# International Association for Hydro-environment Engineering and Research IAHR-WRM / Leadership Team Meeting

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**UNESCO Category II Centre on Integrated and Multidisciplinary Water Resources Management (CIMWRM)**

# "From the Myths of Hercules to the reality of climate change"

## Integrated Water ressources Management in a contexte of Climat Change in West Africa


***Presented by***

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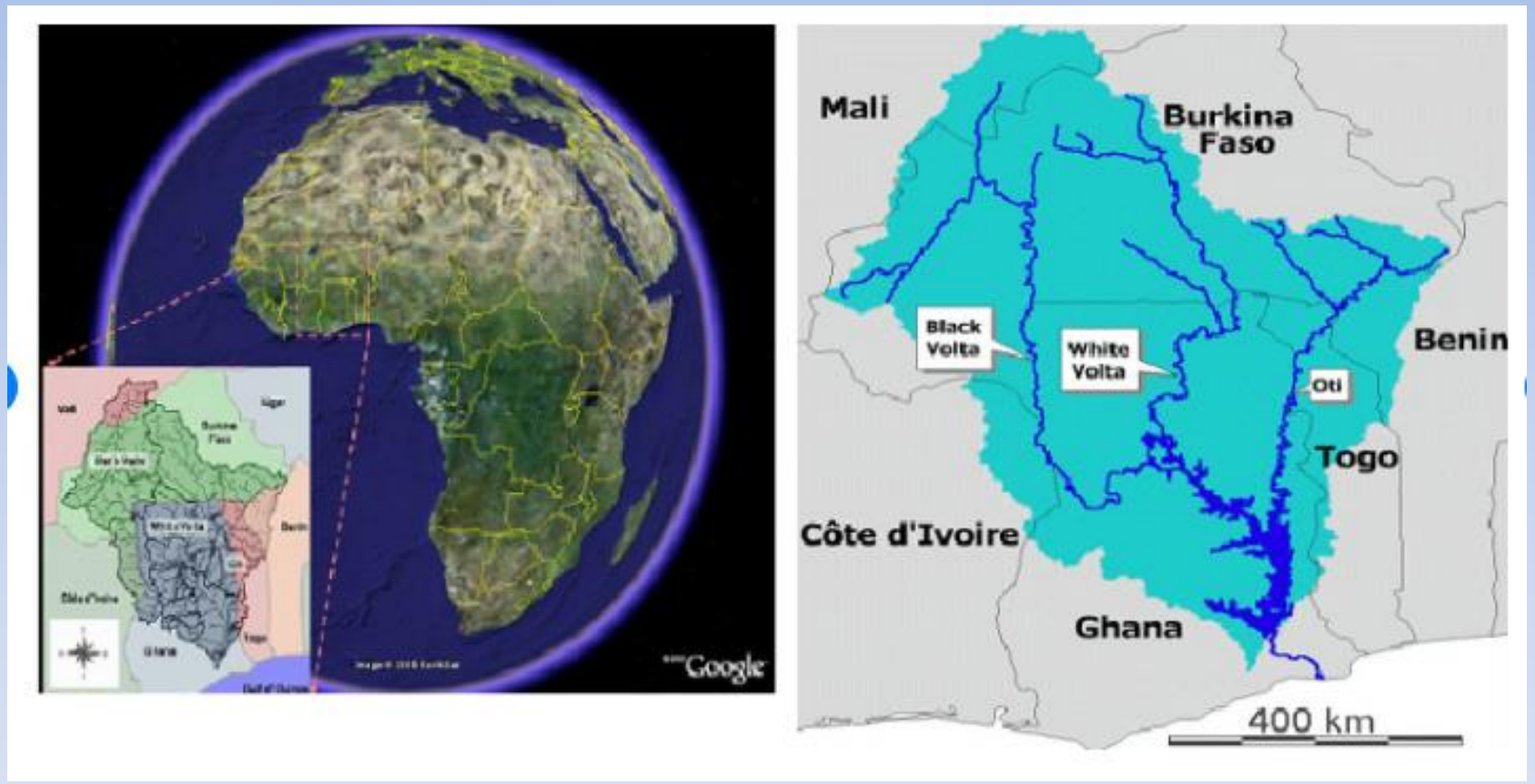
# Content

