

# Addressing scarcity and conflict over water resources in SW Burkina Faso

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J. Zoungrana, P. Kirshen, D. Etkin, G. Hoogenboom



Center for Research on  
Environmental Decisions  
EARTH INSTITUTE | COLUMBIA UNIVERSITY



METEO-BURKINA

## *This presentation will discuss:*

- A **case study** of water resource management in a context characterized by climate uncertainty, resource scarcity, and user conflict
- The participatory development of a **decision support tool** meant to facilitate consensual management of water resources
- The evolving context of **water governance** in which information is introduced and used in negotiating water management decisions

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## *Two contrasting models:*

**Predict-and-then -act** model requires that climate uncertainties be reduced, quantified, and correctly communicated

**Policy and institutional adaptations** support decision-makers' ability to engage uncertainty and respond to variable conditions

Lemos & Rood, WIREs Climate Change, v.1 (5) 2010

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## *Dealing with climate uncertainty:*

A different way of coping with uncertainty with estimates of future climate change is to adopt management measures that are **robust to uncertainty**

**Integrated water resource management (GIRE)** is based on the concept of flexibility and adaptability, using measures which can be altered and are robust to changing conditions

## *Dealing with water scarcity:*

If climate change results in greater water scarcity, adaptation may include **technical changes** that improve water-use efficiency, demand management..., and **institutional changes**

The institutions that govern water allocation will play a large role in determining the overall social impacts of change in water availability as well as the **distribution of gains and losses** across different sectors of society

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# Case Study



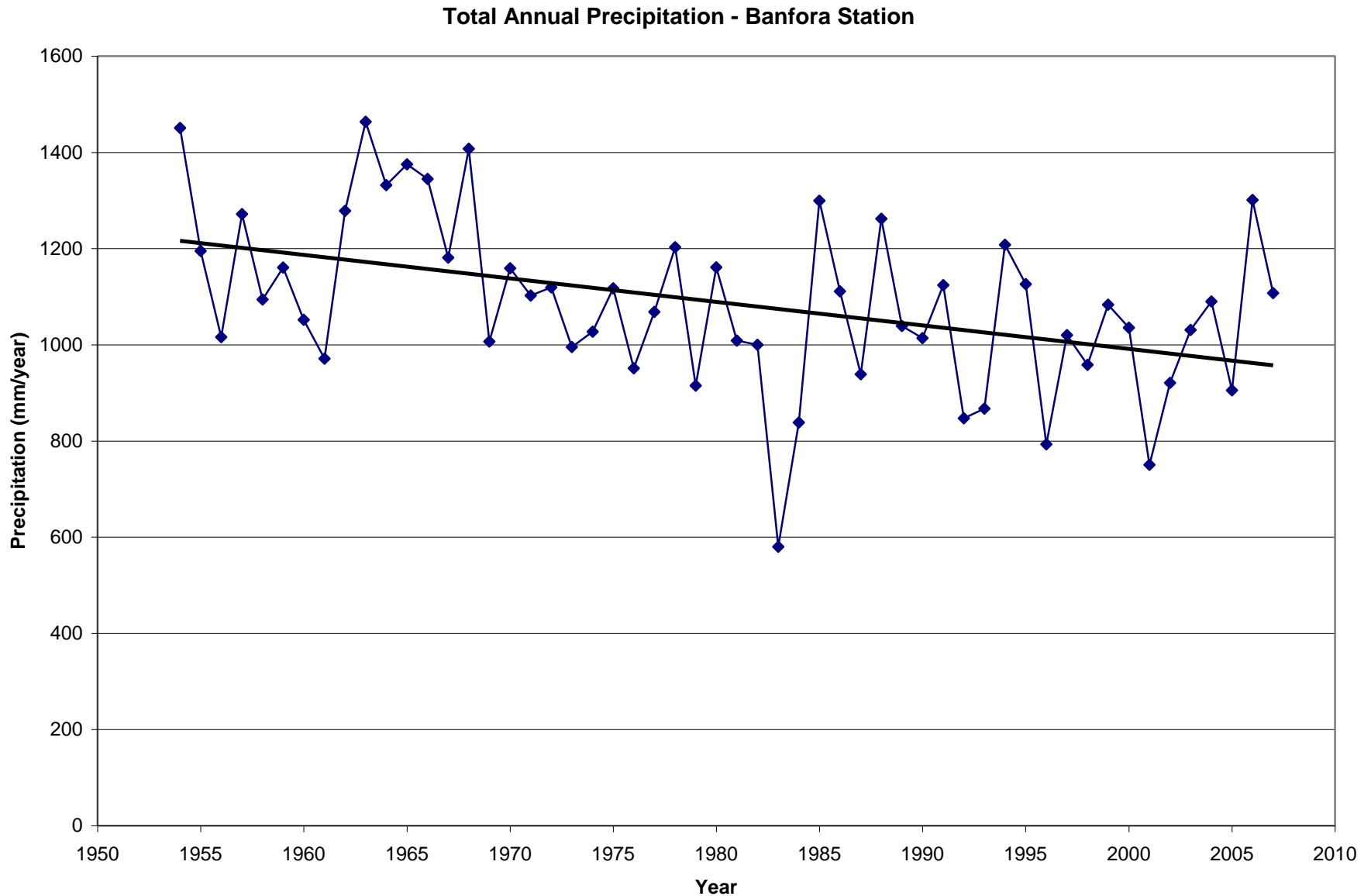


# Case Study - Site

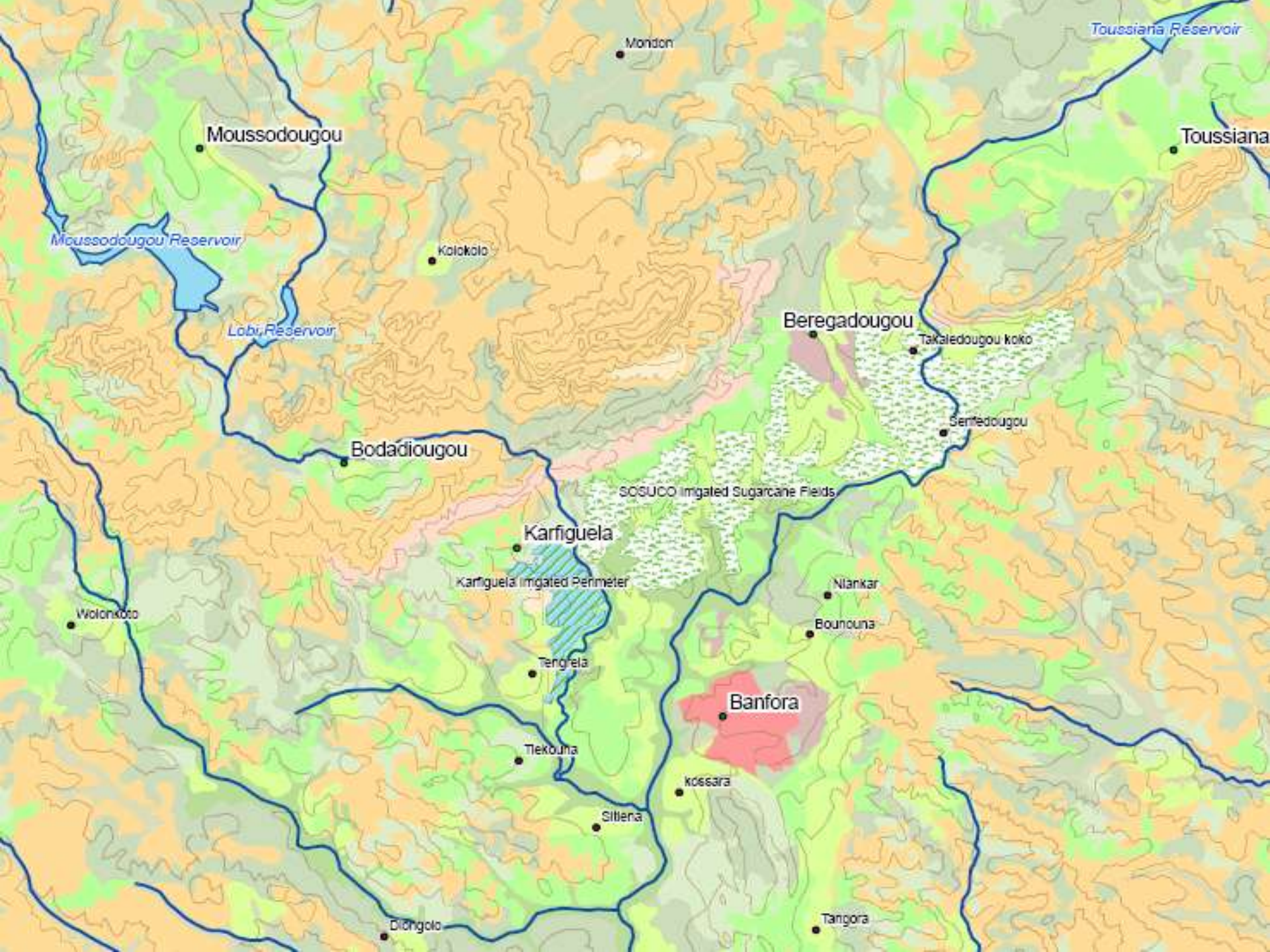
## Haute Comoé'



