



Drought monitoring and early warning in the Sahel : The AGRHYMET experience



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by

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Contents

- **Introduction**
 - Background information about AGRHYMET
- **Monitoring tools and methods**
 - Seasonal forecasting
 - Early warning indicators
 - Assistance to producers
- **Difficulties**
- **Perspectives/Challenges**



Introduction

- **AGRHYMET**, a specialized institution of the **CILSS**
- **A Regional Centre in Niamey and 9 National Components**
Cape Verde, Mauritania, Senegal, The Gambia, Guinea Bissau, Mali, Burkina Faso, Niger, and Chad
- **Created in 1974 following the catastrophic droughts of the early 1970s**
- **Mission : Contribute to a sustainable food security and a rational natural resources management by :**
 - Reinforcing national capabilities (training, equipment and financial support)
 - Producing and disseminating information to **decision makers at different levels** (national authorities, cooperation partners, NGOs and producers)



Introduction

Organization

- **Multidisciplinary working groups at both regional and national level** (specialists in meteorology, hydrology, agricultural extension, crop protection, animal husbandry)
- **Diffusion of information to end-users**
 - Dekadal, monthly, seasonal and special bulletins
 - Radio and television broadcast
 - Web
 - RANET
- **Capacity building through regional and in-country training workshops**



Monitoring tools and methods

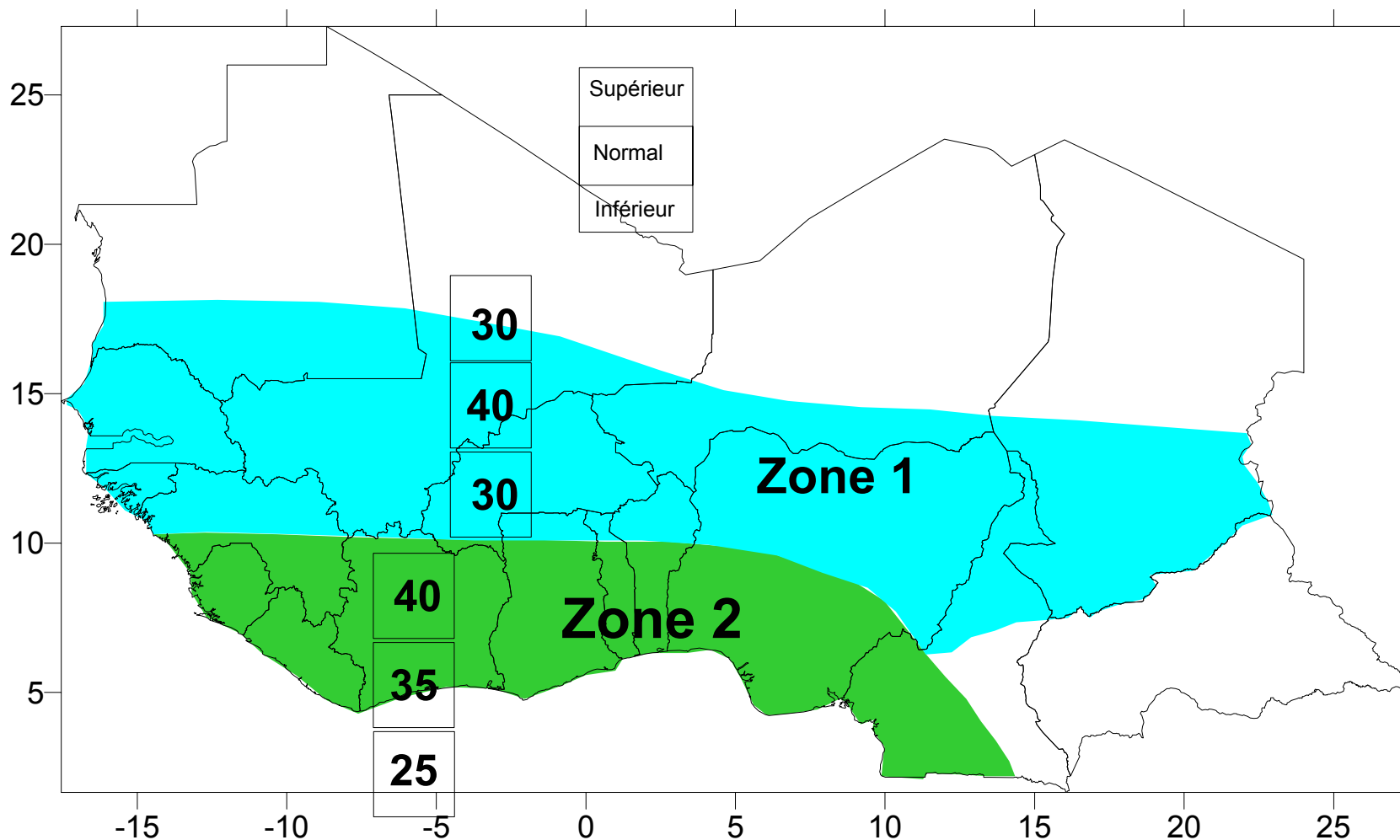
- **Seasonal Forecasting**
- **Early warning : dekadal, monthly and special bulletins**
 - **Rainfall analysis**
 - **Start of the season**
 - **Surface waters**
 - **Crop water requirements satisfaction and yield forecasting**
 - **Crop pests and diseases**
 - **Status of natural vegetation and biomass yield estimation**
 - **Risk zones**
- **Assistance to producers**
 - **Advices on sowing dates and crop management**
 - **Locating good pastures**



Seasonal Forecasting (PRESAO)