- Background
- **Land uses, land and resources degradation**

# Background


Mali
Burkina Faso
Black Volta
White Volta
Oti
Benin
Togo
Côte d'Ivoire
Ghana
400 km
Google

# Background

- In order to promote economic and social development:

⇒ Water must participate effectively in poverty reduction, security, peace, cooperation

Water challenges:

⇒ Population growth / Growing needs in all types of water uses

degradation of water quality / water-borne diseases

⇒ Climate change / extreme hydro - climatic events:

**droughts** (water shortages), **floods**

Consequences: Human losses, material damage, inter-state conflicts

**All problems that require more attention and actions**.

# Land uses, land and resources degradation

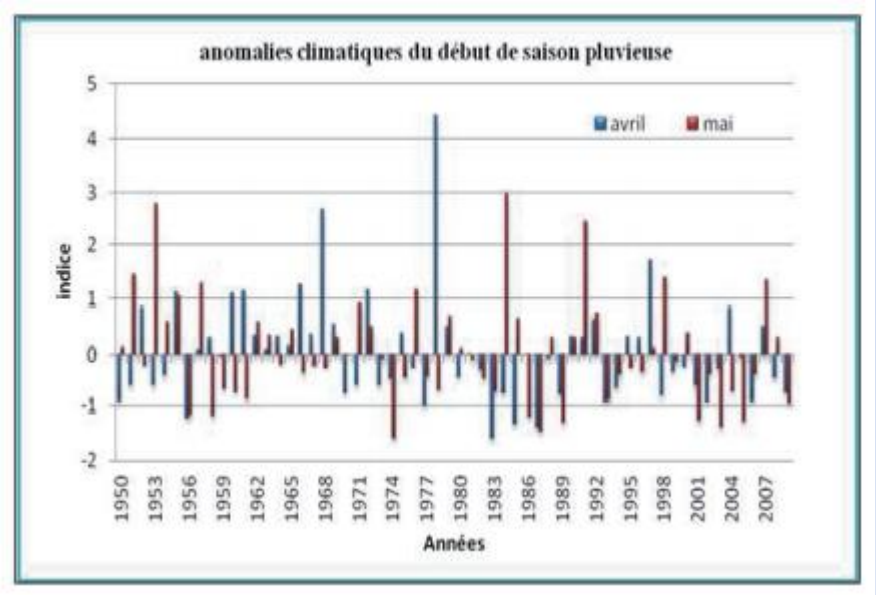
# challenge

the knowledge of the water resources and its seasonal variation at the catchment level has some weaknesses because of hydrological, lithological and geological data that are truncated or missing

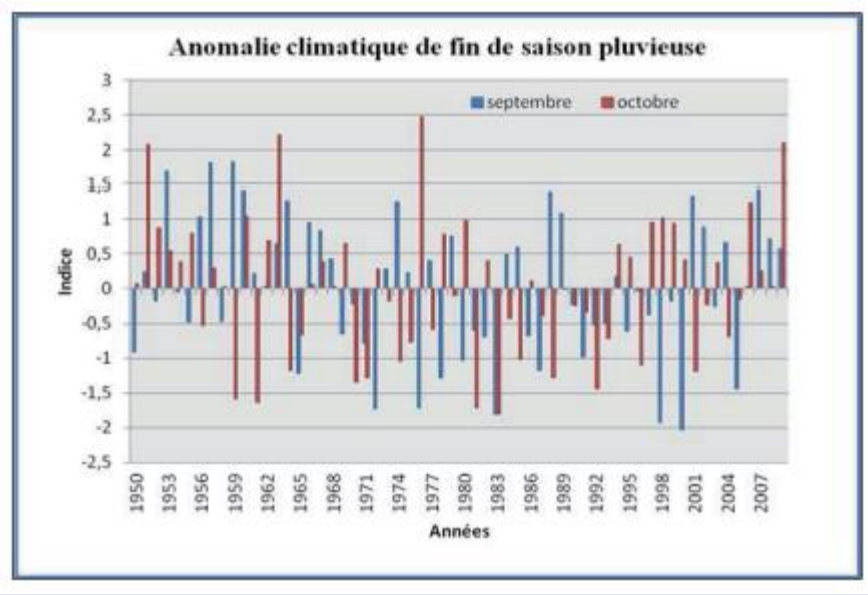
# Descriptive statistics of the rainy season at monthly time step

| × | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Minimum | 0,0 | 0,0 | 0,0 | 14,0 | 60,0 | 69,0 | 46,0 | 87,0 | 116 | 11,0 | 0,0 | 0,0 |
| Maximum | 47,0 | 55,0 | 83,0 | 238 | 268 | 261 | 320 | 354 | 320 | 211 | 78,0 | 54,0 |
| Moyenne | 4,5 | 7,10 | 30,1 | 73,3 | 132 | 167 | 197 | 218 | 223 | 95,4 | 7,6 | 4,35 |
| Ecart-type | 9,5 | 12,1 | 20,8 | 37,1 | 45,5 | 46,2 | 62,9 | 69,1 | 52,7 | 46,5 | 7,6 | 4,35 |
| Mediane | 0,0 | 1,0 | 28,5 | 70,5 | 125 | 166 | 195 | 219 | 224 | 97,0 | 0,5 | 0,0 |

changes in climate anomaly of early season



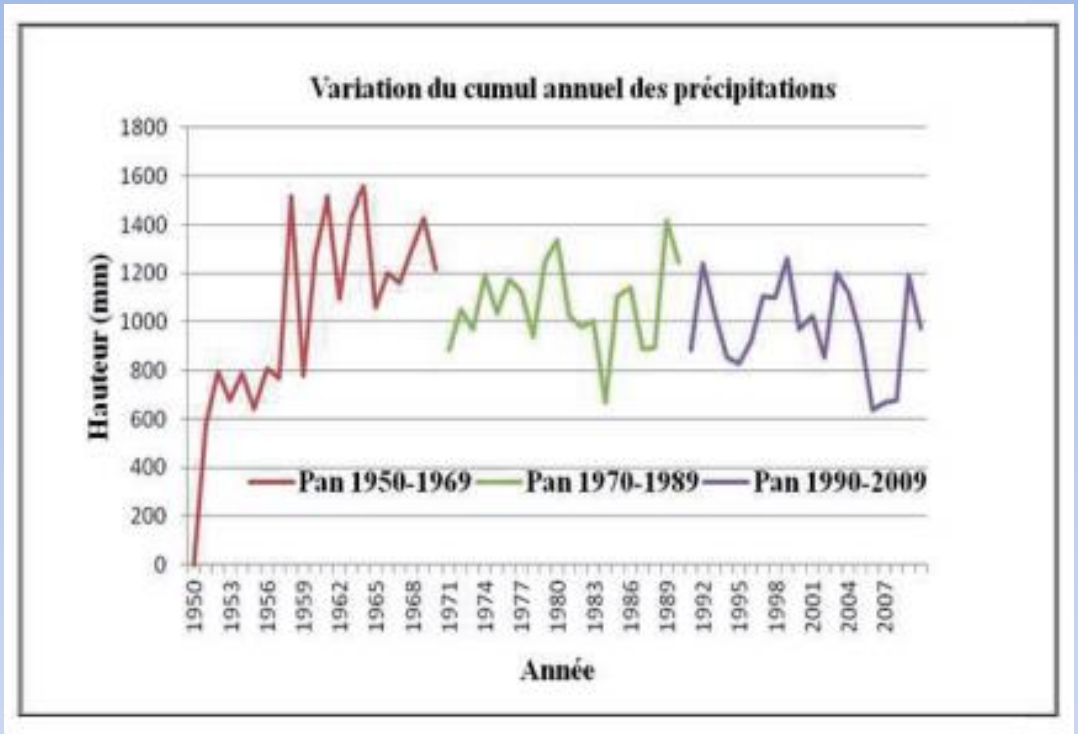

end-of-season climatic anomaly variations



# Rainfall intensity and return period for each month

| × | P 100 | P 50 | P 20 | P 10 | P 5 | P 3 | P 2 |
|---|---|---|---|---|---|---|---|
| Janvier | 42.1 | 34.3 | 23.8 | 15.8 | 77 | 1.6 | 0 |
| Fevrier | 48.9 | 40.9 | 30.2 | 21.9 | 13.3 | 6.8 | 1.5 |
| Mars | 106 | 94.1 | 77 | 63.2 | 48.3 | 36 | 25 |
| Avril | 169 | 155 | 135 | 119 | 100 | 84.5 | 69.4 |
| Mai | 249 | 233 | 210 | 190 | 168 | 148 | 129 |
| Juin | 287 | 271 | 247 | 227 | 204 | 184 | 164 |
| Juillet | 376 | 351 | 315 | 285 | 251 | 221 | 191 |
| Aout | 405 | 380 | 343 | 311 | 275 | 244 | 213 |
| Septembre | 362 | 343 | 317 | 294 | 267 | 244 | 220 |
| Octobre | 234 | 214 | 185 | 161 | 134 | 111 | 89.2 |
| Novembre | 57.8 | 48 | 34.7 | 24.5 | 14.1 | 6.24 | 0 |
| Decembre | 42.7 | 34.6 | 23.6 | 15.3 | 6.86 | 0.588 | 0 |

