Wheat Area-Yield Insurance Effectiveness: Simulating Rates in Australian Reality

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Simulating Rates in Australian Reality

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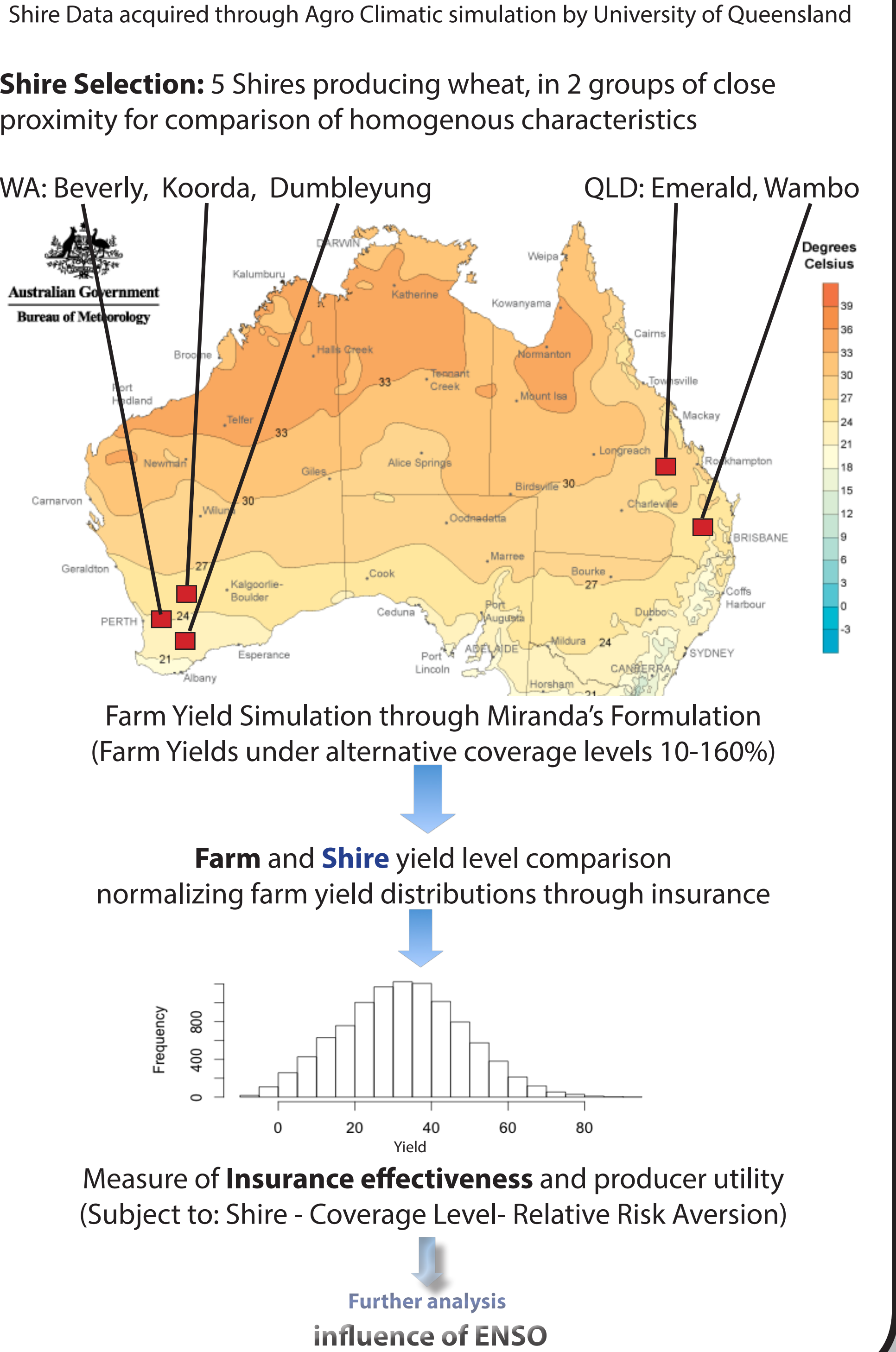
Introduction

Agribusiness inherently encounters various risks. These include risks arising from producer behavior to those resulting from changing weather conditions.

