Food and Agriculture Organization of the United Nations

TRACKING ADAPTATION IN AGRICULTURAL SECTORS

CLIMATE CHANGE ADAPTATION INDICATORS

Selvaraju Ramasamy
Climate and Environment Division,
FAO, Rome

Food and Agriculture Organization of the United Nations

Tracking adaptation in agricultural sectors

Climate change adaptation indicators

http://www.fao.org/documents/card/en/c/1f571627-0253-4d9d-b596-6170d00d3d9f/

Rationale for tracking adaptation processes and outcomes

Specific needs have emerged in the context the Paris Agreement:

- **Countries need to submit and periodically update adaptation Communications to UNFCCC with other communications or documents, including NDCs.**
- **Need to share scientific knowledge and information related to adaptation planning and implementation requires a sector-specific frameworks**

The rationale for tracking adaptation processes and outcomes

The need to track is also growing at the national level:

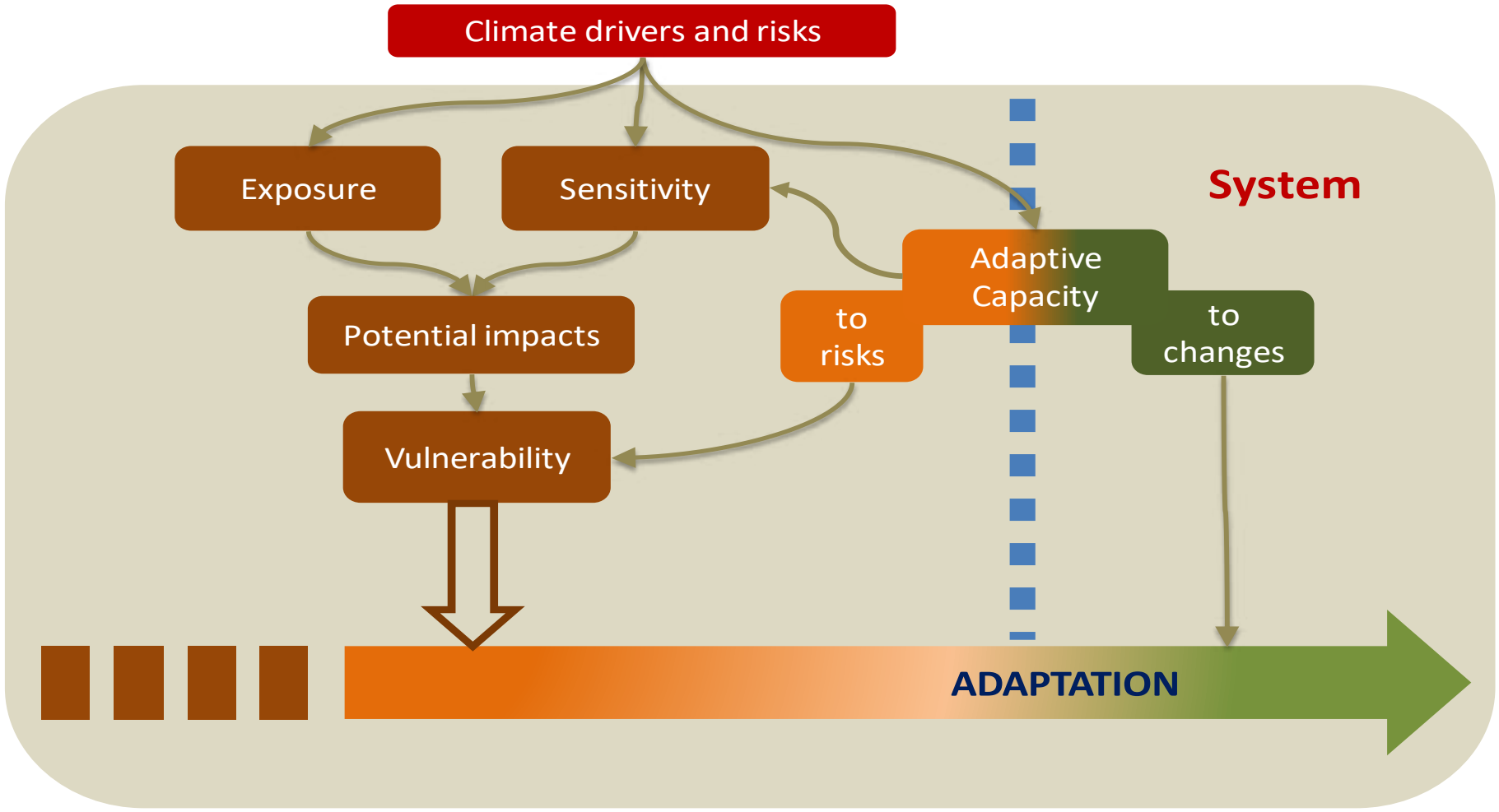
- Identification of agriculture-specific adaptation practices, needs, challenges and gaps, with a view to encouraging good practices and improving the effectiveness and sustainability of adaptation actions
- Implementation of adaptation actions to reduce vulnerability, strengthen adaptive capacity and enhance resilience to climate-related risks within broader sustainable development strategies
- The information generated as part of the tracking process can help to raise broader political and financial support.

Framework/tool/method	Target of monitoring and evaluation (process/outcomes)	Level of application
Monitoring and reporting toolkit of PPCR (CIF, 2015)	Processes related to adaptation planning and mainstreaming	National and programme and/or project level
Stocktaking for national adaptation planning (SNAP) tool (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2014)	Self-assessment of capacities to undertake NAP processes	National
Framework for the assessment of skills for national adaptation planning (Mackay *et al.*, 2015)	Assessment of capacities to design NAP processes	National
Tool for monitoring progress, effectiveness, and gaps (PEG) under NAP processes (UNFCC, 2015b)	Assessment of the essential functions of NAP processes	National
The Vulnerability Sourcebook (Fritzsche *et al.*, 2014)	Changes in outcomes, with a specific focus on vulnerability	National and subnational
Impact evaluation guidebook for climate change adaptation projects (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2015)	Assessment of adaptation interventions contributing to a given outcome	National

Why another framework and methodology?

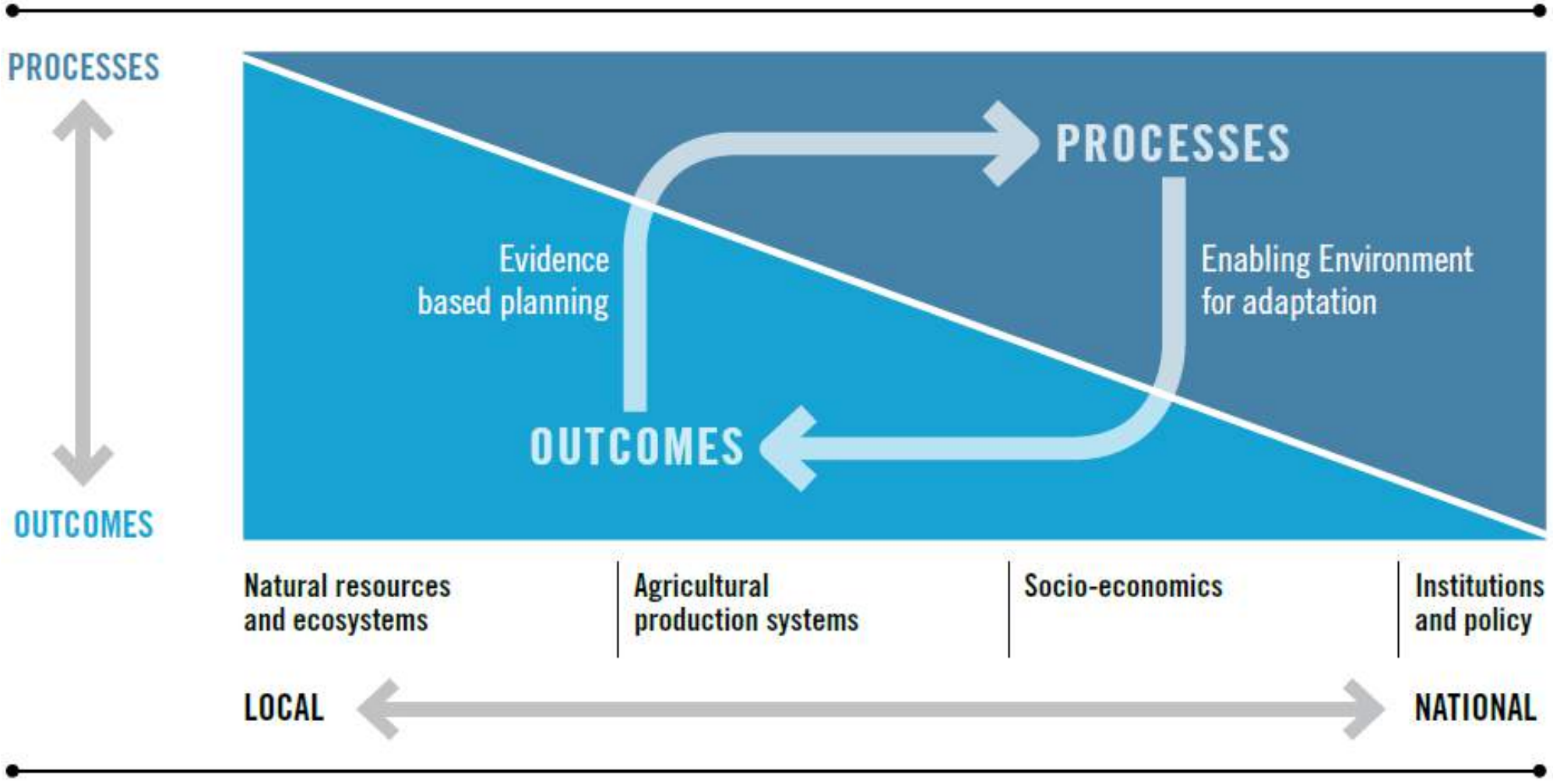
- **Although several frameworks and methods to monitor adaptation processes and their outcomes at national level exist, no agriculture-specific tools have been developed yet.**
- **It captures the interlinkages between adaptation processes and outcomes in agricultural sectors and their effects on food security and nutrition**
- **The framework is specifically designed to monitor climate change adaptation at the national level.**
- **The framework can be customized to monitor adaptation at the local level, whenever granular data are available.**

SCHEMATIC REPRESENTATION OF THE ADAPTATION PROGRESS, CONDITIONED BY EXPOSURE, SENSITIVITY, VULNERABILITY AND ADAPTIVE CAPACITY



Linking theoretical bases and adaptation indicators

THE BASIC FRAMEWORK FOR TRACKING ADAPTATION IN AGRICULTURE



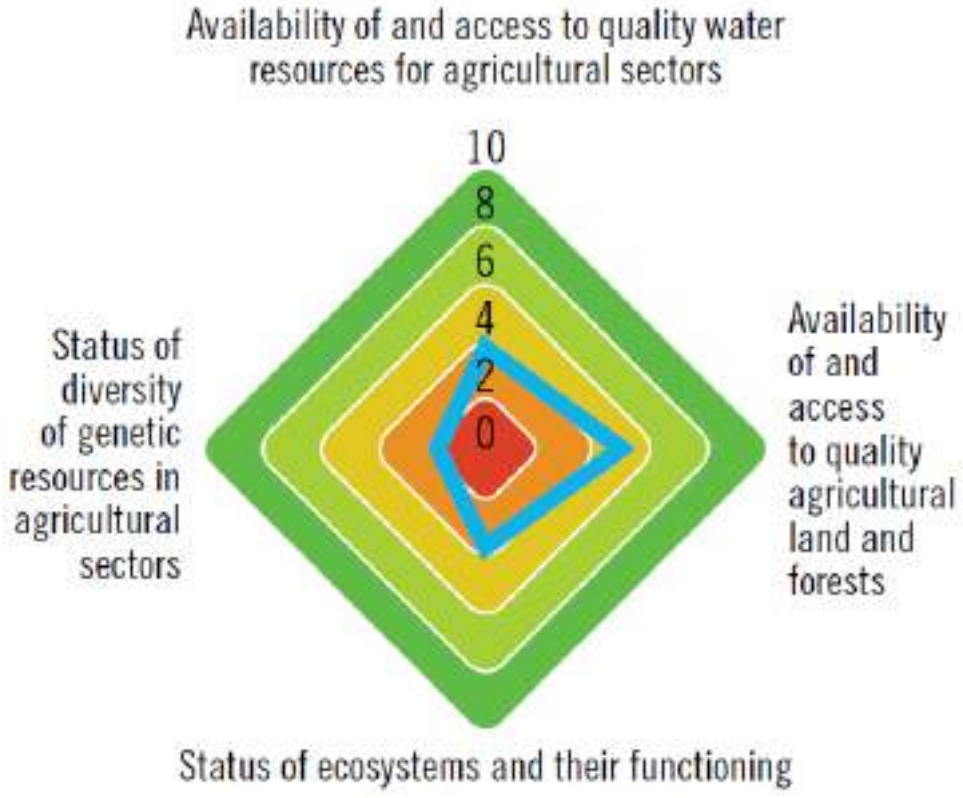
MAIN AND SUBCATEGORIES OF INDICATORS TO TRACK ADAPTATION IN AGRICULTURE

Four subcategories identified for each of the four main categories of indicators, bringing the total number of indicator subcategories to **sixteen.**

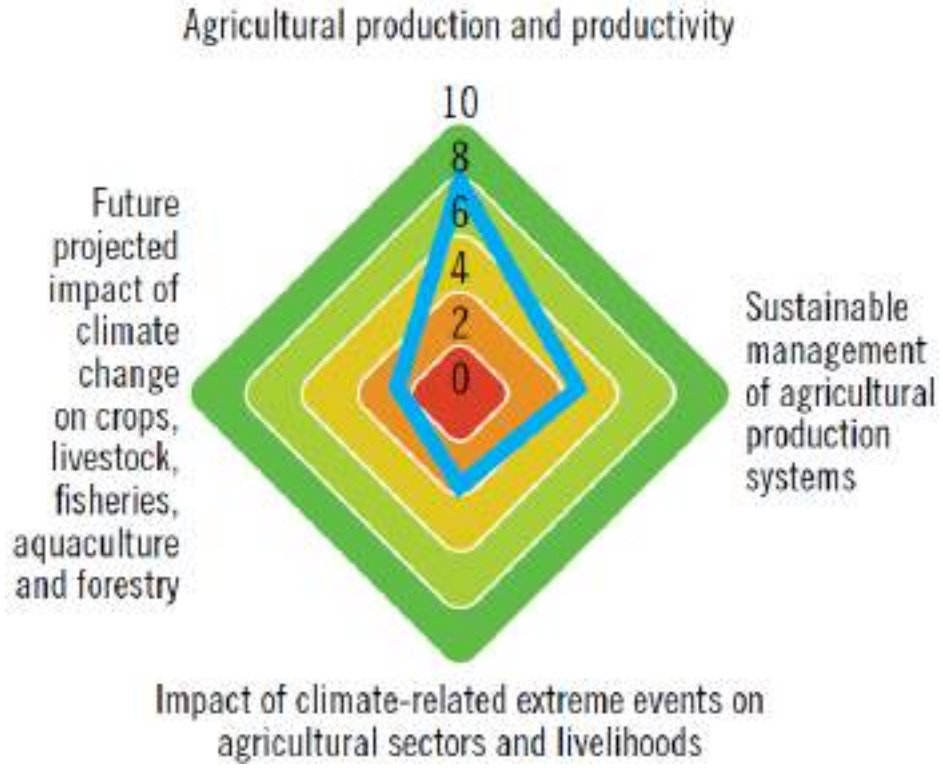
Main categories	Subcategories	
Natural resources and ecosystems	1	Availability of, and access to, quality water resources for agriculture
	2	Availability of, and access to, quality agricultural land and forests
	3	Status of ecosystems and their functioning
	4	Status of the diversity of genetic resources in agriculture
Agricultural production systems	1	Agricultural production and productivity
	2	Sustainable management of agricultural production systems
	3	Impact of extreme weather and climate events on agricultural production and livelihoods
	4	Projected impact of climate change on crops, livestock, fisheries, aquaculture and forestry
Socio-economics	1	Food security and nutrition (vulnerability)
	2	Access to basic services
	3	Access to credit, insurance, social protection in rural areas
	4	Agricultural value addition, incomes and livelihood diversification
Institutions and policy making	1	Institutional and technical support services
	2	Institutional capacity and stakeholder awareness
	3	Mainstreaming of climate change adaptation priorities in agricultural policies, and vice versa
	4	Financing for adaptation and risk management

Main features of a framework and methodology for Tracking Adaptation in Agricultural Sectors (TAAS) at the national level.

1. Natural resources and ecosystems

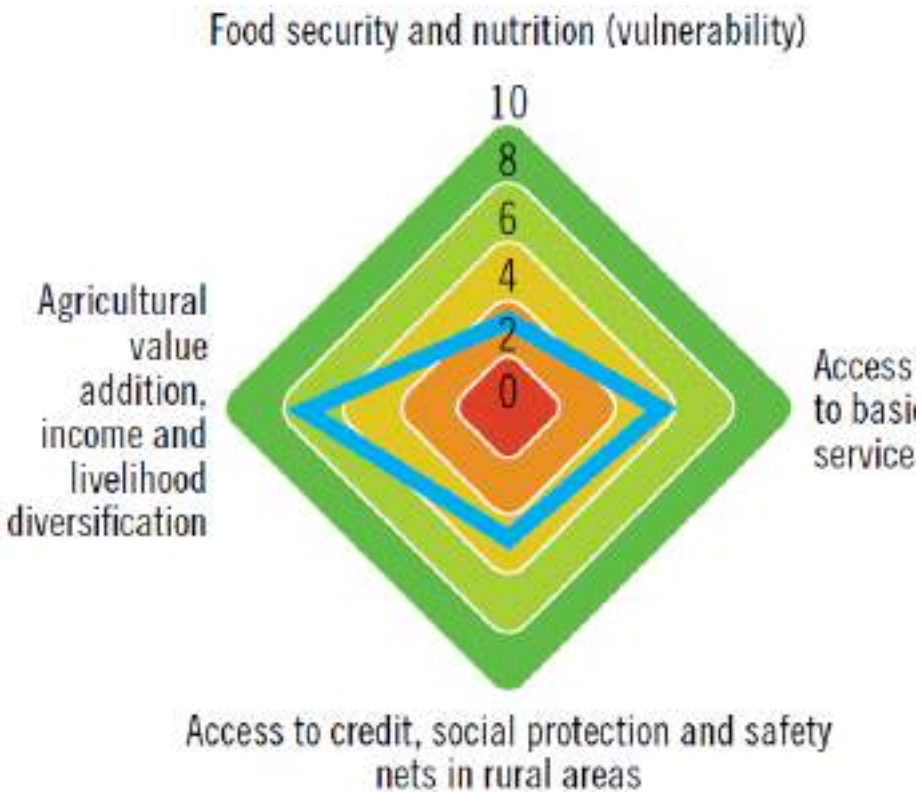


2. Agricultural production systems

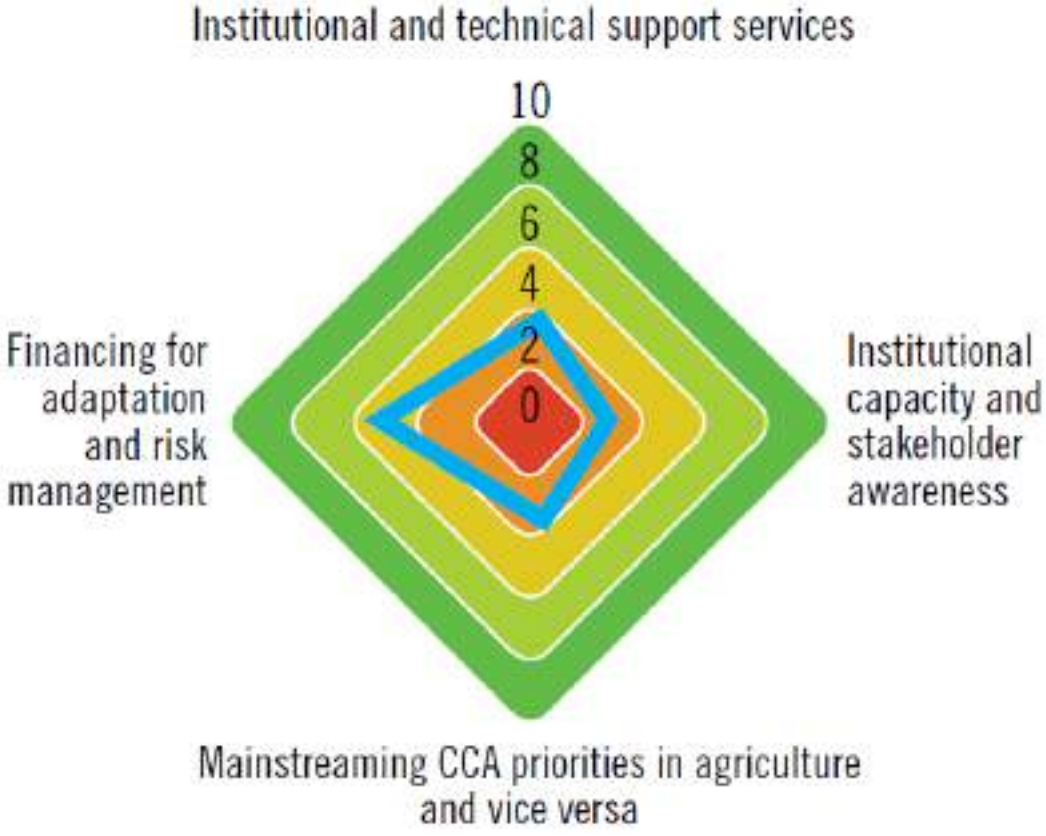


Main features of a framework and methodology for Tracking Adaptation in Agricultural Sectors (TAAS) at the national level.

3. Socio-economics



4. Institutions and policies

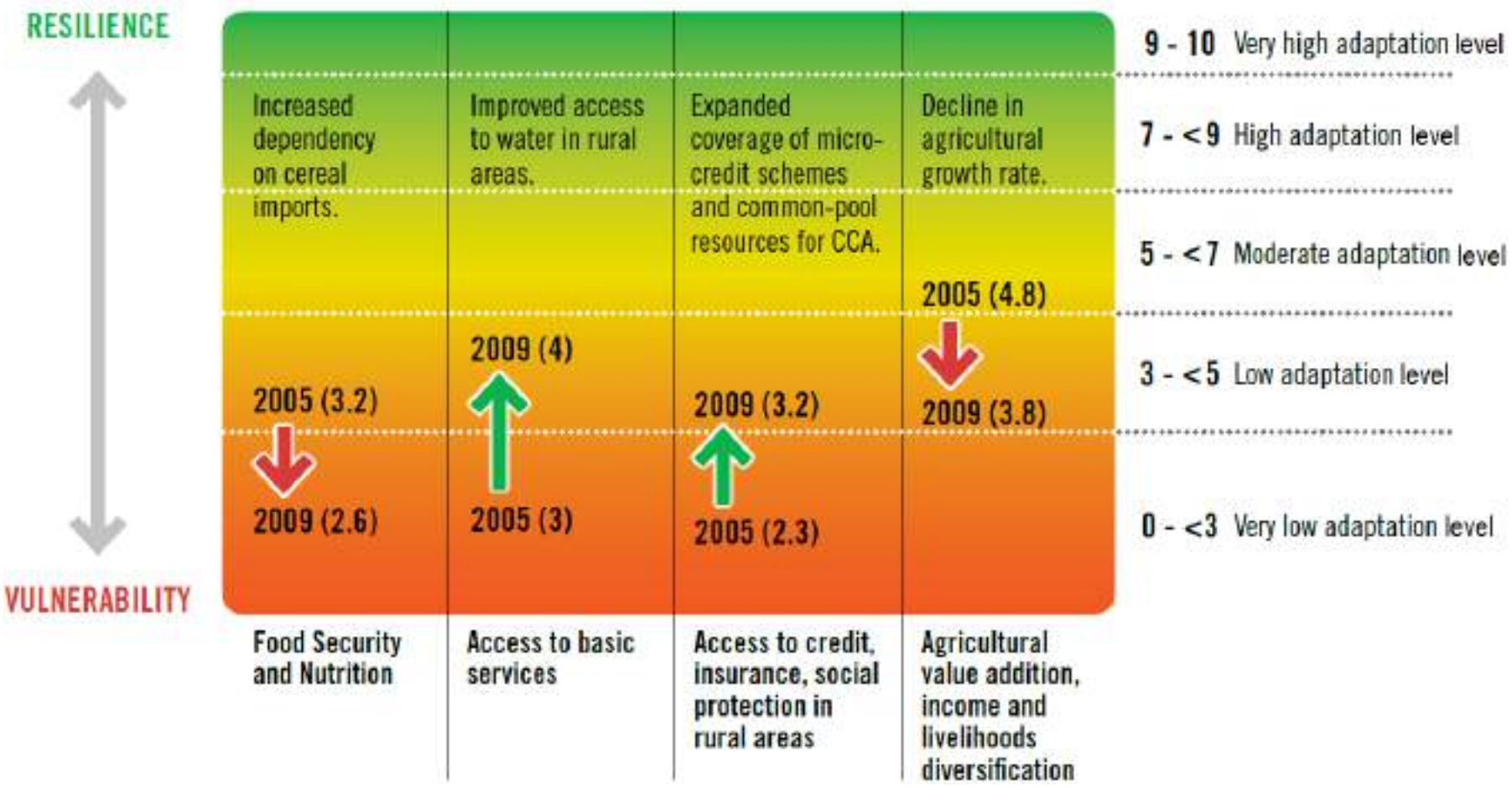


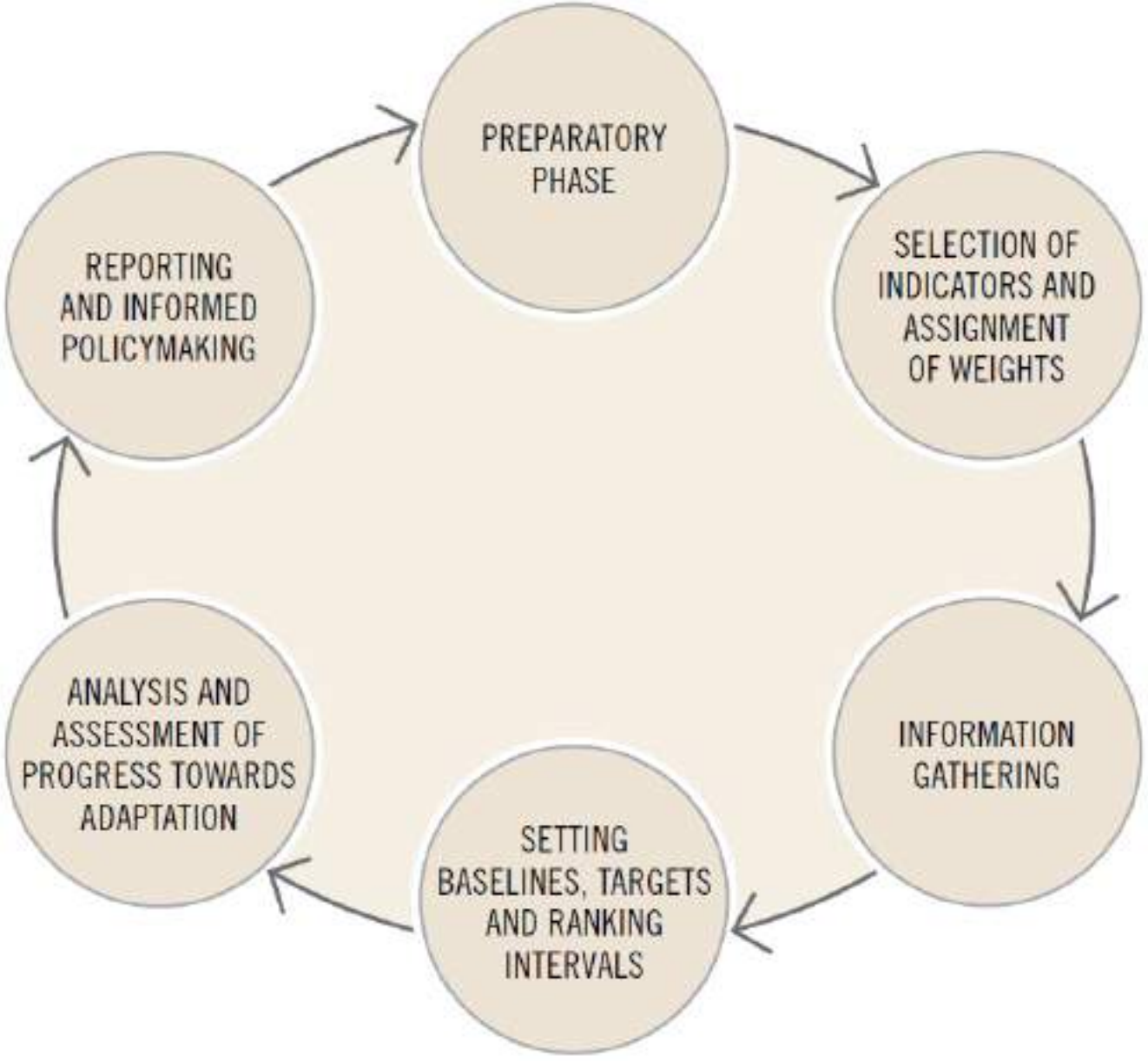
Main features of the methodology for Tracking Adaptation in Agricultural Sectors (TAAS) at the national level.