# Changes of annual rainfall amounts per period

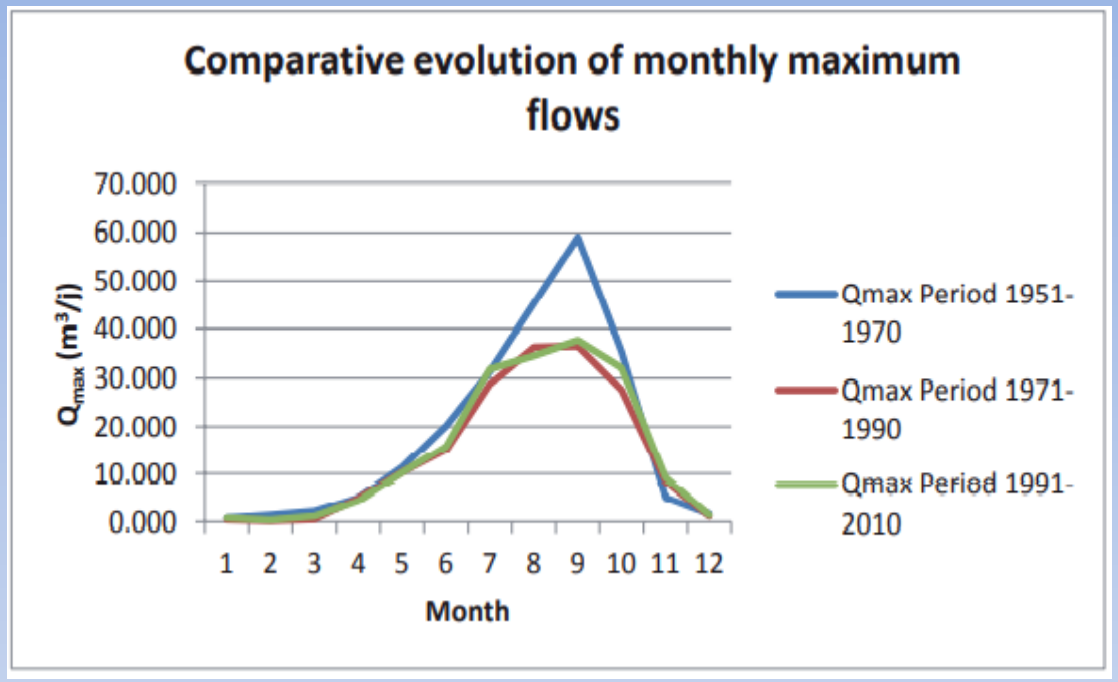


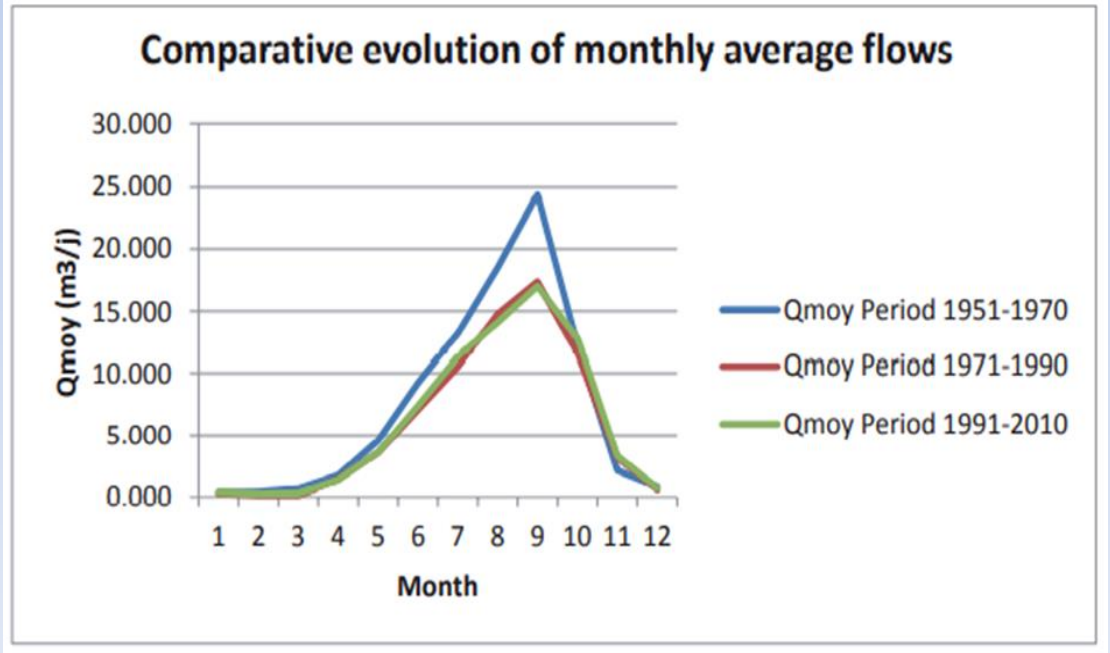

The area has a **savannah climate The Department has a savannah climate with dry winter** (according to Kopper Geiger), with dry season and a rainy season
Annual average temperature is 27°