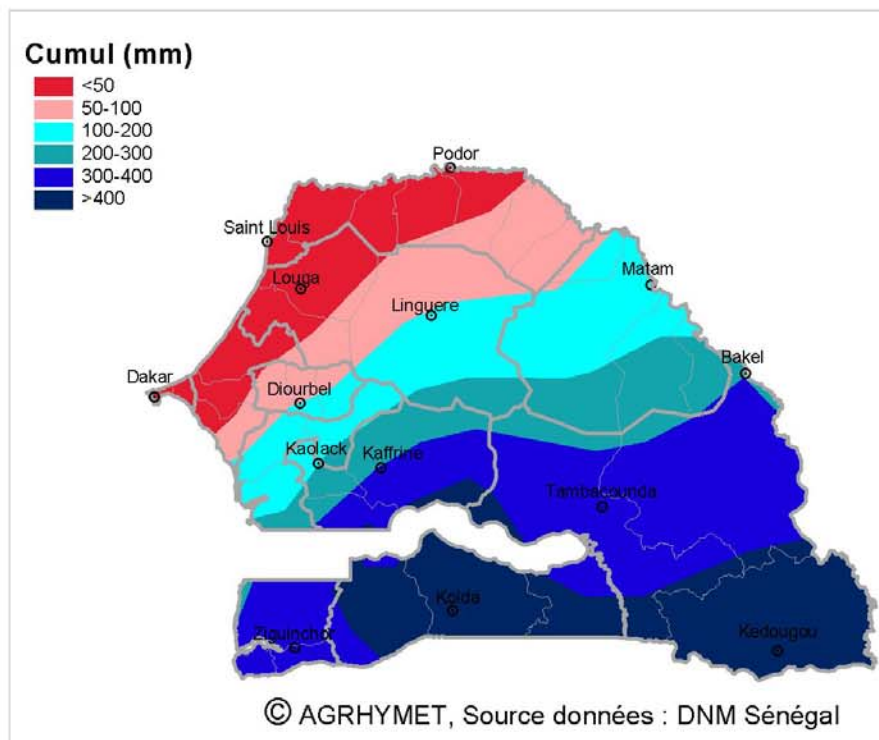
AGRHYMET-ACMAD-ABN consortium

- Forecasts, in May, of
 - the July-August-September rainfall : www.acmad.ne
 - the maximum river flows in West Africa
- Updates at the end of July



Rainfall analysis

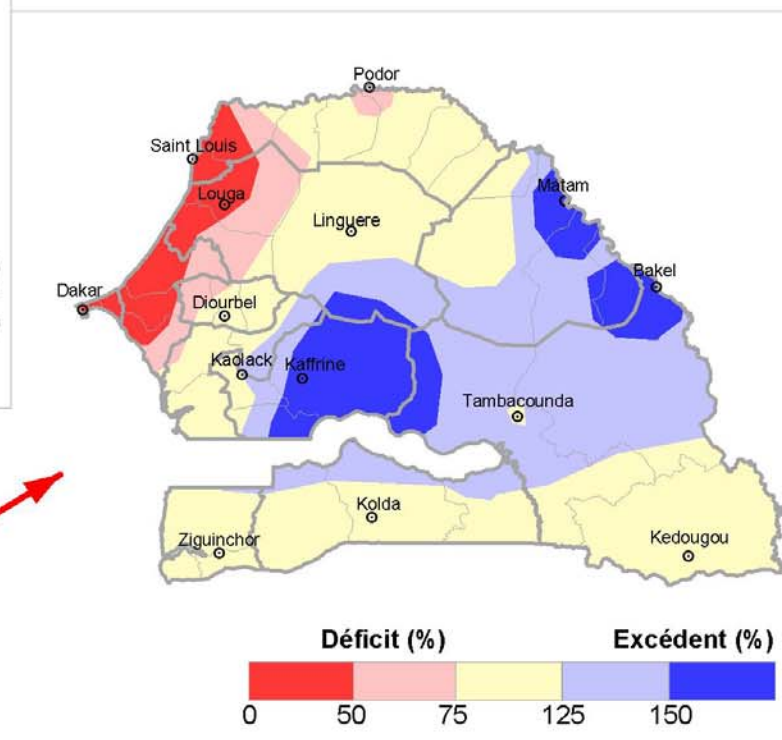
Cumul pluviométrique du 1er mai au 31 juillet 2004



Répartition spatiale très hétérogène. Cumuls variant de moins de 50 mm dans l'Ouest des régions de Saint-Louis, Louga et Thiès à plus de 400 mm au sud de celles de Kaolack, Tambacounda et Kolda.



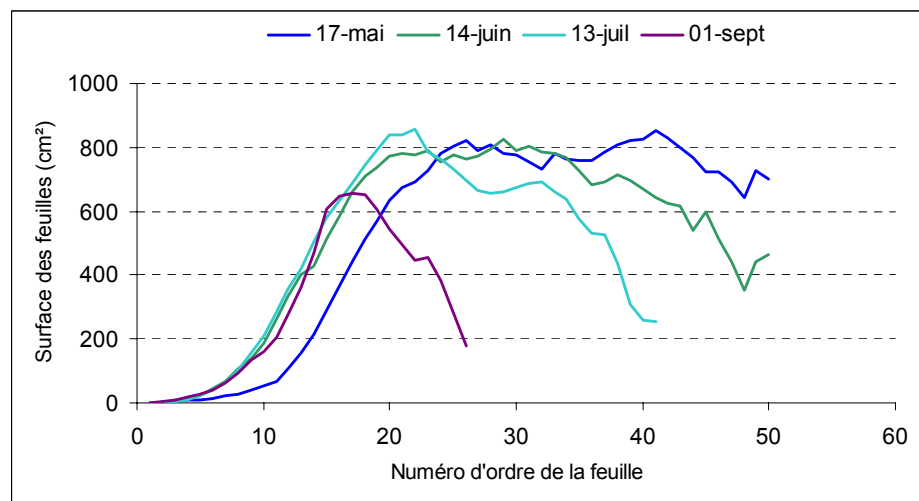
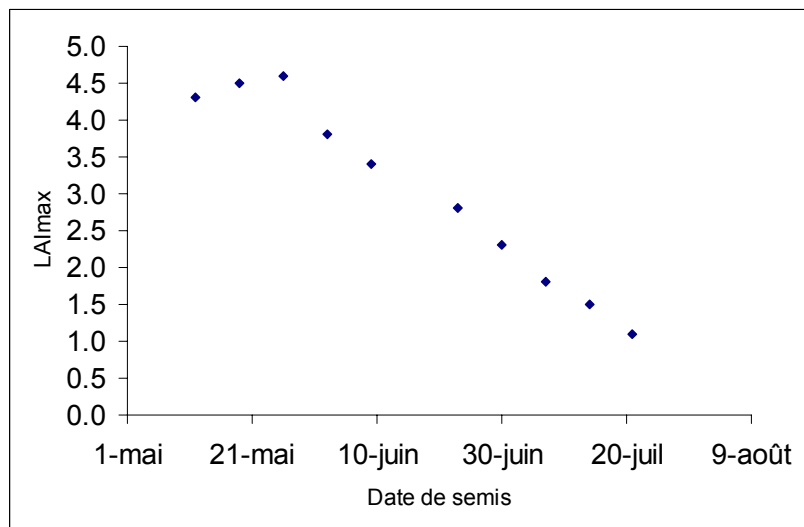
Comparaison du cumul au 31 juillet 2004 par rapport à la moyenne 1971-2000



