Leveraging Optimal Portfolio of Drought Tolerant Maize Varieties for Weather Index Insurance and Food Security

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Research questions

- Does an optimally selected combination of maize varieties offer better protection against drought risk than common practices?

- What are the implications on scaling weather index insurance?

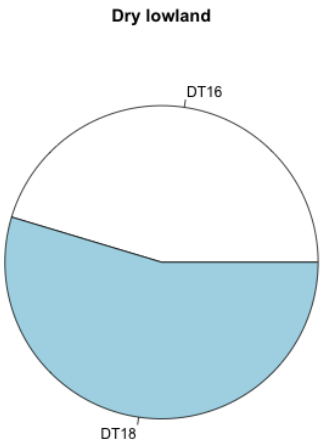
Data

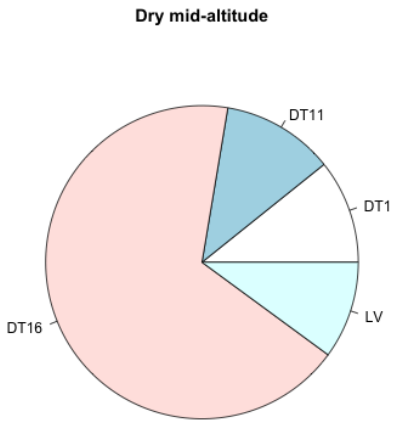
- **On farm trial data by CYMMYT & Partners in 2011**
  - 20 varieties; DT1, DT2, ..., DT19, Local variety (LV)
  - 49 locations
    - 20 Zimbabwe
    - 8 Malawi
    - 4 in Zambia, Uganda, Ethiopia
    - 3 Mozambique
    - 5 Kenya
    - 1 Tanzania
- 5 Mega environment
  - Dry lowland
  - Dry mid-altitude
  - Wet lower mid-altitude
  - Wet lowland
  - Wet upper mid altitude
- High resolution spatial daily rainfall data (1983-2013) from NOAA
  - Cumulative rainfall over growing season

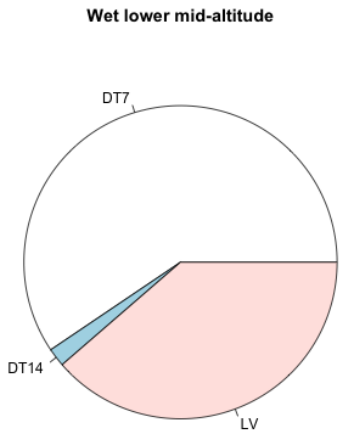
Simulations & Downside Risk Portfolio Optimization

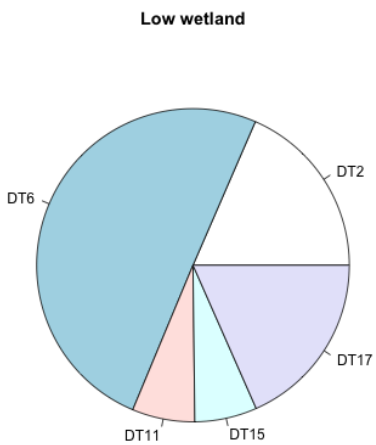
- Simulate 500 years of correlated space-time growing seasonal rainfall
- Predict yields & farm returns from 500 growing seasons
- Select an optimal combination of varieties in each environment that diversify drought risk and maximizes farm returns
- Compare performance of optimal portfolio to 3 baseline practices:
  - Portfolio of equal weights (**Naive**)
  - Relatively high yielding variety (**DT12**)
  - Popular local maize variety (**LV**)

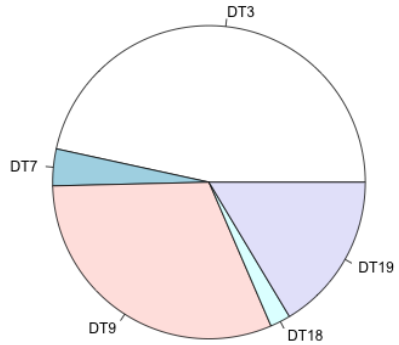
Optimal downside risk portfolios by environment











Insurance performance analysis (Gross returns)

		Baseline			% Change in Optimal		
	Optima	**Naive**	**DT12**	**LV**	**Naive**	**DT12**	**LV**
Dry lowland							
Premium rate	0.279	0.501	0.730	0.509	-44.35	-61.18	-45.27
Dry mid-altitude							
Premium rate	0.687	0.733	1.025	0.852	-6.30	-33.03	-19.40
Wet lower mid-altitude							
Premium rate	0.193	0.344	0.431	0.158	-43.76	-55.12	22.20
Low wetland							
Premium rate	0.347	0.452	0.884	0.921	-23.36	-60.81	-62.36
Wet upper mid-altitude							
Premium rate	0.422	0.708	1.100	1.100	-40.36	-61.60	-61.60

Key results & policy implications

- Optimally diversified portfolios - promising holistic risk management tool
  - Increases expected farm returns by 12 to 127 times
  - Reduces actuarially fair premium rates up to 31% - 55%
  - Potential to spur demand and supply of risk mitigation and transfer products
- Leverage diversified crop/varieties portfolios and Insurance across zones
- Combine seasonal weather forecast & optimum portfolio for better pricing
- Need for regulations to promote pilots/supply by insurers and reinsurance
- Complementary for contract farming and commodity trading

Thank you!

Questions, Comments?

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