



DEGRADING A ROLE-PLAYING GAME ABOUT WATER MANAGEMENT TO TEST BEHAVIOURAL HYPOTHESES IN A CONTROLLED CONTEXT:

AN EXPERIENCE FROM SOUTH AFRICA

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Origin of research project

- ComMod approach
 - understand local system + build up CMP
- Role Playing Game (RPG) in Kat River (Eastern Cape)
- Comparison results RPG and Coop Game Theory model
 - similarities
- Suggest: repeat simplified RPG in *experimental* context
 - gather data; capitalize knowledge
- Methodology: Experimental Economics
 - **decontextualized** instructions
 - Not completely decontextualized

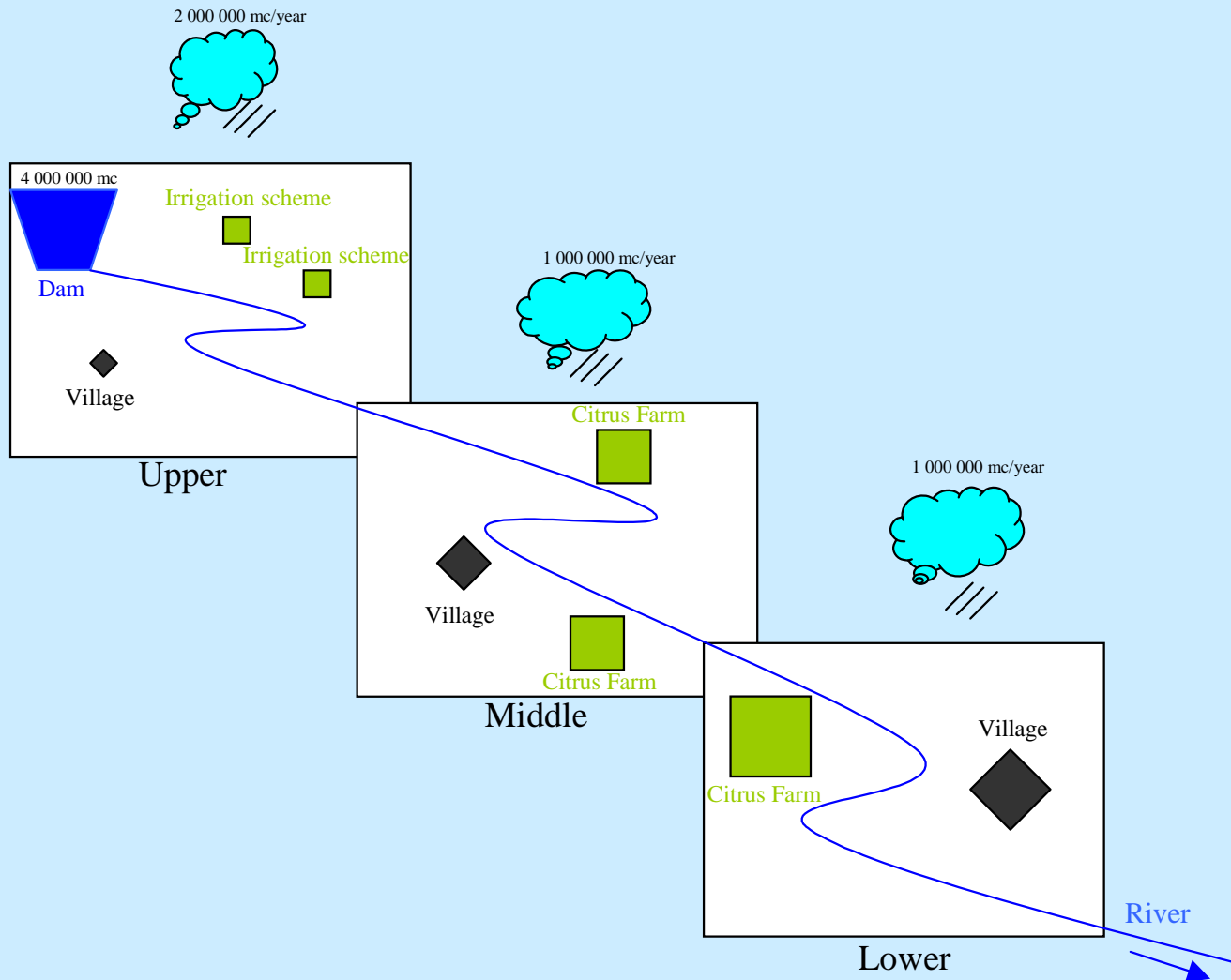
- OBJECTIVES:
- Study Players behaviour when facing situation CPR allocation(**Water**) in a controlled and repeatable context
- Compare EE results with CGT model results