Cumuls pluviométriques normaux au sud et dans le bassin arachidier, excédentaires dans le département de Kaffrine et l'est des régions de Matam et de Tambacounda, et déficitaires dans le nord-ouest du pays.

The start of the season

- **The first and most important early warning indicator**
 - A late start usually means a short season and vice versa (Sivakumar 1988)
 - A short season means a low production potential for the main cereal crops (millet and sorghum) (Kassam and Andrews 1975)





The start of the season

- **DHC model crop water balance simulation**
 - **uses** daily or dekadal rainfall, PET and soil water holding capacity above the wilting point
 - threshold of available soil moisture (10 mm in the top 20 cm layer)
 - threshold of crop water requirements satisfaction (>50% in the next 20 days after the start)
 - **calculates** the “first” and the “successful” sowing dates
- **ZAR model**
 - **uses** dekadal rainfall, average starting and ending dates, starting date of the previous year
 - threshold of rainfall (20 mm in 3 days)
 - threshold of dry spell (no more than 20 days in the next 30 days after the start)
 - **calculates** the “successful” sowing dates and compares them with the average and the previous year
 - **determines** areas of failed sowings
 - **calculates** the potential duration of the season

Sowing dates in 2004

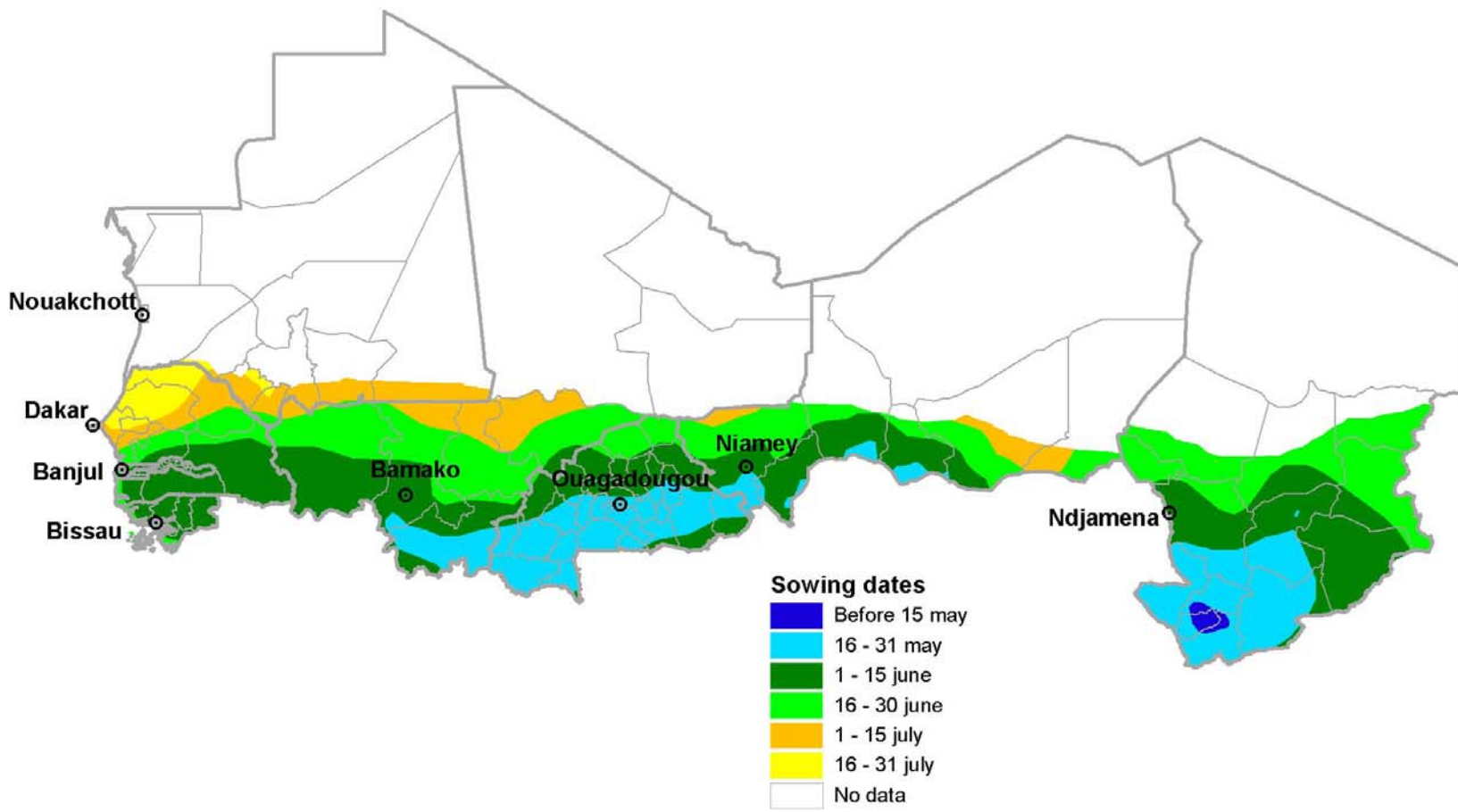
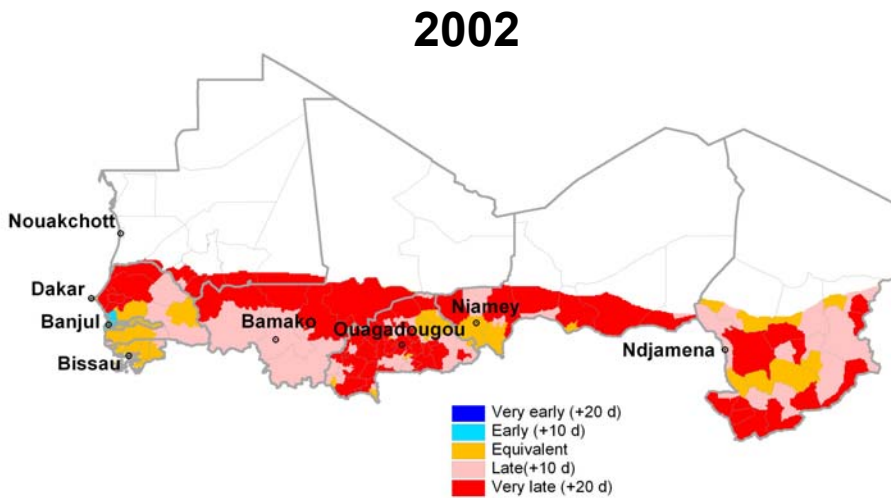
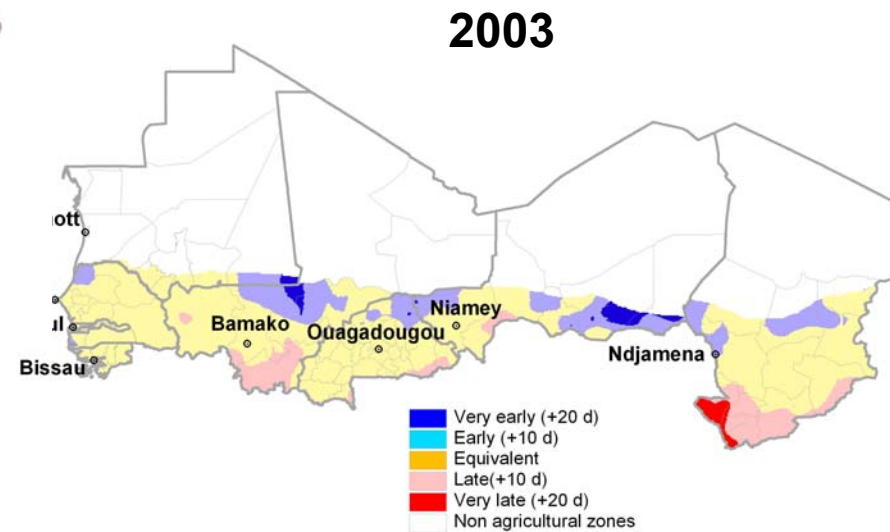
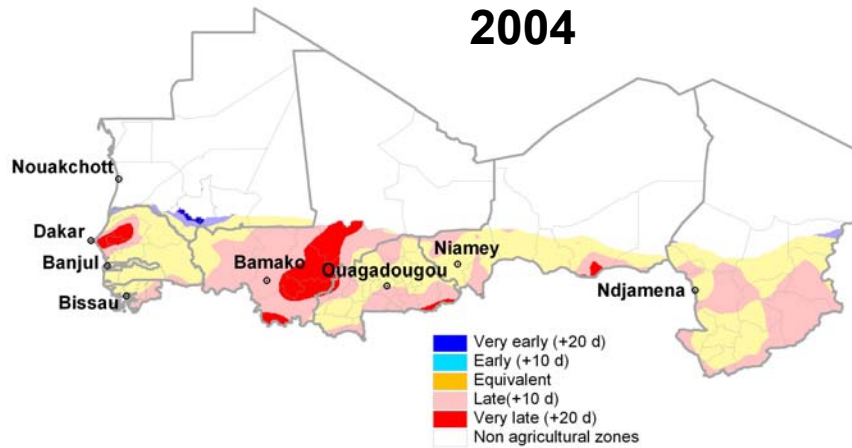