37% of daily measures were missing from rainfall data

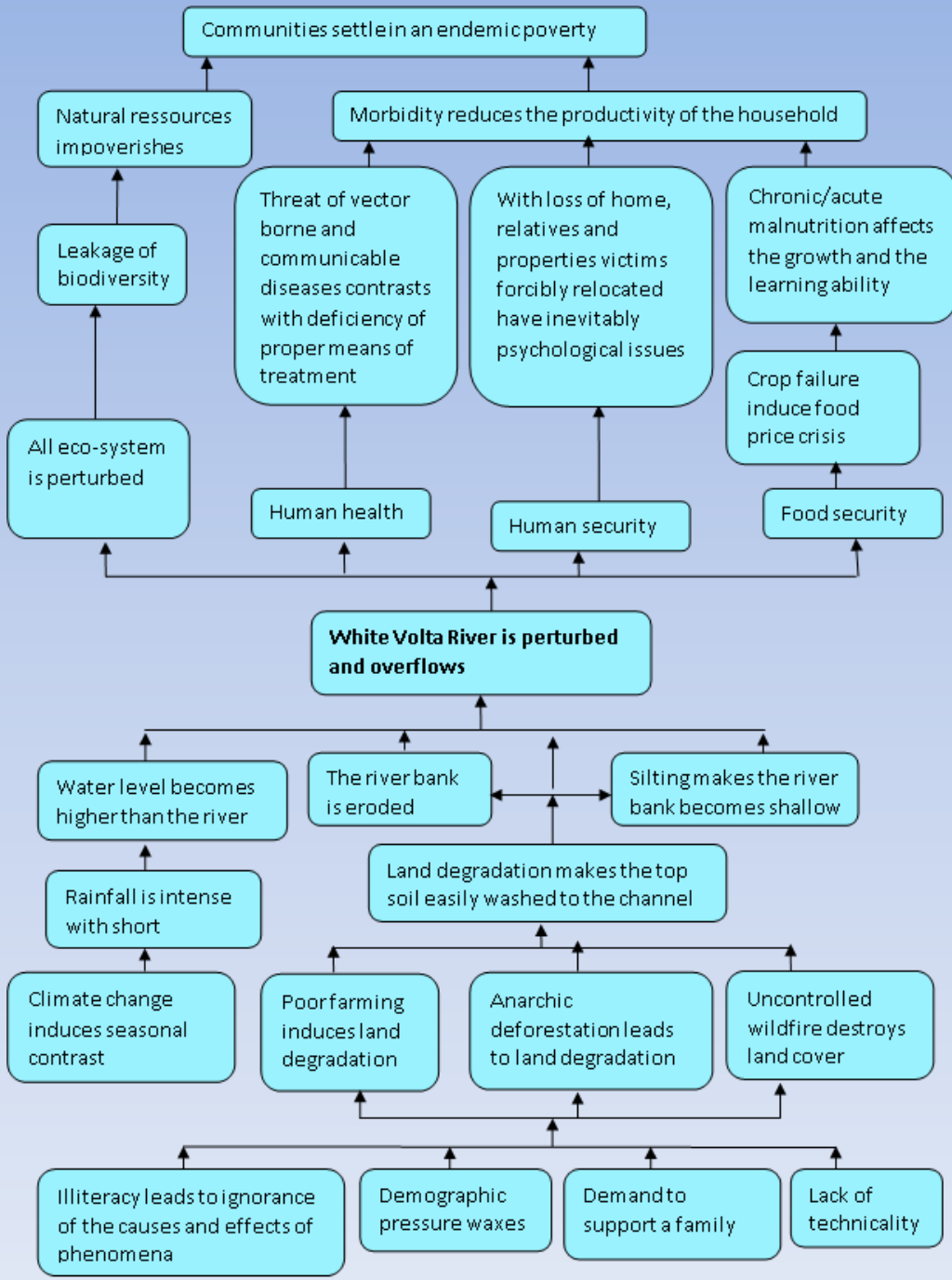
With consequence that it is difficult to use them for a reliable hydrological analysis

There is decrease in precipitation that results in more larger decrease runoff with the existence of an amplifying effect of intagrated features of water sheds: runof coefficients, infiltration vegetation type,