Rising scrutiny and deliberation on climate change/severity forecasts a progressively important need for yield risk mitigation tools. Such tools include financial markets and insurance schemes, with insurance taking the predominant role with regard to yield risk.
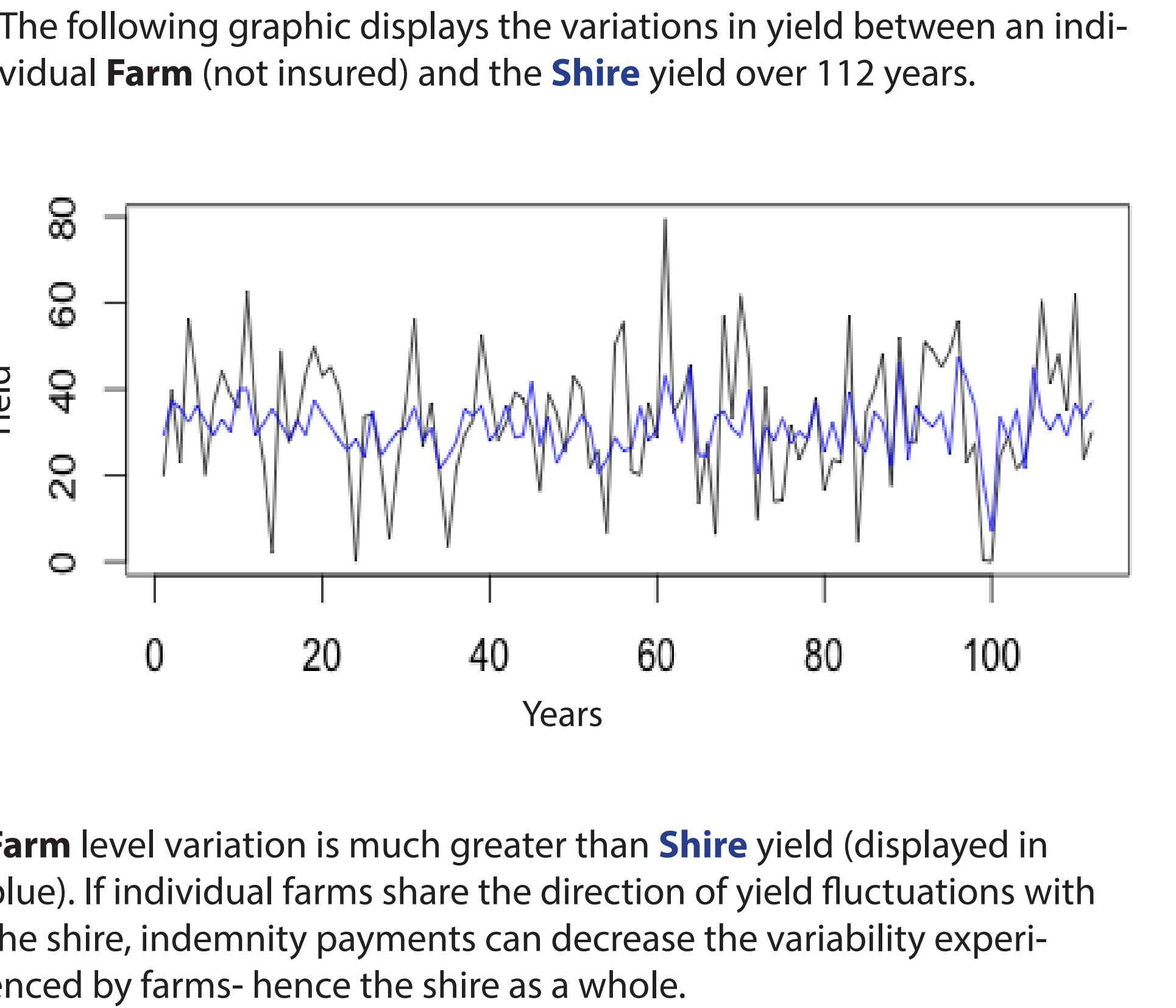
Area Yield Insurance is one of several crop insurance schemes available in the US. AYI differentiates itself by releasing indemnities on an aggregate rather then individual level, thus reducing administrative costs and the impact of both moral hazard and adverse selection.