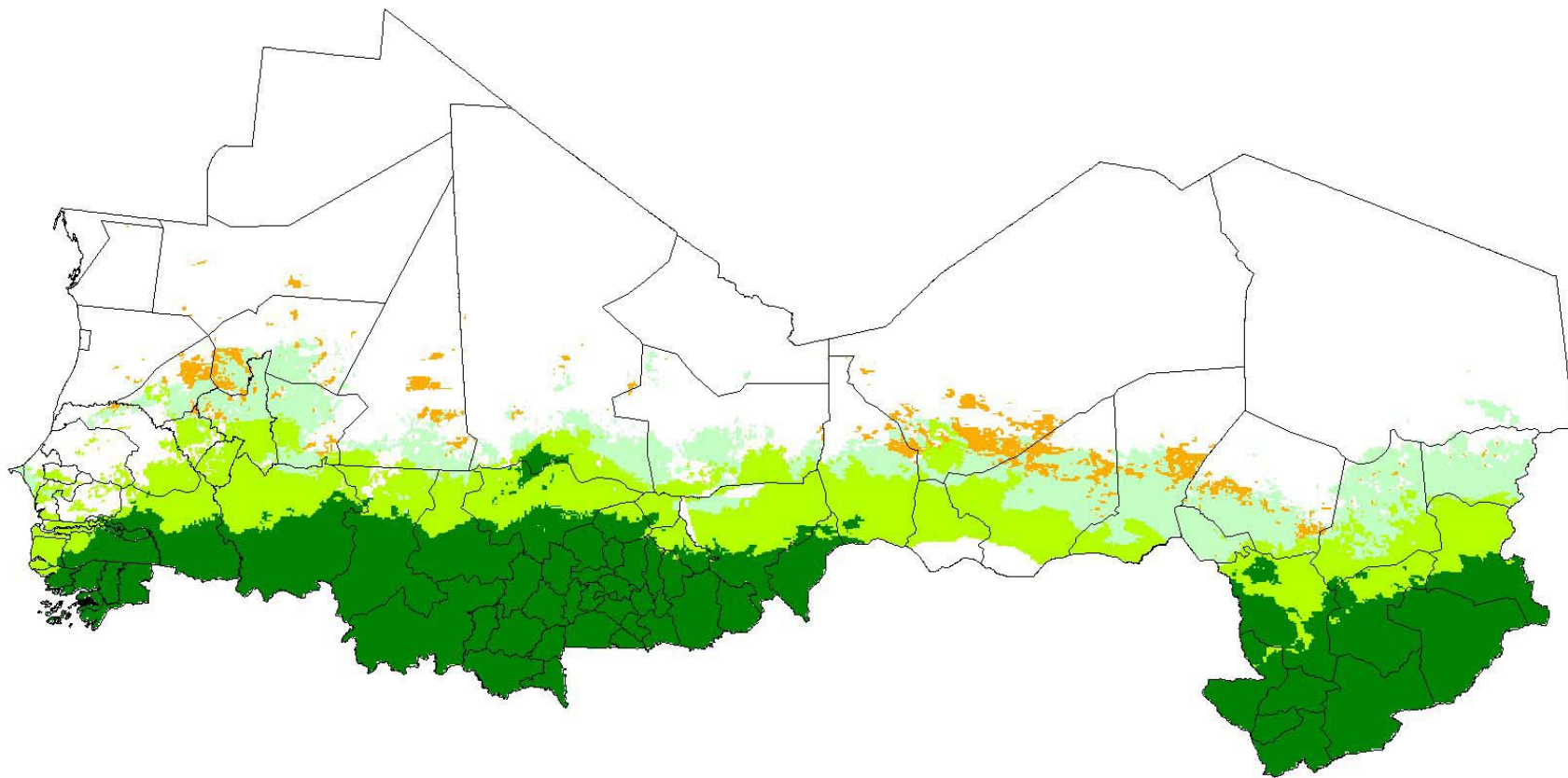
Figure 4.1 : Sowing dates as at 31st july 2004



Sowing dates



Estimated duration of the season / 31 juil. 2003



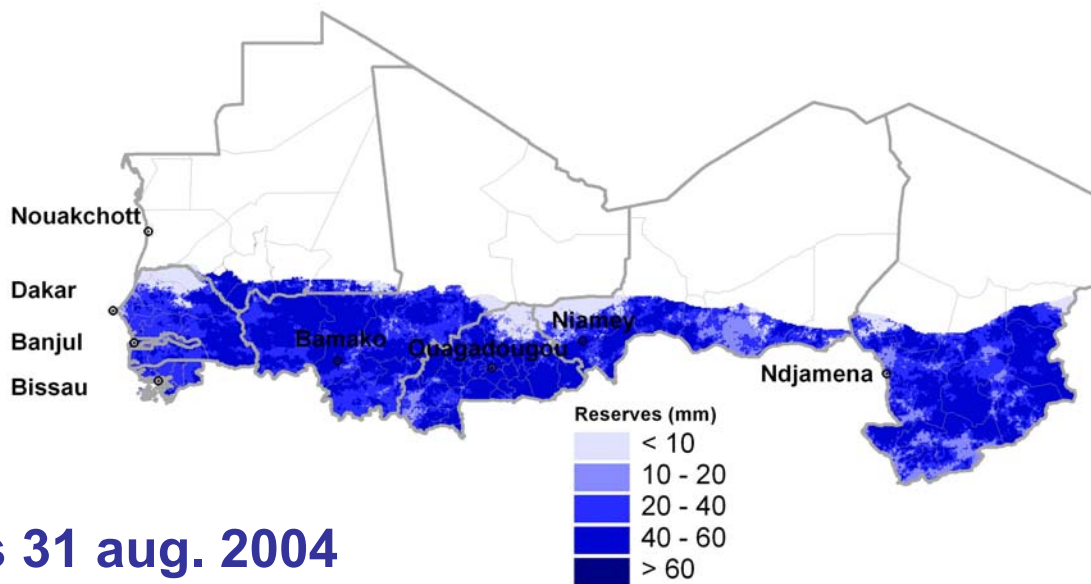
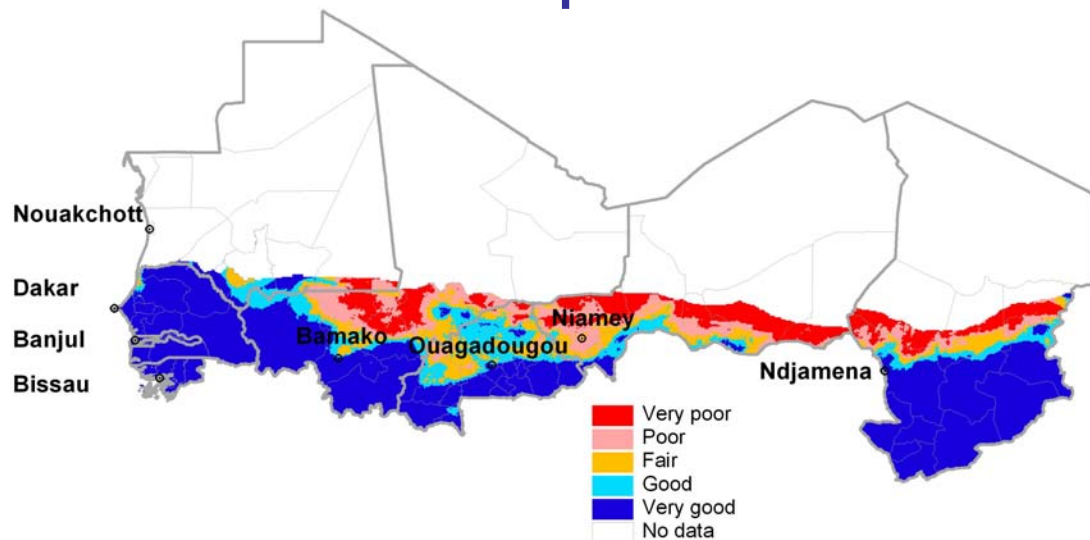
Longueur de saison
50 - 70 jours
70 - 90 "
90 - 120 "
> 120 "

0 500 1000 Kilometers

A horizontal scale bar with markings at 0, 500, and 1000 kilometers.