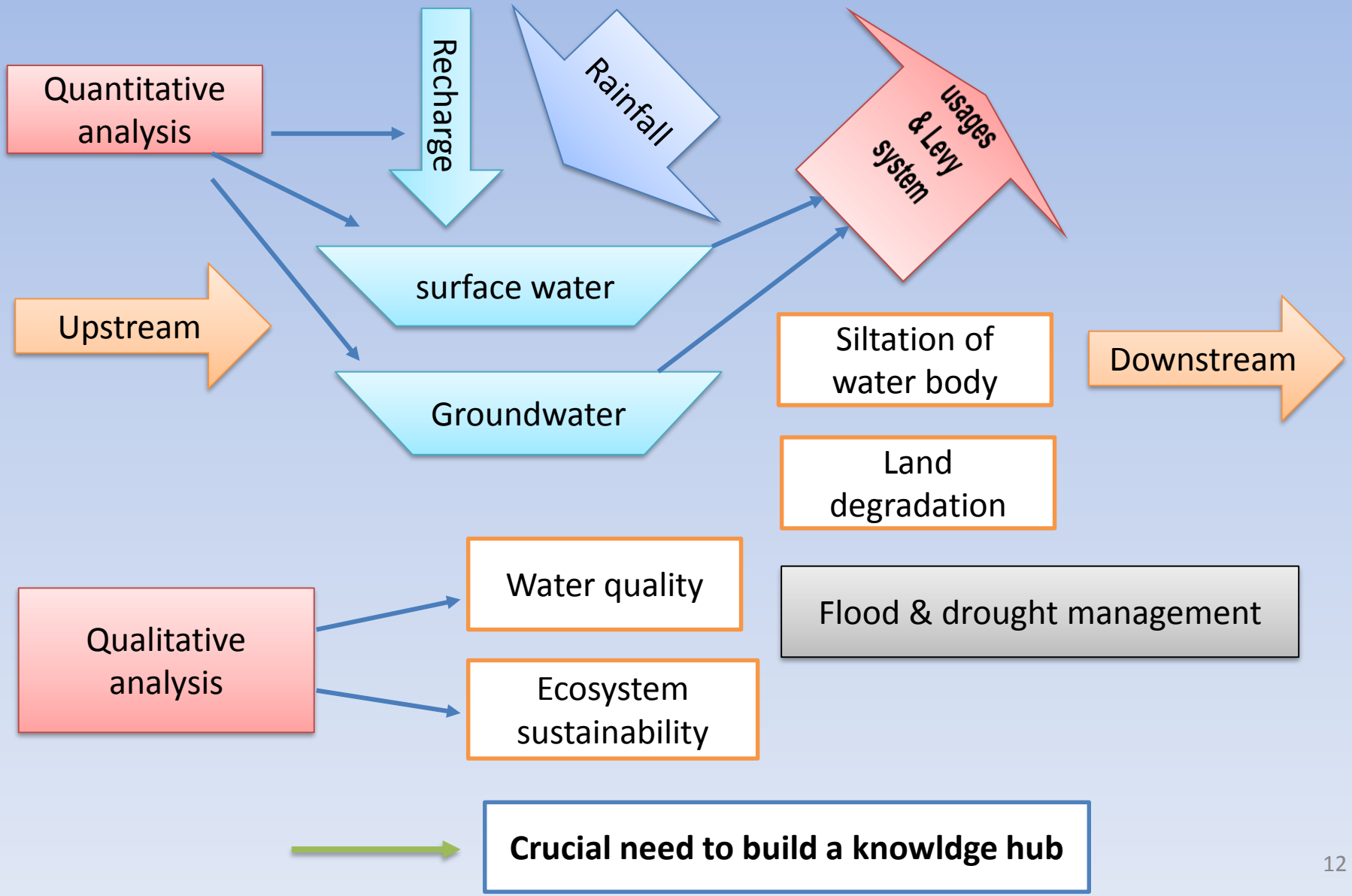

Comparative evolution of monthly maximum flows
70.000
60.000
50.000
40.000
30.000
20.000
10.000
0.000
Qmax (m³/j)
1 2 3 4 5 6 7 8 9 10 11 12
Month
Qmax Period 1951-1970
Qmax Period 1971-1990
Qmax Period 1991-2010


Comparative evolution of monthly average flows
30.000
25.000
20.000
15.000
10.000
5.000
0.000
Qmoy (m3/j)
1 2 3 4 5 6 7 8 9 10 11 12
Month
Qmoy Period 1951-1970
Qmoy Period 1971-1990
Qmoy Period 1991-2010