This KatAWARE RPG with local stakeholders (Kat River)

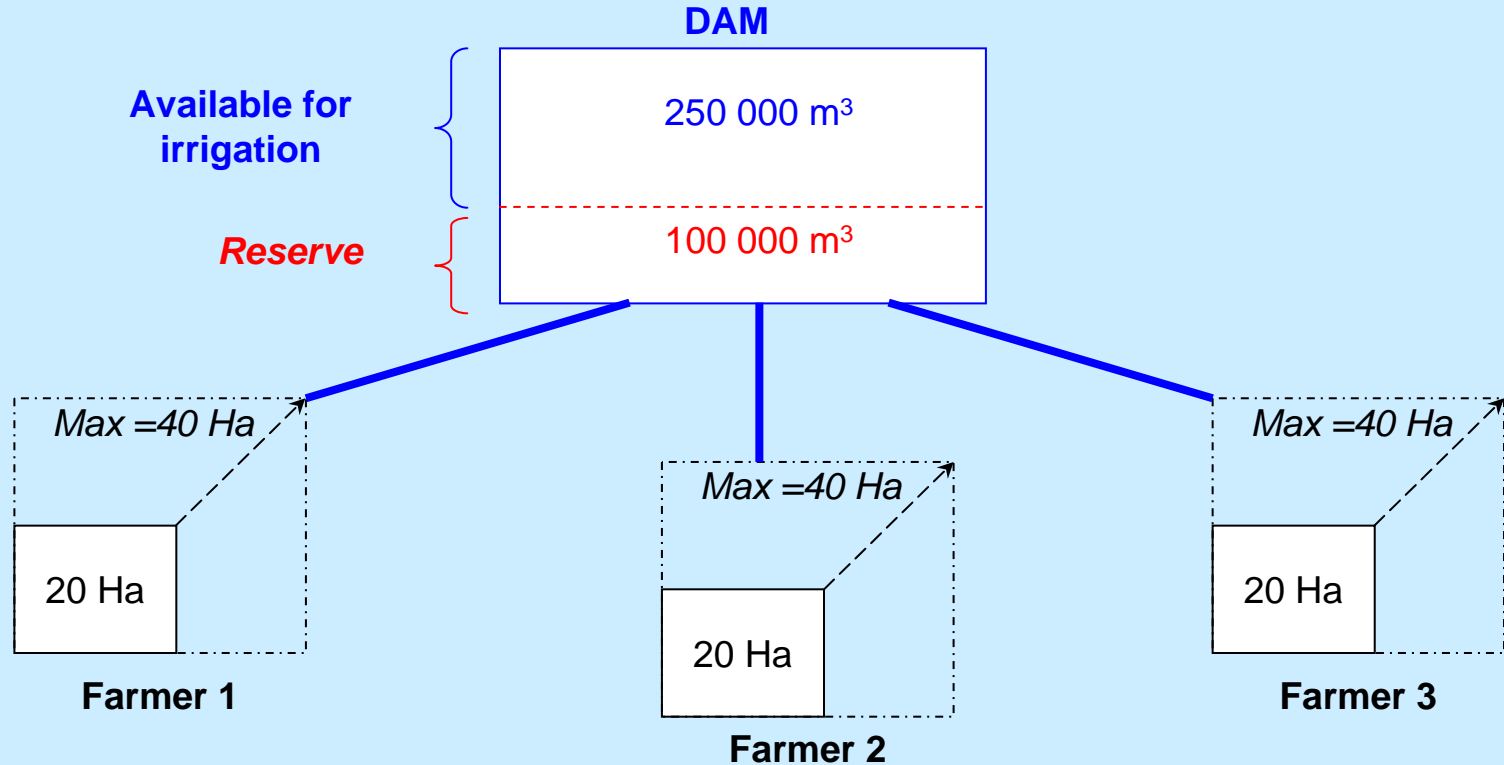
2005-2007



KatAWARE RPG Set-up

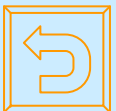


Experimental context Kat-Lab



Dam manager played by the experimenter

Water provided for free



Experimental sessions: The Kat-Lab protocol (University of Pretoria)