LONGUEUR ESTIMEE DE LA SAISON 2003

Crop water satisfaction index 30 sept. 2004



Soil water reserves 31 aug. 2004

Crop yield forecasting

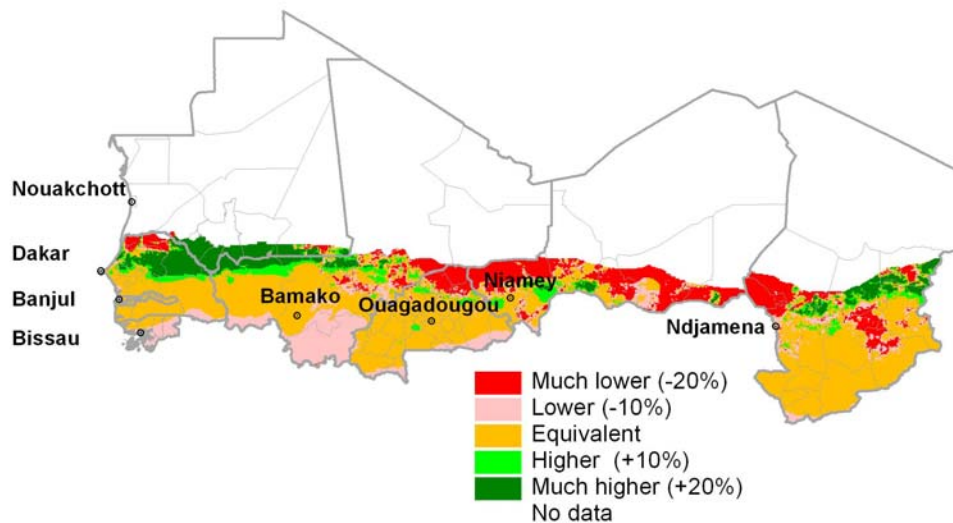


Figure 4.4. Expected pearl millet yields as at 31st A
Normal September rainfall