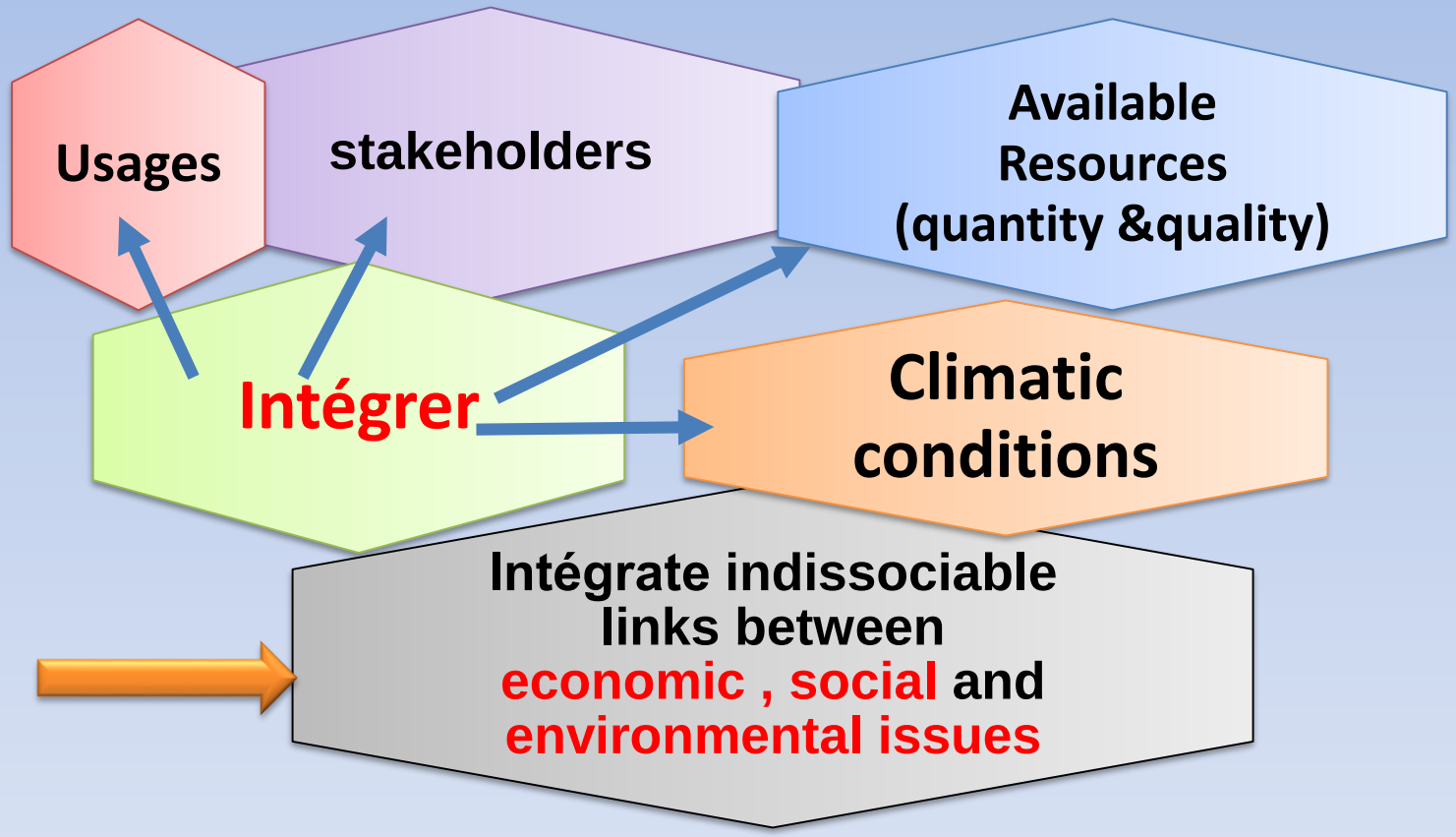
# The Problem tree



# Water resources as a pluridisciplinary area



# What should we Integrate in terms of Water Resources Management




Basin is known to the preferred unit for Water Resources Management

# Thanks

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