First test session
with students

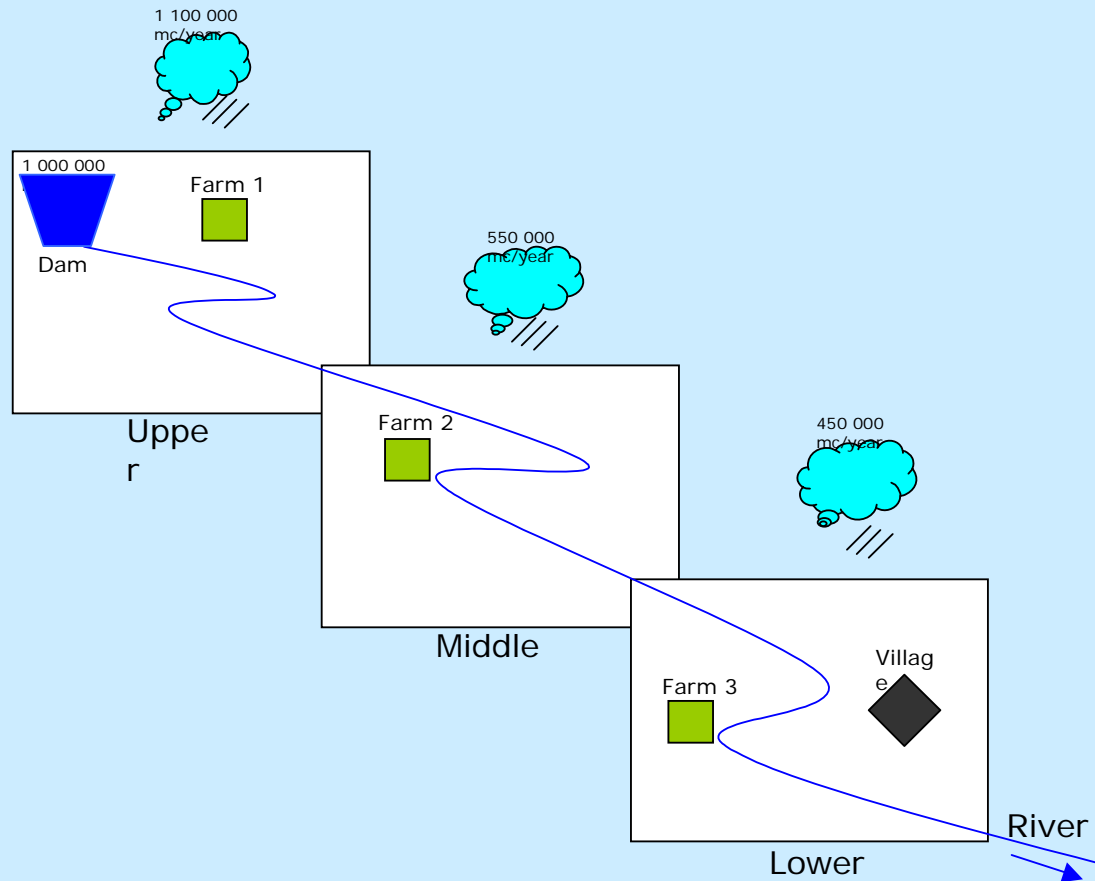
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Second test session
with researchers