- The selection and choice of indicators depends on the national context, user needs and the relevance and availability of data
- Indicators are given scores from **0 to 10**, converted from quantitative and qualitative data.
- Most process-based indicators are qualitative, and most outcome-based indicators are quantitative.
- The one to ten scoring system matches the **five** levels of **adaptation progress**: very low, low, moderate, high and very high.
- The score of a subcategory is calculated as **the average** of the weighted scores of the indicators` values included in the subcategory.
- The score of an overall category of indicators is calculated as **the average** of the scores calculated to each of its subcategories.
- Methodology allows to rank quantitative indicators measured both in percentage and absolute values and also Yes/No and 0-10 scale qualitative scales.

An indicative example of tracking adaptation

COMPARISON OF SELECTED SOCIO-ECONOMIC INDICATORS OF ADAPTATION IN KENYA BETWEEN 2005 AND 2009 – INDICATIVE EXAMPLE





The six *TAAS* (*Tracking Adaptation in Agricultural Sectors*) interrelated steps

THE CONTINUOUS, STEP-BY-STEP PROCESS OF CLIMATE CHANGE ADAPTATION TRACKING

Conclusions

- Criteria for the selection of indicators depend on consensus on the purpose and scope of the adaptation tracking
- It is generally advisable to track indicators belonging to all four categories and subcategories
- Despite of many of the proposed indicators are already being monitored at the national level additional efforts and guidance are needed to define baselines, targets for tracking adaptation
- Participatory processes involving multiple stakeholders at both the national and the local level at each TASS step

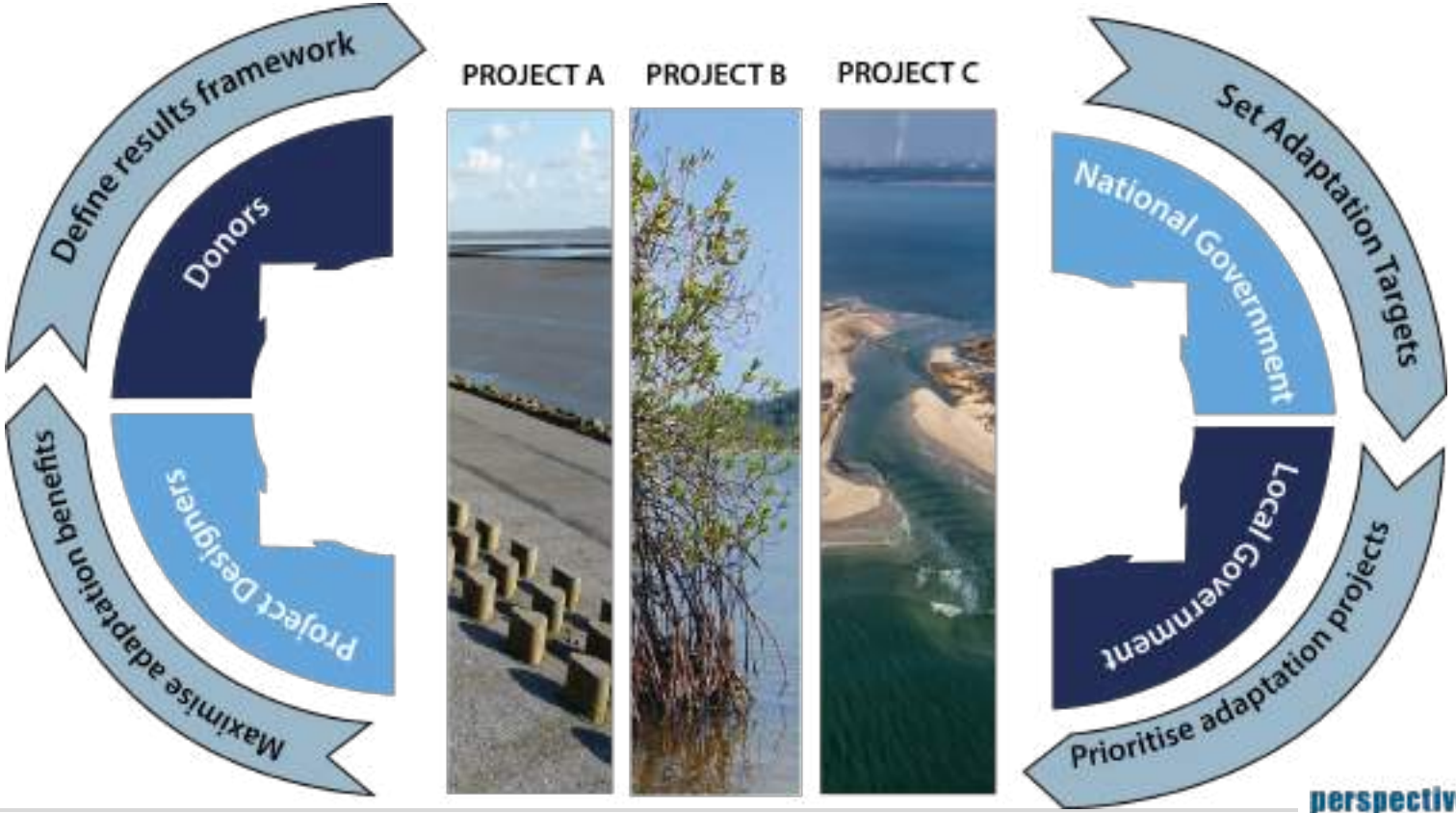
Saved Wealth/Saved Health as a metric to quantify adaptation benefits and select adaptation projects in the agricultural sector

Matthias Krey
Senior Advisor, Perspectives Climate Group

International Conference on **Adaptation Metrics & Techniques for Water, Agriculture & Resilient Cities**
Benguerir, Morocco
27.10.2018

www.perspectives.cc | info@perspectives.cc

The „ideal world“: Use of a universal metric



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GCF project on adaptation metrics

General context – GCF Board Decision

- The **GCF**, with the aim of contributing to its main objective to ¨**promote a paradigm shift to** low-emission and **climate-resilient development**¨, has started to analyze **options to determine "the extent to which the AE's overall portfolio of activities beyond those funded by the GCF has evolved in this direction during the accreditation period"** (Board Decision B.11/10, par 35).

Objective of the project

- Develop **a tool to systematically gather information on the impacts of** mitigation and **adaptation projects of AEs** beyond GCF projects, and evaluate the GHG emissions caused by carbon intensive projects in AEs portfolios

GCF adaptation sub-sectors

Adaptation

- Livelihoods of people and communities.
- Infrastructure and built environment.
- Ecosystems and ecosystem services.
- Health, food and water security.

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Livelihoods of people and communities

A1.2 Total number of people adopting climate resilient livelihood options
A1.2 Average % of women adopting climate resilient livelihood options
A8.1 Average % of targeted population aware of predicted adverse impacts of climate change and appropriate responses
A7.1 Total number of people adopting climate resilient technologies and practices
A7.1 Average % of women adopting climate resilient technologies and practices
Total avoided lives losses
Average % of avoided women´s lives losses
Avoided economic losses (USD)
Number of projects for which they have been measured the economic improvement of the beneficiaries
Average income improvement (USD/per person)
Total infrastructure built for the project
Total value of the infrastructure built (USD)

Indicator typology:

1. Pink – GCF Performance Measurement Framework (PMF)
2. Framed in red – very ambitious indicators (various sources)
3. Other indicators (various sources)

Infrastructure and built environment

A3.1a Total number of new climate resilient - physical assets built
Total value of the new physical assets
Total value at risk (new physical assets)
Total number of infrastructure strengthened
Total value of infrastructure strengthened
Total value at risk of the infrastructure strengthened
Total number of projects for which adaptation measures have been identified
Total value of the adaptation measures

Indicator typology:

1. Pink – GCF Performance Measurement Framework (PMF)
2. Framed in red – very ambitious indicators (various sources)
3. Other indicators (various sources)

Ecosystems and ecosystem services

A4.1 Total number of ecosystems restored
A4.2 Total number of ecosystems protected
Total number of natural resources restored
Total number of natural resources protected
Total number of people directly benefited from the natural resourses and ecosystems
A4.2 Economic benefits of the restoration and protection of the ecosystems and natural resources (USD)
Total endangered species protected (Animals)
Total endangered species protected (Plants)

Indicator typology:

1. Pink – GCF Performance Measurement Framework (PMF)
2. Framed in red – very ambitious indicators (various sources)
3. Other indicators (various sources)

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Health, food and water security

Total number of health infrastructure built
Total value of the health infrastructure built (USD)
A2.1 Total number of people benefited from health measures
A2.1 Average % of women benefited from health measures
A2.1 Average % of children under 5 benefited from health measures
Total avoided lives losses
Average % avoided women´s lives losses
Average % avoided children under 5 lives losses
Total reductions in visits to hospitals (climate related diseases)
Average % reductions in women´s visits to hospitals (climate related diseases)
Average % reductions in children under 5 visits to hospitals (climate related diseases)
A.2.2 Total number of people benefited from food security measures
A.2.2 Average % of women benefited from food security measures
A.2.2 Average % of children benefited from food security measures
Total reduction of hunger indicators (related to climate change-food security)
Average % reduction of women- hunger indicators (related to climate change-food security)
Average % reduction of childer under 5- hunger indicators (related to climate change-food security)
A.2.3 Total number of people with year round access to reliable and safe water
A.2.3 Average % of women with year round access to reliable and safe water
A.2.3 Average % of children under 5 with year round access to reliable and safe water

Indicator typology:

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3. Other indicators (various sources)

Adaptation - General indicators

Name
Sector
Project Type
Total amount of the project (USD)
Amount disbursed by the AE (USD)
Financial instrument
Year of disbursement
Total population
Total number of direct beneficiaries
Direct beneficiaries as % of the total population
% of women directly benefited of the total beneficiaries
Vulnerability assessment of the target population (Yes/No)
Impact on the local policy regarding climate change (Yes/No)

Saved wealth of the project (USD)
Saved health of the project (DALYs)

Universal metric (cross-sectoral)

Indicator typology:

1. Pink – GCF Performance Measurement Framework (PMF)
2. Framed in red – very ambitious indicators (various sources)
3. Other indicators (various sources)

Indicator 1: Saved Wealth

- **Applied for:**
  - Public **infrastructure**
  - Private **property**
- **Natural resources and services are included in public property**
- **Frequency distribution of damage from climate change driven extreme events taken into account for the "baseline scenario"**

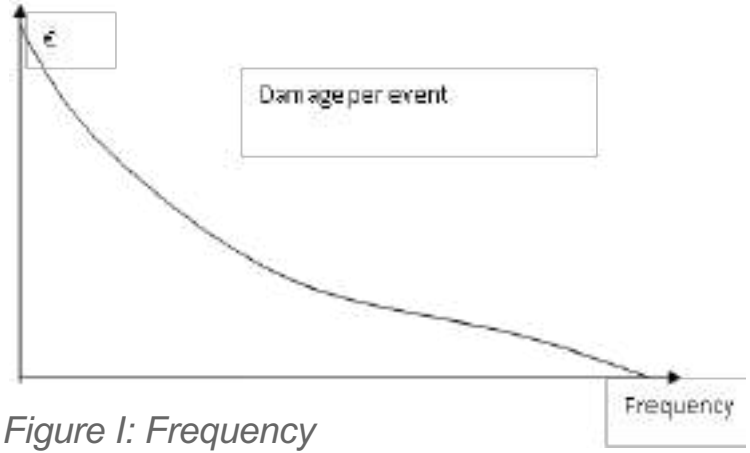

Figure I: Frequency

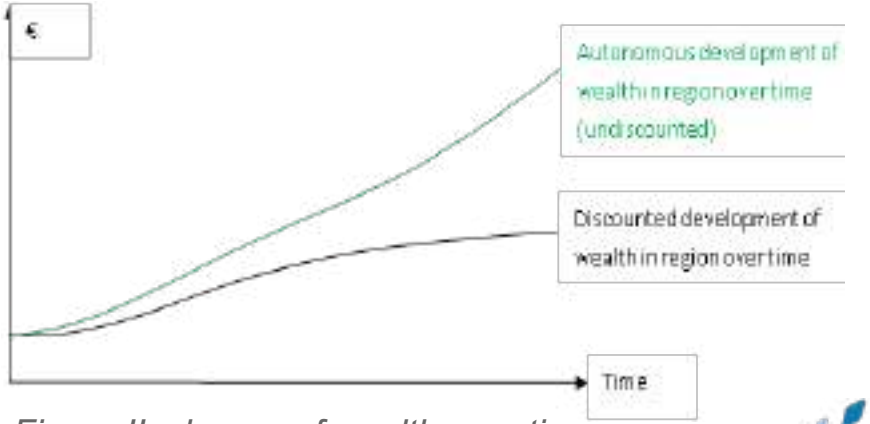

Figure II: change of wealth over time

Indicator 2: Saved Health

- **Valuation of human life** is fraught with ethical challenges
- Alternative quantification indicator: **DALYs**

$$DALY = \underbrace{N \cdot L}_{\text{Years of life lost}} + \underbrace{\sum_i I_i \cdot DW_i \cdot D_i}_{\text{Years lived with disability}}$$

Where:

- DALY — Disability-adjusted Life Years (Introduced by World Bank (1993); used by the WHO)
- N — Numbers of deaths
- L — Standard life expectancy at age of death (in years).
- I_i — Cases of disease / injury i
- DW_i — Disability weight of disease / injury i.
- D_i — Average duration of disease / injury in (years)

Applying SW/SH

1. Definition of applicability and methodological boundaries
2. Deriving a baseline scenario
3. Describing project scenario(s)
4. Assessment of Saved Wealth and Saved Health and Environmental Benefits

- **For each** project type a **new methodology** needs to be developed
- Once the methodology has been developed, **data needs to be gathered**
  - Project data preferable
  - Regional/national/international defaults are second choice
- The methodology can then be applied to **calculate SW/SH**

Example: Solar Irrigation Kenya

- **SW/SH methodology:**
  "Irrigation technology in the agricultural sector"
- **Baseline scenario:**
  - Rain-fed agriculture (4% irrigated), insufficient water distribution and storage
  - Manually operated irrigation systems are common practice (some diesel-driven pumps)
  - Crops: Cabbage, onions, pepper and tomatoes
  - Negative impacts of current irrigation practices: salinization of soil, waterlogging, yield decreases
- **Project scenario:**
  - Solar irrigation technology

Source: REEEP IMPAQT

Project adaptation benefits over ten years at different scales

Scope 1: Rollout of 90 irrigation systems in Kenya

SW $13.42m

SH 570 DALYs

Donor Budget: USD 115,000

Scope 2: Increase project target to 1400 farms

SW $123m

SH 5,200 DALYs

Donor Budget: USD 1.5m

Scope 3: Kenya Solar Irrigation Potential

SW $280bn

SH 3.7m DALYs

Imaage sources: Sunculture ASIK 2016 (Left), Futurepump 2016 (Right)

THANK YOU FOR LISTENING

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Perspectives Climate Group GmbH
krey@perspectives.cc | www.perspectives.cc

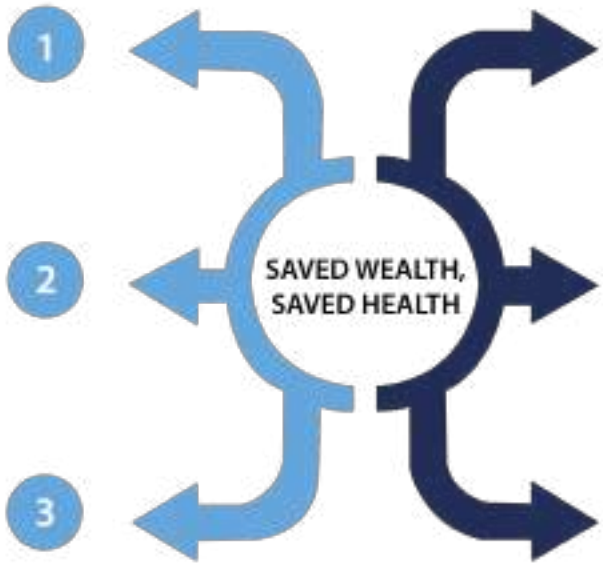
Strenghts and challenges

STRENGHTS

Ex-ante: Allows comparison of project types among each other and against a baseline

Ex-post: If monitoring parameters are defined properly and consistent for several projects the concept can be applied as a useful tool for M&E that improves transparency and comparability

Planning and target definition and communication across levels

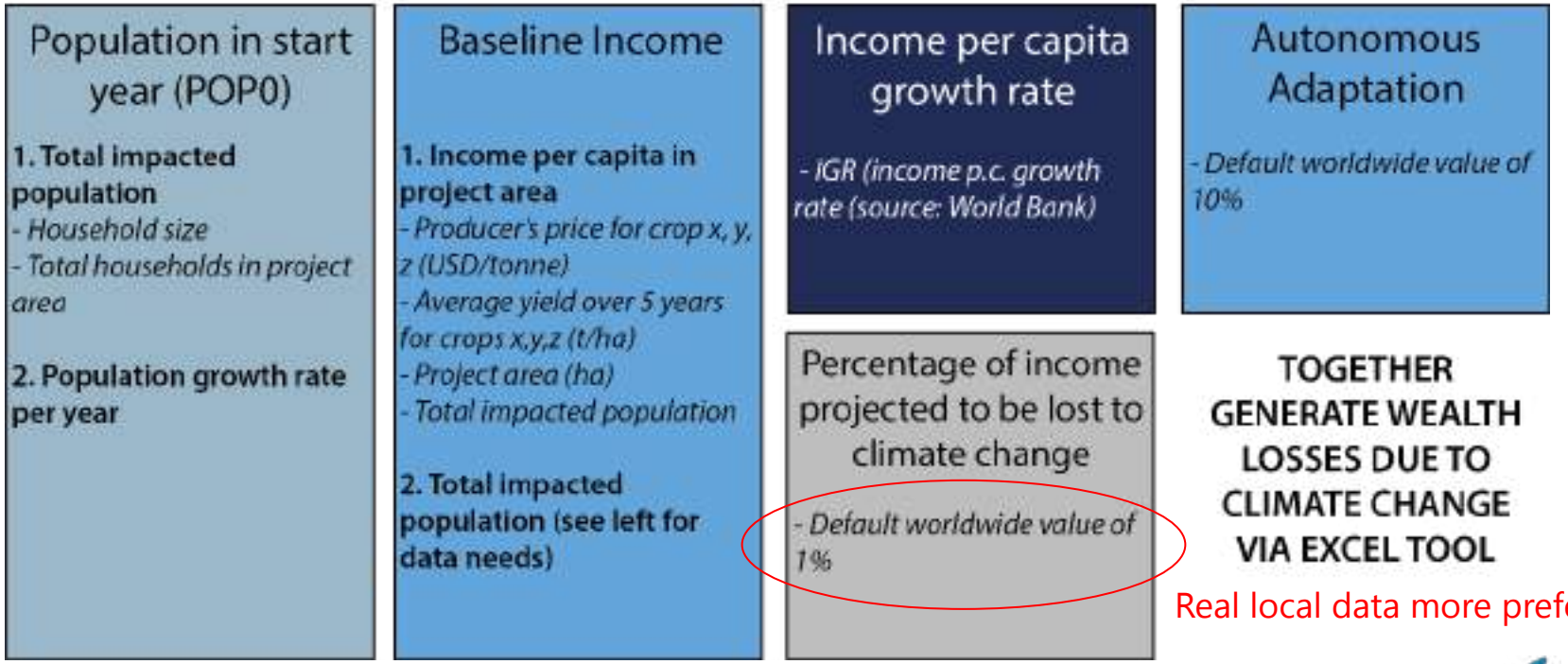


CHALLENGES

1. **Data gathering** can be challenging on the local level
2. **Uncertainty** of climate change projections
3. Application of the complex tool **requires good understanding of economic methods** (CBA) and impacts of climate change.