As is the case with many forms of yield insurance, AYI requires excessive subsidization in its current form. This study primarily addresses effectiveness and benefits offered to Australian producers through AYI, as well viability and risk diversification opportunities.
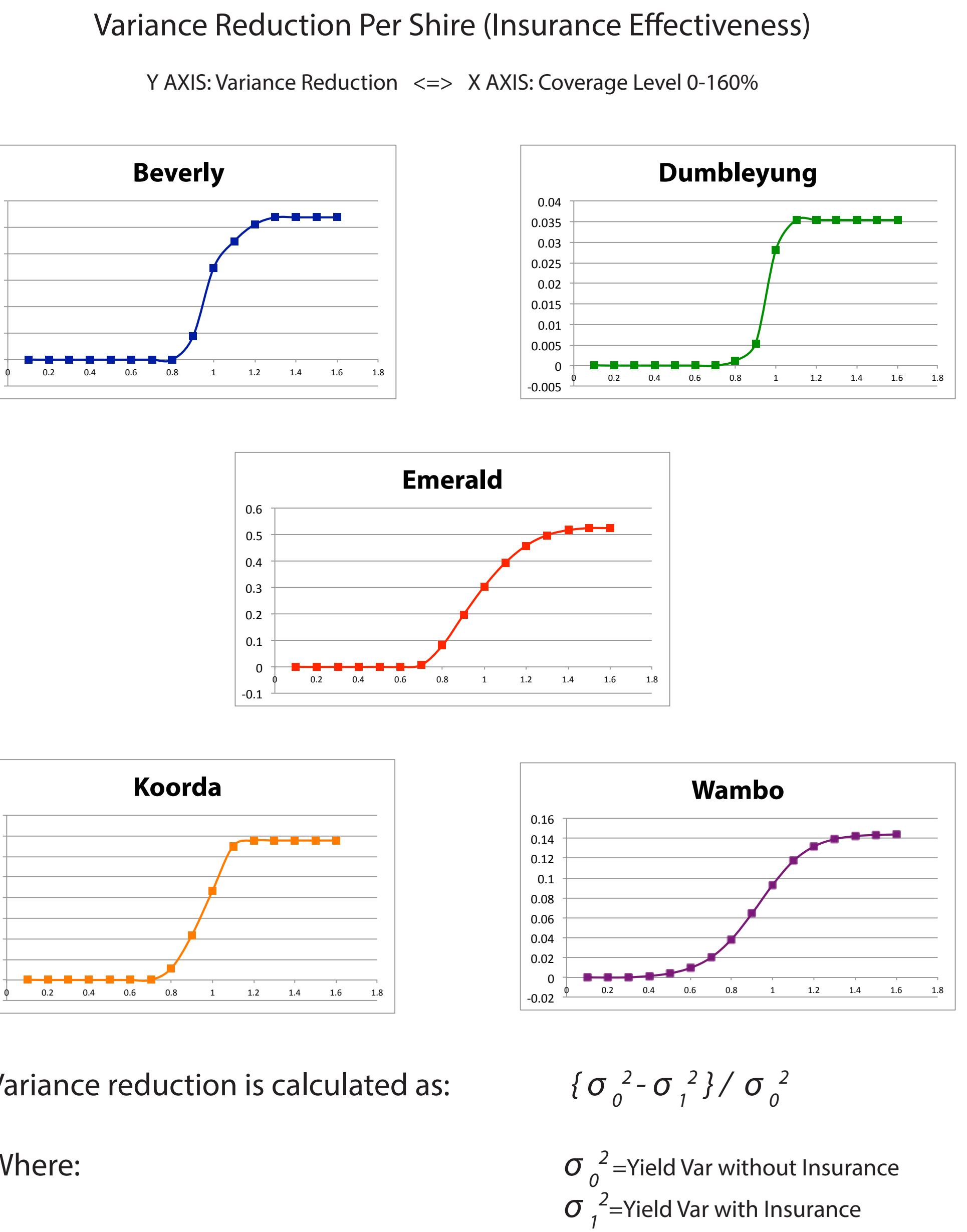
Methodology

