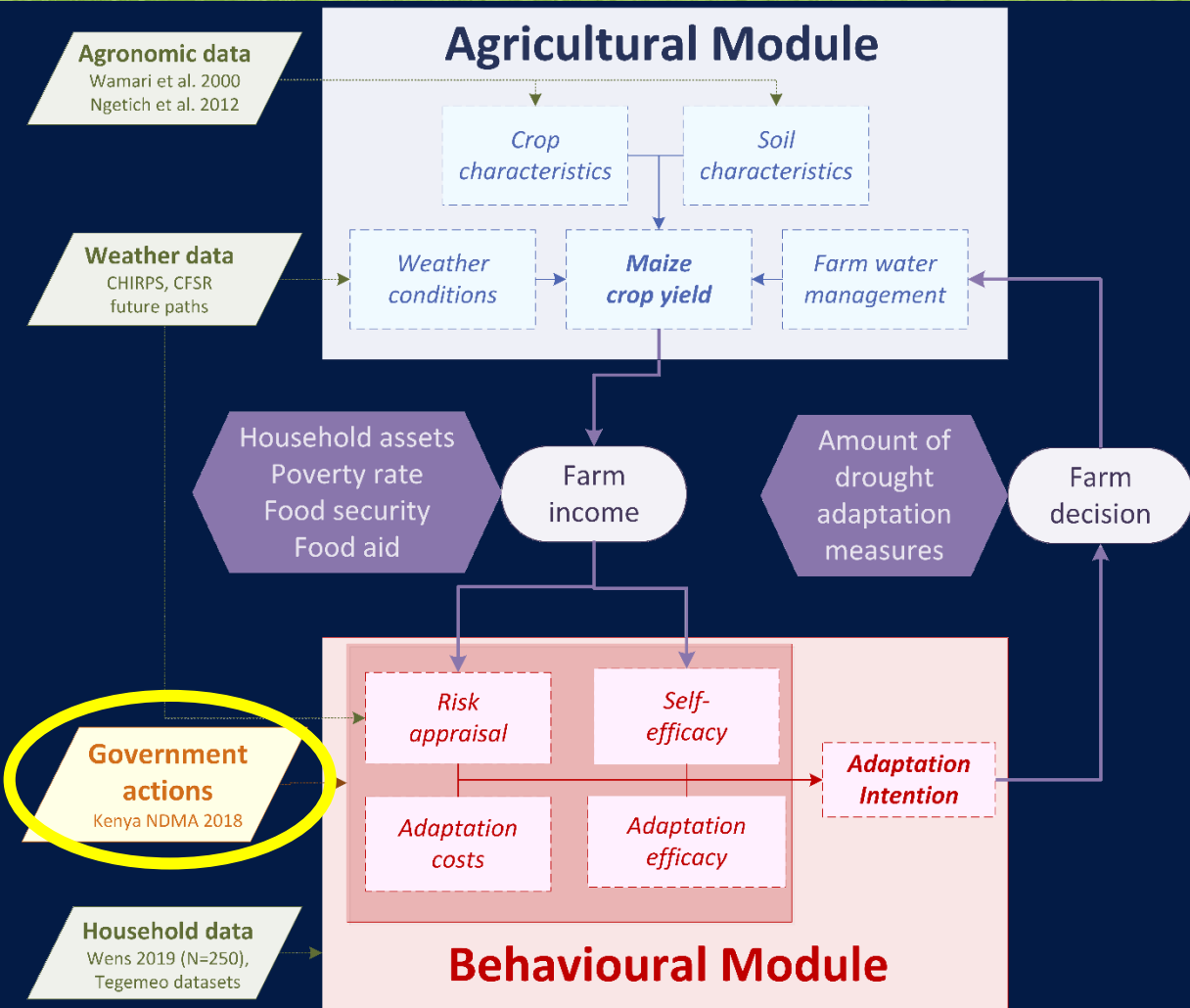
Has adopted measures	Odds
(Intercept)	0.38
Number of droughts	0.88*
Perceived future water scarcity	0.52.
Size of agricultural land	1.60**
Overcome financial challenge	3.09*
Believes in own capacity	1.55*
Executed a CBA	2.62*
Attended Extension services	2.53*
Has No suitable Location	0.40**
Has access to sufficient forecast	0.74
Receives remittances	0.55