Irrigation technology methodology baseline data I

INPUT COMPONENTS: Wealth losses due to climate change during project lifetime (WLCplt)



Real local data more preferable

Irrigation technology methodology baseline data II

INPUT COMPONENTS: Health losses due to climate change during project lifetime (HLCplt)

Population in start year (POP0)

1. Total impacted population
- *Household size*
- *Total households in project area*

Percentage of income/health projected to be lost due to climate change

- *Default worldwide value of 1%*

DALYs per year (kcal malnutrition)
- *Life years saved due to additional food calories*
- *Life years saved due to additional protein*
- *Live years saved due to additional fat*
- *Food supply deficit (kcal/cap/day)*
- *% of average undernourishment (compared to minimum requirements)*
- *Estimated Minimum Fat, g/cap/day*
- *estimated minimum proteins (g/cap/day)*
- *Life expectancy at birth*

Population with disability due to CC (DALYs per year: Kcal malnutrition)
- *Life years saved due to additional food calories*
- *Life years saved due to additional protein*
- *Food supply deficit (kcal/cap/day)*
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- *Life expectancy at birth*
- *Average disability weight*

Project Lifetime in years

TOGETHER GENERATE HEALTH LOSSES DUE TO CLIMATE CHANGE VIA EXCEL TOOL

Real local data more preferable

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Project Lifetime in years

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United Nations Entity for Gender Equality and the Empowerment of Women

CLIMATE SMART AGRICULTURE FOR EMPOWERMENT OF WOMEN FARMERS

JOHNSON NKEM

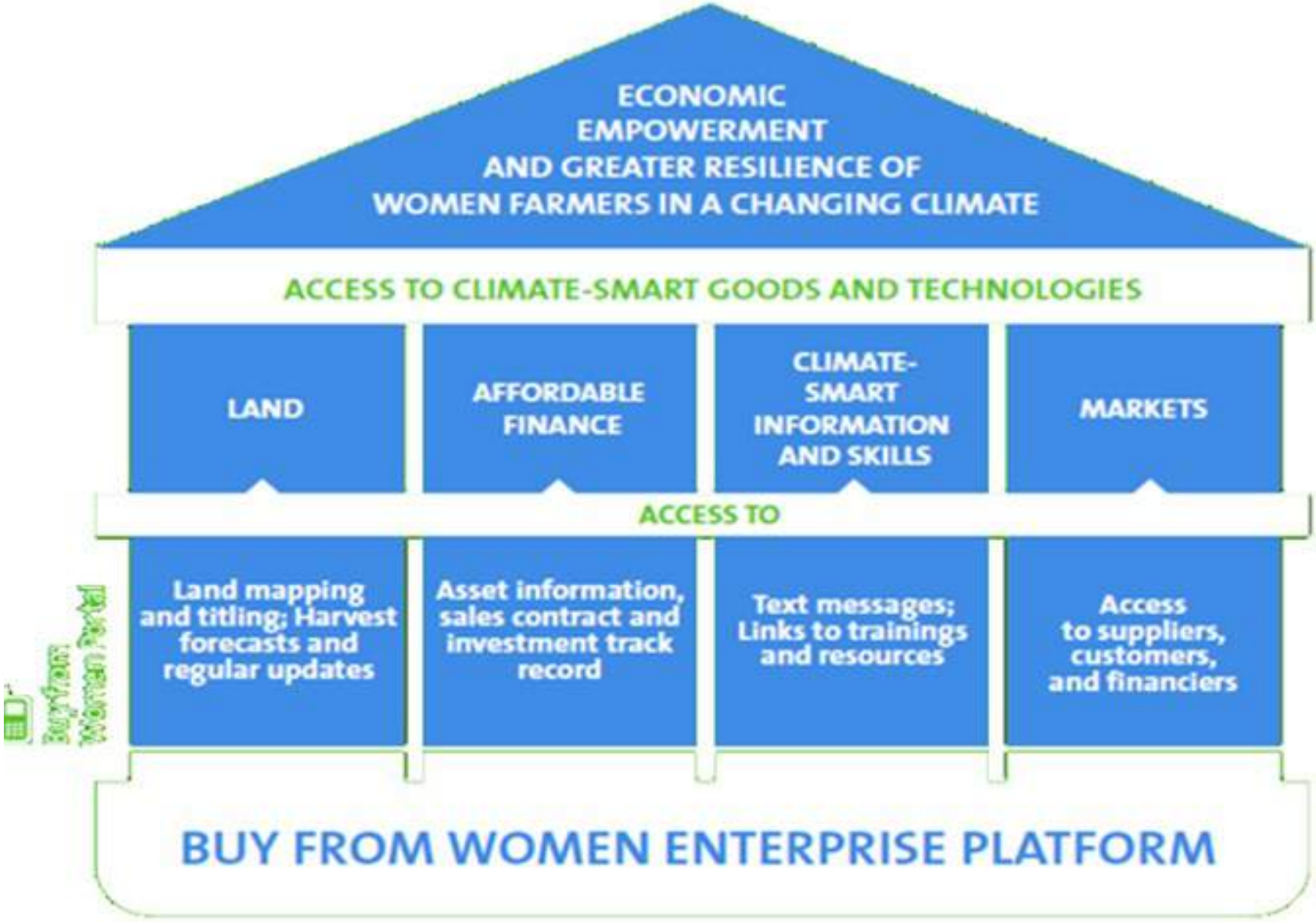
Session III, Panel 3: Agriculture: Lessons learned, progress, needs and challenges
10.20-11.05 AM.

International Conference on Adaptation Metrics for Agriculture, Water and Resilient Cities

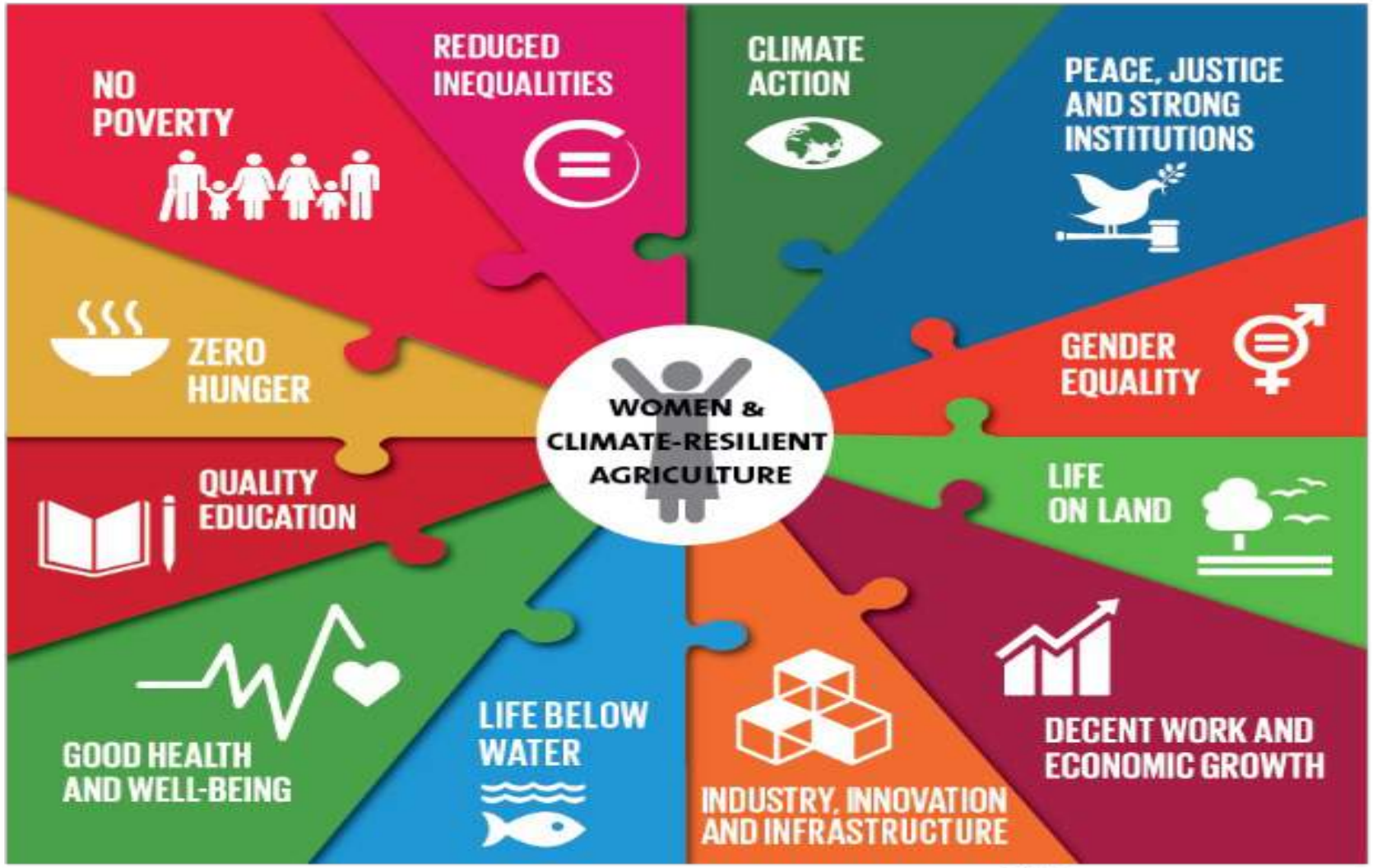
Rationale: Agribusiness solution for climate change

- Trade as a transactional tool for development
- Coupling actions across sectors, countries, and regions
- Expanding opportunities for youth engagement and utilization of new technology
- Establishing gender parity in harnessing opportunities
- Enhancing efficiency by retooling production based on comparative advantage
- Exerting on the power of partnerships

Programme Components



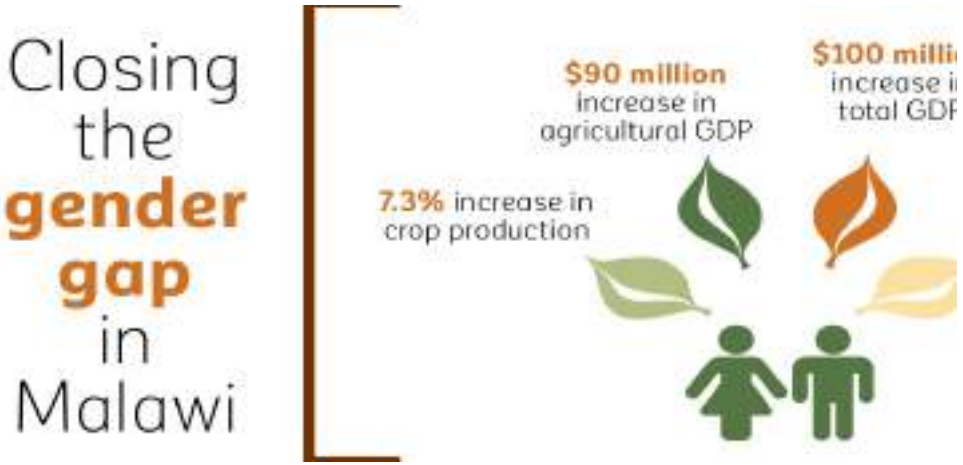
Development co-benefits of women's engagement in Climate Smart Agriculture



UN Women, UNDP-UNEP PEI and World Bank report: The cost of the gender gap in agricultural productivity

Annual cost of gender gap

Potential benefits of closing the gender gap :



Mobile Apps for Women Farmers

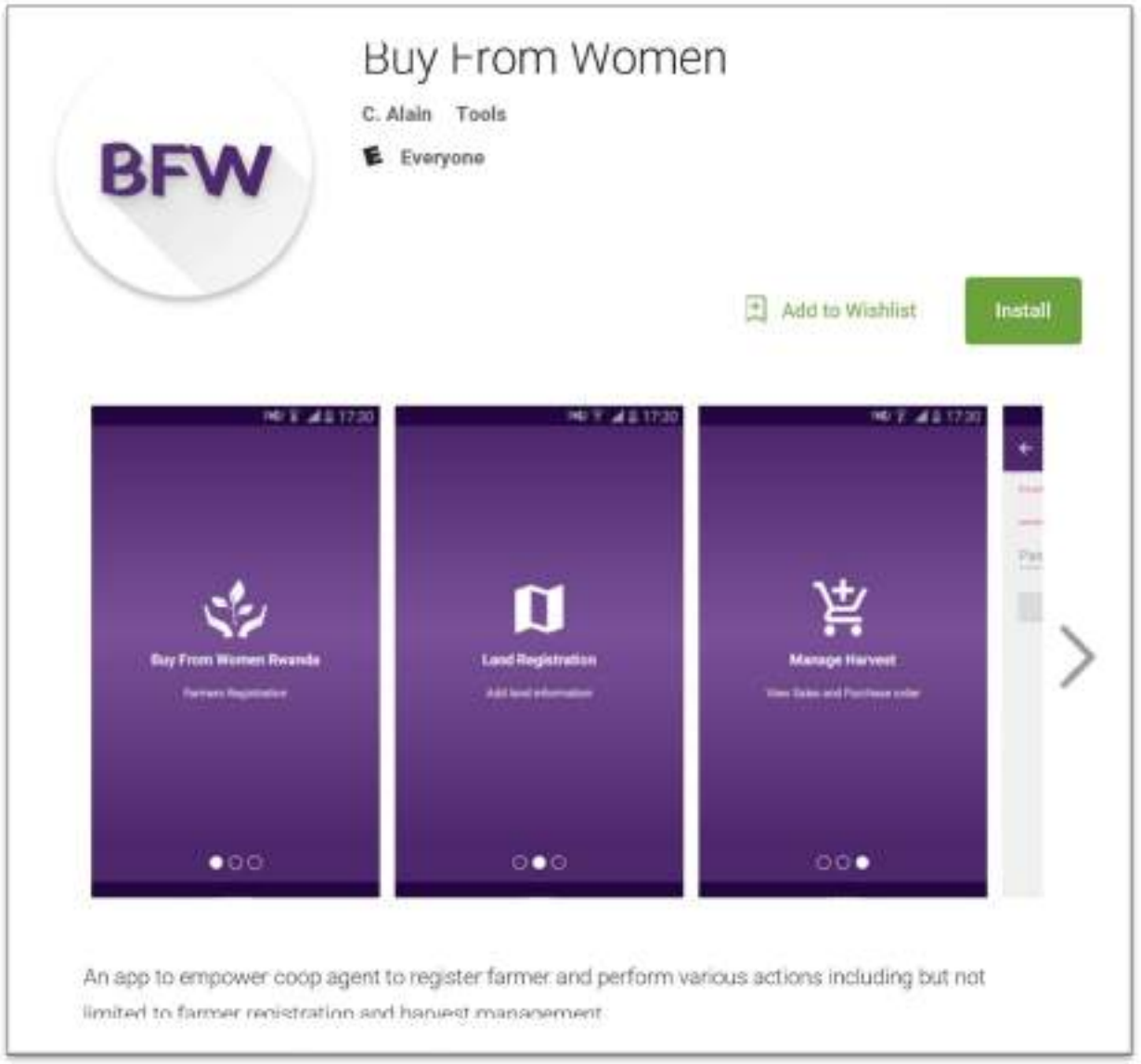
Buy From Women
Provide access for women farmers and cooperatives to markets, information & finance.

We Learn- Agriculture
e-Learning platform with access to capacity development content

Ending Violence
Mobile App to address gender based violence

Wallet-Blockchain
Enable transformative changes in transferring digital assets, and building economic identity for women

“Buy from Women” (available on App Store)



Instant Classroom Kit Overview

Power, connectivity and hardware

- In-build charging solution (Li-Ion battery can run a 8 hr class)
- Solar for auxiliary power
- Laptop for teacher (doubles up as a content server)
- 25 tablets for students
- 3G connectivity via Ethernet Modem, Inbuilt Wi-Fi router
- Projector and speaker

Tablet management

- Tablet management software offers tools for teachers to create, manage lessons and tools for students to engage with lessons
- Learning management software for students
- Works in both online and offline environments

Educational Content

- A repository of open source websites for download and use without internet
- Past Exams, Revision apps
- Mobile apps
- Scoping for more local content partnerships as per needs

Teacher training, M&E

- Teacher training module developed in collaboration with Columbia University's Teachers College
- 1 week induction course for teachers during IC deployment
- Cloud based M&E

PRISE
Pathways to resilience in semi-arid economies

Innovative Approaches in Assessing Risks and Designing Adaptation Responses

The example of value chain (VC-ARID)

Catherine SIMONET

Adaptation Metrics 25-26 October 2018

Aim and Questions

To identify climate change impacts and adaptation options in selected sectors with potential for economic transformation and diversification *in the semi-arid lands*.

1. What are the pathways for climate-resilient economic development in semi-arid lands through vertical and horizontal transformation?

2. What are the adaptation options for business and private sector investment opportunities in responding to climate change in semi-arid lands?

From a hotspot approach...

The CARIAA framework: Identification of climate change 'hotspots', where strong climate signal and high concentrations of vulnerable people are present.

These hotspots include semi-arid regions and deltas of Africa and Asia, and glacier- and snowpack-dependent river basins of South Asia.

Source: Authors

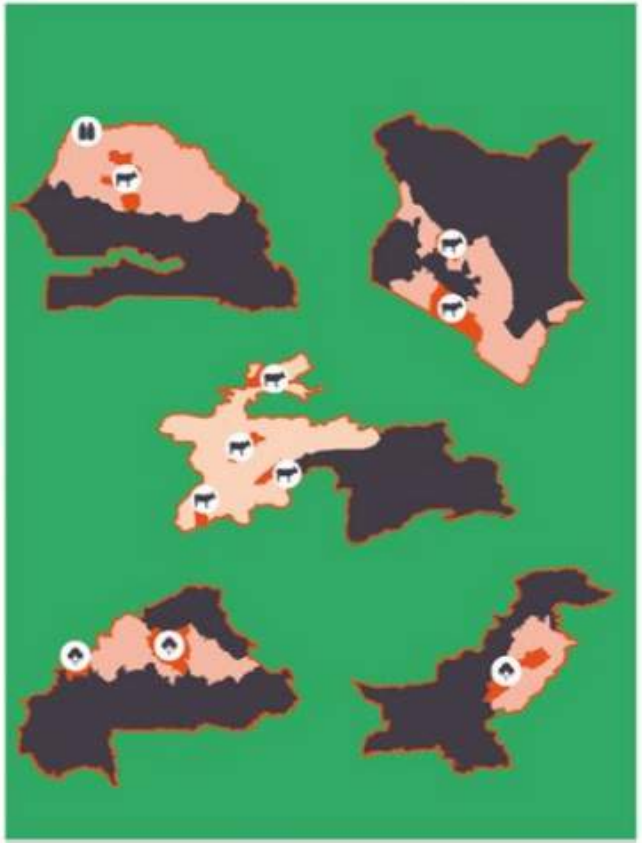
...to...

PRISE national countries

Semi-arid lands

PRISE aims to strengthen the commitment of decision-makers in local and national governments, business and trade bodies to rapid, inclusive and resilient development in semi-arid regions.

...a territorial approach



Linking semi-arid lands to national economy through a value chain approach

VC-ARID is an innovative and interdisciplinary approach to value chain anlysis in that it takes into account the specific characteristics of semi-arid systems.

Key to the approach is the recognition that, in semi-arid lands, ecological and socioeconomic variability represent key structural differences when compared with other production systems.

VC-ARID is a three-step methodology that includes:

Step 1:
Mapping the value chain

Step 2:
Assessing climate risks at each level of the value chain

Step 3:
Identifying adaptation and private sector investment options for climate-resilient value chain transformation


Tajikistan
Livestock
Pakistan
Cotton
Senegal
Cow's milk
and beef
Kenya
Beef
Burkina Faso
Cotton

Methodology and Survey implementation

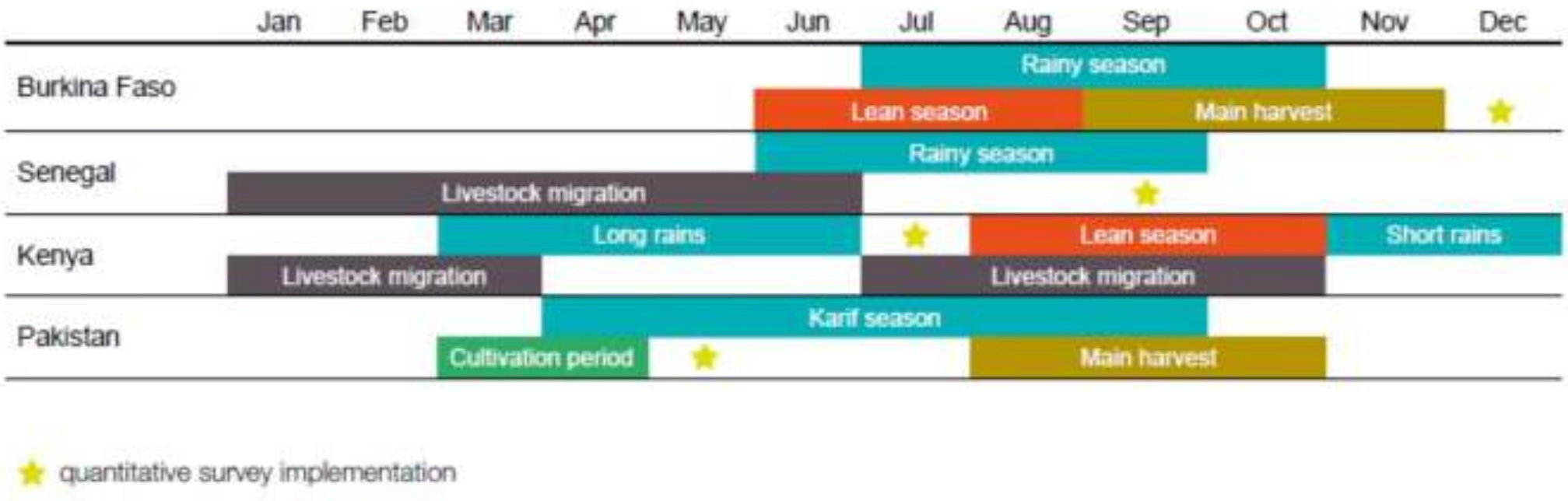
Consistent methodology across all Value chains (3 steps)

Step 2: Implementation of 6 quantitative surveys in 4 countries at the producers and traders level.

Representative sample of the sites selected and sampling adapted to each context.

On average 400 producers surveyed : 2300 producers

→ **Econometric** analysis on determinants of private adaptation decisions in 5 VC



Methods

Consistent methodology BUT…

- Analysis in different context
- Samples different for quant analysis
- Questionnaires are slightly different
- Full vs. light VC-ARID approaches

SEN beef, BF, KEN North, PAK, KEN South

TJK, ETH, SEN milk, UG

We apply low, medium, and high level of confidence when synthesis the results

Dahra, Senegal, September 2016

Source : E. Carabine

Headline findings

- Semi-arid lands make a major contribution to national economies — High
- Private sector actors are diverse and co-exist within all these value chains, linked both horizontally (competition) and vertically (transformation) — High

- Wealth is necessary but not sufficient for private adaptation action — Medium
- The provision of, and satisfaction with, extension services is critical in private adaptation decisions across the value chains, but there are differences depending on type of service, sector and country — High
- Climate risks and shocks are key in driving private adaptation decisions but that does not mean that they are sustainable over time — High

- The formal private sector is not incentivised to invest in adaptation. Medium to large private sector actors look to producers and/or policymakers to take adaptation action — High
- Private adaptation plus adaptation planning are required for climate-resilient and inclusive economic development — High
- In SALs, national adaptation action is required but local et regional levels are also important for governance and climate-resilience economic development — High

RESULT 2: Private sector actors along the VCs are diverse

High level of confidence

High

Insights :

Senegal : Changes of the role

Kenya : Heterogenous power and voices

Several individuals represent the private sector

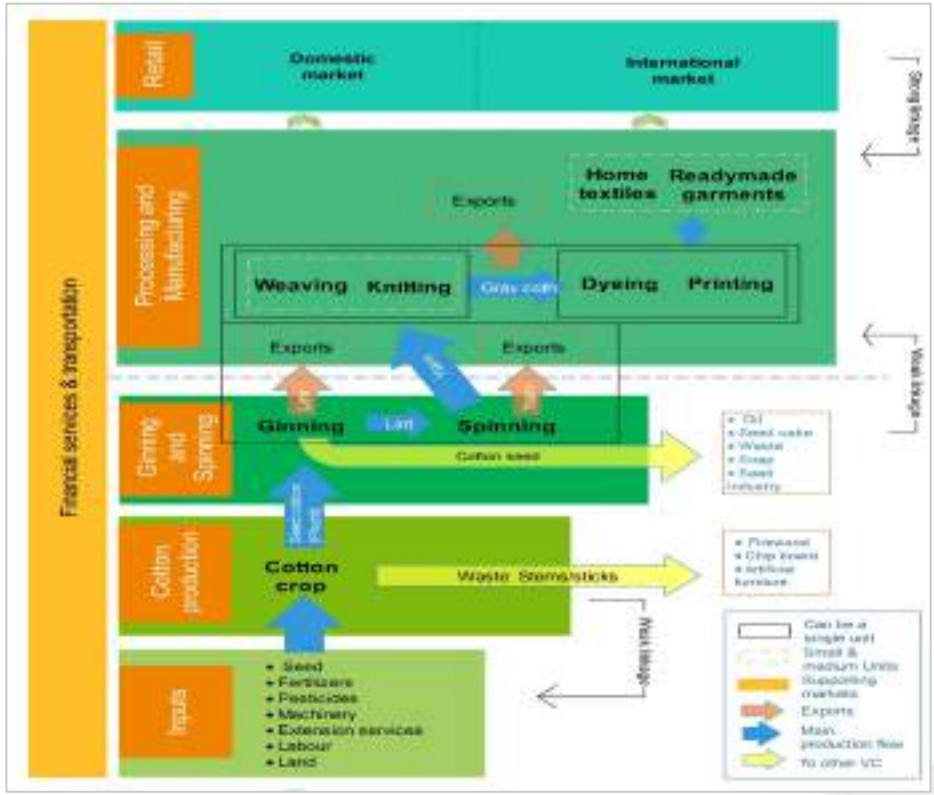
Why is it important ?

- How to include private sector in adaptation?

Better understanding of what is private sector (for policies, access to GCF Fund and Adaptation fund…)

- Change of paradigm from subsistence to economic development

Diversity of actors in the Cotton Value Chain - Pakistan



RESULT 6 : Wealth is necessary but not sufficient for adaptation action – issue of equity

Medium level of confidence

Medium

Insight : Wealth indices do not always explain adaptation decisions but those that make adaptation decisions are often more wealthy.

Synthesis of the econometric analysis - Multivariate probit

	Increased mobility			Storage/ purchase of feed and fodder			Change in water mangement		
	Senegal Beef	Kenya North	Kenya South	Senegal Beef	Kenya North	Kenya South	Senegal Beef	Kenya North	Kenya South
Wealth index	<0*			<0*		< 0**			
Livestock size	>0***					<0*			
Education level		>0**		>0**				>0**	
Distance to market									
Early warning system	>0***	>0***		>0*		>0***			< 0**
Surveillance & Vaccination						< 0**			
Loans	<0***	>0*		>0*	<0*		>0*	>0**	

Why is it important ?

There is an issue of equity

- Income generation may not lead to adaptation action → change in the paradigm of income generation and subsistence programmes

RESULT 8 : The provision of, and satisfaction with, extension services is critical in private adaptation decisions across the value chains, but there are differences depending on type of service, sector and country

High

High Level confidence

Insight : Extension services satisfaction is heterogenous within country and between countries

Why is it important ?

Role of public/ private sector in the provision is disputable.