Shire Data acquired through Agro Climatic simulation by University of Queensland

Shire Selection: 5 Shires producing wheat, in 2 groups of close proximity for comparison of homogenous characteristics

WA: Beverly, Koorda, Dumbleyung   QLD: Emerald, Wambo

Farm Yield Simulation through Miranda's Formulation
(Farm Yields under alternative coverage levels 10-160%)

Farm and **Shire** yield level comparison
normalizing farm yield distributions through insurance

Measure of **Insurance effectiveness** and producer utility
(Subject to: Shire - Coverage Level- Relative Risk Aversion)

Further analysis
influence of ENSO

Results

The following graphic displays the variations in yield between an individual **Farm** (not insured) and the **Shire** yield over 112 years.

Farm level variation is much greater than **Shire** yield (displayed in blue). If individual farms share the direction of yield fluctuations with the shire, indemnity payments can decrease the variability experienced by farms- hence the shire as a whole.
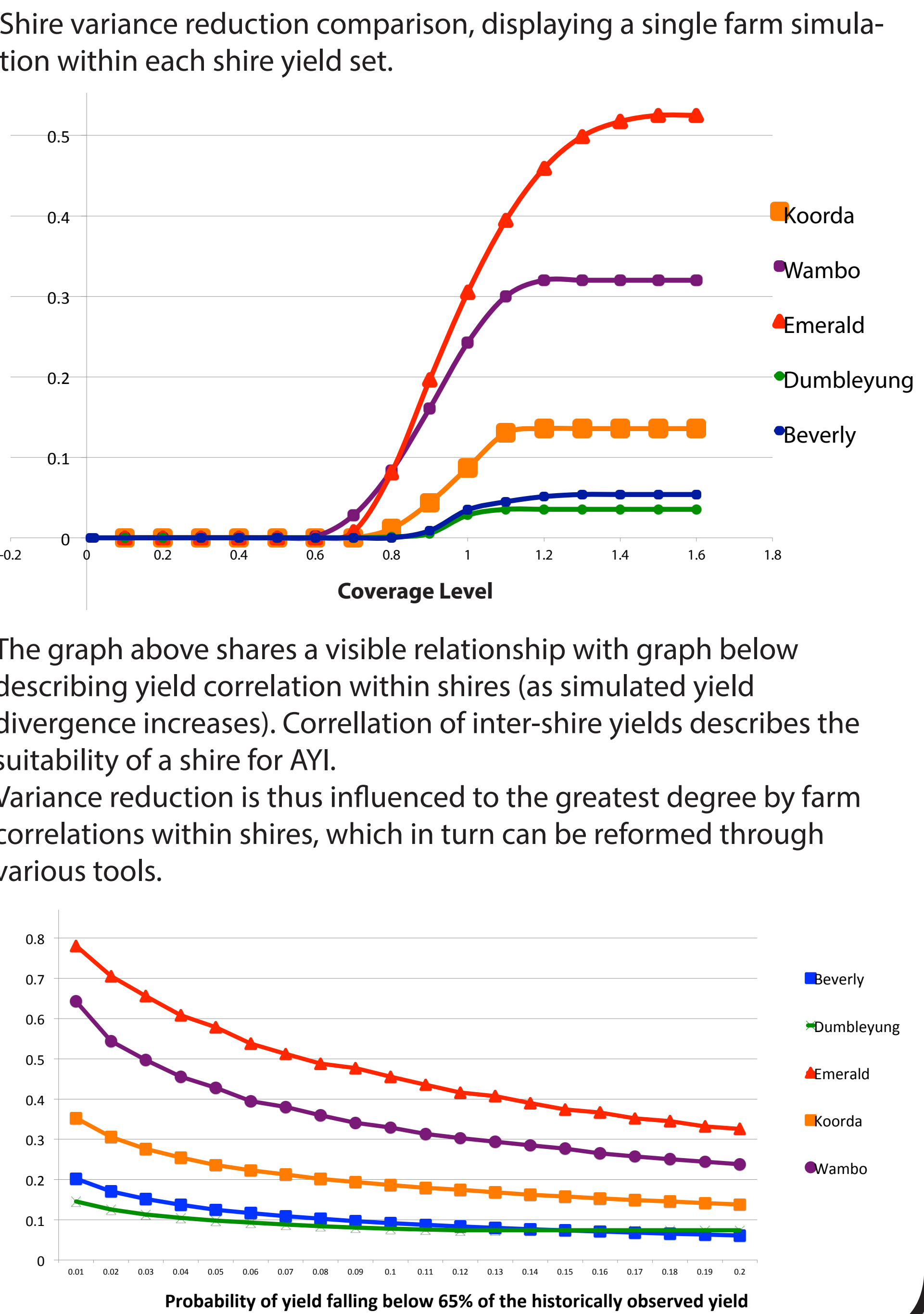
Through indemnity pay-off, based on coverage level, the variation within each farm is reduced, allowing for more stable income. The yield under insurance is represented by actual yield + indemnity.
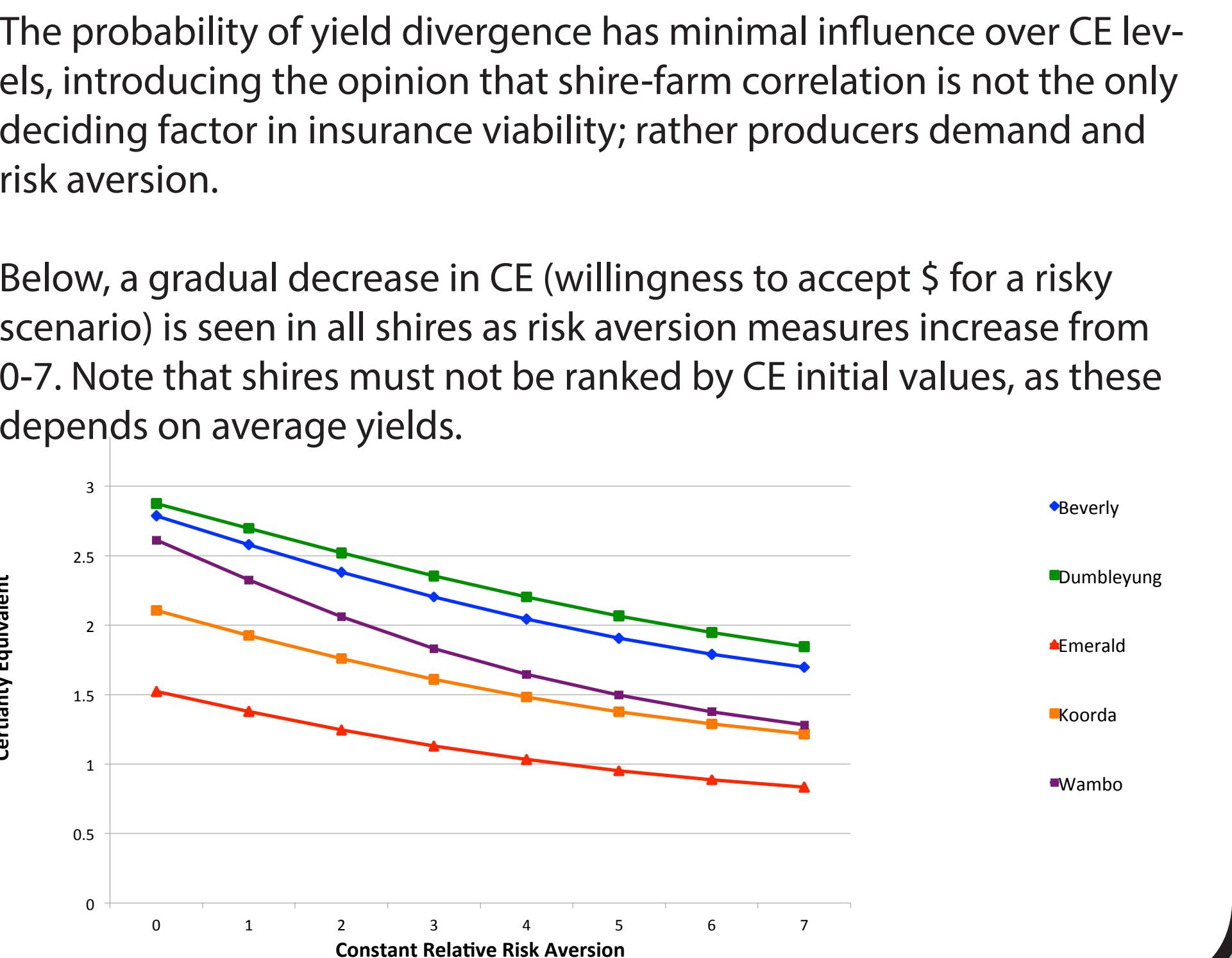
Indemnity is paid out when a pre-determined threshold shire yield is breached; resulting is payouts for all insured.