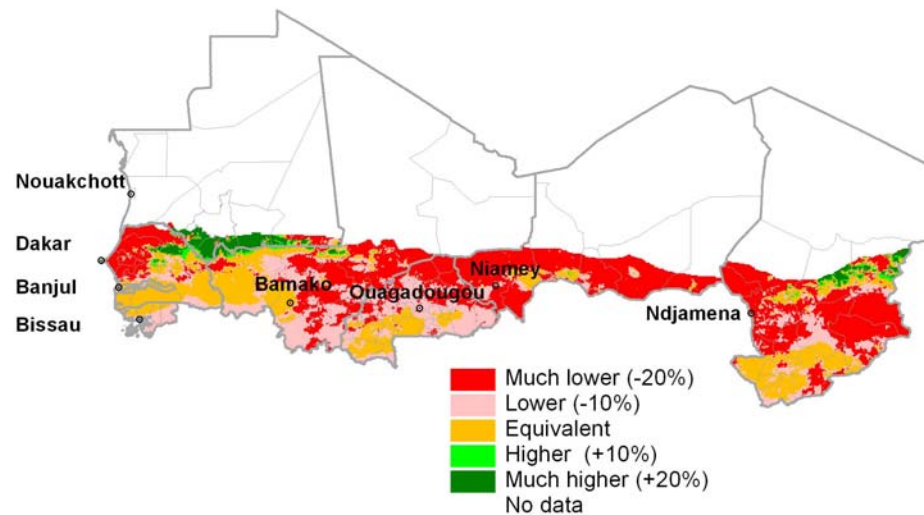
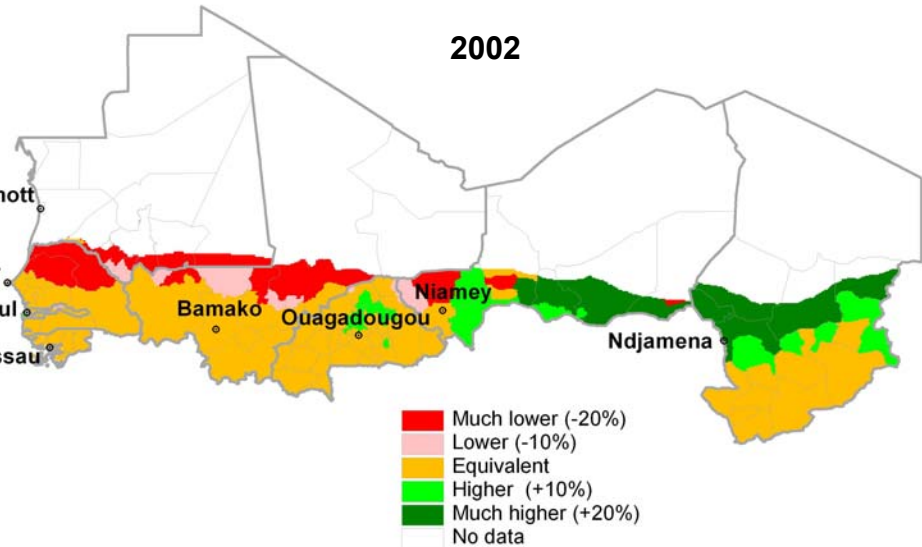
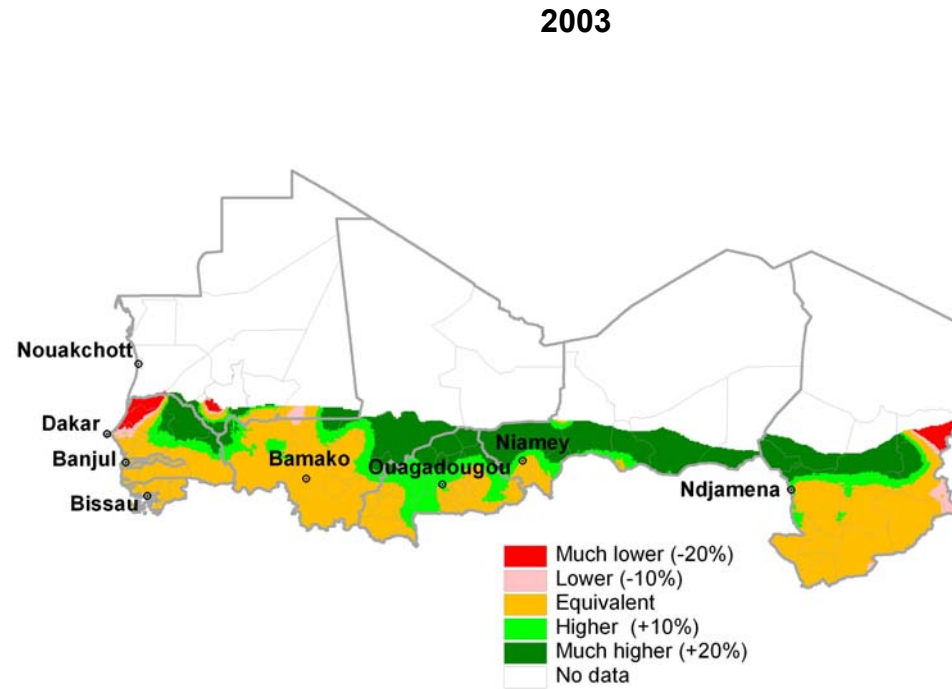
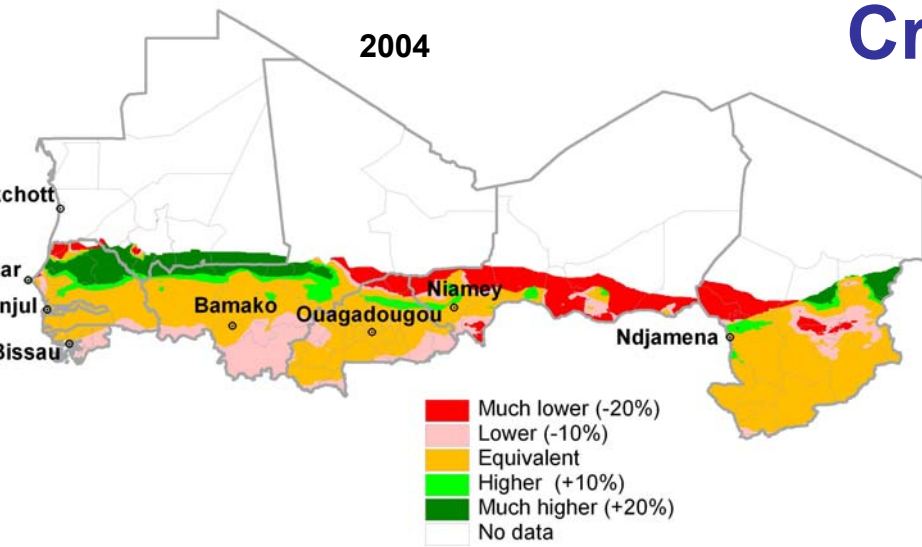


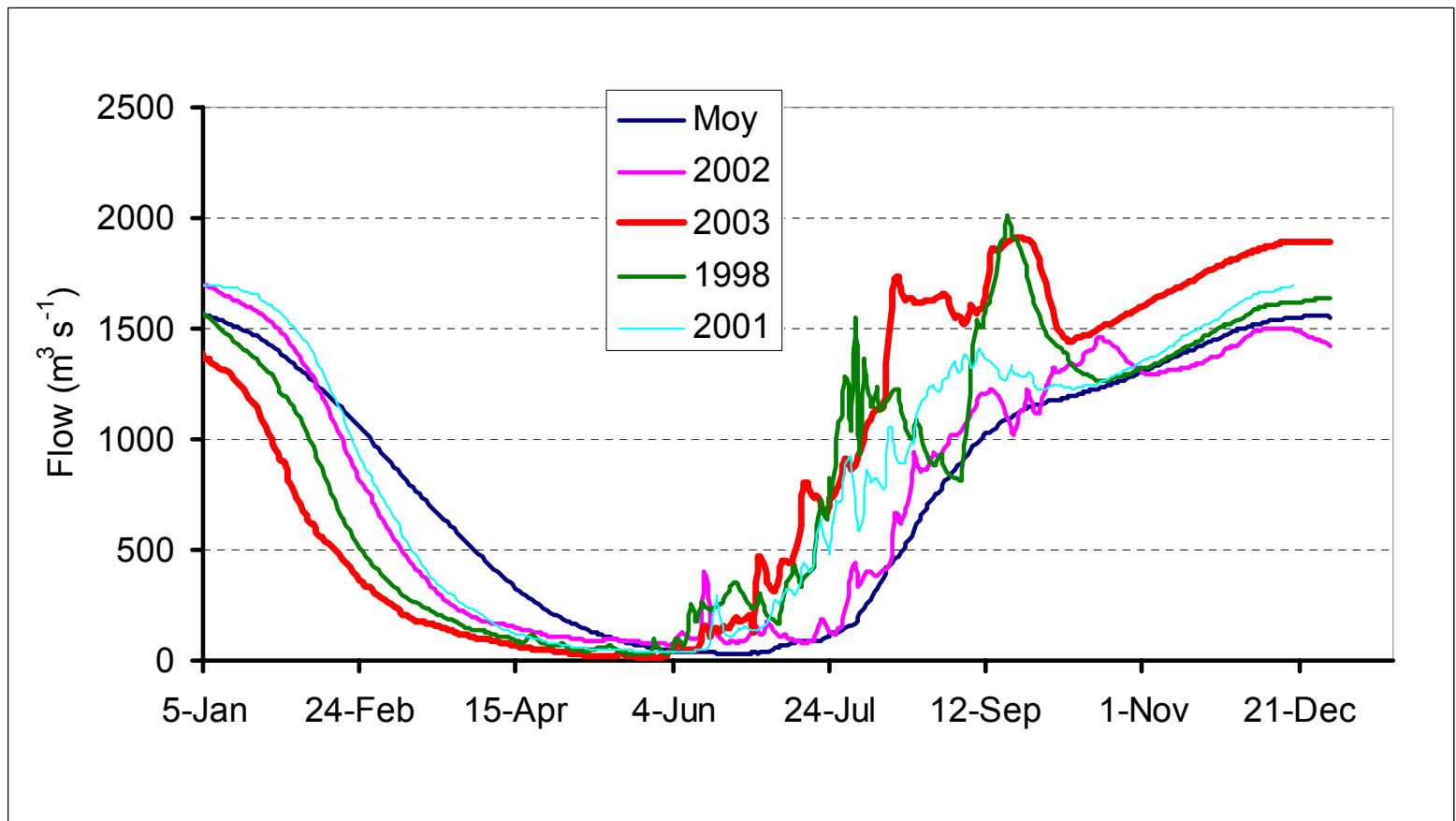
Figure 4.3. Expected pearl millet yields as at 31st August 2004
Below-normal September rainfall