This kind of results give opportunities for sectoral –international exchange → African Regional Dialog on Livestock Transformation (IDRC)

Conclusion on VC-ARID and Impact Chains

- Scales issue is at the heart of the Adaptation Metrics challenge:
  - Aggregation/Disaggregation

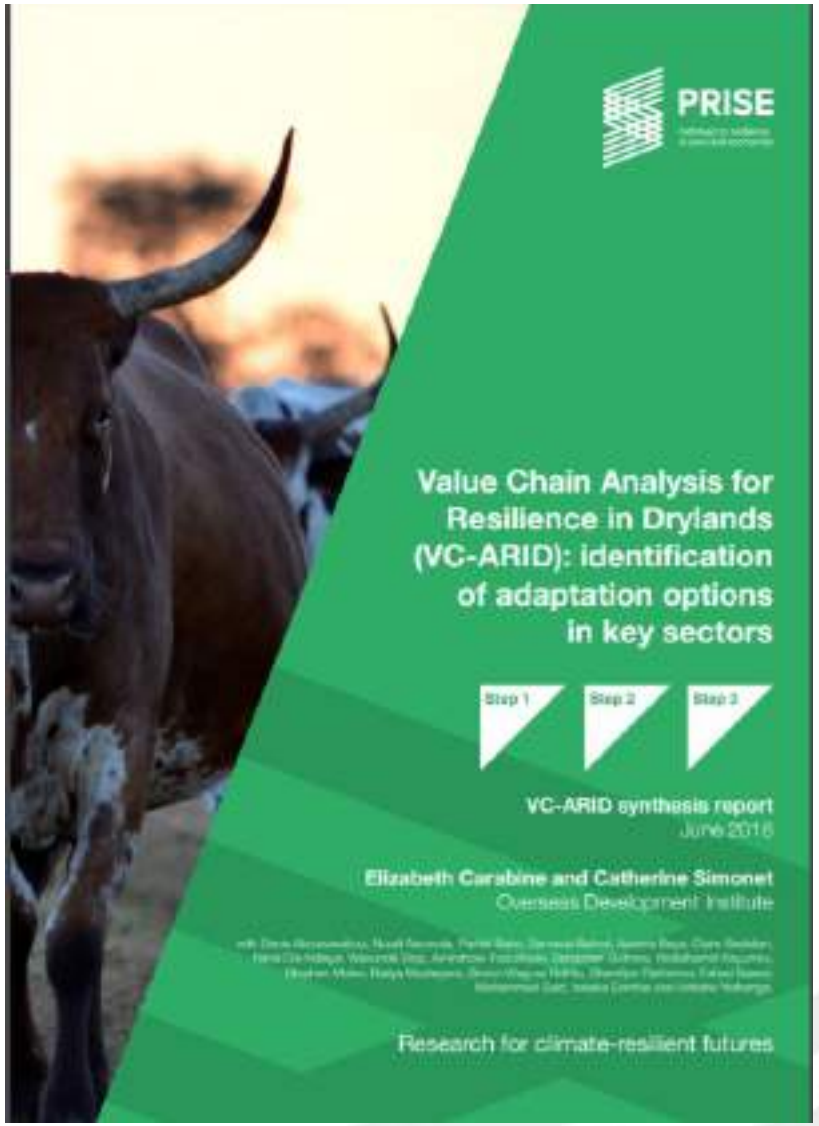
  → *Territorial approach can bring some solutions*

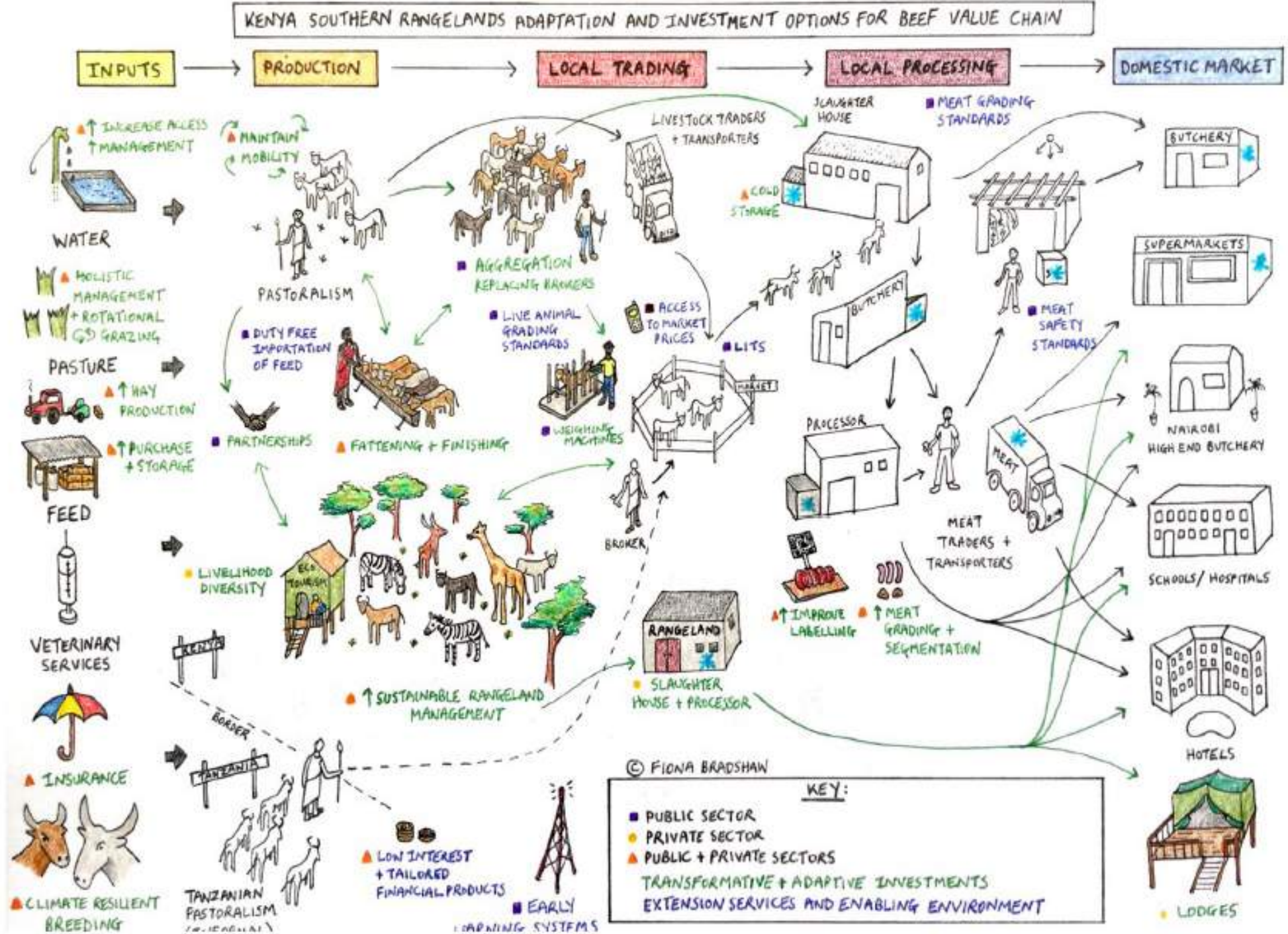
- An holistic understanding of metrics is necessary
  - Beyond indicators/ lack of data dilemma
  - Some methods can make the best of what is already here

  → *VC-ARID/Impact chains for risk informed decision*

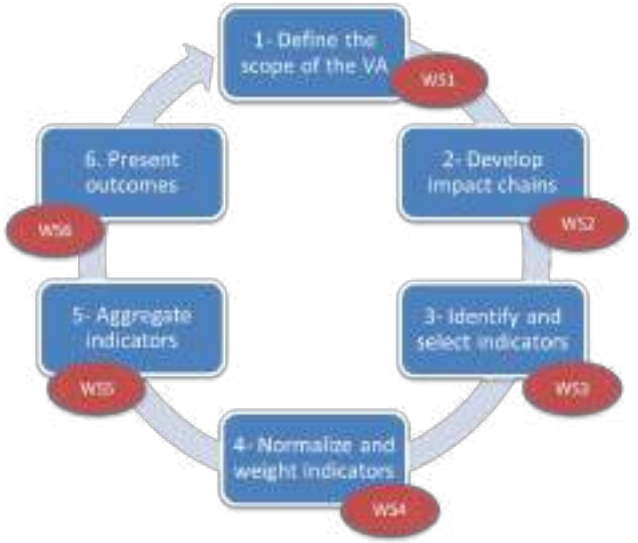
- Overcome adaptation /sustainable development

The full range of evolutions undertaken by the economy and society towards sustainable development. This is characterised by a shift towards sectors that boost inclusive and adaptive growth and a gain of productivity within sectors. This increase in productivity must be attained without putting extensive pressure on natural assets and without generating negative environmental spillovers that cannot be internalised.




KENYA SOUTHERN RANGELANDS ADAPTATION AND INVESTMENT OPTIONS FOR BEEF VALUE CHAIN
INPUTS
PRODUCTION
LOCAL TRADING
LOCAL PROCESSING
DOMESTIC MARKET
INCREASE ACCESS
MANAGEMENT
WATER
MAINTAIN
MOBILITY
PASTORALISM
HOLISTIC MANAGEMENT
ROTATIONAL GRAZING
PASTURE
HAY PRODUCTION
PURCHASE
STORAGE
FEED
VETERINARY SERVICES
INSURANCE
CLIMATE RESILIENT BREEDING
DUTY FREE IMPORTATION OF FEED
PARTNERSHIPS
FATTENING + FINISHING
AGGREGATION
REPLACING BROKERS
LIVE ANIMAL GRADING STANDARDS
WEIGHING MACHINES
LIVESTOCK TRADERS + TRANSPORTERS
ACCESS TO MARKET PRICES
LITS
MARKET
BROKER
LIVELIHOOD DIVERSITY
ECO TOURISM
SUSTAINABLE RANGELAND MANAGEMENT
KENYA
BORDER
TANZANIA
TANZANIAN PASTORALISM
LOW INTEREST + TAILORED FINANCIAL PRODUCTS
EARLY
SLAUGHTER HOUSE
MEAT GRADING STANDARDS
COLD STORAGE
BUTCHERY
PROCESSOR
MEAT
MEAT TRADERS + TRANSPORTERS
IMPROVE LABELLING
MEAT GRADING + SEGMENTATION
SLAUGHTER HOUSE + PROCESSOR
BUTCHERY
SUPERMARKETS
MEAT SAFETY STANDARDS
NAIROBI HIGH END BUTCHERY
SCHOOLS/ HOSPITALS
HOTELS
LODGES
© FIONA BRADSHAW
KEY:
PUBLIC SECTOR
PRIVATE SECTOR
PUBLIC + PRIVATE SECTORS
TRANSFORMATIVE + ADAPTIVE INVESTMENTS
EXTENSION SERVICES AND ENABLING ENVIRONMENT

Impact Value Chains

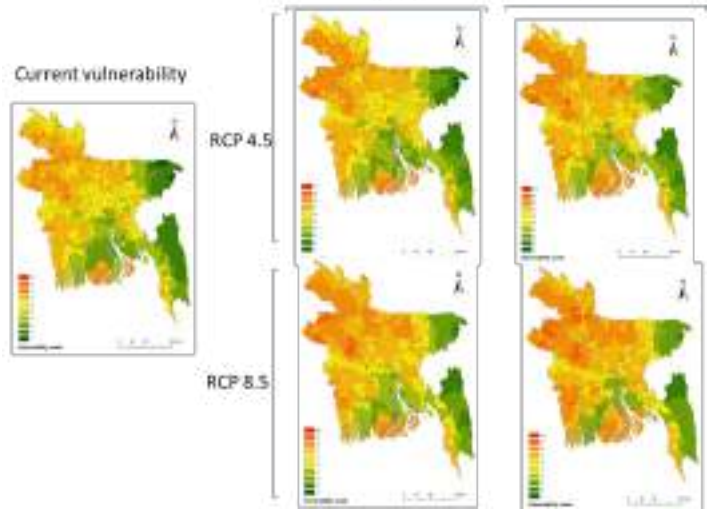


Objectives: Assessing the vulnerability of different sectors to climate change:

- at the national level with a local resolution (upazilas);
- for different temporal horizons (2050 & 2085) and climate scenarios (RCP4.5 & RCP8.5).

Framework and methods based on GIZ's analysis

Approach that is flexible to the context and depending of the data availability.



→A decision making and monitoring tool to foster country or territory 's resilience to climate variability and change

Examining the Critical Impacts of Climate Change in Nigeria Key Challenges and Concrete Solutions.

International Conference on
Adaptation Metrics &
Techniques for Water,
Agriculture & Resilient Cities
Mohammed VI Polytechnic
University (UM6P)
Benguerir, Morocco
October 26-27, 2018

ADEBOLA ADEDUGBE
FarmIdeas Nigeria

Climate Change Vulnerability

Climate change is increasingly recognized as a major challenge facing households and communities, local and national governments and international agencies and organizations. The earth's climate has already been altered to such an extent that mitigation (efforts to reduce the concentrations of greenhouse gases in the atmosphere) alone will be inadequate. Therefore adaptation (responding to the impacts of climate change) is increasingly necessary

The Population Explosion

As the Nigerian population climbs steadily towards 200 million, natural systems that support it may not be able to withstand the pressure that this growth exerts. Water scarcity, land degradation and the loss of natural (ecosystem) services it depends on, point to fundamental problems caused by unsustainable development.

How Farmers cope with climate change

Farmers have found innovative ways of tackling climate change

Rain ravaged community in Nigeria

Thousands rendered homeless with property worth millions of Naira lost to Flood

Nigeria's Vice President's visit to flood victims in a community in Anambra state south east Nigeria

A farmer pushing his produce through the havoc caused by flood

A flooded street in Lagos

A building immersed in water

The UNHCR has been supportive in distributing relief materials to victims of flood across the Nigeria

Livestock- victim of flood !!!

Conclusion

Rural smallholder farmers are the majority of farmers in Nigeria who contribute up to a significant 90% of agricultural production. There is a need to adopt up-scaling ecosystem-system based approaches, maximizing policy frameworks to integrate ecosystem-based approaches and the scientific perspective of ecosystem-based approaches. There should be capacity building for producer organizations, and farmers through adult literacy.

Administration de la Défense Nationale
Centre Royal de Télédétection Spatiale

المركز الملكي للاستشعار البعدي الفضائي

International Conference on Adaptation Metrics & Technique for Water, Agriculture & Resilient Cities

Mohammed IV
Polytechnic
University

Benguerir, October 26-27 218

IRRISAT Maroc

Gestion Opérationnelle de l'Irrigation basée sur les données Satellite

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Driss ELHADANI (elhadani@crts,gov.ma)
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Ministère de l'Agriculture et de la Pêche Maritime
Direction de l'Irrigation et de l'Aménagement des Espaces Agricoles
Office de Mise en Valeur Agricole de Tadla

Introduction

Les effets des changements climatiques sur les ressources en eau au Maroc exigent de la part des différents acteurs du domaine agricole d'entreprendre les actions suivantes :

- **contrôle et rationalisation de l'utilisation des eaux de surface pour l'irrigation**

- **modernisation des techniques d'irrigation → gouttes à gouttes**

- **rationalisation de l'usage des eaux souterraines**

Rappel du Contexte et des objectifs du Projet

Objectif

Le Projet de Recherche - Développement IRRISAT-Maroc a pour objectif de réaliser un système basé sur l'exploitation des données satellite pour fournir aux acteurs de l'agriculture des indicateurs d'aide à la décision pour l'optimisation de l'irrigation

Utilisateur	Couverture spatiale
Agriculteur	Parcelle/ exploitation
Offices de Mise en Valeur	Secteur/Périmètre
Agence de Bassin	Bassin/Sous-Bassin
Ministère	Nationale

Liste des Indicateurs Produits par le Système IRRISAT

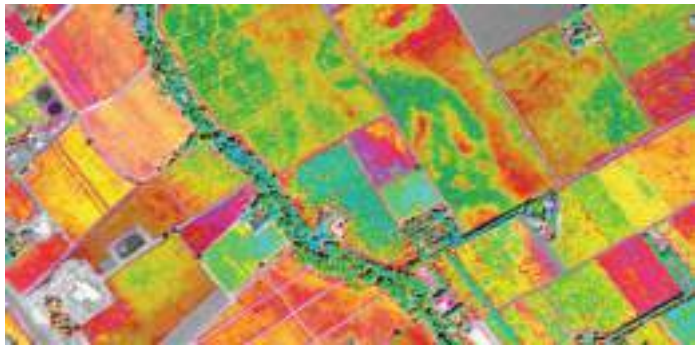
Information d'irrigation	Fréquence	Description	Définition	Niveau	Champ	Secteur	Périmètre	Bassin	Intervenant
1 – IWR	Journalier	Besoins en eau d'irrigation	$(ET_{pot} – P_{net}) / Eff$	D	v	v	v		Agriculteur, ORMVA, Agence du Bassin
2 – CU	Journalier	Consommation	ET_{act}	C	v	v	v	v	Agriculteur, Agence du bassin
3 – CWD	Journalier	Déficit hydrique des cultures	$ET_{pot} – ET_{act}$	D	v	v	v		Agriculteur, ORMVA
4 – IA	décade	Adéquation d'irrigation	ɵ	C	v	v	v		Agriculteur, ORMVA
5 – IE	décade	Equité de l'irrigation	$ɵ_{std}$ (espace)	C	v	v	v		ORMVA
6 - LN	décade	Azote des feuilles	N	C	v				Agriculteur
6 – PROD	Journalier	Production	Bio	C	v	v	v		Agriculteur, MinAg

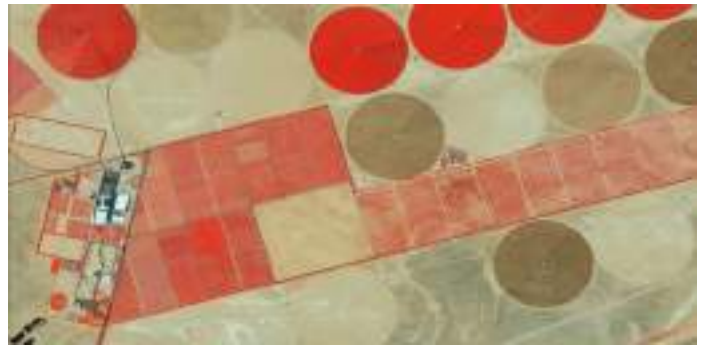
Liste des Indicateurs produits par le Système IRRISAT (Suite)

Information d'irrigation	Fréquence	Description	Définition	Niveau	Champ	Secteur	Périmètre	Bassin	Intervenant
7 – WPS	Journalier	Score de la productivité de l'eau(WPS)	Bio / ET_{act} normalisée pour le climat et le type de culture	D	v	v	v		MinAg
8 – NGU	mensuel	Utilisation nette des eaux souterraines	NGU = ET_{np}	D	v	v	v	v	Agriculteur, Agence du bassin
9 – IDR	mensuel	Taux de dépendance de l'irrigation	(ET_{np} + ET_{Sw}) / ET_{act}	D		v	v		ORMVA, Agence du bassin
10 – GCR	mensuel	Taux de consommation des eaux souterraines	ET_{Enp} / (ET_{Enp}+ET_{Sw})	D		v	v		Agence du bassin
11 – IR	saison	Fiabilité de l'irrigation	ɵ std (temps)	C	v	v	v		FORMVA
12 – EWP	saison	Productivité économique de l'eau	Revenue brute Dhm /ha & Revenue brute Dhm / ET_{act}	D	v	v	v		Agriculteur, MinAg
13 – SWP	saison	Productivité sociale de l'eau	salaire Dhm /ha & salaire Dhm / ET_{act}	D	v	v	v		Agriculteur, MinAg

Le Système IRRISAT





SYSTÈME DE PRODUCTION

IRRISAT
Schéma fonctionnel

Phase de Recherche et de Développement

Phase Opérationnelle

Modules Acquisition des données RS, SIG, autres

Modules de Pré-traitements

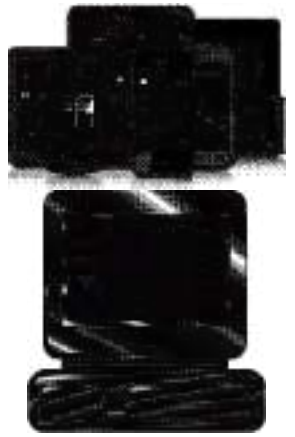
Modules d'extraction de l'information : ET, Biomasse, Humidité du sol

Processus de validation

Modules de génération d'indicateurs

Module de dissémination

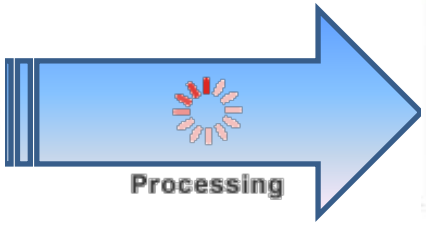
utilisateurs

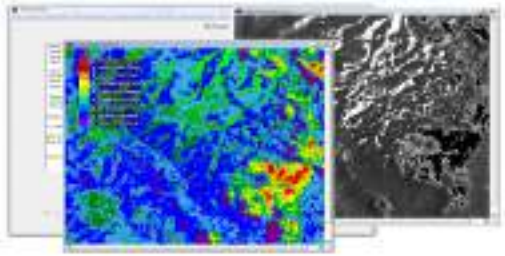


Modules Acquisition des Données

Données	Résolution spatiale	fréquence	source
Images satellites			
Landsat 7/8	30 m	16 j	USGS
VIIRS	375 m	1 j	NOAA
PROBA-V	100 m	5 j	VITO
Données météo			
Rayonnement solaire	3 km / point	30 mn / 1h	LandSAF / Station CRTS
Température de l'air **Vitesse du vent** **Humidité de l'air** **Précipitation**	Point/ 25km/ 1km	Horaire/3h/ 3h	Stations CRTS/ Nasa/ CRTS
Données auxiliaires			
Occupation du sol	parcelle	annuelle	ORMVAT
Type de sol			
Plan parcellaire	parcelle	annuelle	ORMVAT

LDM
Modules prétraitement Landsat





Vers SEBAL

Téléchargement des images

Classification non supervisée

Codage –

1 : nuages/ ombre/neige 0: non nuage

Masque nuage

Images Prétraitées

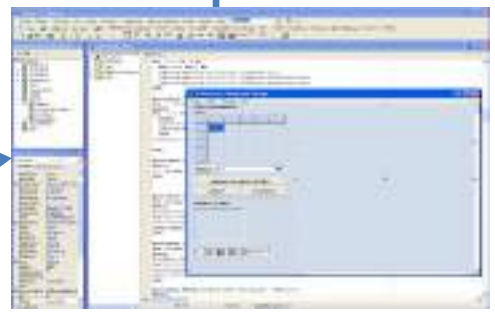
VDM
Modules Prétraitements des Données VIIRS

Instrument VIIRS à
Bord du Satellite NPP

Module HANTS

Vers SEBAL

NAS CRTS



Prétraitement VIIRS

Générations des paramètres géophysiques de surface à travers le module PRESEBAL

PVDM
Modules Prétraitements des Données PROBA-V

Satellite
Proba Végétation

esa

Télécharger

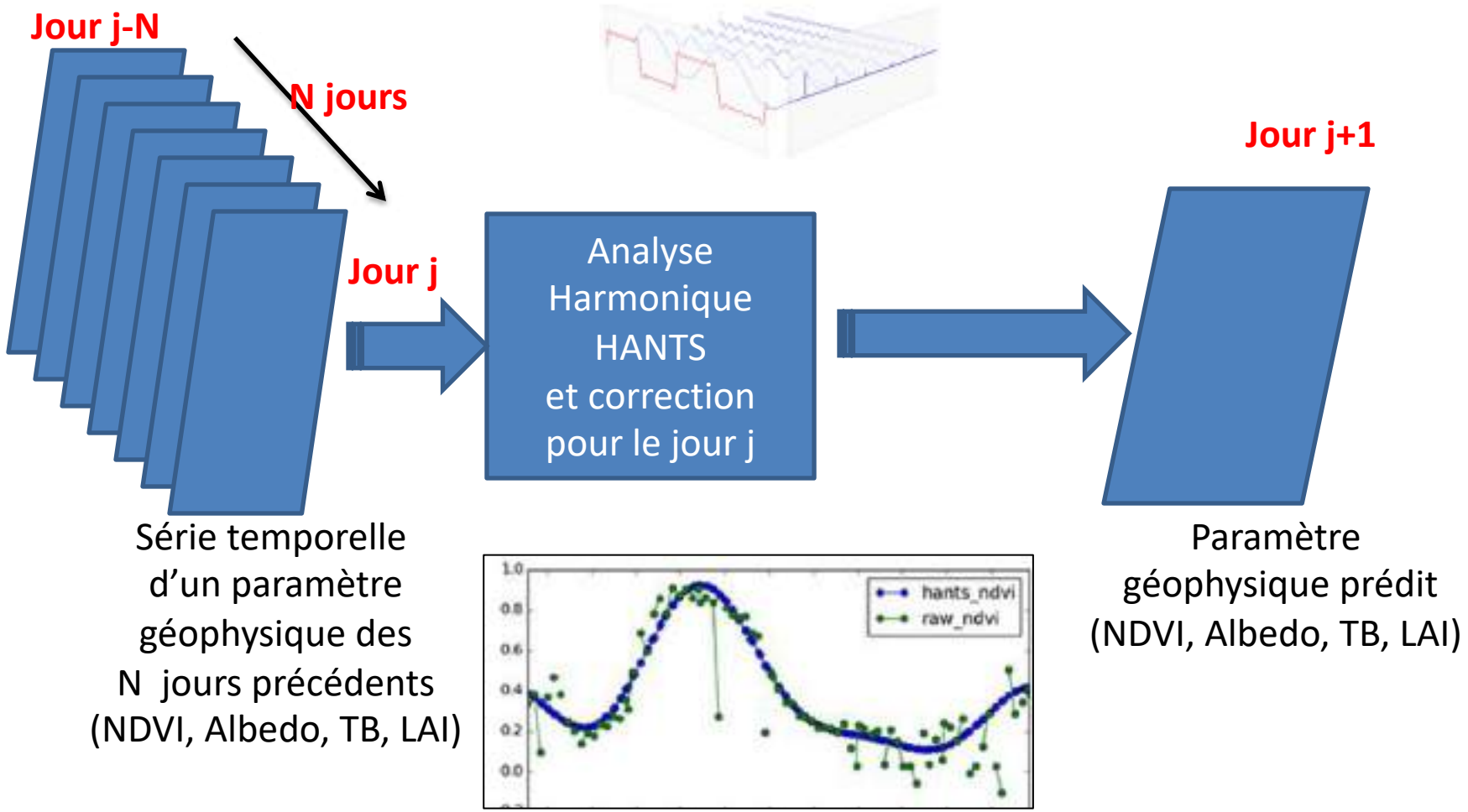
NAS CRTS

Générations des paramètres géophysiques de surface à travers le module PRESEBAL

Base de Données IRRISAT

Vers SEBAL

Modules Prétraitements
Module corrections des effets atmosphériques (nuages)
Par Analyse Harmonique des Séries Temporelles
HANTS