Variance Reduction Per Shire (Insurance Effectiveness)

Y AXIS: Variance Reduction   <=>   X AXIS: Coverage Level 0-160%

Beverly

Dumbleyung

Emerald

Koorda

Wambo

Variance reduction is calculated as: $\{\sigma_0^2 - \sigma_1^2\} / \sigma_0^2$

Where: σ_0^2 =Yield Var without Insurance
σ_1^2 =Yield Var with Insurance

Results

Shire variance reduction comparison, displaying a single farm simulation within each shire yield set.

Koorda
Wambo
Emerald
Dumbleyung
Beverly

The graph above shares a visible relationship with graph below describing yield correlation within shires (as simulated yield divergence increases). Correlation of inter-shire yields describes the suitability of a shire for AYI.
Variance reduction is thus influenced to the greatest degree by farm correlations within shires, which in turn can be reformed through various tools.

Beverly
Dumbleyung
Emerald
Koorda
Wambo

Probability of yield falling below 65% of the historically observed yield

Results: Certianty Equivalent

The probability of yield divergence has minimal influence over CE levels, introducing the opinion that shire-farm correlation is not the only deciding factor in insurance viability; rather producers demand and risk aversion.

Below, a gradual decrease in CE (willingness to accept $ for a risky scenario) is seen in all shires as risk aversion measures increase from 0-7. Note that shires must not be ranked by CE initial values, as these depends on average yields.

Beverly
Dumbleyung
Emerald
Koorda
Wambo

Constant Relative Risk Aversion

Conclusions

The WA shires represent significantly lower variance reduction then those located in QLD, and through this experience weaker insurance effectiveness.
The study explores assorted factors such a varying climatic zones, severity of yield fluctuations, and most importantly shire boundary designation and homogeneity of influencing characteristics.

Regrettably it appears that significant variance reduction occurs at upper coverage, hence implying high premium rates (not pictured) and greater subsidization.

E(u) and CE results encourage further study on producer demand and risk aversion as factors influencing the viability of AYI success. A significant observation lies in highest CE change at 90% CL.

	Beverly	Dumbleyung	Emerald	Koorda	Wambo
Beverly	1.00000	153.46 Km	3,206.60 Km	155.98 Km	3,360.82 Km
Dumbleyung	0.37428	1.00000	3,166.5 Km	276.36 Km	3,284.77 Km
Emerald	-0.02876	0.01938	1.00000	3,130.5 Km	511.55 Km
Koorda	0.46507	0.31595	-0.09078	1.00000	3,301.72 Km
Wambo	0.05081	0.05355	0.43212	0.12913	1.00000

The table above displays inter-shire correlations and the corresponding distance in Km between them. The results offer insight for risk diversification within Australia. Ideally between homogeneous farms between heterogeneous shires.
Financial markets, shire characteristic diversification and global reinsurers are a few potential solutions for systemic risk elimination.

Literature Cited

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