# Case Study – Climate Variability and Change



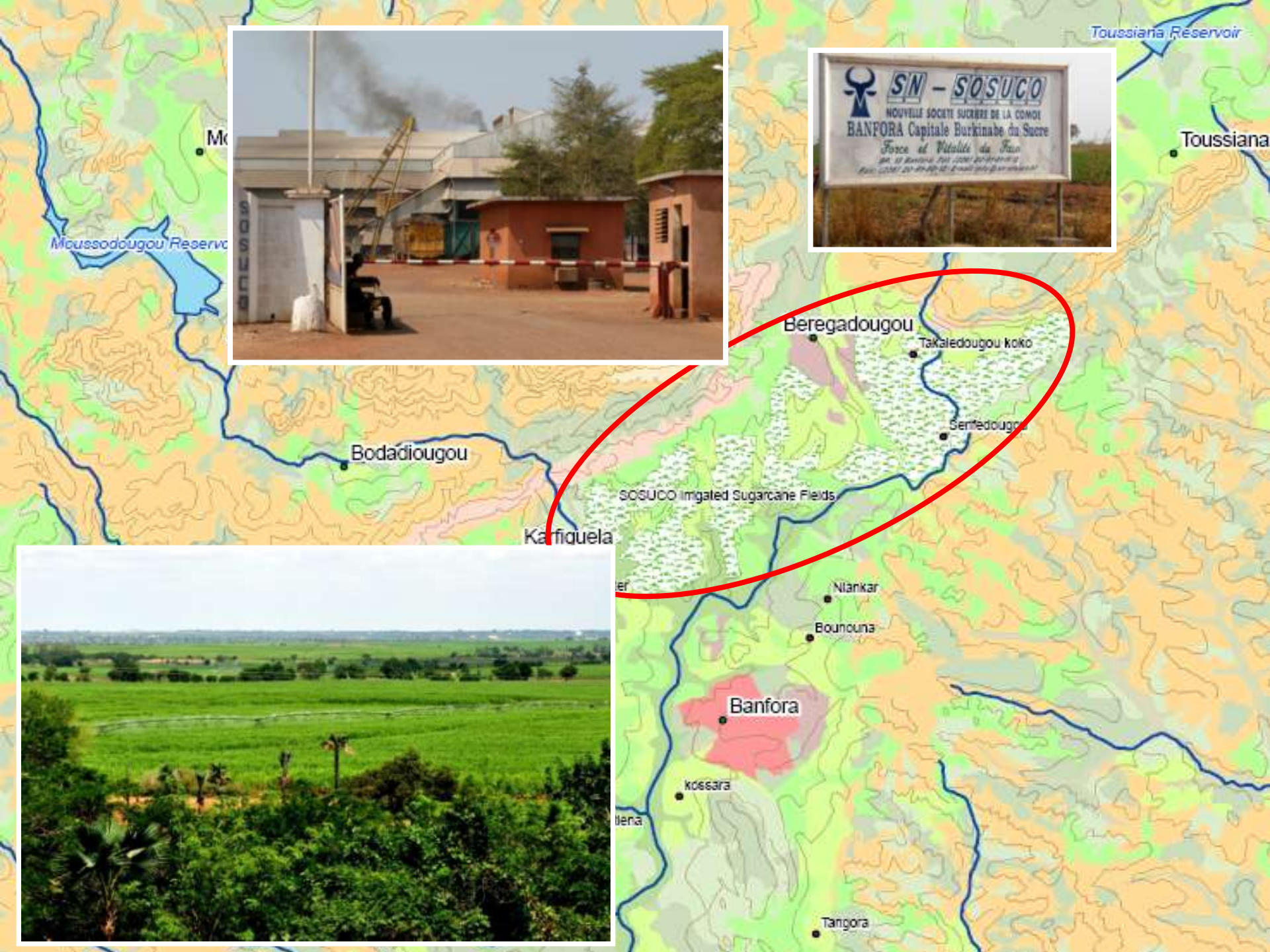




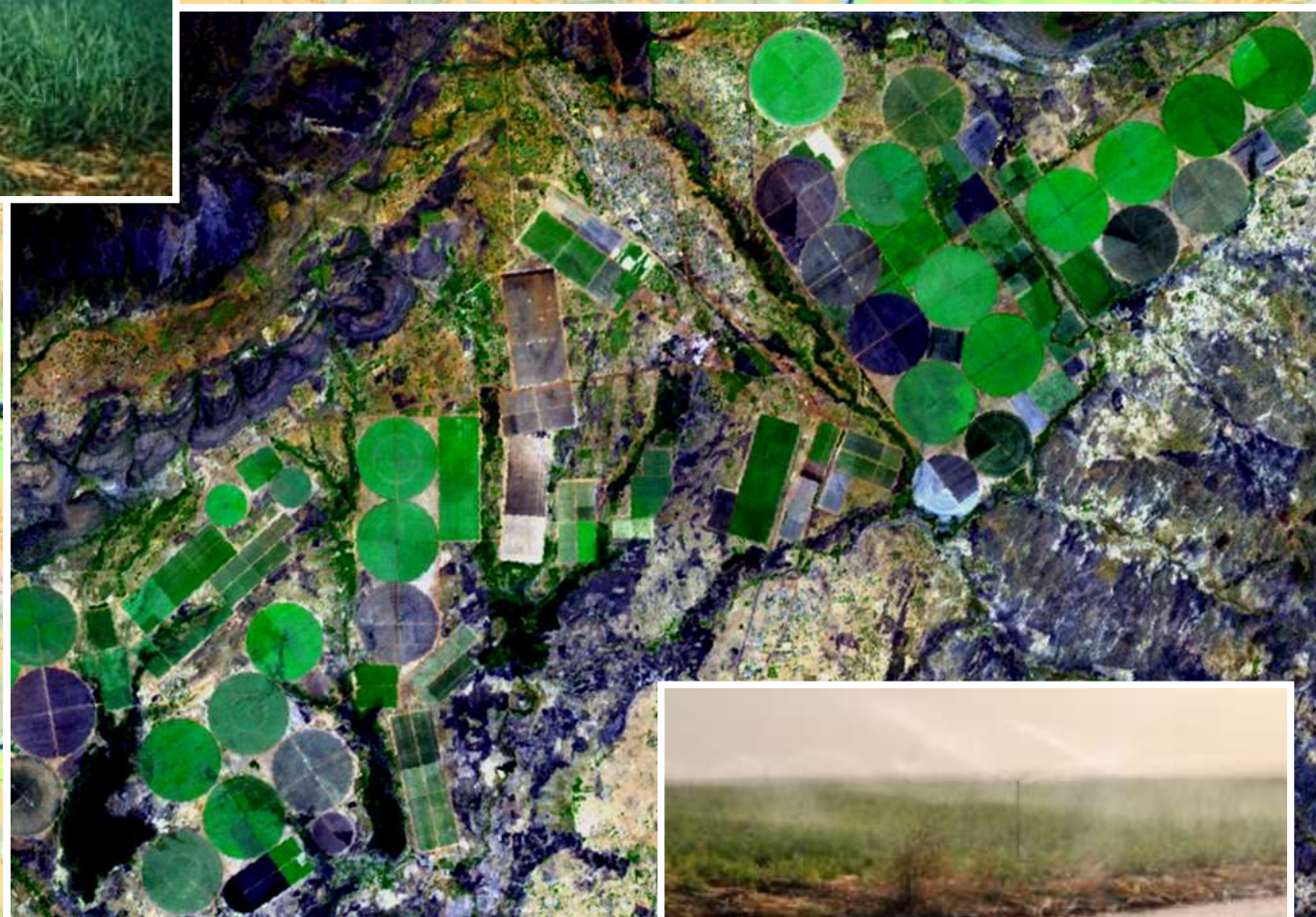




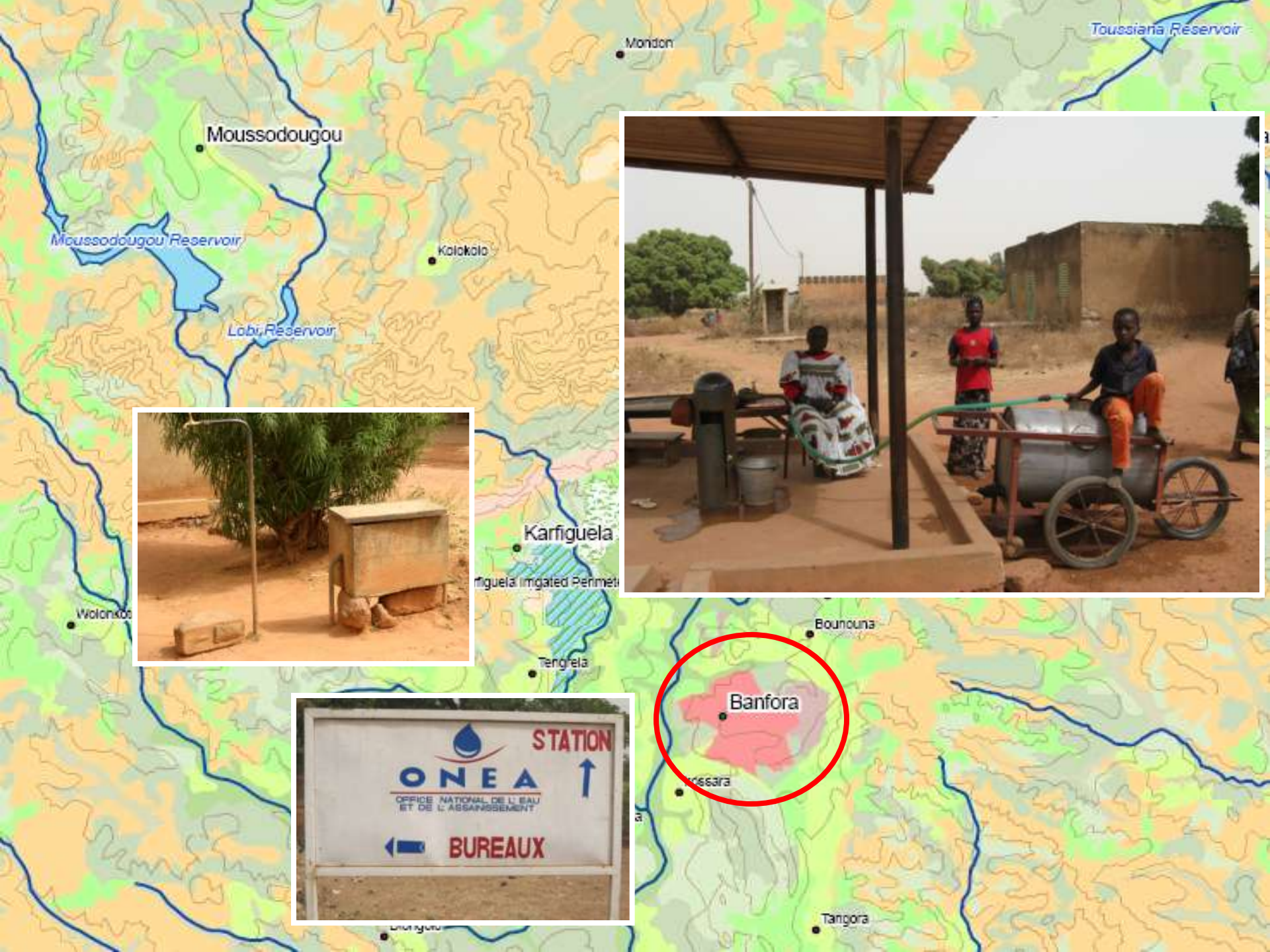


























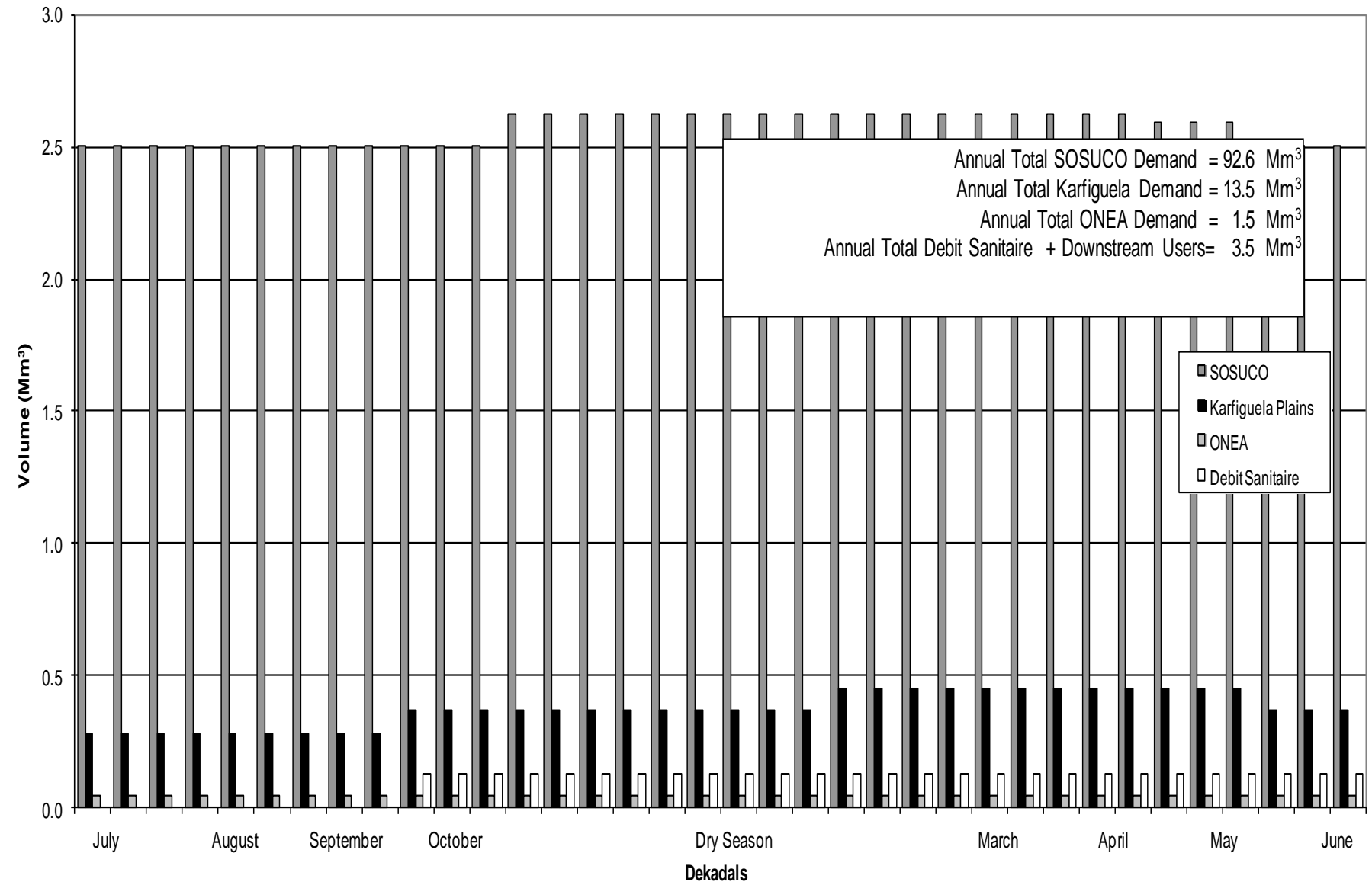








## Case Study – Unequal User Demands



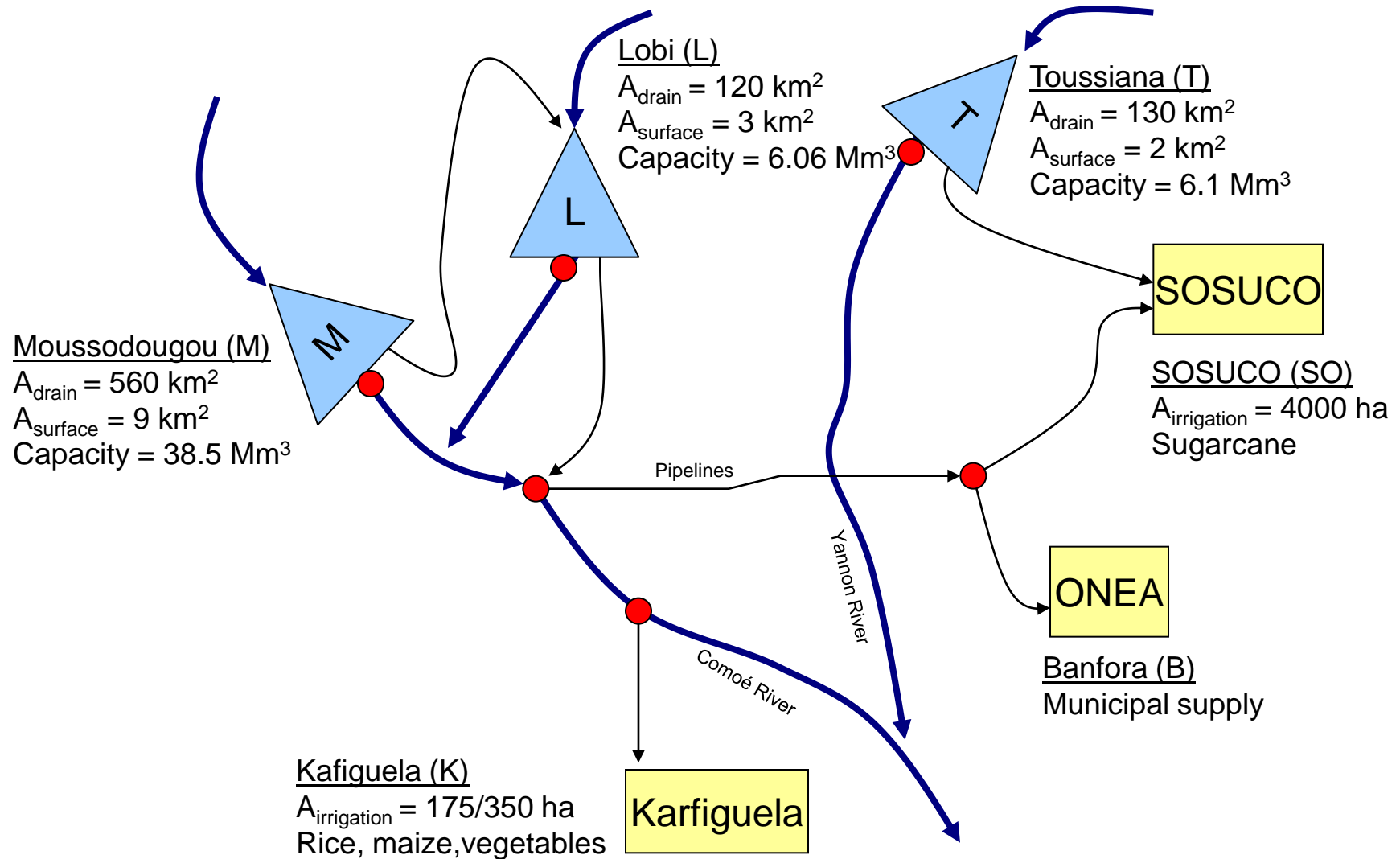
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# Decision Support Tool



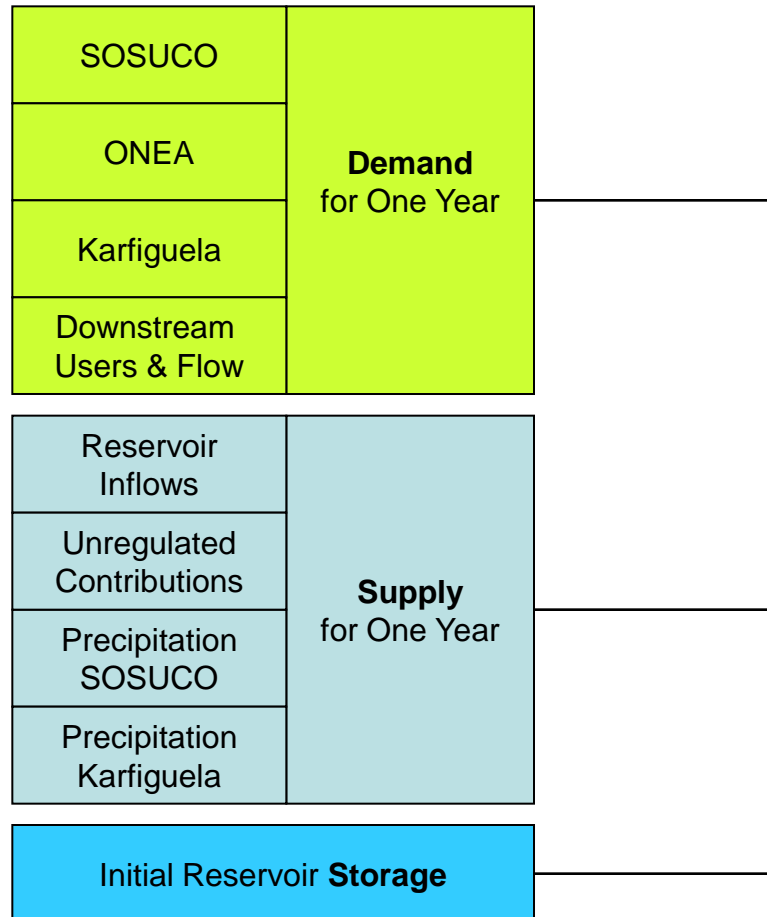
# Decision Support Tool - Network Schematic



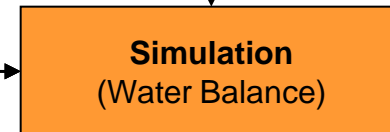
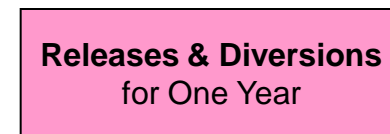
# Decision Support Tool - Structure

Given certain *climate and hydrological conditions (input)*, the tool simulates the impact of *different management decisions (decisions)* in terms of *deficits incurred by each user (output)*

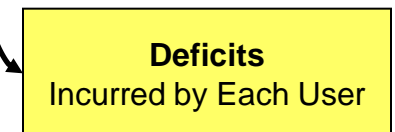
## Input – Water Demand & Supply



## Decisions – Releases & Diversions



## Output





# Decision Support Tool – Input

Microsoft Excel - Comoe Simulation Tools

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Security...