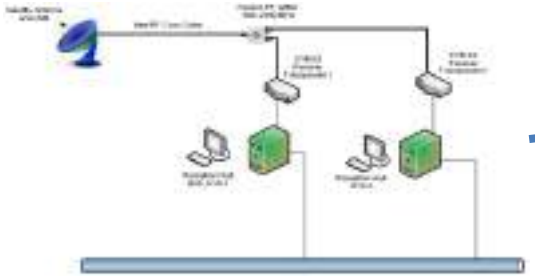


SRM
Modules Prétraitements Rayonnement Solaire

METEOSAT
MSG

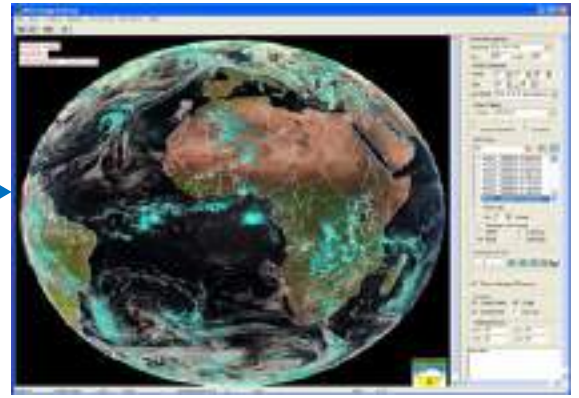
EUMETCast

Extraction des images Rayonnement solaire 30mn et création d'images journalières



Antenne CRTS

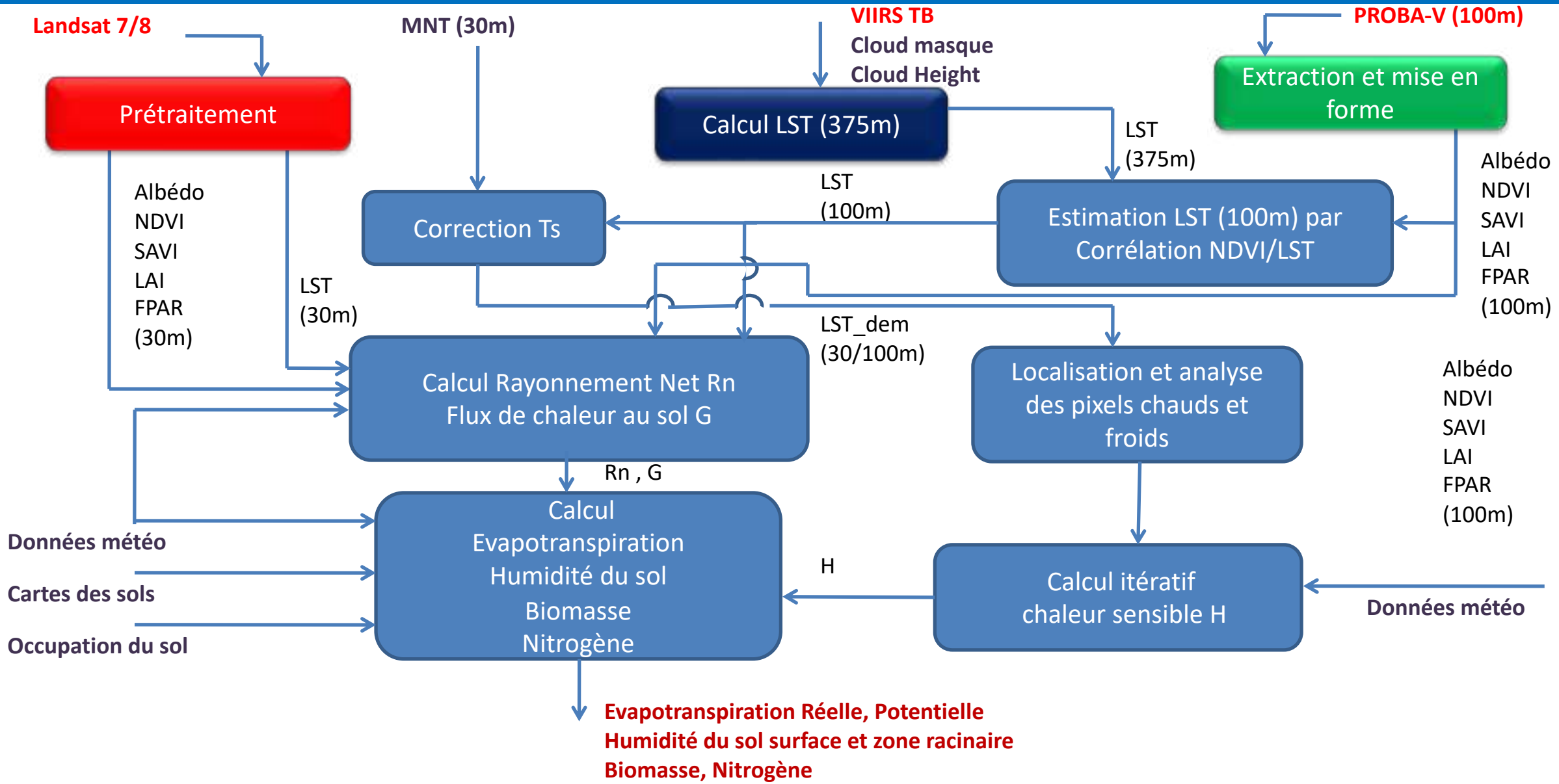
NAS CRTS



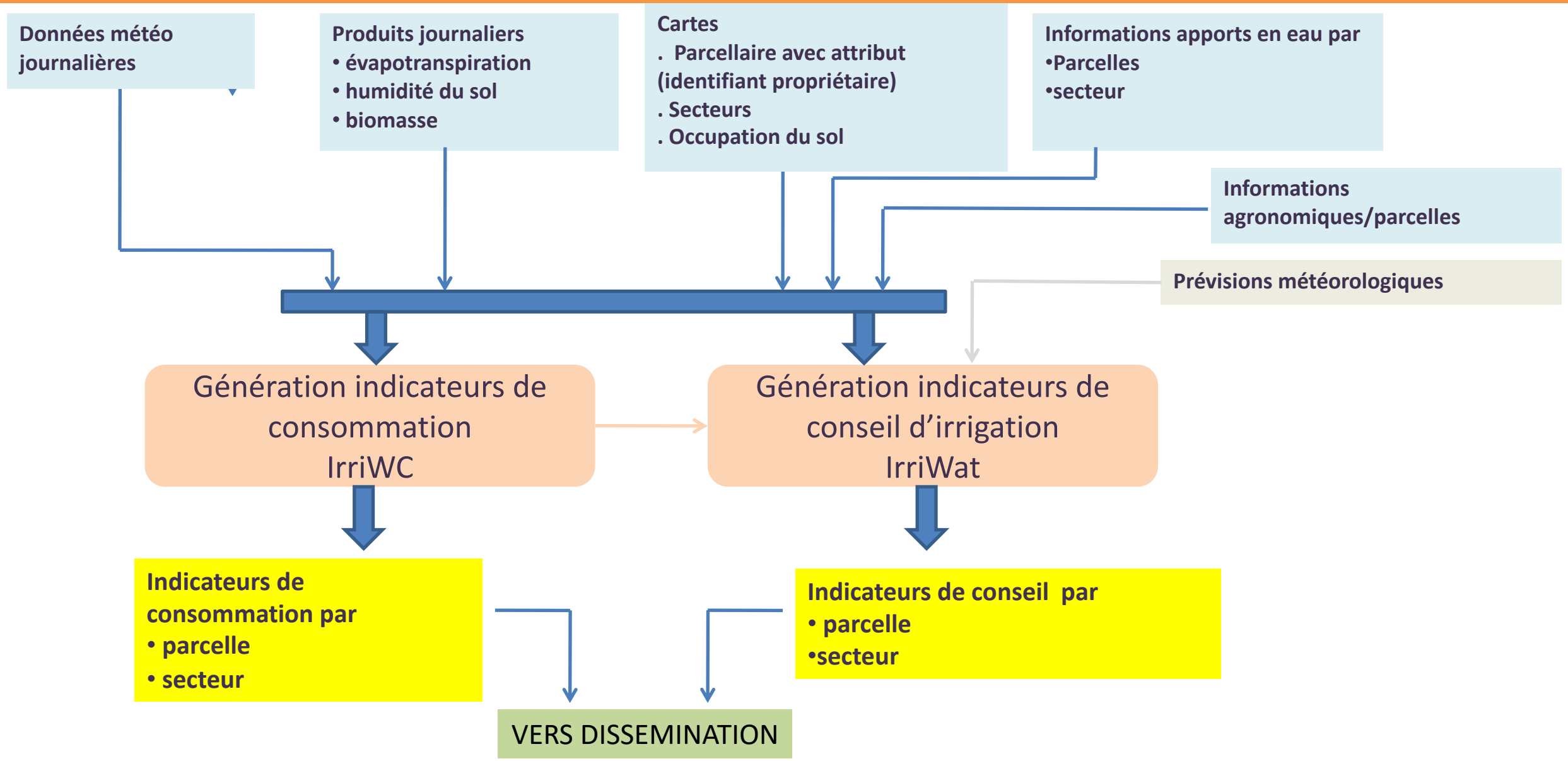
MSG Toolbox

Vers SEBAL

Module **SEBAL** d'extraction de l'information de l'irrigation

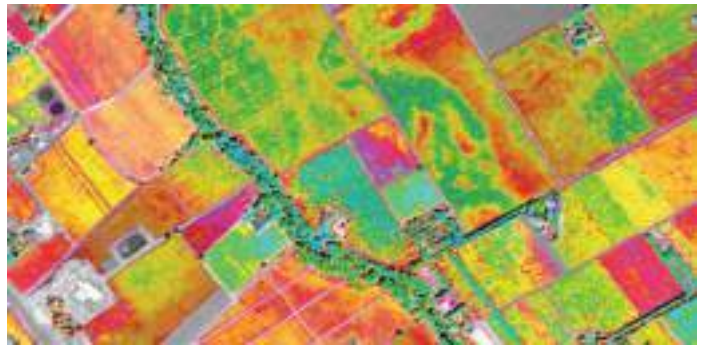


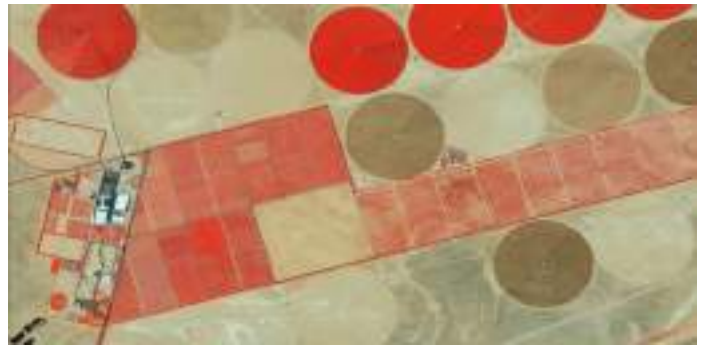
Modules Génération des Indicateurs



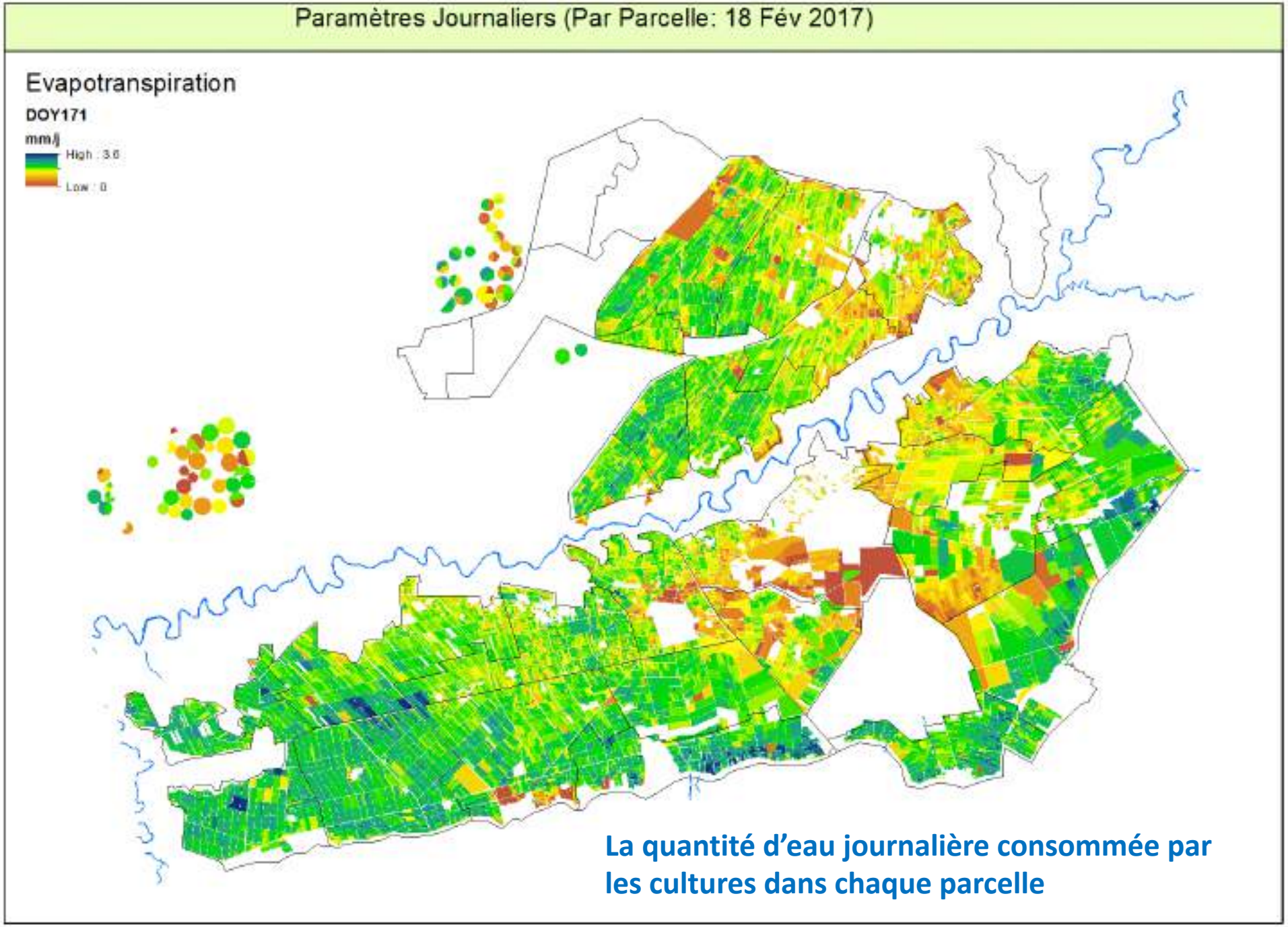
Le Système IRRISAT



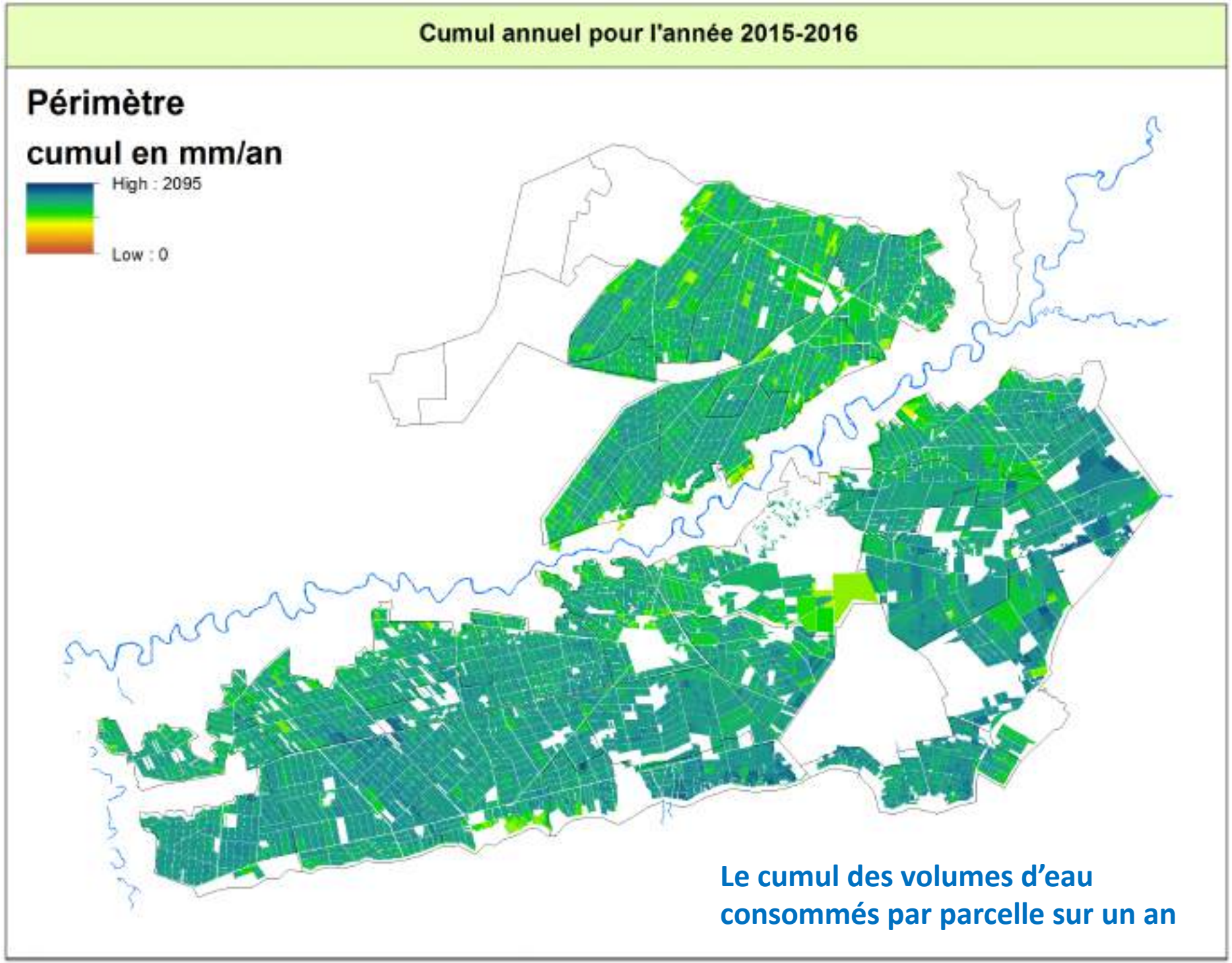



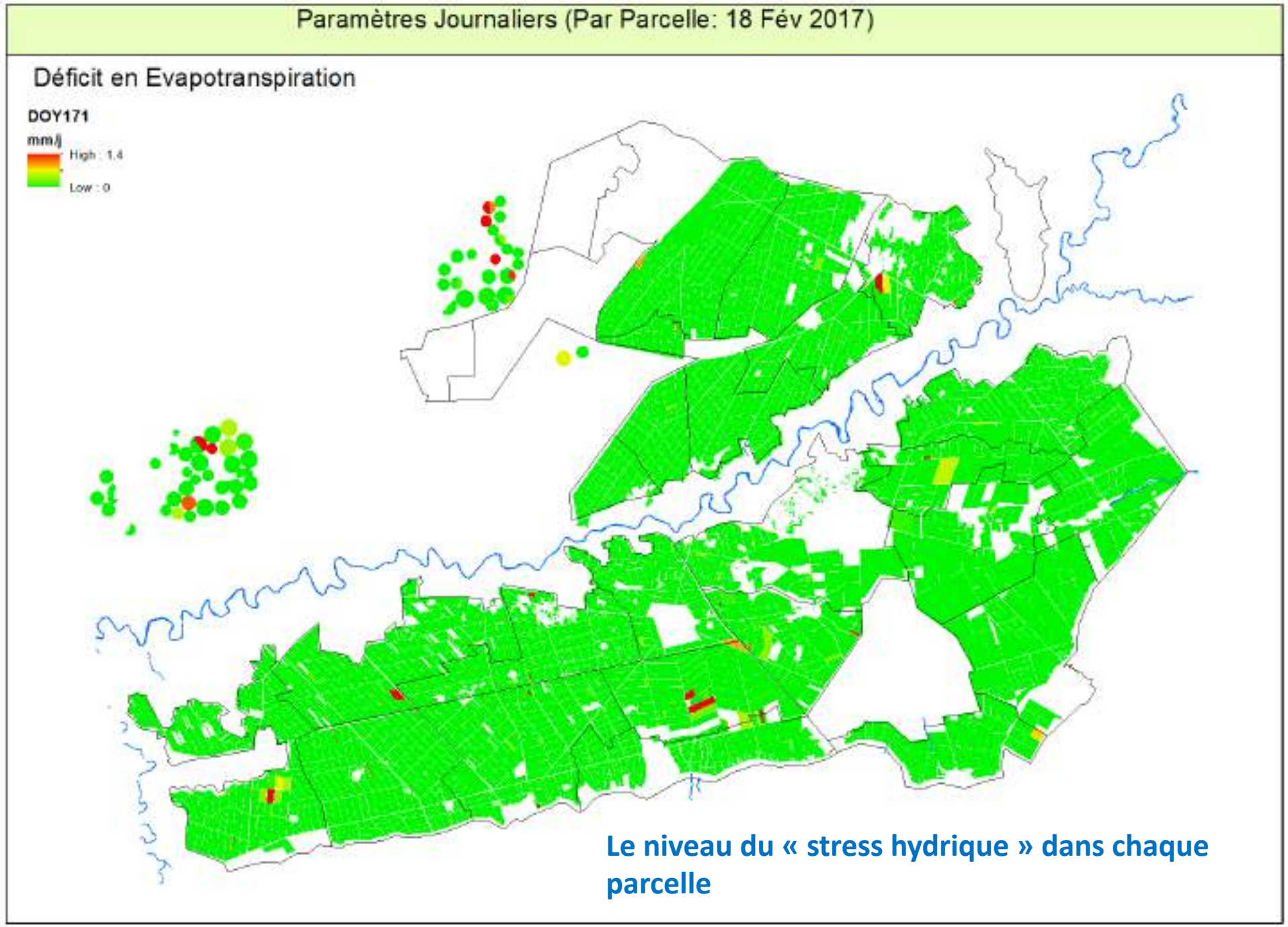


Des informations sur l'utilisation de l'eau pour l'ORMVAT

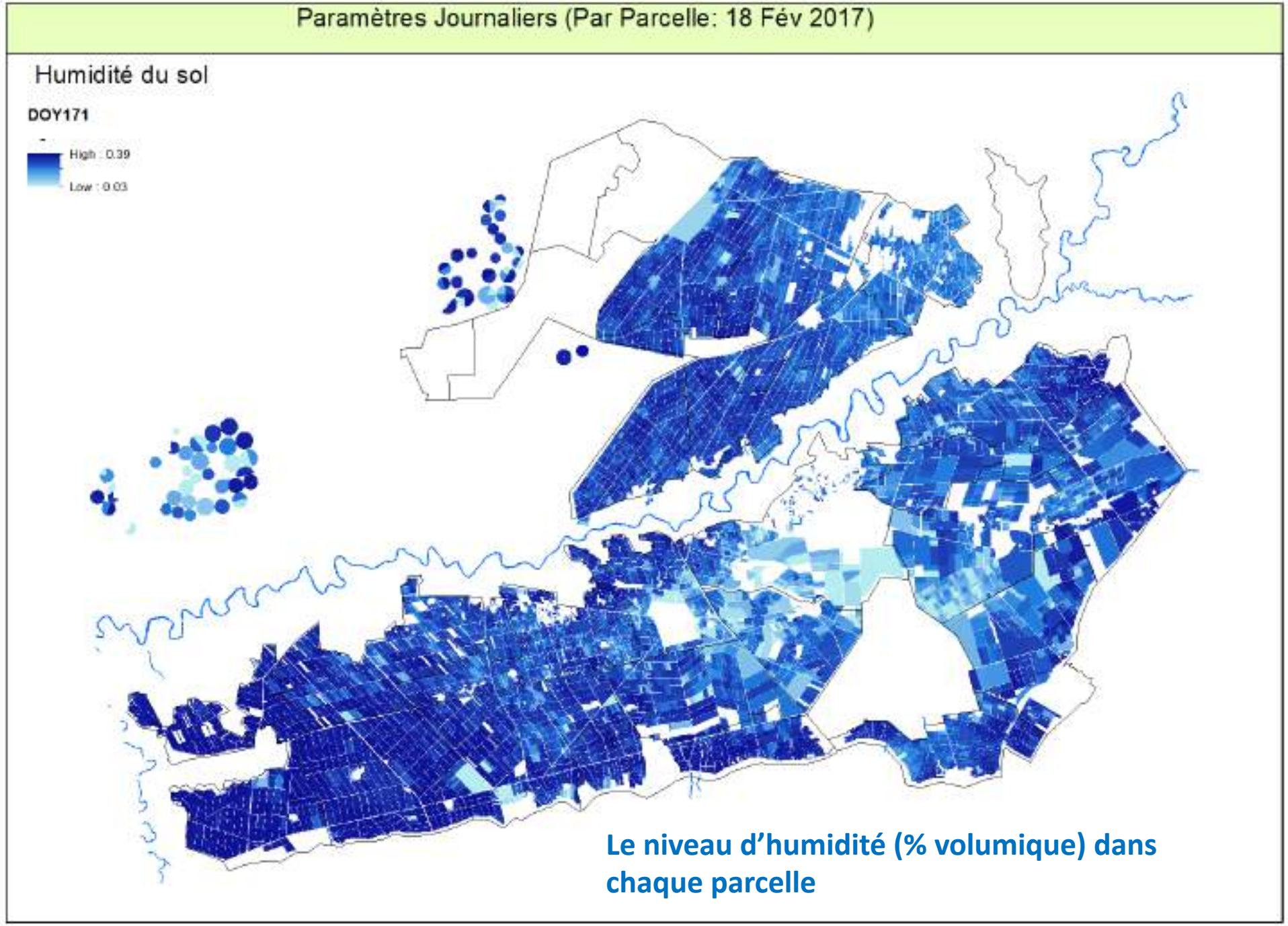


La quantité d'eau journalière consommée par les cultures dans chaque parcelle

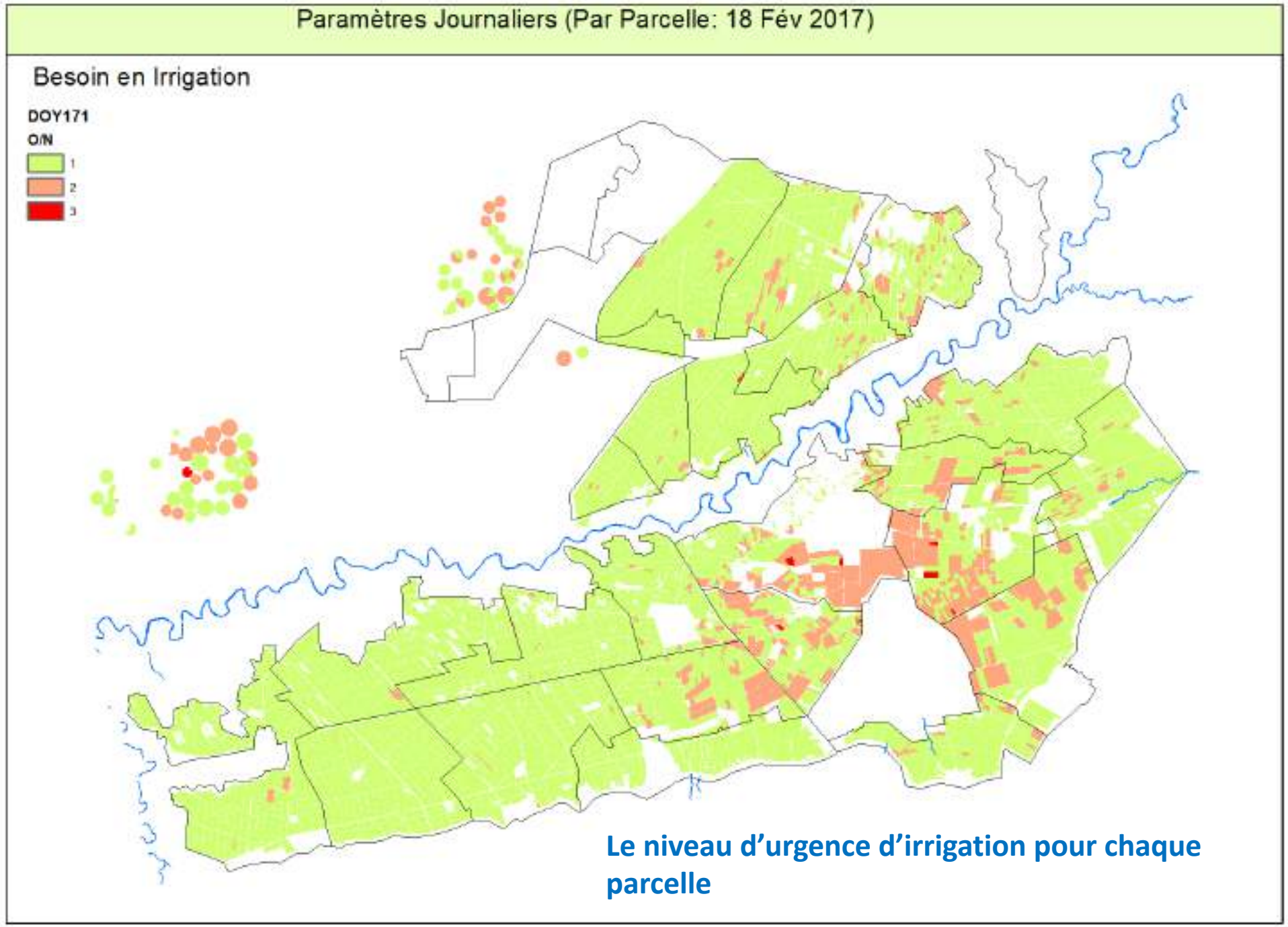

Cumul annuel pour l'année 2015-2016