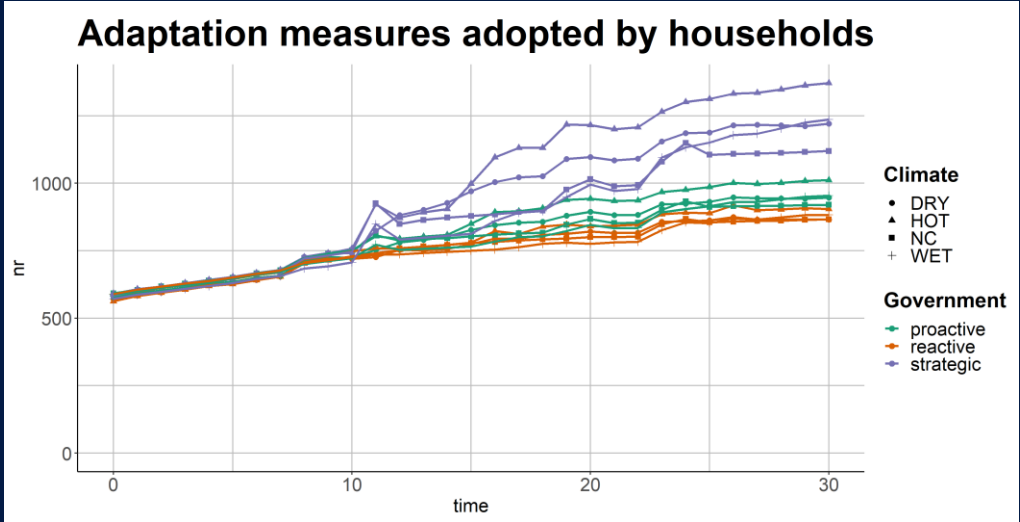
Discrete choice experiments are used to evaluate the adaptation intention of individuals under potential governmental actions



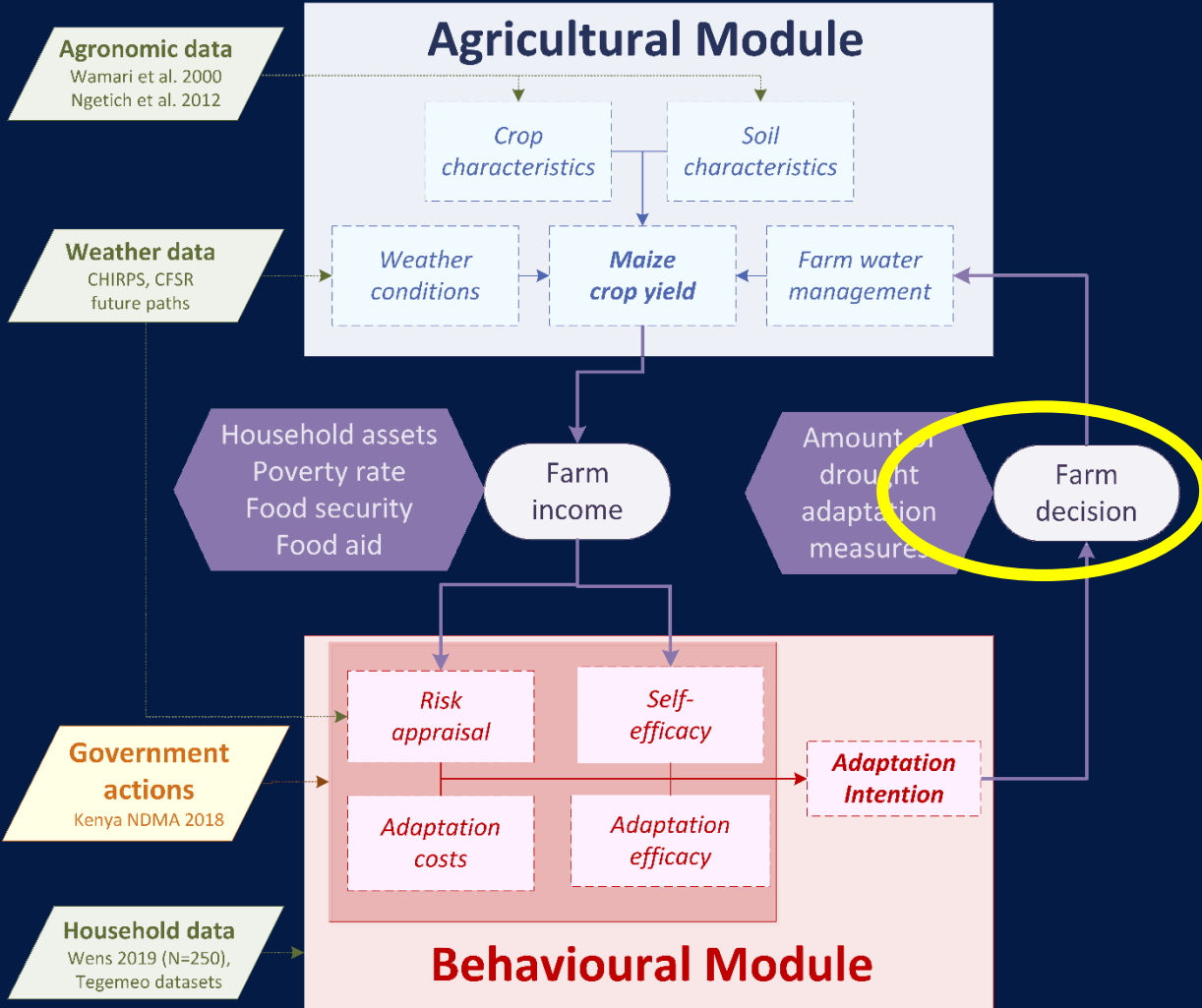
	Scenario A	Scenario B
Extension Services	No usefull trainings are given by the government	Usefull trainings are given by the government twice a year
Early warning	An early warning is send out in October and/or March if a drought season is expected 	No early warning is send out by the government if a drought season is expected
Cash/ food tranfers	Assistance is provided by the government in October and/or March when an extreme drought season is expected 	Only after a drought assistance is provided by the government
Credit schemes	Interest rates of credit schemes are not facilitated	The government ensures credit schemes whith an interest rate of 2%