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8																								
9			Inflows				Rainfed Supply		Evap	Demand		Debits		Net Demand				Rainfed Supply						
10	Starting Date	1-Jul	Moscardo (Mm <sup>3</sup> /day)	Lobi (Mm <sup>3</sup> /day)	Toussiana (Mm <sup>3</sup> /day)	Comoe Unregulated (Mm <sup>3</sup> /day)	SOSUCO (Mm <sup>3</sup> /day)	Karfiguela (Mm <sup>3</sup> /day)	Rate (mm/day)	SOSUCO (Mm <sup>3</sup> /day)	ONEA (Mm <sup>3</sup> /day)	Karfiguela (Mm <sup>3</sup> /day)	Sanitaires (Mm <sup>3</sup> /day)	SOSUCO (Mm <sup>3</sup> /day)	ONEA (Mm <sup>3</sup> /day)	Karfiguela (Mm <sup>3</sup> /day)	Sanitaires (Mm <sup>3</sup> /day)	SOSUCO (Mm <sup>3</sup> /day)	ONEA (Mm <sup>3</sup> /day)	Karfiguela (Mm <sup>3</sup> /day)	Sanitaires (Mm <sup>3</sup> /day)	SOSUCO (Mm <sup>3</sup> /day)	Karfiguela (Mm <sup>3</sup> /day)	
12	stage1	1-Jul	0.34	0.07	0.08	0.08	1.30	0.12	12	2.30	0.04	0.22	0.20	1.08	0.04	0.13	0.32	1.33	0.12					
13	stage2	11-Jul	0.35	0.07	0.08	0.08	3.40	0.30	12	2.30	0.04	0.22	0.20	0.00	0.04	0.00	0.12	2.30	0.12					
14	stage3	21-Jul	0.85	0.18	0.20	0.20	2.56	0.22	12	2.30	0.04	0.22	0.20	0.00	0.04	0.00	0.00	2.30	0.22					
15	stage4	31-Jul	1.21	0.26	0.28	0.28	3.02	0.26	12	2.30	0.04	0.22	0.20	0.00	0.04	0.00	0.00	2.30	0.22					
16	stage5	10-Aug	1.51	0.32	0.35	0.36	3.14	0.27	12	2.30	0.04	0.22	0.20	0.00	0.04	0.00	0.00	2.30	0.22					
17	stage6	20-Aug	1.70	0.36	0.39	0.40	1.59	0.14	12	2.30	0.04	0.22	0.20	0.73	0.04	0.10	0.00	1.53	0.14					
18	stage7	30-Aug	2.46	0.53	0.57	0.58	1.21	0.11	12	2.30	0.04	0.22	0.20	1.21	0.04	0.14	0.00	1.21	0.11					
19	stage8	9-Sep	2.58	0.55	0.60	0.61	1.5	0.10	12	2.30	0.04	0.22	0.20	1.28	0.04	0.15	0.00	1.15	0.10					
20	stage9	19-Sep	2.63	0.56	0.61	0.62	1.26	0.11	12	2.30	0.04	0.22	0.20	1.16	0.04	0.14	0.00	1.26	0.11					
21	stage10	29-Sep	2.56	0.55	0.59	0.60	0.42	0.04	12	2.30	0.04	0.22	0.20	2.09	0.04	0.23	0.00	0.42	0.04					
22	stage11	9-Oct	1.82	0.38	0.42	0.43	0.11	0.01	12	2.20	0.04	0.22	0.20	2.32	0.04	0.26	0.00	0.11	0.01					
23	stage12	19-Dec	1.54	0.33	0.36	0.36	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
24	stage13	29-Dec	3.84	0.82	0.89	0.91	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
25	stage14	8-Nov	3.60	0.77	0.84	0.85	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
26	stage15	18-Nov	1.54	0.33	0.36	0.36	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