Périmètre
cumul en mm/an
High : 2095
Low : 0
Le cumul des volumes d'eau consommés par parcelle sur un an



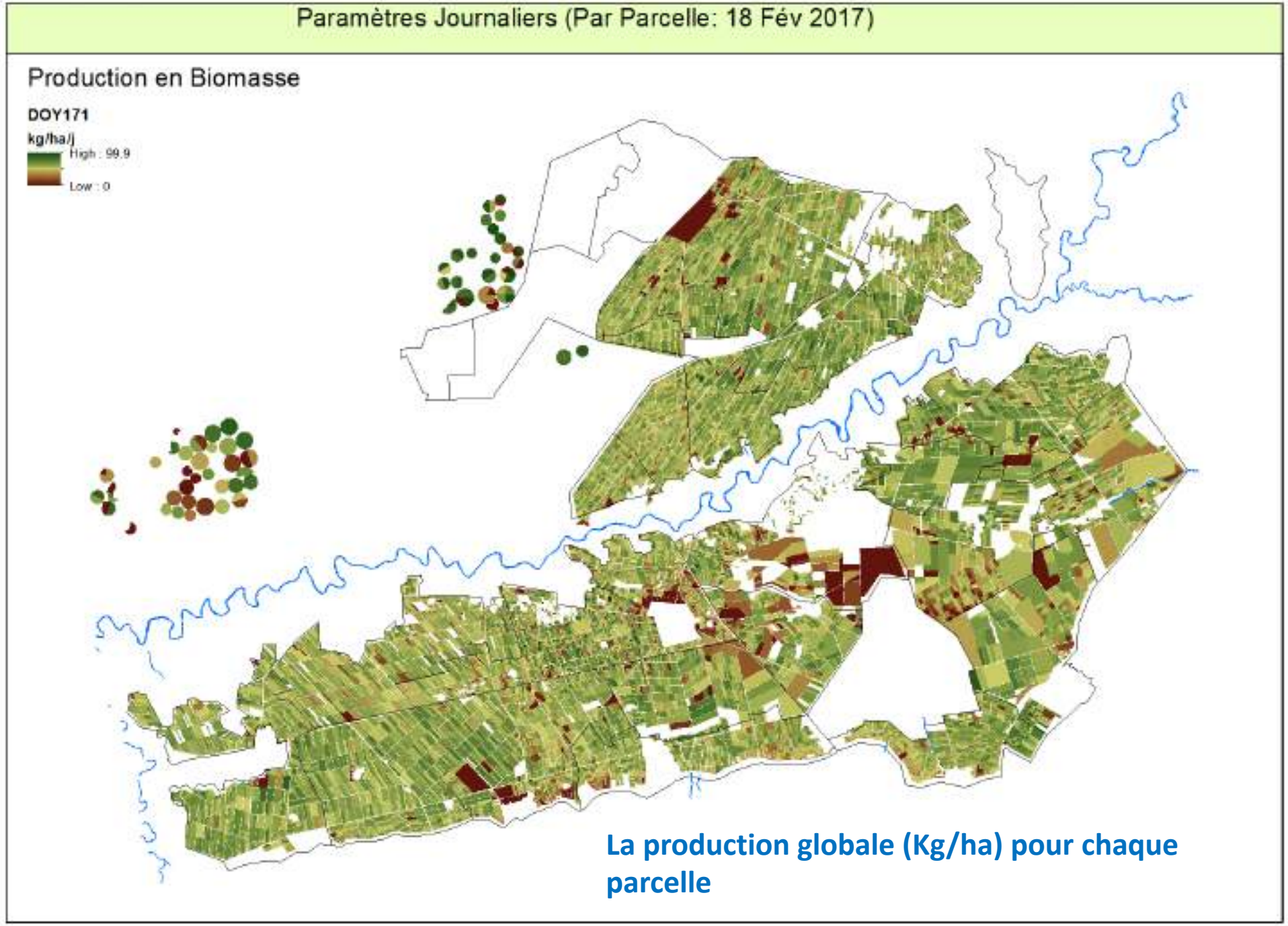
Le niveau du « stress hydrique » dans chaque parcelle



Le niveau d'humidité (% volumique) dans chaque parcelle

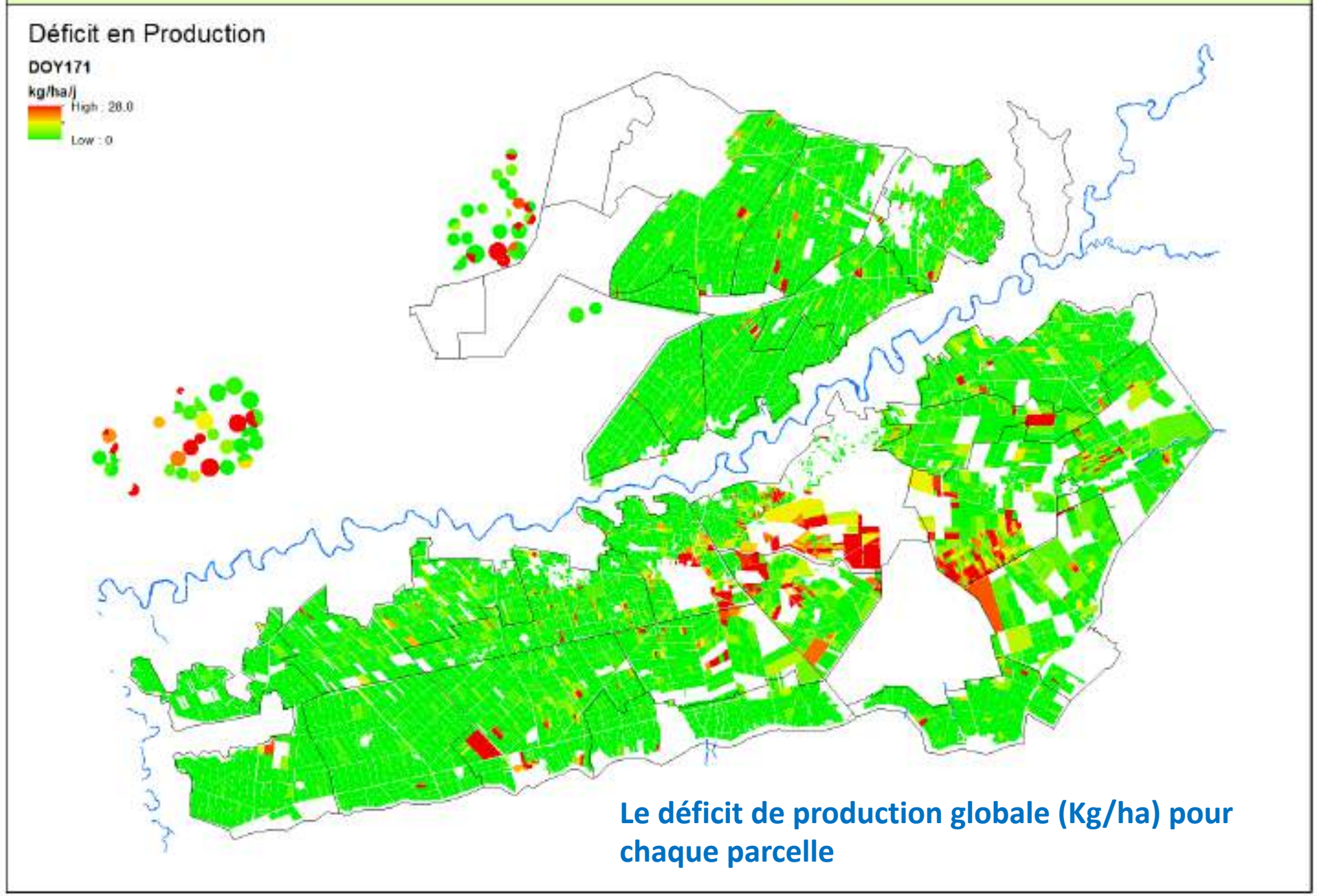


Le niveau d'urgence d'irrigation pour chaque parcelle

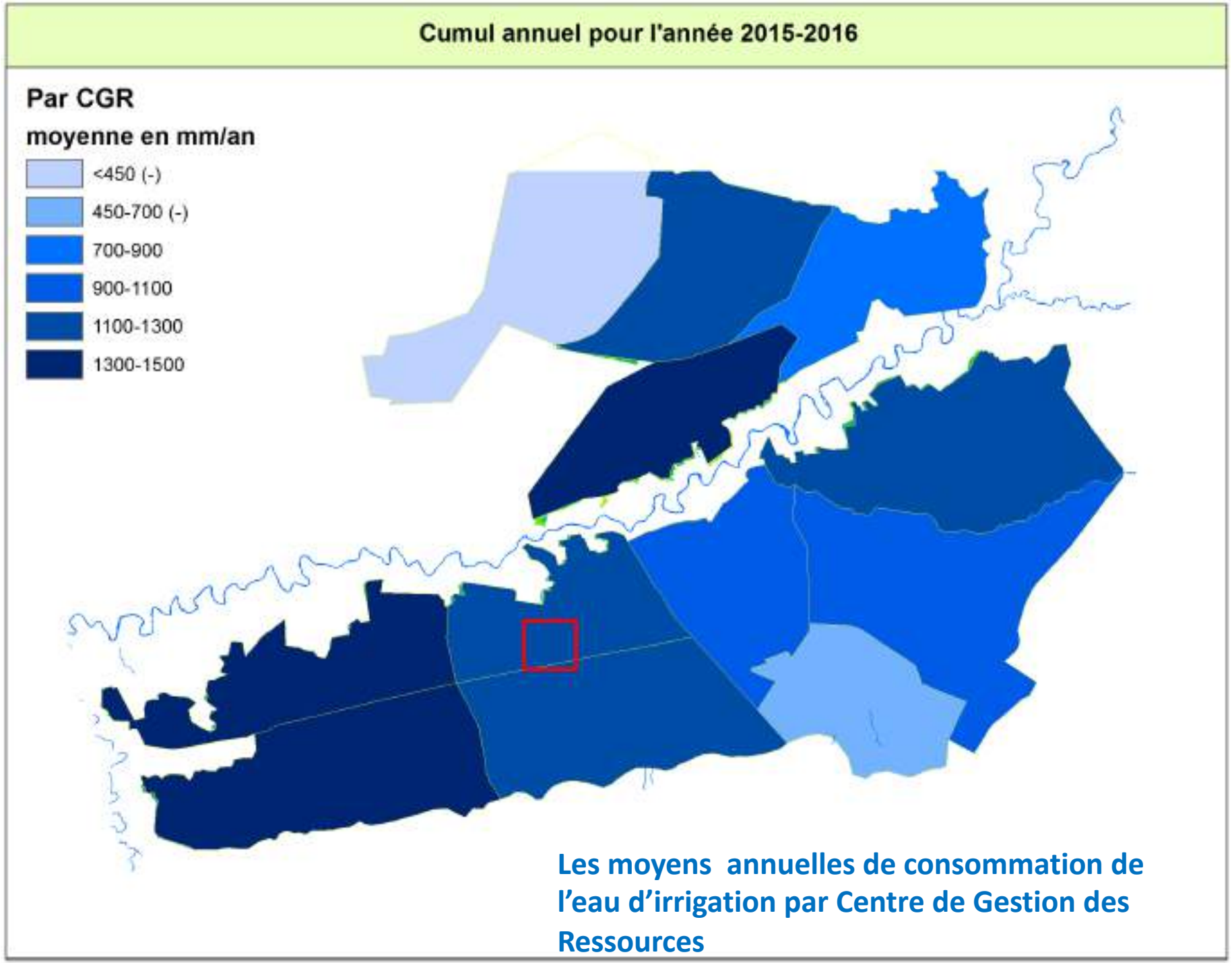


La production globale (Kg/ha) pour chaque parcelle

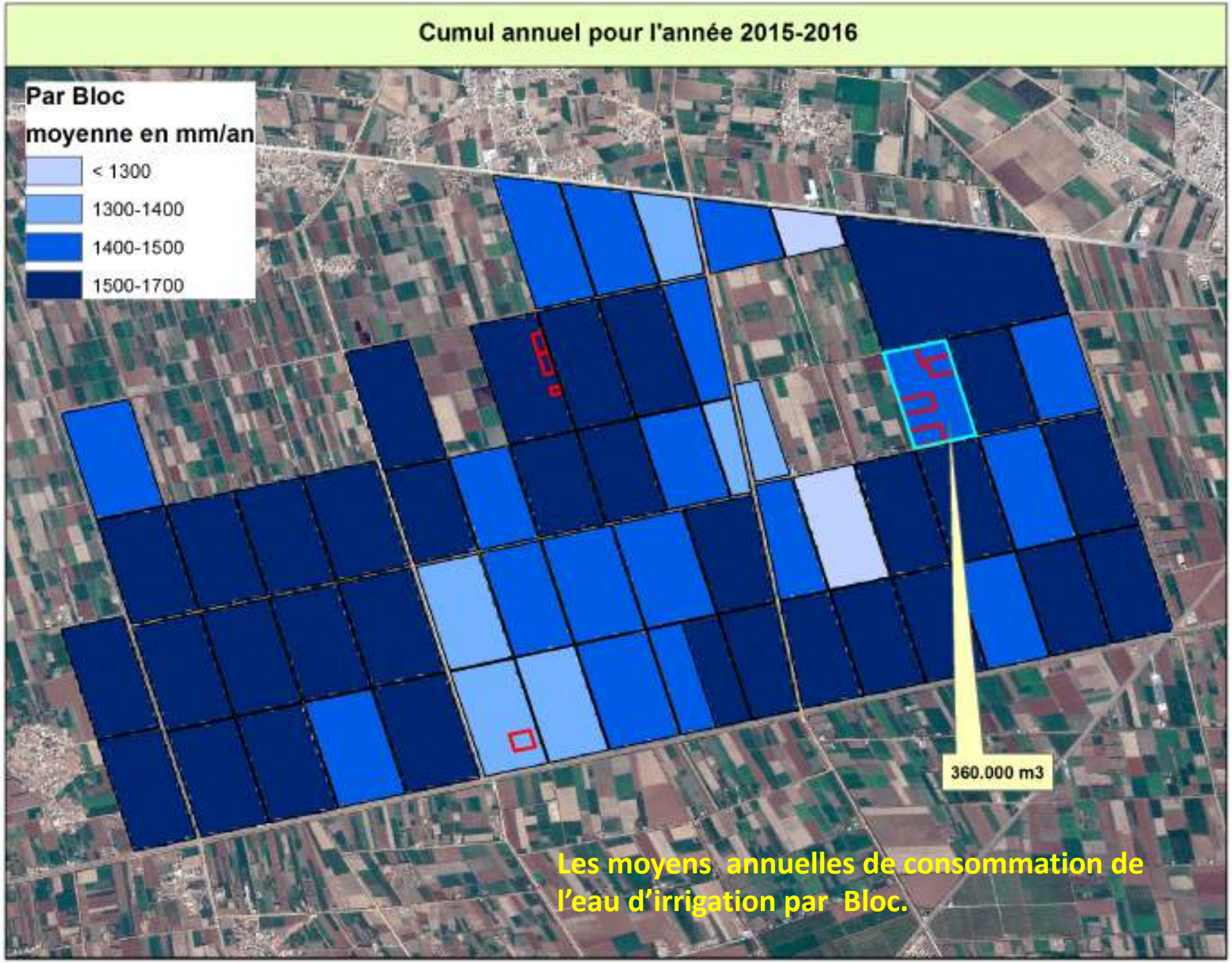
Paramètres Journaliers (Par Parcelle: 18 Fév 2017)



Le déficit de production globale (Kg/ha) pour chaque parcelle

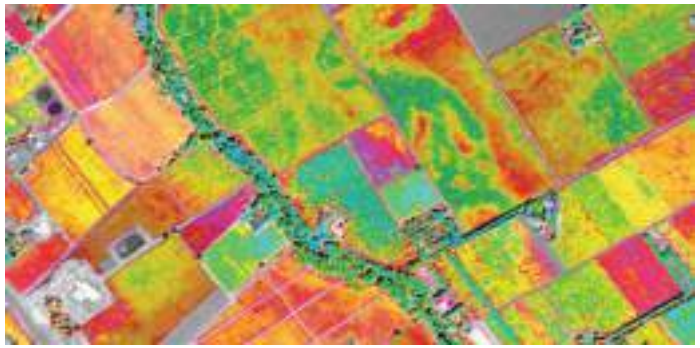


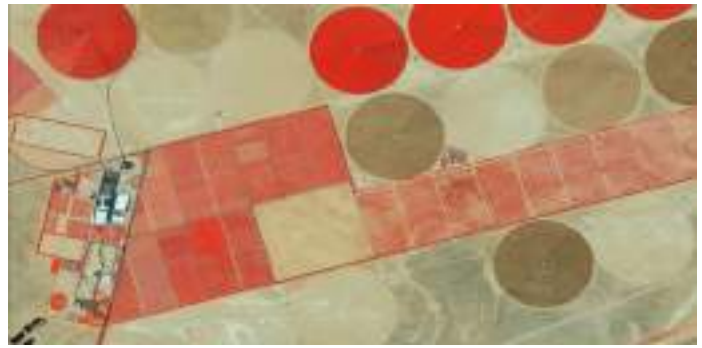
Les moyens annuelles de consommation de l'eau d'irrigation par Centre de Gestion des Ressources


Cumul annuel pour l'année 2015-2016
Par Bloc
moyenne en mm/an
< 1300
1300-1400
1400-1500
1500-1700
360.000 m3
Les moyens annuelles de consommation de l'eau d'irrigation par Bloc.