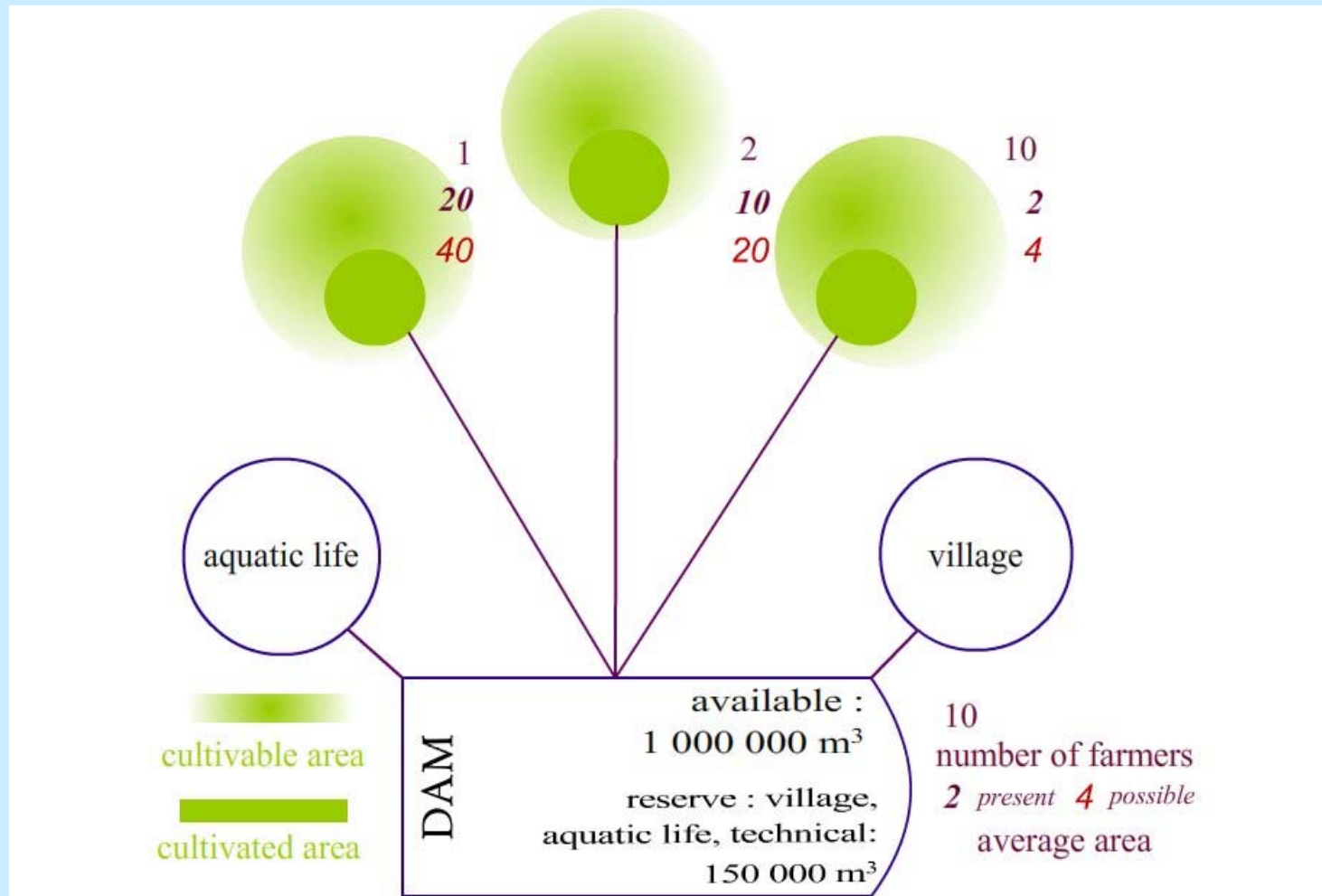
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Experimental context Kat-Game (Rochebrune)



Experimental context Kat-Game (Montpellier)



Experimental sessions: The Kat-Game protocol (Rochebrune - France) 2008



The Kat-Lab Experimental protocol

The experiment is specifically designed to test CGT hypotheses, and particularly:

- 1) Players' **rationality** (selfishness) and **profit maximization**
- 2) Players' behaviour in terms of resources allocation **within a coalition** (*water, land*)
- 3) Players' capacity to take advantage of the **side payments** in coalitions
- 4) Players' choice to **stay** in partial or grand coalition
- 5) If players stay in the grand coalition, **allocation of coalition's payoff** in comparison with theoretical values (Shapley)