27	stage16	29-Nov	0.71	0.15	0.16	0.17	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
28	stage17	9-Dec	0.49	0.10	0.11	0.11	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
29	stage18	19-Dec	0.42	0.08	0.10	0.10	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
30	stage19	29-Dec	0.35	0.08	0.08	0.08	0.01	0.00	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.01	0.00					
31	stage20	7-Jan	0.30	0.06	0.07	0.07	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
32	stage21	18-Jan	0.24	0.05	0.06	0.06	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
33	stage22	28-Jan	0.18	0.04	0.04	0.04	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
34	stage23	7-Feb	0.12	0.02	0.03	0.03	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
35	stage24	21-Feb	0.08	0.02	0.02	0.02	-	-	12	2.20	0.04	0.12	0.20	2.44	0.04	0.15	0.00	0.00	0.00					
36	stage25	3-Mar	0.08	0.02	0.02	0.02	0.63	0.05	12	2.30	0.04	0.22	0.20	1.06	0.04	0.21	0.36	0.63	0.05					
37	stage26	13-Mar	0.07	0.02	0.02	0.02	0.50	0.08	12	2.30	0.04	0.22	0.20	1.28	0.04	0.18	0.38	0.50	0.08					
38	stage27	23-Mar	0.07	0.01	0.02	0.02	-	-	12	2.30	0.04	0.22	0.20	2.76	0.04	0.28	0.38	0.00	0.00					
39	stage28	2-Apr	0.06	0.01	0.01	0.01	-	-	12	2.30	0.04	0.22	0.20	2.56	0.04	0.29	0.38	0.00	0.00					
40	stage29	12-Apr	0.06	0.01	0.01	0.01	0.95	0.08	12	2.30	0.04	0.22	0.20	1.50	0.04	0.17	0.39	0.95	0.08					
41	stage30	22-Apr	0.05	0.01	0.01	0.01	0.07	0.01	12	2.30	0.04	0.22	0.20	2.47	0.04	0.27	0.39	0.07	0.01					
42	stage31	2-May	0.05	0.01	0.01	0.01	-	-	12	2.30	0.04	0.22	0.20	2.56	0.04	0.28	0.39	0.00	0.00					
43	stage32	12-May	0.07	0.01	0.02	0.02	0.27	0.02	12	2.30	0.04	0.22	0.20	2.26	0.04	0.25	0.38	0.27	0.02					
44	stage33	22-May	0.28	0.05	0.06	0.07	0.51	0.04	12	2.30	0.04	0.22	0.20	1.88	0.04	0.22	0.30	0.51	0.04					
45	stage34	1-Jun	0.07	0.01	0.02	0.02	2.15	0.19	12	2.30	0.04	0.22	0.20	0.17	0.04	0.04	0.38	2.15	0.19					
46	stage35	11-Jun	0.26	0.06	0.06	0.06	0.24	0.02	12	2.30	0.04	0.22	0.20	2.29	0.04	0.25	0.34	0.24	0.02					
47	stage36	21-Jun	0.34	0.07	0.08	0.08	-	-	12	2.30	0.04	0.22	0.20	2.56	0.04	0.28	0.32	0.00	0.00					
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# Decision Support Tool – Output

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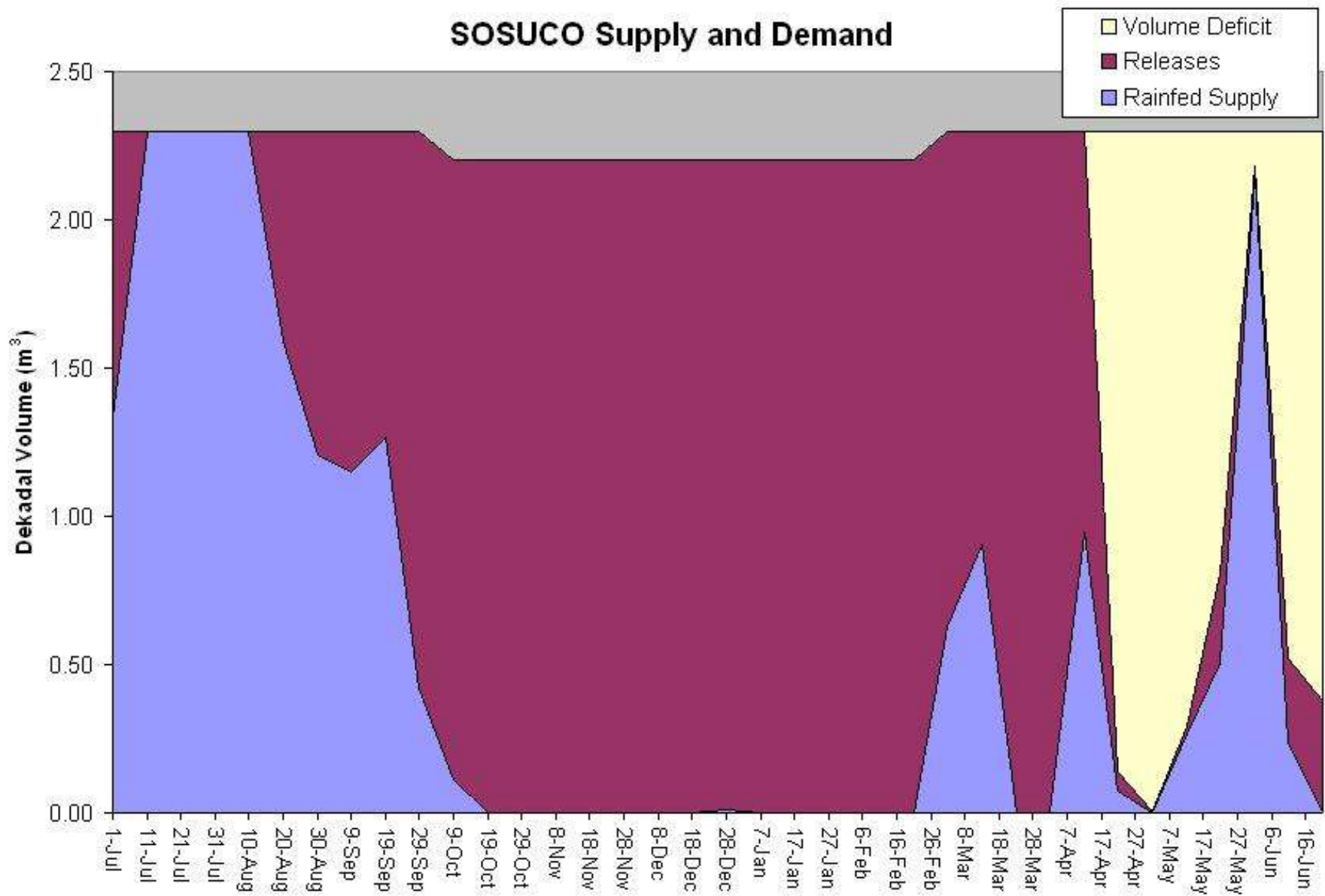
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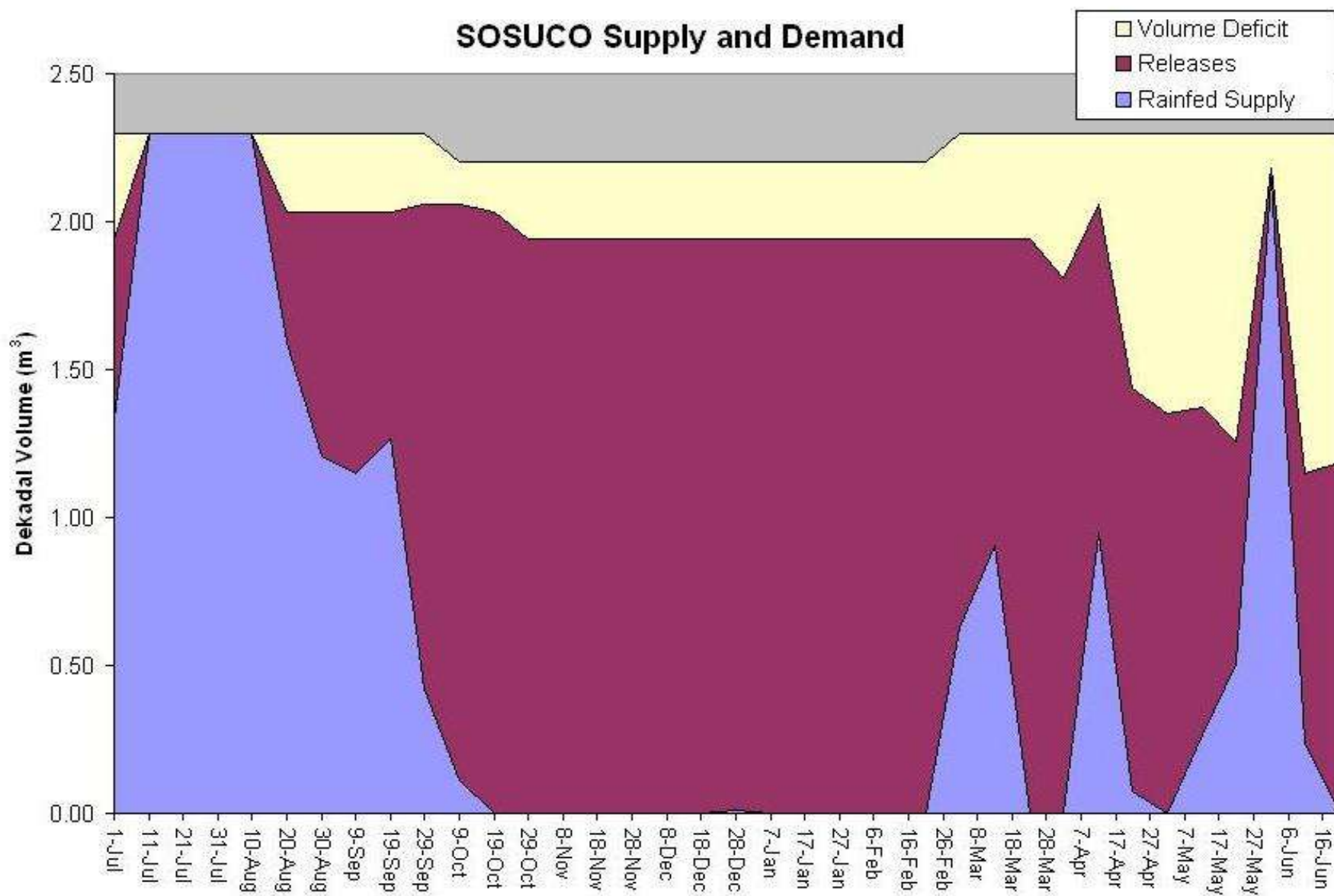