Le Système IRRISAT

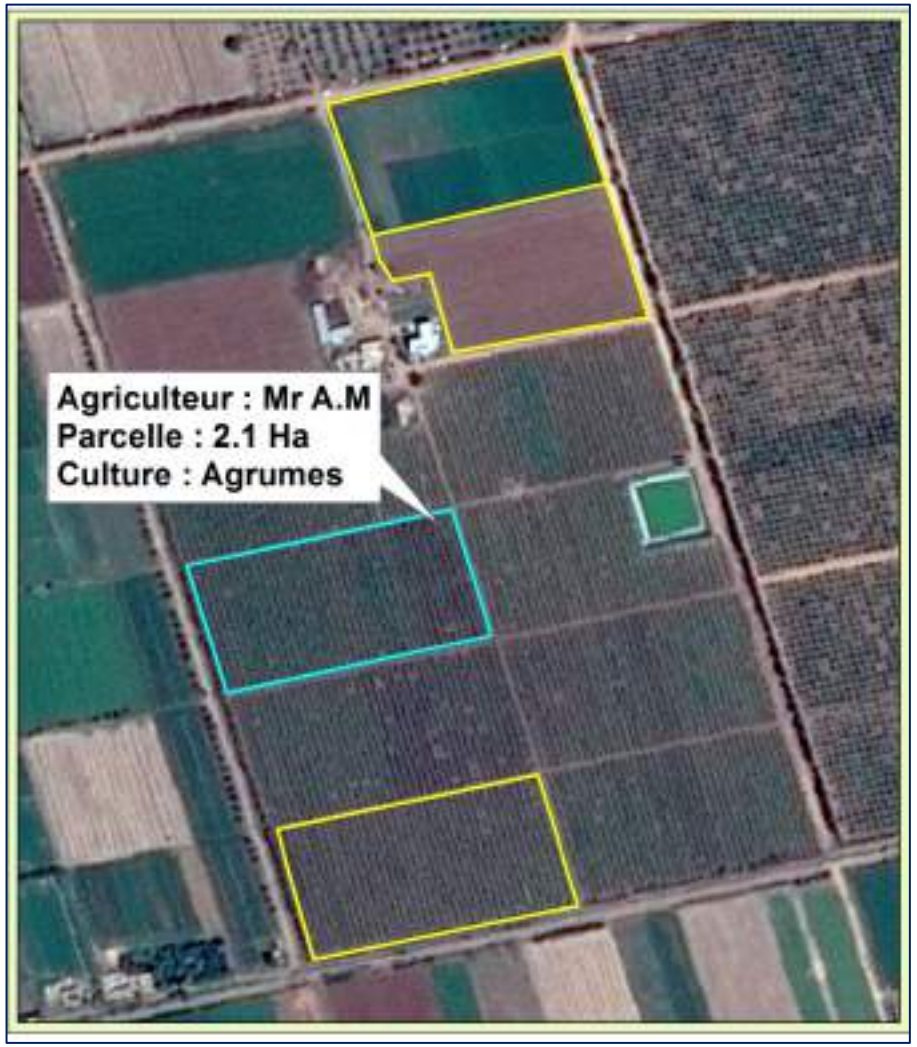




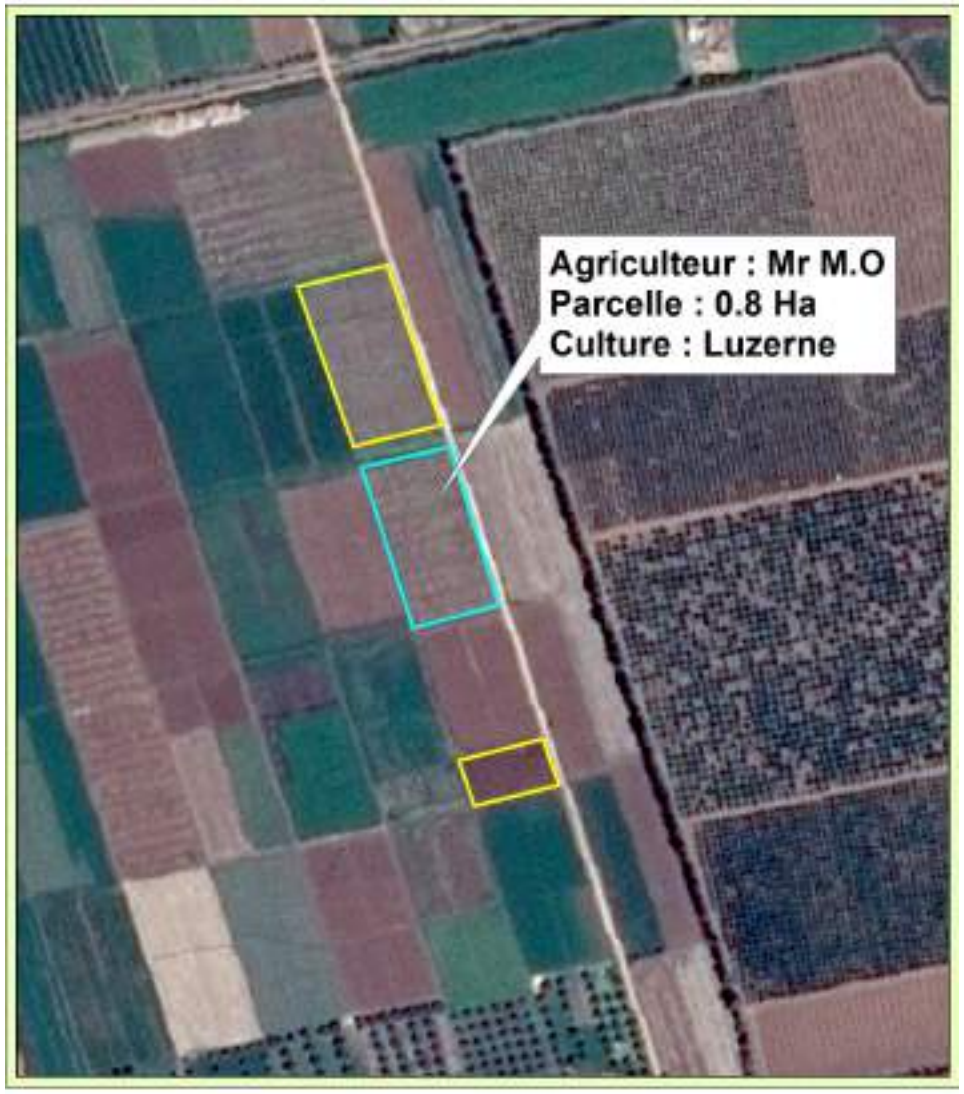
Des Informations pour l'Agriculteur

Informations / Conseils à l'Agriculteur



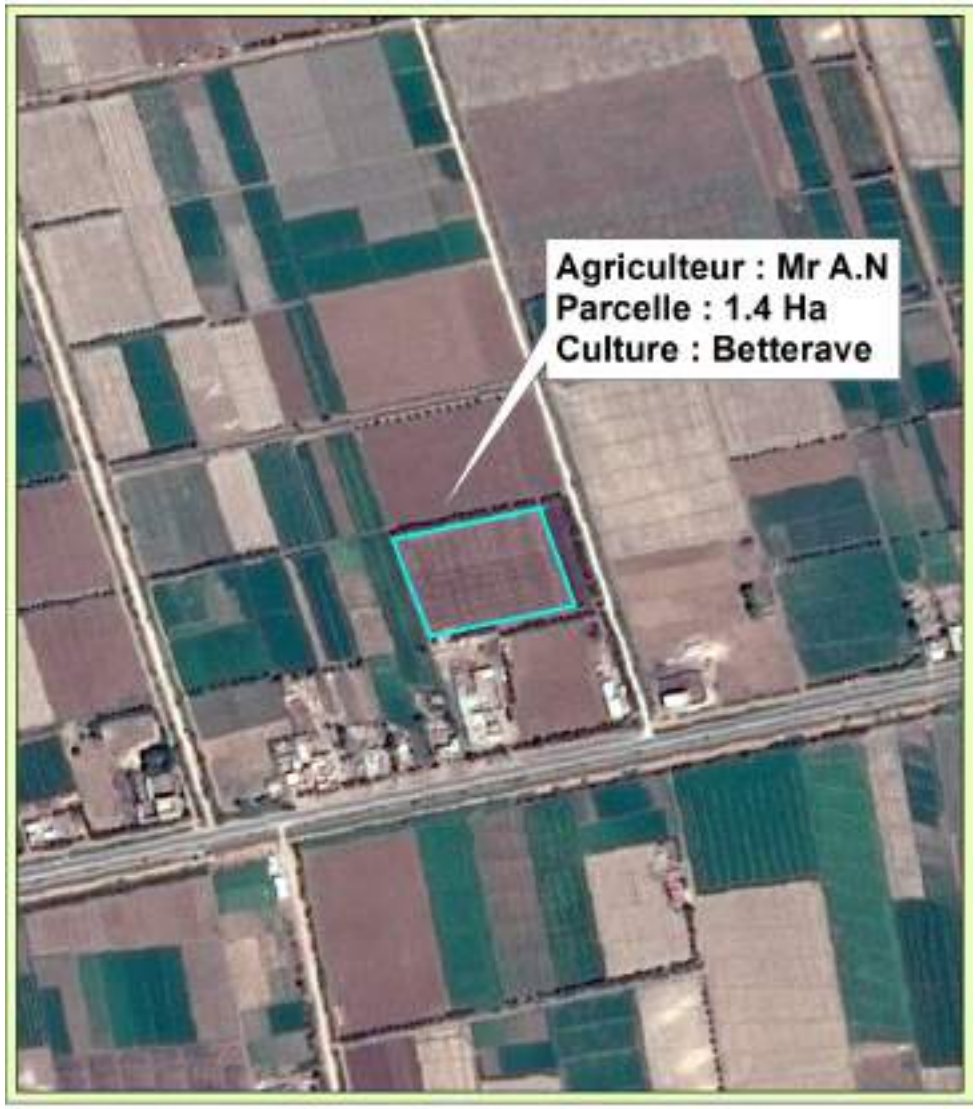
	Niveau de stress	Quantité d'eau à apporter	Cumul d'eau consommée	Production (biomasse)
Jour 1	0.0	3.2	164	53
Jour 2	0.0	3.8	312	44
Jour 3	0.0	2.4	353	17
Jour 4	0.0	3.7	435	76

Informations / Conseils à l'Agriculteur



	Niveau de stress	Quantité d'eau à apporter	Cumule d'eau consommée	Production (biomasse)
Jour 1	0.15	2.6	139	63
Jour 2	0.10	2.2	266	57
Jour 3	0.0	2.0	301	24
Jour 4	0.0	3.5	371	78

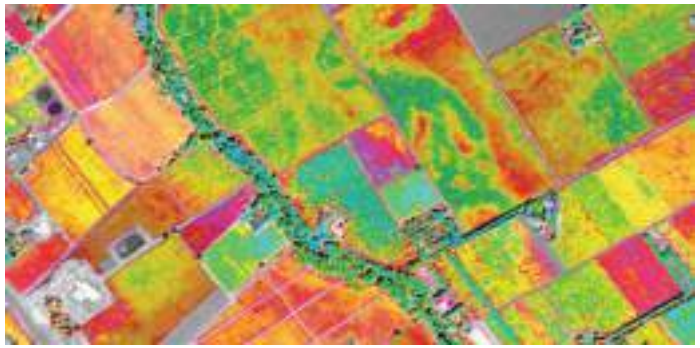
Informations / Conseils à l'Agriculteur

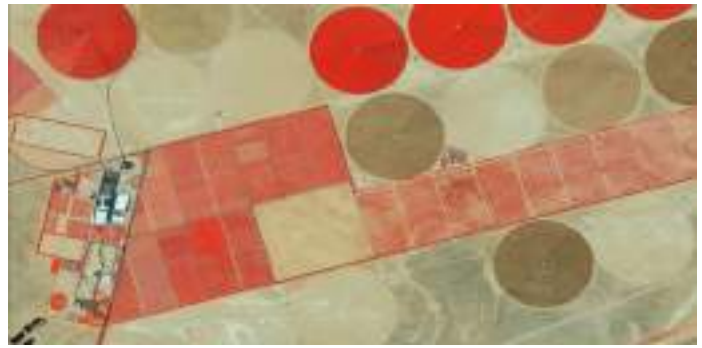


	Niveau de stress	Quantité d'eau à apporter	Cumul d'eau consommée	Production (biomasse)
Jour 1	0.0	2.9	6	68
Jour 2	0.5	1.8	130	48
Jour 3	0.0	1.9	164	26
Jour 4	0.0	3.5	232	61

Le Système IRRISAT

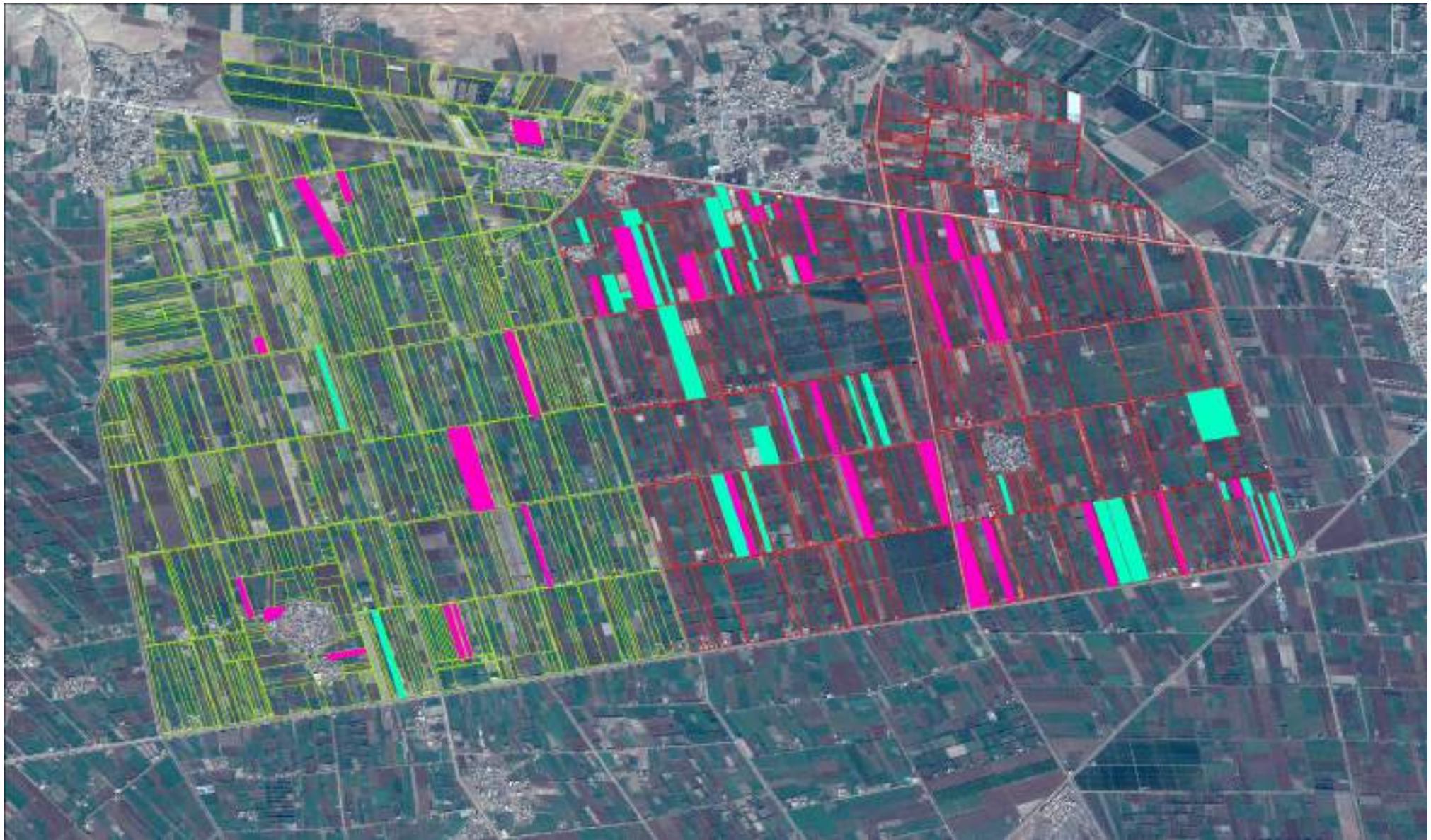


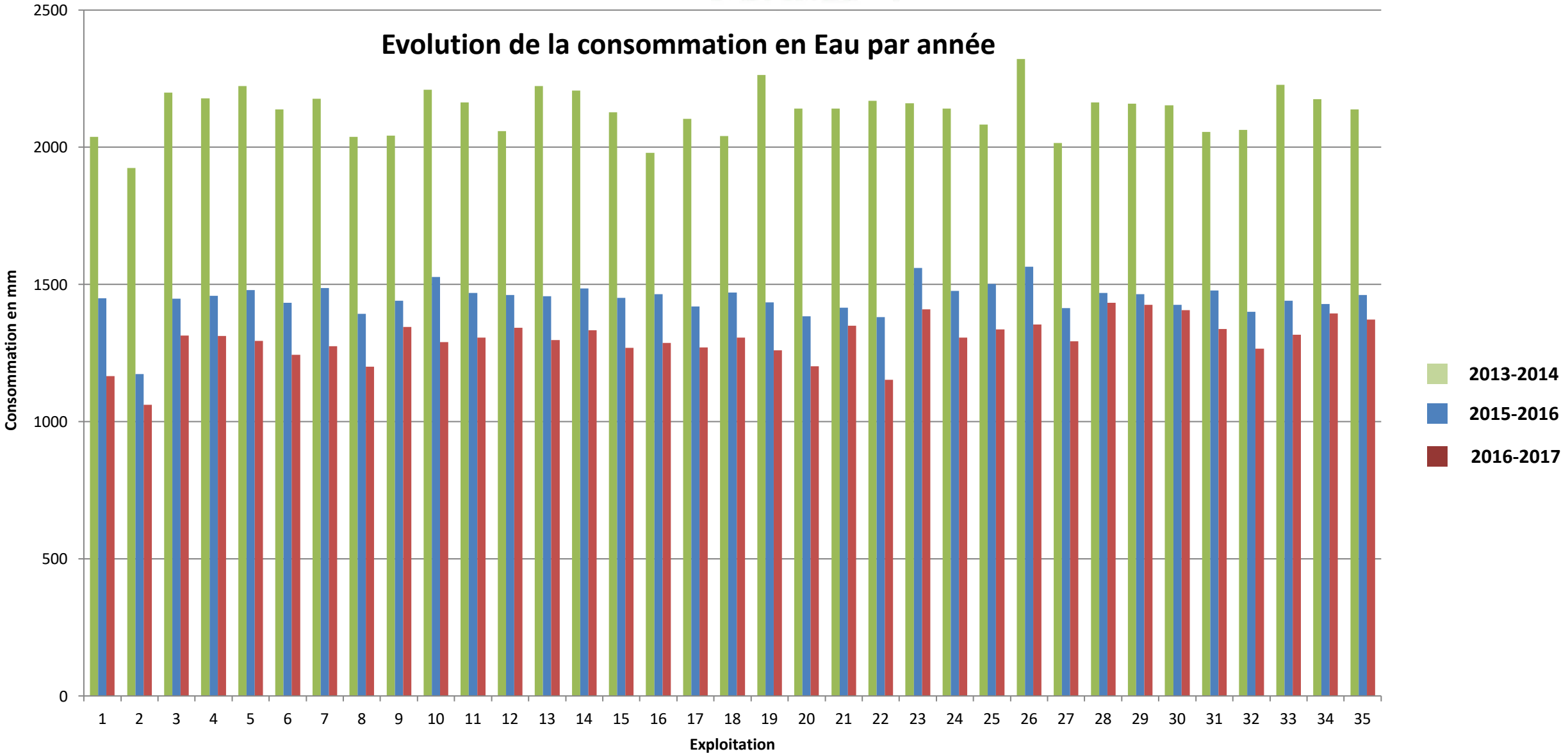


Evaluation de l'impact de la modernisation des techniques d'irrigation sur la consommation en eau
Cas de de reconversion de gouttes à gouttes
Périmètre de Tadla

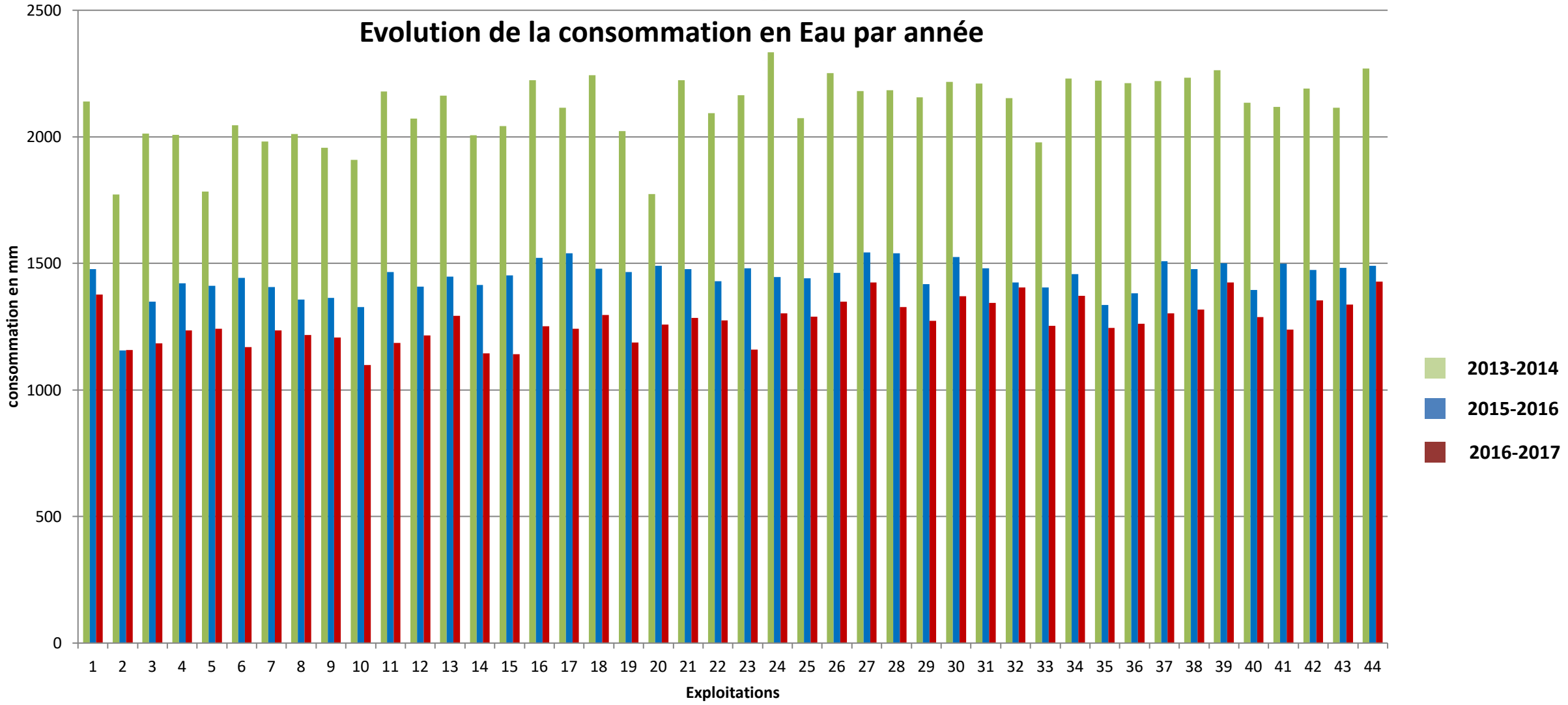
ECHANTILLONS : 2 ASSOCIATIONS D'USAGERS DE L'EAU AGRICOLE
GROUPE 1 : RECONVERSION APRÈS CAMPAGNE 2013-2014
GROUPE 2 : RECONVERSION APRÈS CAMPAGNE 2015-2016



COMPARAISON ENTRE ANNÉES : CONSOMMATION PAR EXPLOITATION GROUPE - 1



COMPARAISON ENTRE ANNÉES : CONSOMMATION PAR EXPLOITATION GROUPE - 2



CONCLUSIONS

- **Résultats encourageants**
  - ❑ Système de production opérationnel et automatique à une fréquence quotidienne des indicateurs sur la consommation, le déficit hydrique, la production de biomasse, etc.
  - ❑ La consommation en eau annuelle par cultures est globalement conforme comparativement aux apports d'eau fournis par l'ORMVAT
  - ❑ Une plateforme de dissémination est en cours d'implémentation
- **Le processus de validation est en cours**

  (instrumentation : Eddy-Covariance, stations météorologiques, sondes capacitives)
- **L'expérience est extensible sur d'autres périmètres irrigués**

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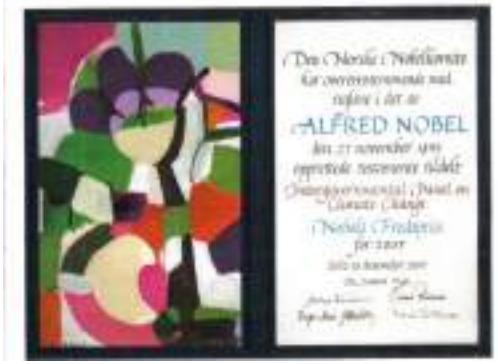
Lessons learned, progress, needs and challenges
Pannel 3 : Agriculture & Water

Improving agricultural inputs and land use efficiency is beneficial both for adaptation and mitigation



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Directeur de recherche honoraire de l'INRA France, 2007 Co-Nobel Prize winner with IPCC
Former member of the French Task-Force on Climate Change (Agriculture Forestry and North-South Cooperation)

Chair of Oikos Institute & Co-founder of IFSDAA (International Foundation for Sustainable Development in Asia and Africa)

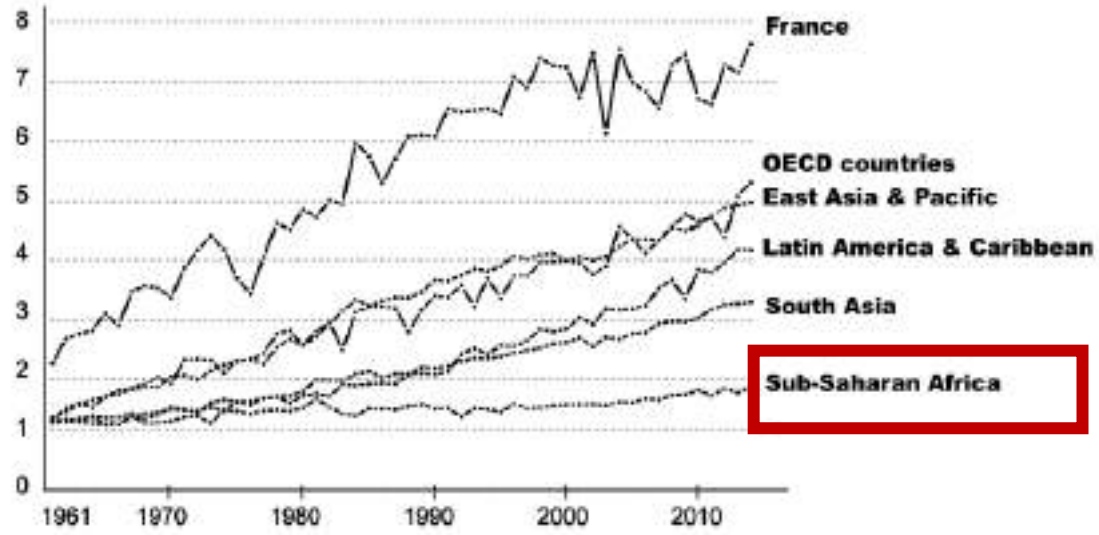
Conférence Internationale sur les métriques et techniques de l'adaptation 26-27 Octobre 2018 Benguerir Maroc

Improving agricultural inputs and Land Use Efficiency is beneficial both for adaptation and mitigation

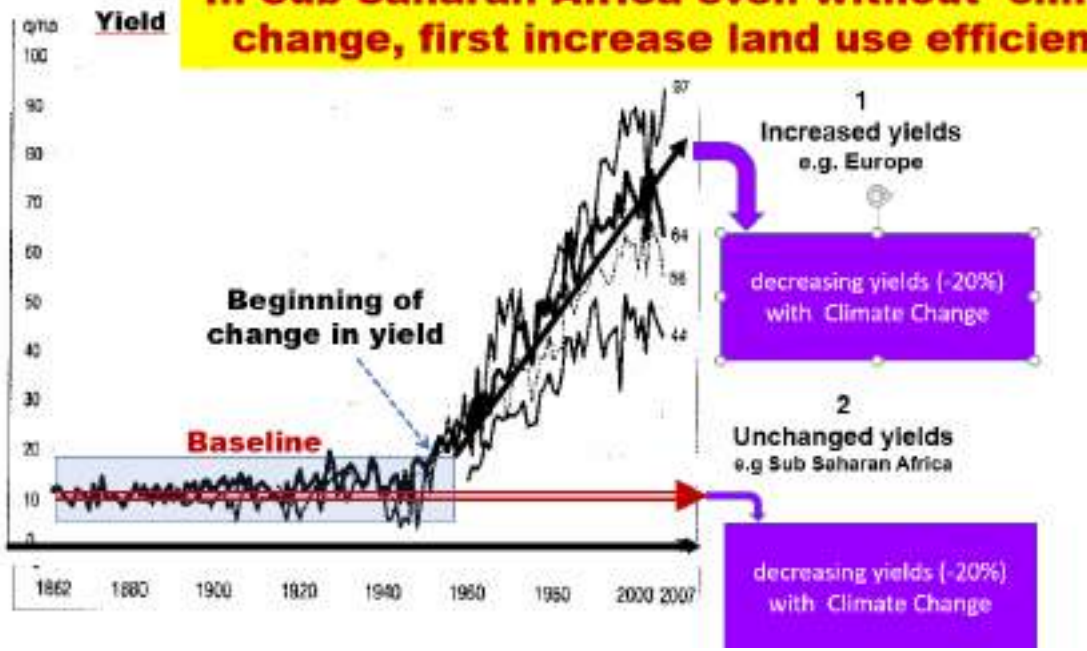
1. **Using improved seeds**
   - This is well known and is the task of research stations, seed centers and extension services
2. **Better fertilization as recommended by NEPAD in Abuja in 2006** ***Generally not properly understood***
   - *Increasing yields is good for adaptation to climate variability and to climate change*
   - *Improving "Land Use Efficiency" also avoids Land Use Change=> good for mitigation*
3. **Complementary irrigation necessary because of more erratic, lower or excessive rainfall**
   - **Reservoirs better than zaïs and half moon ditches (better control of water supply)**
   - **Good both for adaptation and mitigation (higher yields, less land needed per capita, lower necessity to migrate, less importation => less land use change => less GHG emissions)**
4. **A "Solidarity Fund" to co-subsidize increasing input for Adaptation of African Agriculture**
   - ***Fertilizer inputs up to 50 kg/ha***
   - ***Improved seeds and complementary irrigation***

2/ Increasing average cereal yields in Sub Saharan Africa to adapt to climate change: not too complicated.....