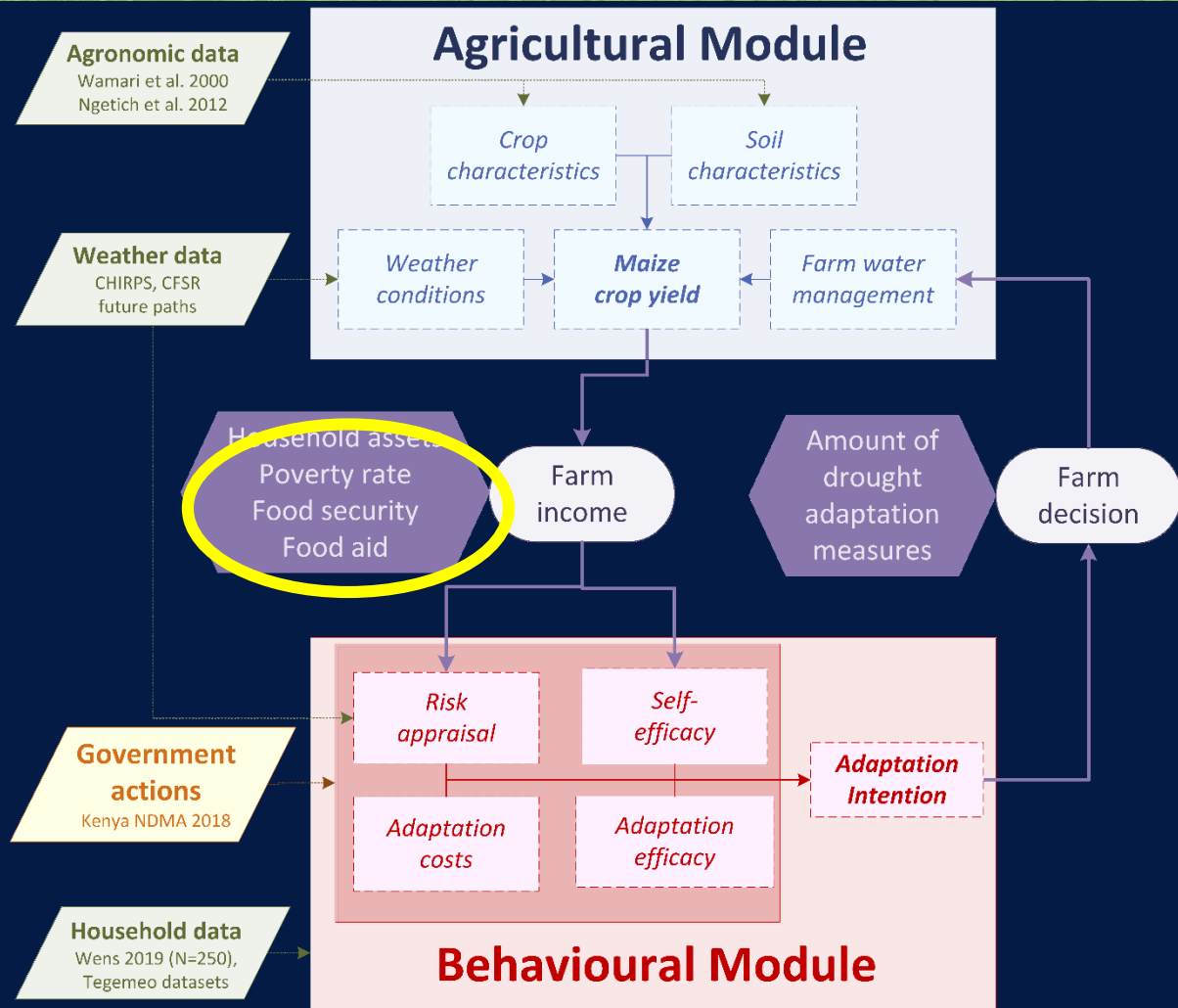
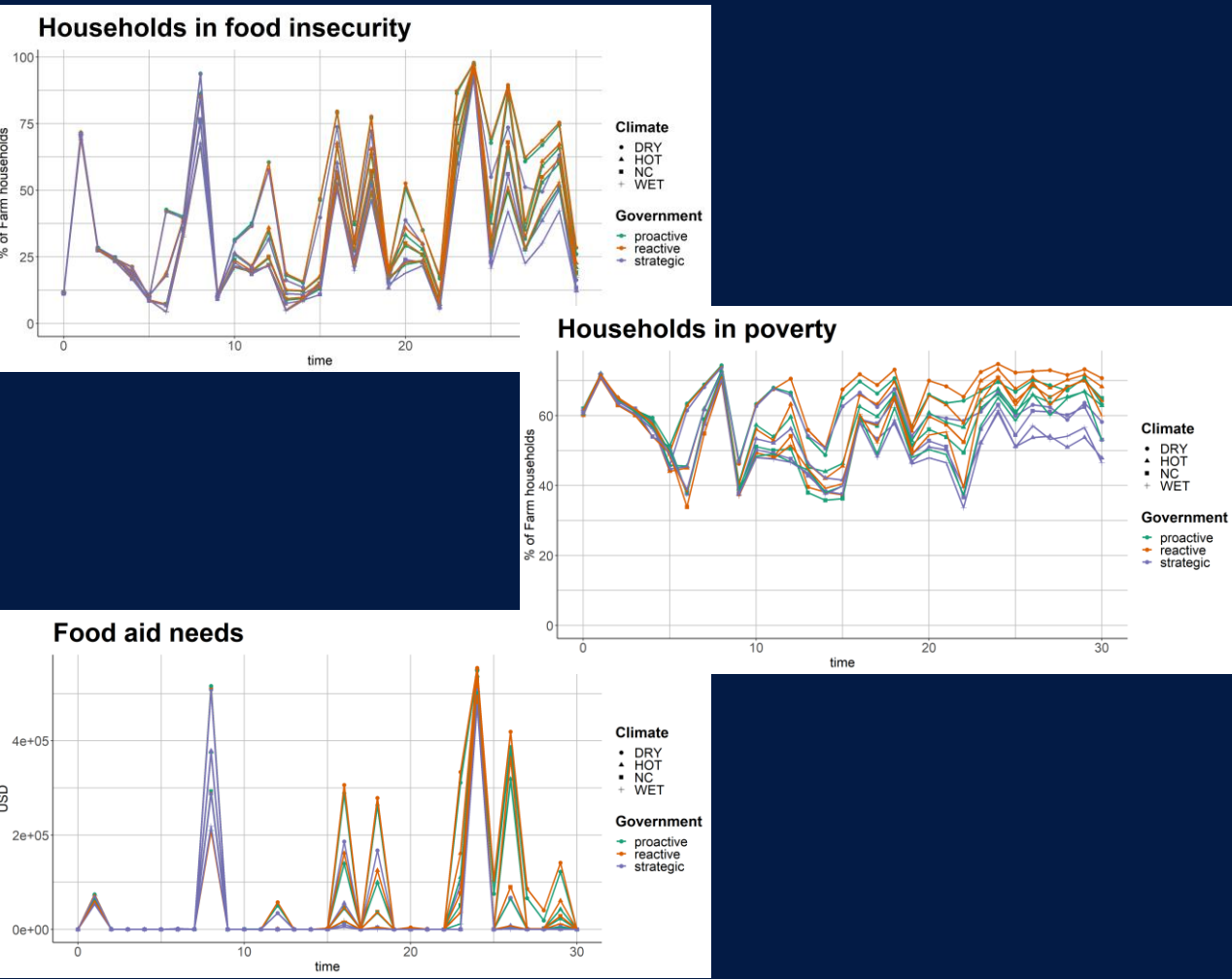
The adoption of adaptation measures by the farm households, influenced by government and climate, is simulated over time