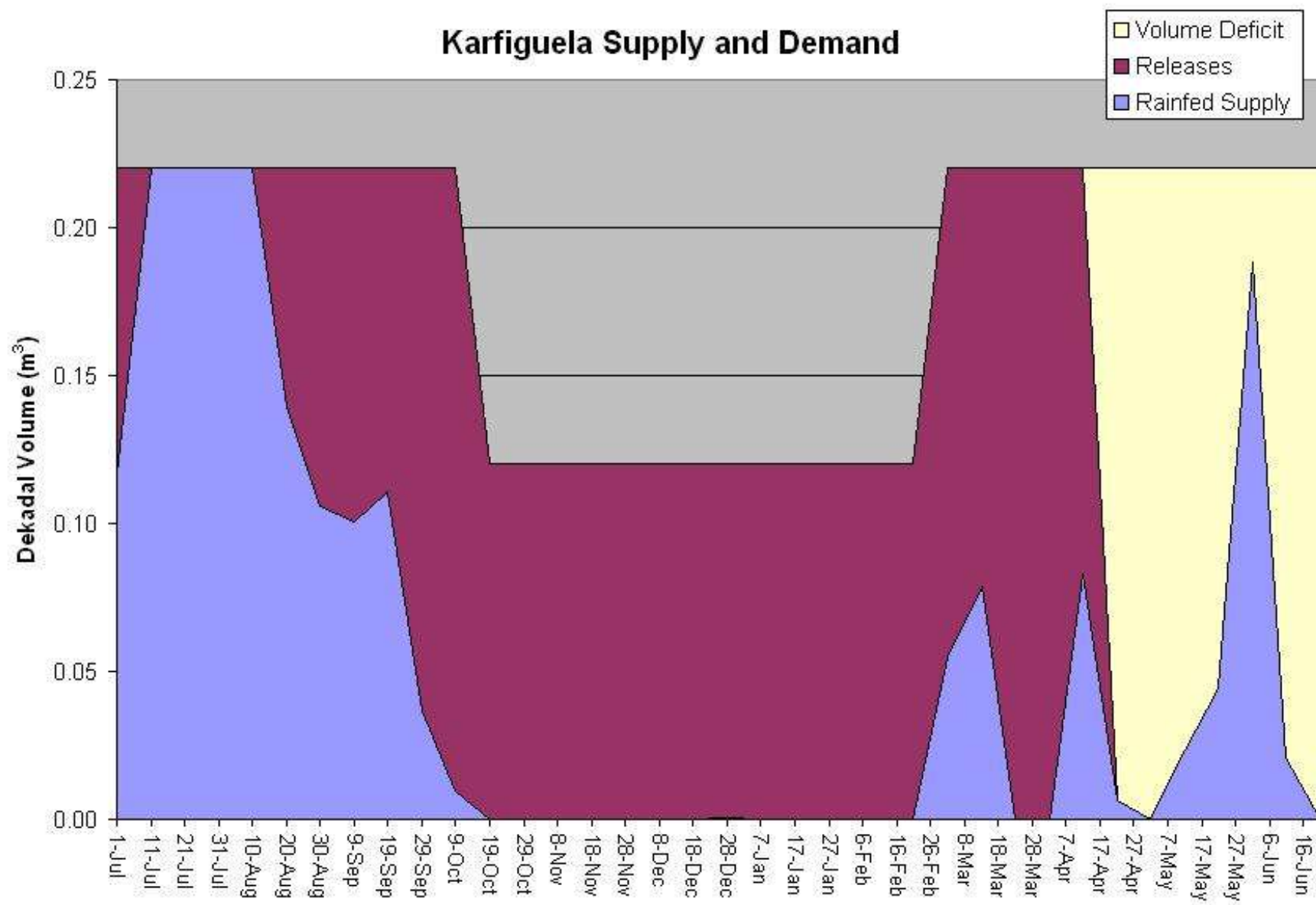
# Decision Support Tool – Output 1



# Decision Support Tool – Output 2

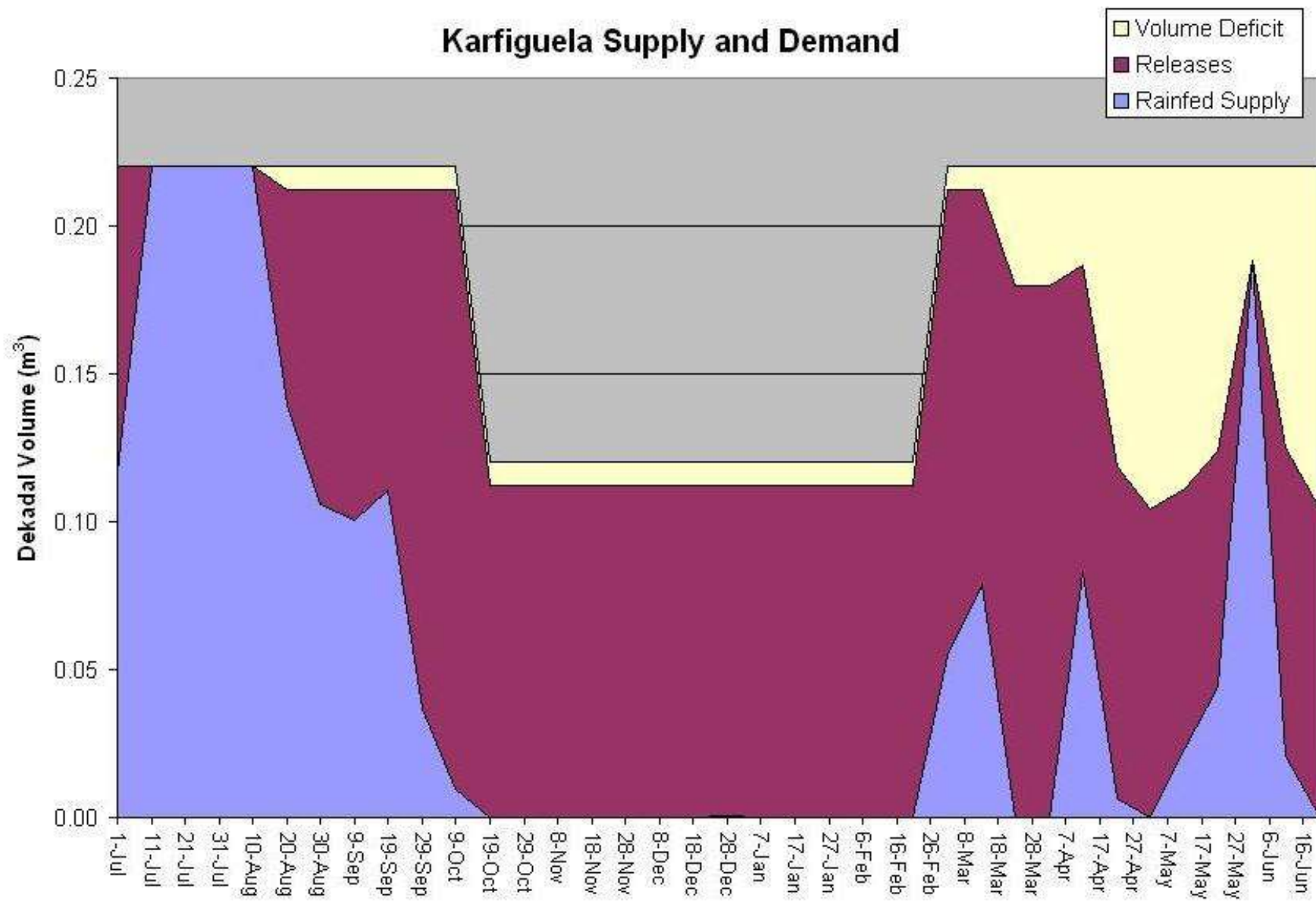


# Decision Support Tool – Output 1



# Decision Support Tool – Output 2

Karfiguela Supply and Demand



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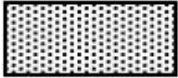