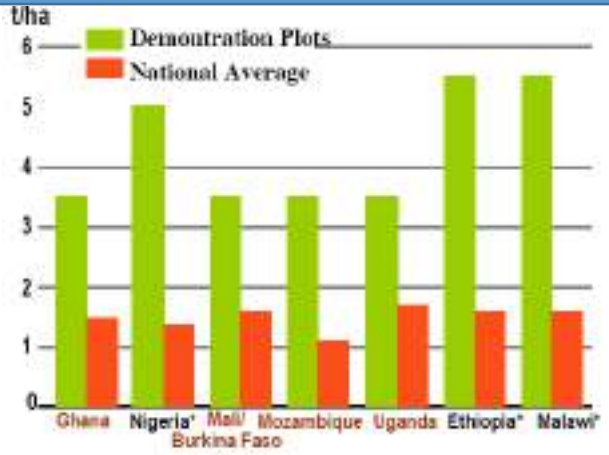
Evolution of average cereal yield in the world since 1960



In Sub-Saharan Africa even without climate change, first increase land use efficiency



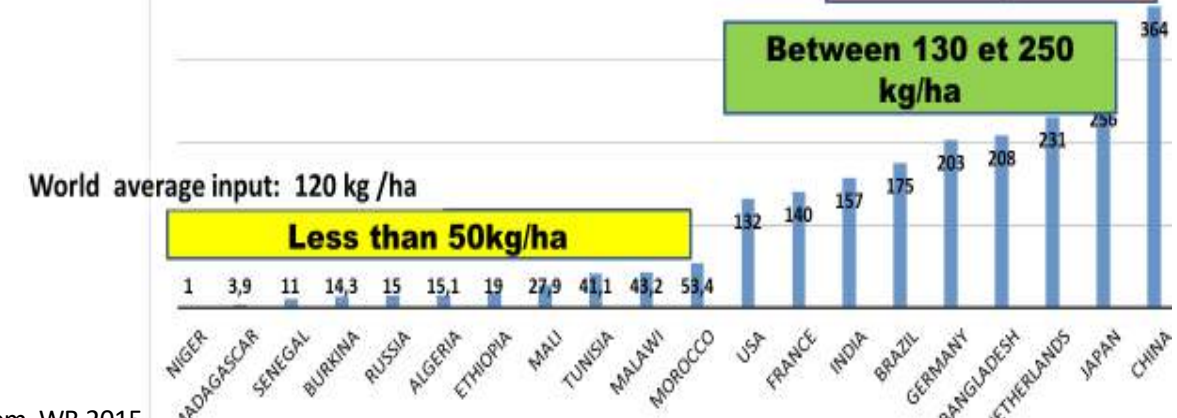
Possibility of improving maize yield in Africa with higher input IfDC



Increase fertilizer input in Africa at least up to 50 kg/ ha

NEPAD 2006

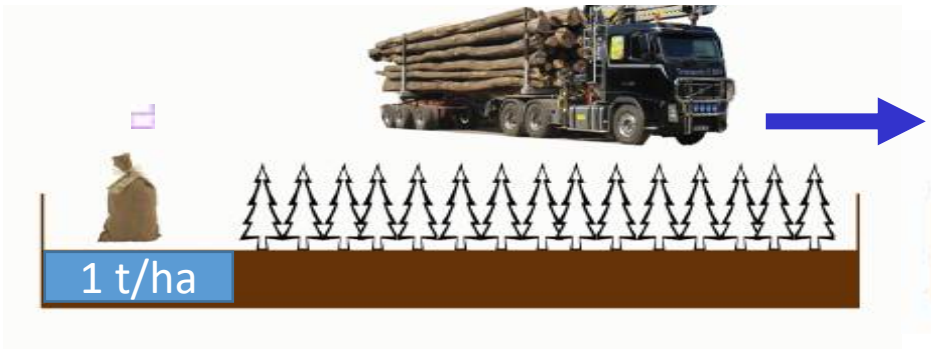
China
often too much nitrogen => unnecessary N_2O emissions and nitrate leakage

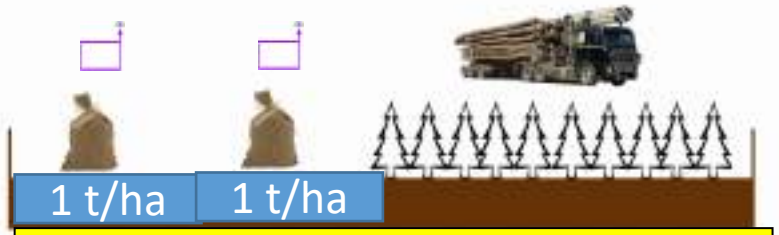


In 2012 data from WB 2015

To double crop production : doubling cropland area or yield ?

from i to j





(j) : Increasing cropland area

from i à k

0,15 tCO2/ha/an

100 kg
de 10-20-20

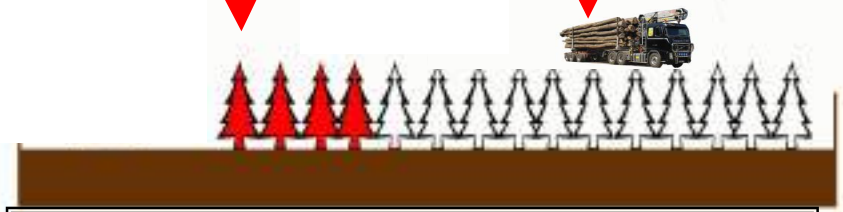
(k) Increasing land use efficiency

Land use change j/k : 1 ha

~ 300 tCO2/ha for forestland

~ 90 tCO2 /ha for grassland

Decrease of annually harvestable wood or grass on 1 ha for j /k



Differences between doubling yield and doubling cropland

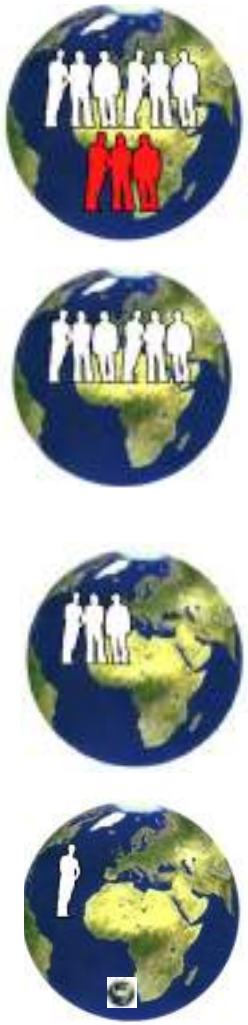
Better doubling yield => Less net GHG emissions

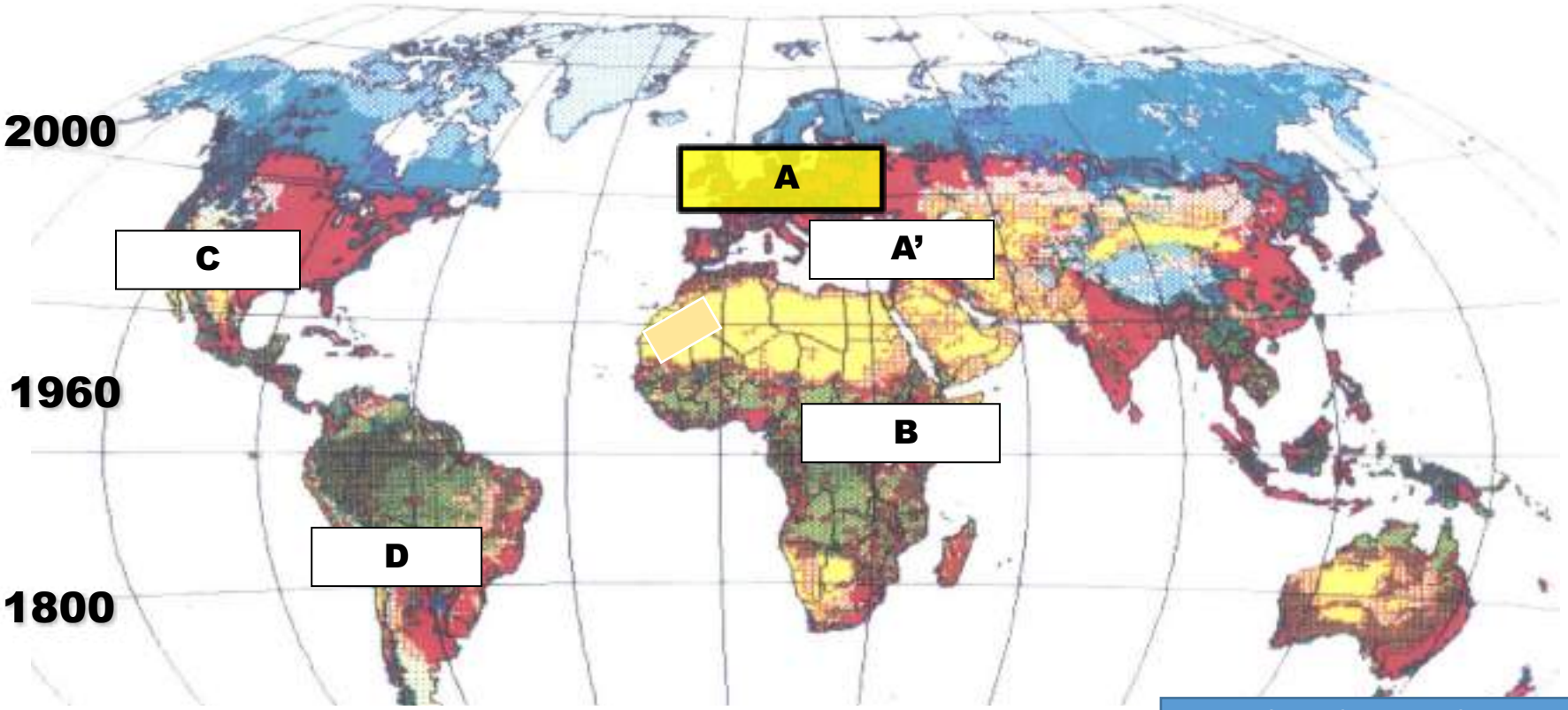
We have but one planet .....

Each additional unit of biomass (e.g. with increasing total consumption *due to population growth, oil shocks, climate change etc.)*

is to be produced in one (A) or several places (A and A', B,C,D etc.)

(with increasing land use efficiency or land use change....)





For the climate better avoid land use change

Additional cropland needed and GHG emissions per additional capita in Benin

DEFORESTATION = 0,21 ha

Conventionnal seeds, no fertilizer

Maize | **Peanut**

TI capita **= 0.21 ha**

=> 63 tCO_2 (assuming an emission of 300 tCO2/ ha deforested)
=>Net GHG : 1,26 tCO_2 /year/capita during 50 years

Improved maize seeds + fertilizer

TI capita **= 0.06 ha**

10.6 kCO_2e/year

Maize | Peanut

DEFORESTATION = 0,06 ha
⇒ 18 tCO_2 => 0,36 tCO_2/year during 50 years
⇒ Net GHG : 0,371 tCO_2/year
⇒ Avoided Emissions: 0,89 tCO_2/year/capita

AVOIDED DEFORESTATION /CONVENTIONAL = 0,15 ha

Avoided loss of annual wood production

To adapt to more erratic rainfall better harvest rainwater in ponds than in zaïs

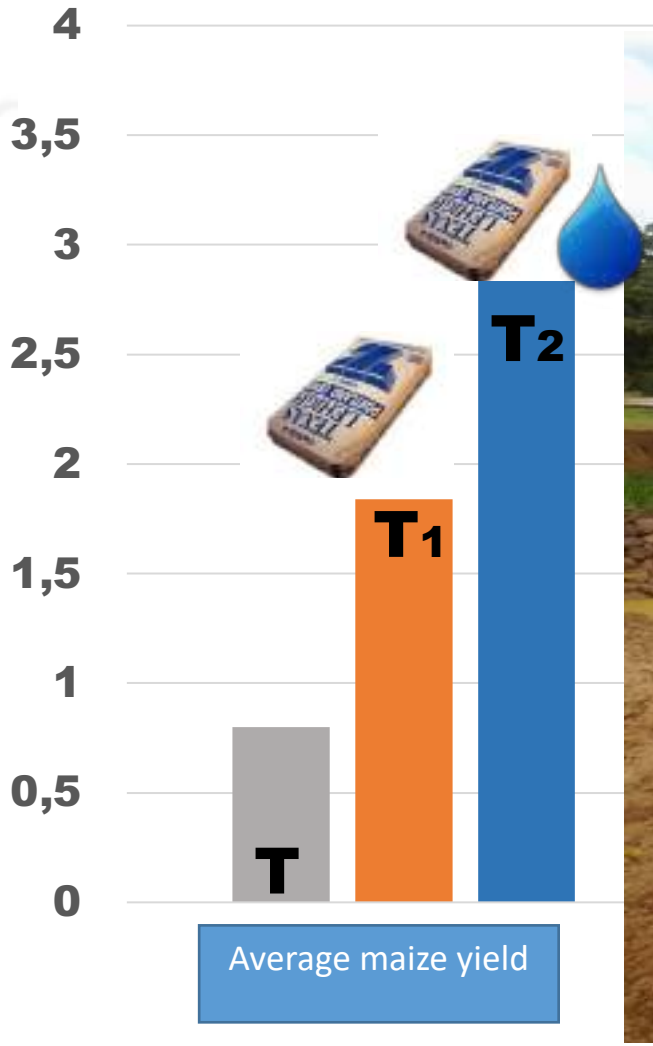
- Zaïs

Only good yield with well distributed rainfall

- Reservoirs

More regular yield, better water control
and post-season gardening

Average maize yield in t/ha, higher and more regular in North of Burkina Faso with complementary irrigation and fertilization



Control

With fertilizer but no complementary irrigation

With fertilizer and complementary irrigation

Climate and Adaptation Metrics for Agriculture

For which reasons do we need « Adaptation Metrics » ?

- *" The Paris Agreement emphasizes transparency, but does not request adaptation metrics "*(Climate Change Policy Brief GIZ)
- *" There is no standardized way to identify vulnerability at global level and global indices often come to different conclusions. The allocation of funding is ultimately a political decision and should not be based solely on a vulnerability index, since there is no objective way of measuring vulnerability"*. (Climate Change Policy Brief GIZ)

Discussion of some proposed metrics

- **Crop Yield (ton /ha) and remote sensing** (e.g. Rosenweig & Tubiello and Prabhakar & Srinivasan)
  - **Academic but not practical: At least five year averages are necessary.The annual MRV seems to be the "best" way to postpone any adaptation:**
- **Periods without a minimum amount of rainfall per couple of weeks during sensitive periods**
  - National Research station, ICRISAT, IITA etc., should publish more detailed information on that.
- **Excess of rainfall**
  - Without drainage, may lead to hypoxic condition and decrease plant growth: Site and species specific, same suggestion as above

To change farmers behavior and to adopt new policies for climate change adaptation and mitigation takes time, trust and money

Climate Adaptation & Mitigation
Metrics for Agriculture and Food Security

Suggestion

not financing, but co-financing ,
***country efforts* to establish adequate national agricultural policies**

- **Co-finance average input of fertilizer up to 50 kg per ha**
- **Co-finance complementary irrigation systems and improved seeds**
- **Co-finance *"Avoided Land Use Change"*** (conversion of grassland and forestland into cropland) **& *"Avoided GHG emissions"*** (based on average national data of carbon stocks per ha)
  - Determine land necessary to cope with possible climate change and population growth
  - **e.g. Benin: Population + 15,7 Million people between 2010 and 2050** (8.8 M in 2010, ~ 24,5 M in 2050)

  ⇒Land use change with conventional System: 3.3 Mha, with Improved System: 0.94 Mha (Avoided LUC: 2,36 Mha)

  ⇒Avoided GHG emissions with improved systems about 708 $MtCO_2$ and deforestation can be reduced or postponed during a certain number of years

DISTRIBUTION OF CASSAVA BACTERIAL BLIGHT (CBB) IN THE VEGETATIVE ZONES OF COTE D'IVOIRE

BY

HOWELE MICHAELLE ANDREE CELESTINE TOURE,

K. J. N. Ehui, A. N. N. K. Boko, D. Traore, H. Babana and D. Kone

OUTLINE

- INTRODUCTION
- METHODOLOGY
- RESULTS AND DISCUSSION
- PROGRESS, NEEDS, CHALLENGES FOR THE MANAGEMENT OF THE DISEASE
- CONCLUSION

INTRODUCTION

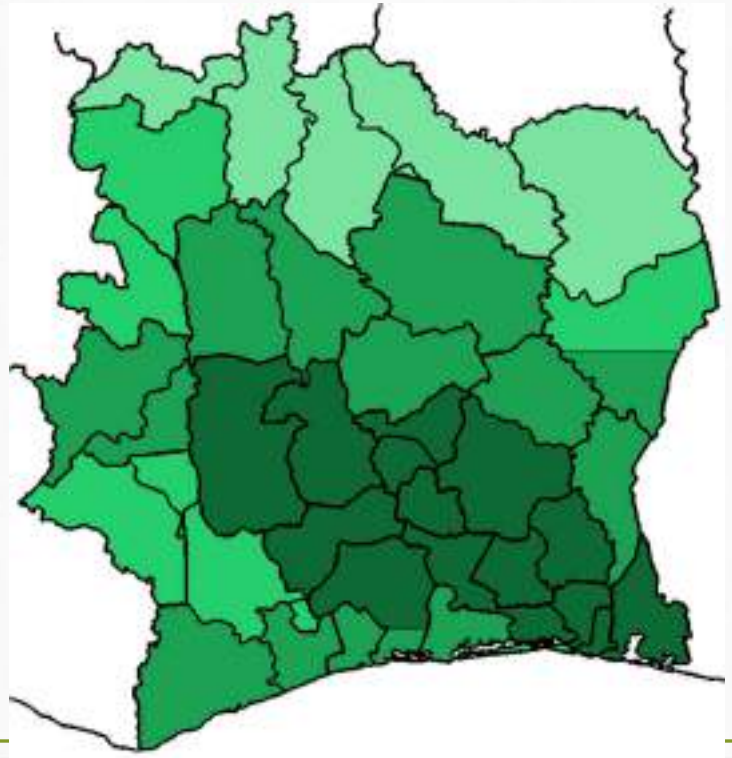
INTRODUCTION

Cassava, one of Ivorians' staple foods

Food of "drought, war and famine" (Pearce, 2007)

2d place after yam (Fao, 2016)

Production 2016: 4.54 million of tons (DPFS cited by ANA, 2017)



Very lower production zones

Lower production zones

Middle production zones

High production zones

Source: Perrin *et al*. (2015)

Cassava bacterial blight (CBB)

Major bacterial disease

Agent causal:

Xanthomonas axonopodis pv. *manihotis* (*Xam*)

Great economic losses, up to 100% of the total production (Restrepo *et al*., 2000; Mamba-Mbayi *et al*, 2014).

Reported in the North-Western part of Cote d'Ivoire in 1979, a lot of damages (Aïdara, 1984)

CBB, threat for cassava producers, importance current distribution following

METHODOLOGY

METHODOLOGY

Surveys in 2017, rainy season

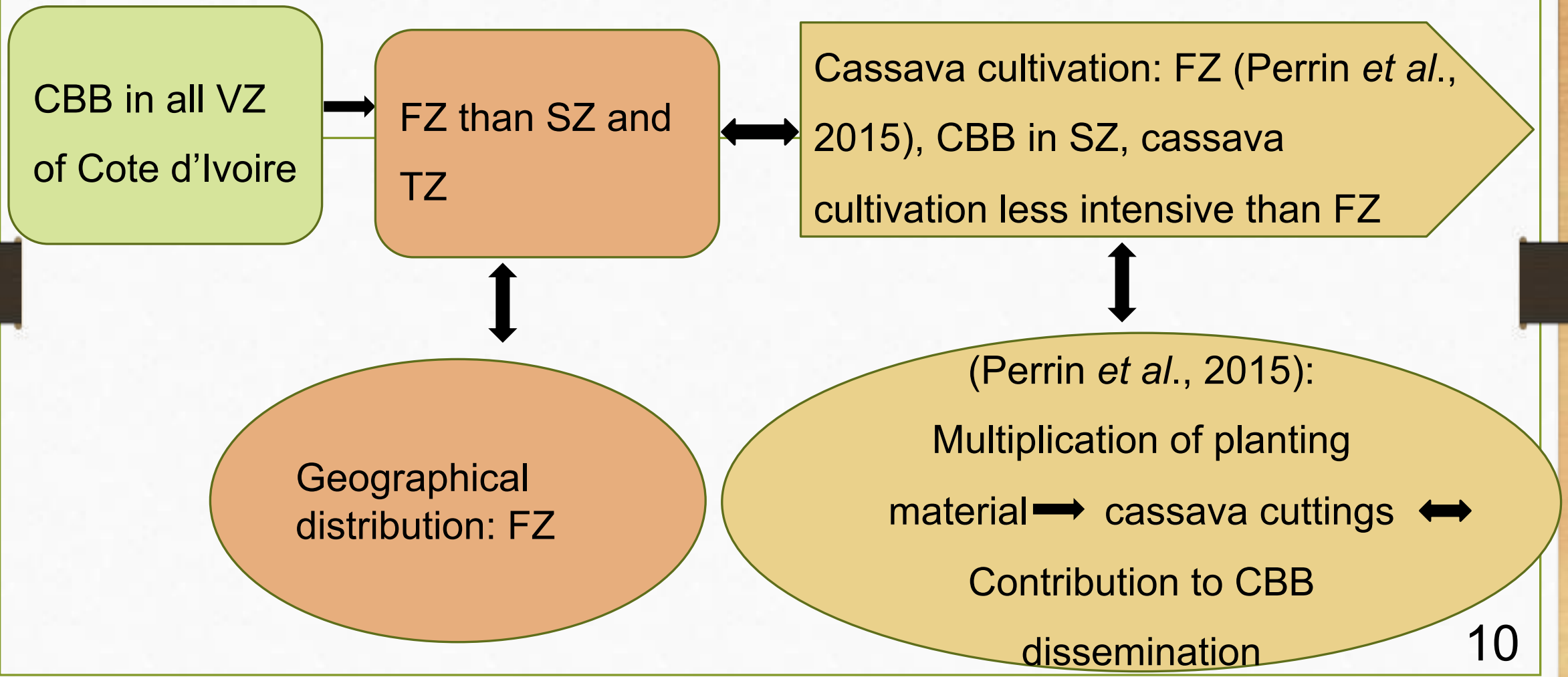
Different cassava producing areas of Cote d'Ivoire

Figure 1: Vegetative zones of Cote d'Ivoire

Three major agroecological zones (FAO, 2005): Forest Zone (FZ), Transition Zone (TZ) and Savannah Zone (SZ)

RESULTS

RESULTS AND DISCUSSION: GEOGRAPHICAL DISTRIBUTION



RESULSTS AND DISCUSSION: CAUSES OF DISEASE MANIFESTATION

Forest reduction, High relative humidity constancy, lower temeratures ➞ Expression of CBB

Banito *et al*. (2007, 2008): Degration of forest cover, heavy rains, relative humidity, variation of daily time and night time temperatures ➞ Development of CBB

Banito *et al*. (2007): Appearance of new strains ➞ Overcome unfavourable climatic conditions

Raquel et *al*. (2008): Interactions host-pathogen-environment

Terry (1976) and Fanou (1999): Establishment of relationship climatic factor and CBB development in Forest Region

PROGRESS, NEEDS, CHALLENGES FOR THE MANAGEMENT OF THE DISEASE

- Establishment of disease distribution through sanitary maps
- Evolution of the disease according to climatic parameters
- Cassava varieties screening under fields and greenhouse conditions
- Critical zones
- Use of biopesticide (NECO) for the fight against CBB (Affery *et al*., 2016)

⬇

- More knowlegde and equipment for early disease detection, modeling of climate change on CBB evolution ➡ relationship CBB - Cassava cultivation
- Tolerant varieties to CBB in VZ, diffusion of these varieties to producers, strong decrease of CBB effect through biopesticides: despite the changes in climate

CONCLUSION

CONCLUSION

- Cassava bacterial blight, a reality in the VZ of Cote d'Ivoire

---

- Present in the high areas productions despite unfavourable environmental conditions
- Constitutes a threat for cassava producers ➡ consumers
- Fight undertaken but many needs and challenges