Increased adoption under NO climate change	Mulching	Fanya Juu	Shallow well	Drip irrigation
Extension services	+35%	+29%	+13%	+5%
Early warning systems	+31%	+20%	+8%	+4%
Ex-ante cash transfer	+31%	+19%	+8%	+4%
Credit schemes at 2% interest	+31%	+26%	+18%	+8%

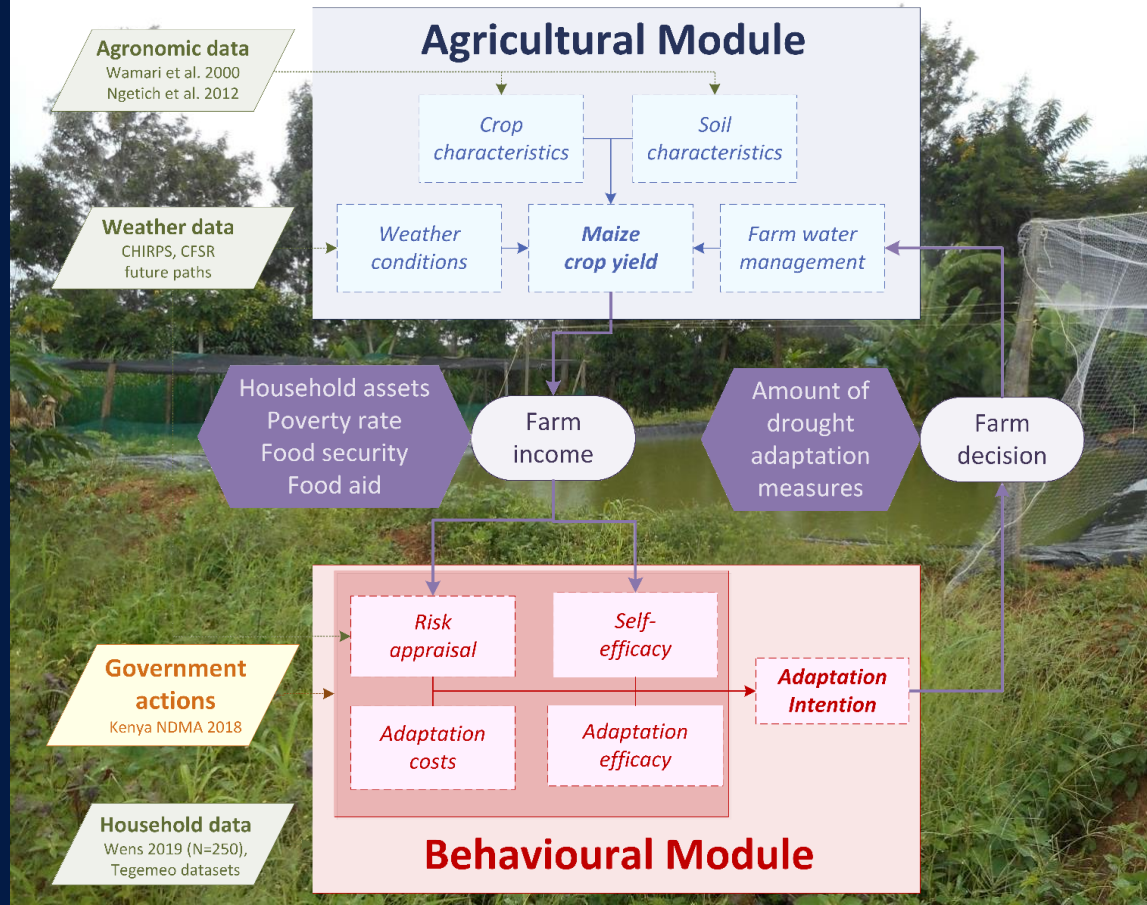


Better adaptation leads to less yield loss, and the effect on different farm household drought risk indicators can be evaluated



Behavioural theories and empirical data support ADOPT, a decision support model to simulate and evaluate heterogeneous drought risk of smallholder farmers over time

ADOPT – Agent-based drought adaptation model



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