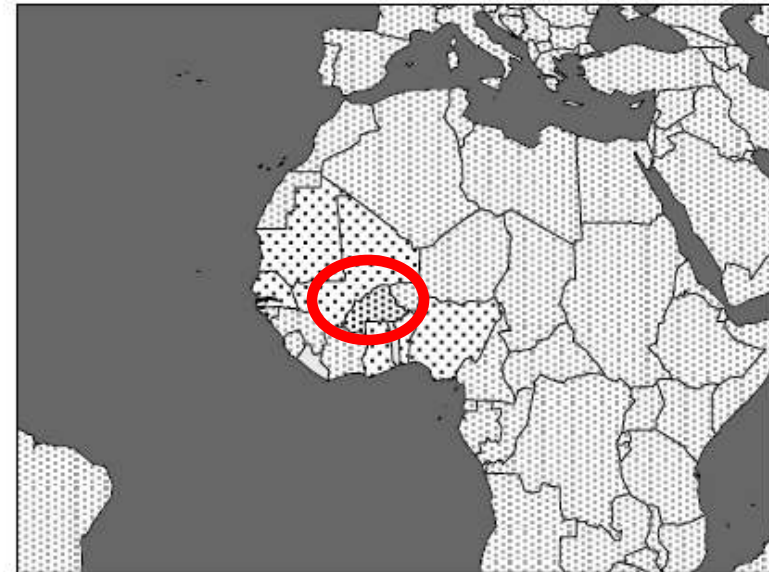
# Water Governance



# Water Governance – GIRE in Burkina Faso

**A survey of almost 100 countries ranks Burkina Faso among the 20 most advanced cases of GIRE implementation**

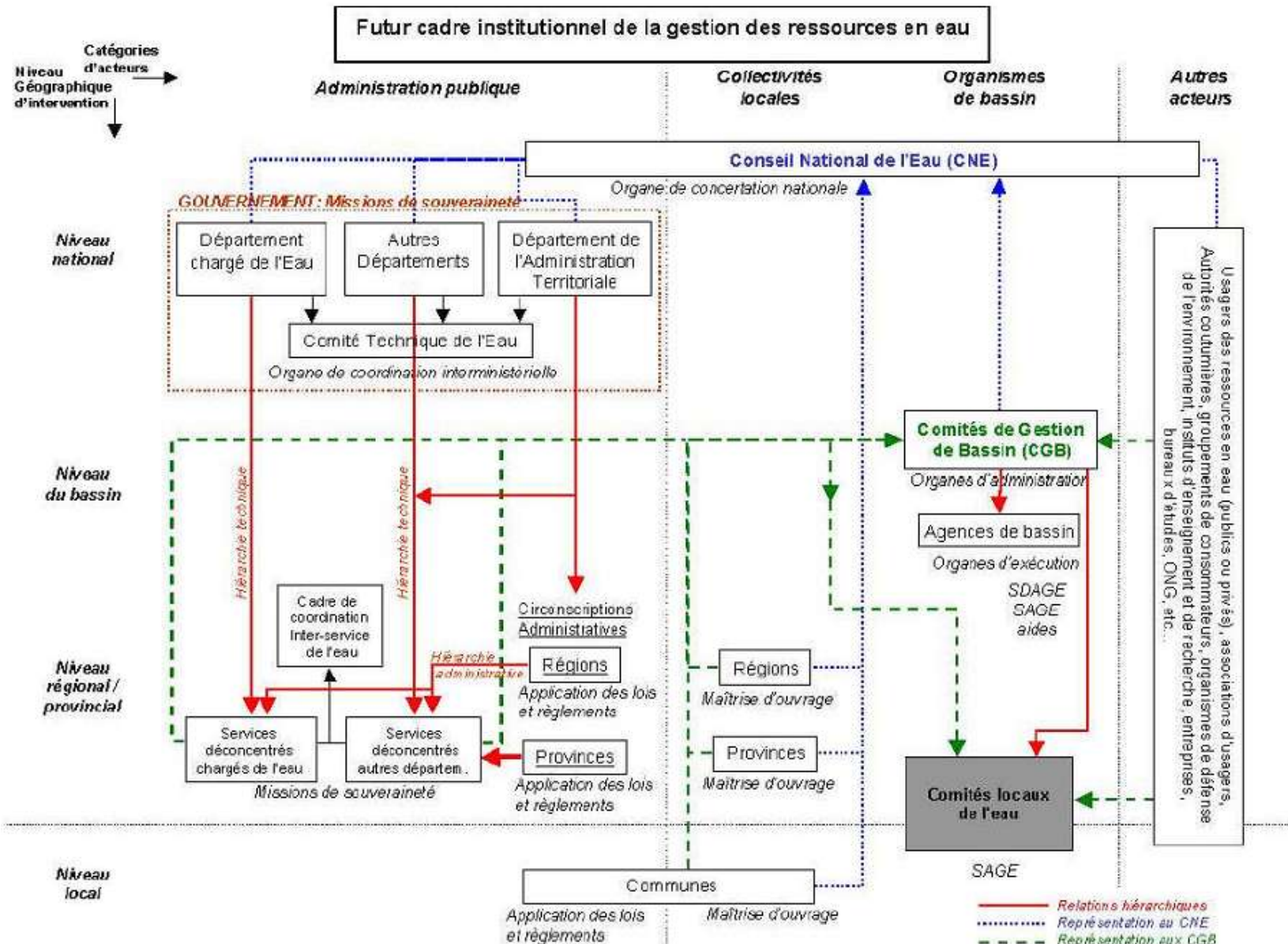
	Countries that have plans/strategies in place, or a process well underway, and that incorporate the main elements of an IWRM approach.
	Countries that are in the process of preparing national strategies or plans but require further work to live up to the requirements of an IWRM approach.
	Countries that have taken only initial steps in the process towards preparing national strategies or plans and have not yet fully embraced the requirements of an IWRM approach.
	Countries that have not submitted a survey reply, or been included in the survey.



Global Water Partnership 2006 *Setting the Stage for Change*



# Water Governance – GIRE in Burkina Faso

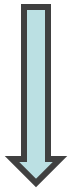




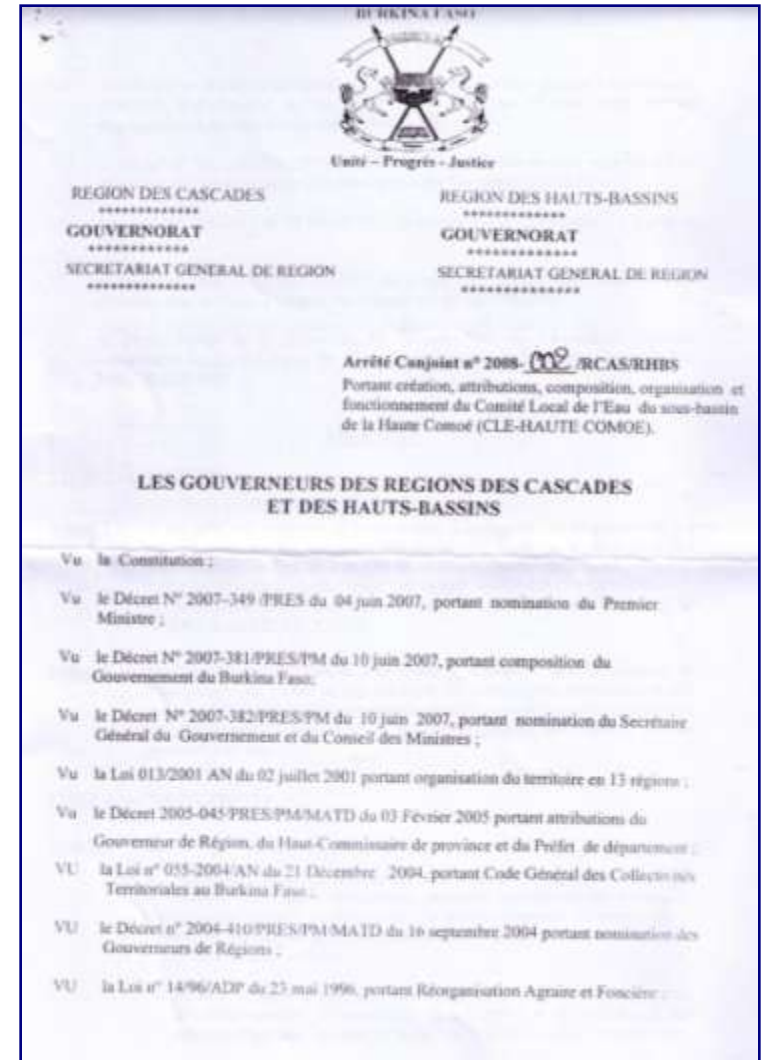
# Water Governance – GIRE in Haute Comoé