Experimental framework

Phase	Name	Round	Description
1	Singletons		Farmers 1, 2 and 3 play alone
2	Partial coalitions	1	Farmers 1 and 2 play together; <i>Farmer 3 plays alone</i>
		2	Farmers 1 and 3 play together; <i>Farmer 2 plays alone</i>
		3	Farmers 2 and 3 play together; <i>Farmer 1 plays alone</i>
3	Grand coalition		Farmers 1, 2 and 3 play together

Water allocation rules

WR_i : Water Requested by farmer i

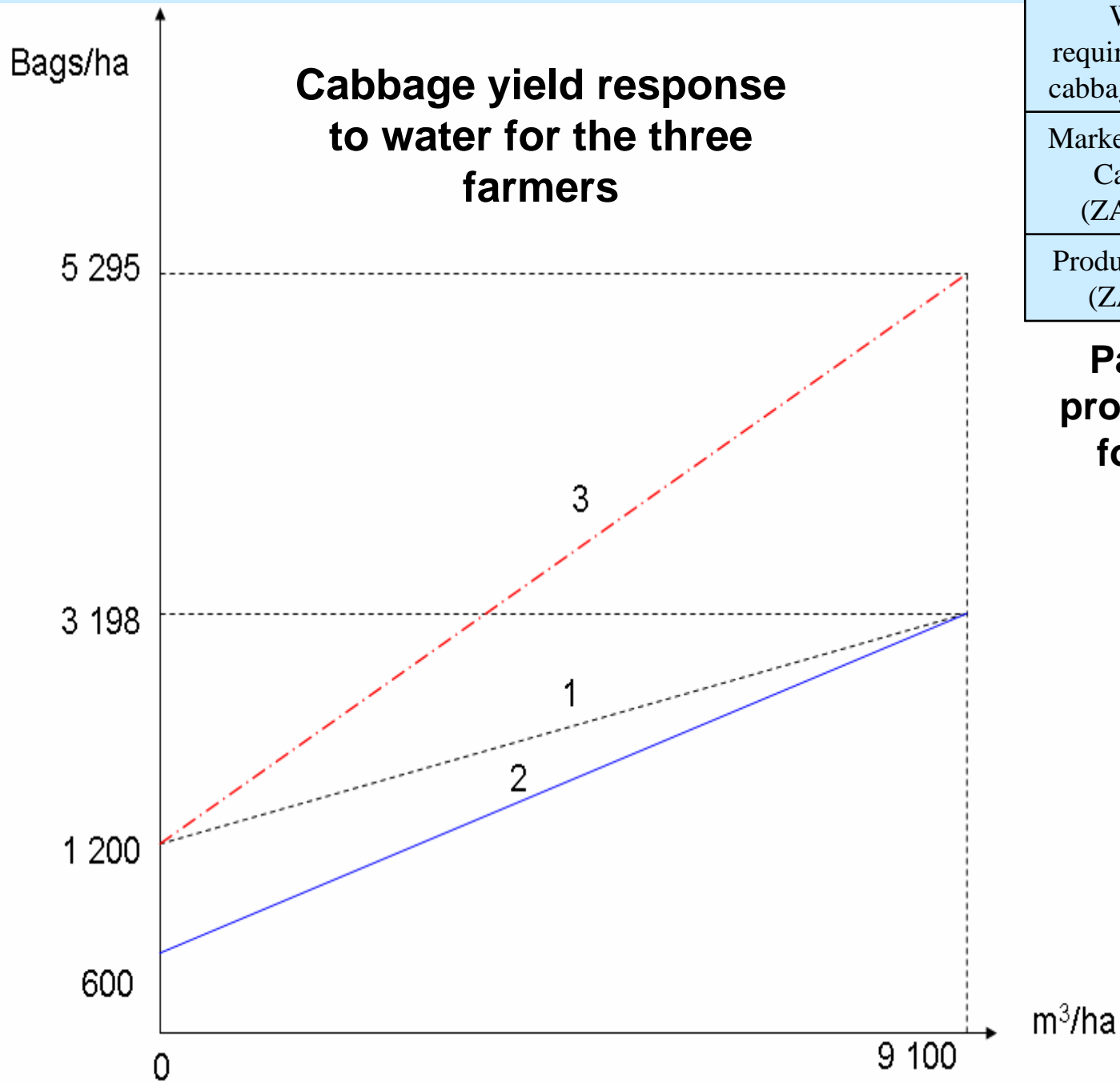
- If $WR_1 + WR_2 + WR_3 < 250\ 000\ m^3$, then each farmer will get the water he requested.
- If $WR_1 + WR_2 + WR_3 > 250\ 000\ m^3$, then each farmer will get **at the maximum** $1/3$ of the $250\ 000\ m^3$