## *Comité Local de l'Eau (CLE) Haute Comoé*

*Assemblée Générale  
Comité Restraint*



Elected officials (mayors)  
Technical services (ministries)  
Civil society organizations  
User representatives



## Examples of CLE deliberation outcomes

- July 2010: SOSUCO agree to release water during prolonged dry spell to allow farmers to irrigate rice plots
- Feb 2011: After poor rainy season, farmers agree to postpone rice planting to allow SOSUCO to irrigate its sugar cane fields
- Jan 2012: Due to drought and dam problems, CLE proposes that deficit is split equally among users and planted acreages be reduced accordingly



# Water Governance – GIRE in Haute Comoé



## Interviews

Institutional representatives	14
CLE members (CR+AG)	18
Cooperative members	17
Riparian farmers	12
Livestock owners	12
Fishermen	8
Urban users	1
<b>Total</b>	<b>82</b>



## Information processes

- One user (SOSUCO) has monopoly of key data needed for water management decisions
- Limited technical competence means lack of transparency in how data is analyzed and applied to decisions
- Scientific instrumentation for measuring water levels at key points of the system is lacking
- Independent verification of water availability and amounts released is constrained by lack of resources
- Scale of downstream riparian agriculture and other demands are poorly appreciated and quantified
- Water losses due to poor state and multiple uses of canal water are not estimated

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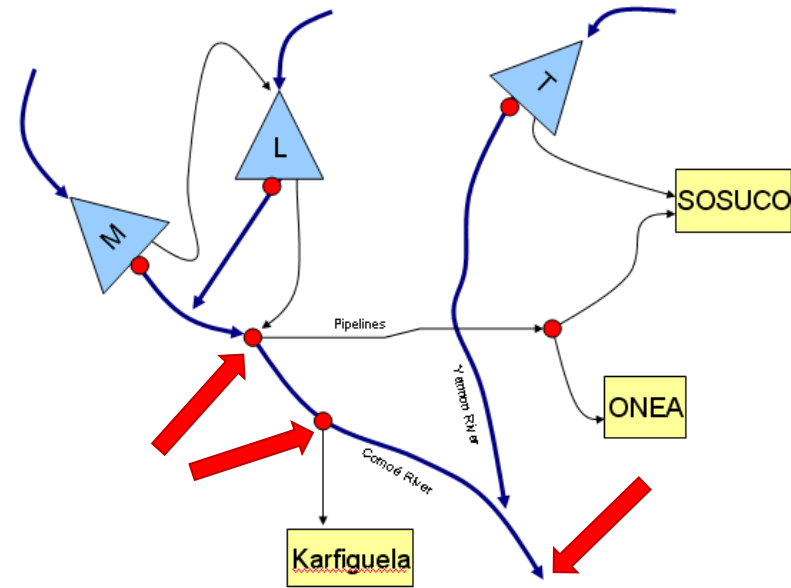
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## Operational issues

- Discussion are in French, with occasional summary translation in local language for farmers
- Awareness (and, therefore, legitimacy) of CLE and GIRE policy is very low in rural areas and even in town
- Meetings are often convened at short notice, and attended by a few key actors
- State authorities (rather than CLE leadership) play key role in convening, moderating meetings
- State authorities mediate most conflicts, “begging” SOSUCO on farmers’ behalf
- The CLE operations are largely supported by SOSUCO financial contributions

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# Water Governance – GIRE in Haute Comoé

## Ambiguities & contradictions

- Decentralization
- Food security
- Stream bank protection
- Mining



# Water Governance – GIRE in Haute Comoé

## Blind spots

- Access to water points by livestock and wildlife
- Water quality, pollution
- Ecosystem transformation
- Cultural values, sense of place
- Land tenure





# Conclusions



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- GIRE is recognized as an important instrument of climate change adaptation and management of resulting *water scarcity and conflict*
- *Decision support tools* can assist GIRE but require reliable instrumentation, regular verification, transparency in data management, and incorporation of all needs and uses
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# Center for Research on Environmental Decisions

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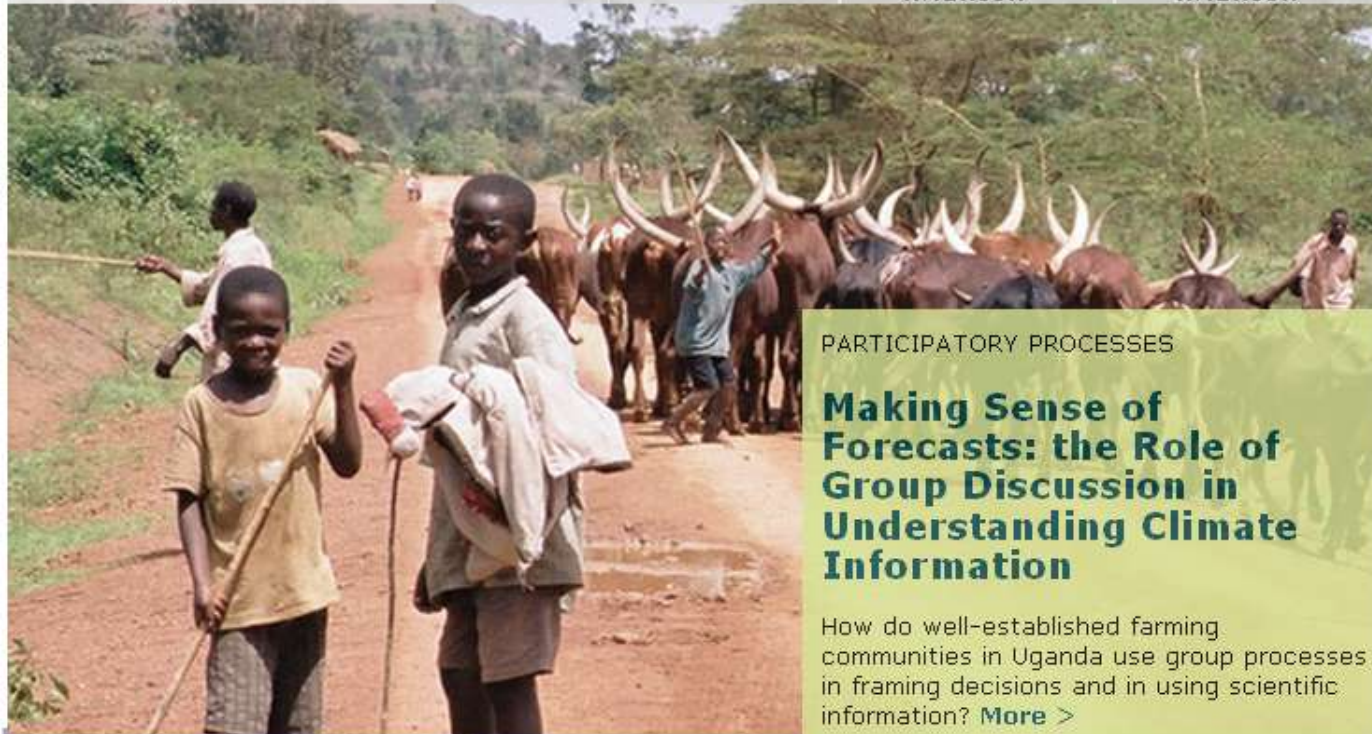
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## PARTICIPATORY PROCESSES

### **Making Sense of Forecasts: the Role of Group Discussion in Understanding Climate Information**

How do well-established farming communities in Uganda use group processes in framing decisions and in using scientific information? [More >](#)

## NEWS & EVENTS

### **CRED Co-Director Ben Orlove travels to Antarctica**

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### **CRED Co-Director Elke Weber speaks at Falling Walls**

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