Excel sheet as players' tutorial

Farmer 1				
Initial area (Ha)	Additional area (Ha)	0		
20	Additional water (m3)	0		
Total water (m3)			Irrigation water/Ha	
182000				9100
Total area (Ha)			Total cabbage production (bags)	
3198				63960
3198			Total profit (Zar)	
				54860

You may introduce any additional area and any water request...

... and the program calculates the corresponding profit.



Water requirement for cabbage (m ³ /ha)	9 100
Market price for Cabbage (ZAR/bag)	6
Production cost (ZAR/ha)	16 445

Parameters for profit calculations for all farmers

Phase 1: Singletons

Decision sheet

2 decision steps

Water request from the dam	<i>Dam manager's water allocation decision</i> <i>Reserved to the experimenter. Do not fill</i>	Additional cultivated area	<i>Profit obtained</i> <i>Reserved to the experimenter. Do not fill</i>
..... m ³ m ³ Ha	ZAR

1) Indicate here how much water you require from the dam...

...After you know how much water you will get from the dam...

...2) Indicate here how many additional Ha of cabbage you want to cultivate

CGT solutions for Grand Coalition payoff sharing

- Set of solutions
 - **The Core**
 - Etc...
- One-point (= unique) solution
 - **Shapley values**
 - Etc...

Results of the second test session

Phases	Coalitions	Payoff (ZAR)	Shapley values in Grand Coalition
Singletons	{1}	79 547	< 110 848
	{2}	79 547	< 110 848
	{3}	444 599	< 520 224
Partial coalitions	{1,2}	159 094	< 221 697
	{2,3}	612 794	< 631 073
	{1,3}	612 794	< 631 073
Grand coalition	{1,2,3}	741 921	741 921

2nd test session → Shapley values in the Core → Farmers in Grand Coalition

Grand coalition payoff sharing

Second test session

	Value (ZAR)	Rate X_i (%)	Rate V_i (%)	“Shapley” Rate (%)
Farmer 1	$x_1 = 100\ 575$	13,5	13,2 $v(1) = 79\ 547$	15 $x_1 = 110\ 848$
Farmer 2	$x_2 = 100\ 346$	13,5	13,2 $v(2) = 79\ 547$	15 $x_2 = 110\ 848$
Farmer 3	$x_3 = 541\ 000$	73	73,6 $v(3) = 444\ 599$	70 $x_3 = 520\ 224$
<i>Total</i>	$v(1,2,3) =$ 741\ 921	100	100 $\Sigma v(i) = 603\ 693$	100 $\Sigma x_i = 741\ 921$

Observations from the Kat-lab tests

- Players play rationally
- Know how to take advantage from coalitions
- Identify side payments issue
- Decide to play in a GC (superadditivity)
- Allocate GC payoffs not following the Shapley Value, but on the basis of the singleton allocation.

The way round -> Kat Game

After having de-contextualized the RPG to test CGT hypotheses

=> to rebuild the situation over a combination of elementary components (bricks)

Research question

- In the “bottom-up” approach, the question could be seen as the difficulty to choose the bricks and their ordering during the context building process. **What effect on players' behaviour?**

Support to decision-making for IWRM

- Understand the **robustness of the RPG-methods to elicit stakeholders' behaviour** about water management.
- Understand whether the **simplification of RPG facilitate the participatory construction of the water management problem.**
 - ⇒ Insights on the institutional / rule-building process
 - ⇒ Acceptability of policy measures about water management



**Thank you for
your
attention!**