Crop yield forecasting



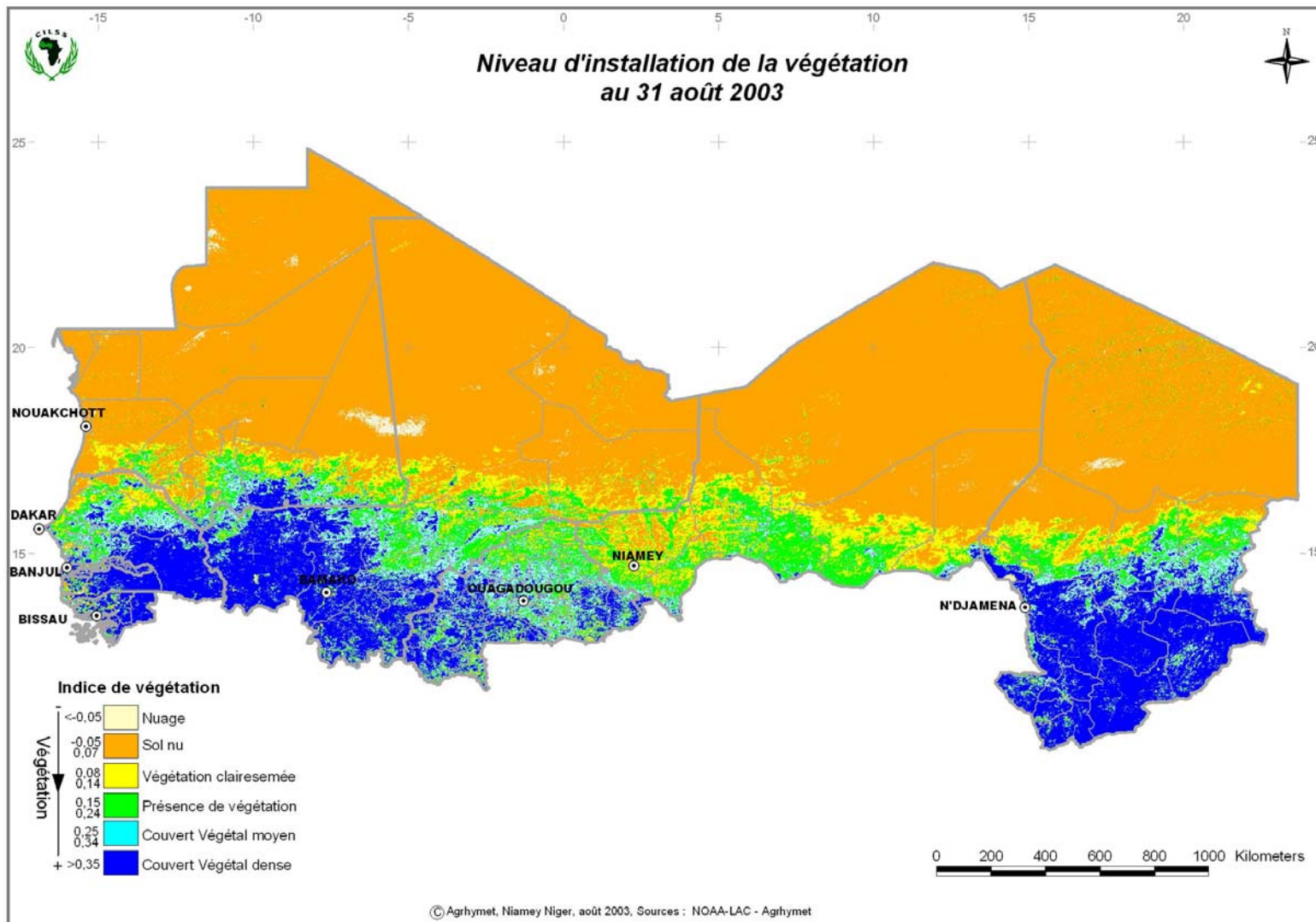
Surface waters

- Monitoring of water levels and flows at some key stations on the main rivers, lakes and pounds
- Inter annual comparisons
- Flood advisories








Natural Vegetation

- Emergence dates and growth conditions



Comparaison 2003 et moyenne 1990/2002

-  Forte régression
-  Faible régression
-  Equivalent
-  Faible progression
-  Forte progression

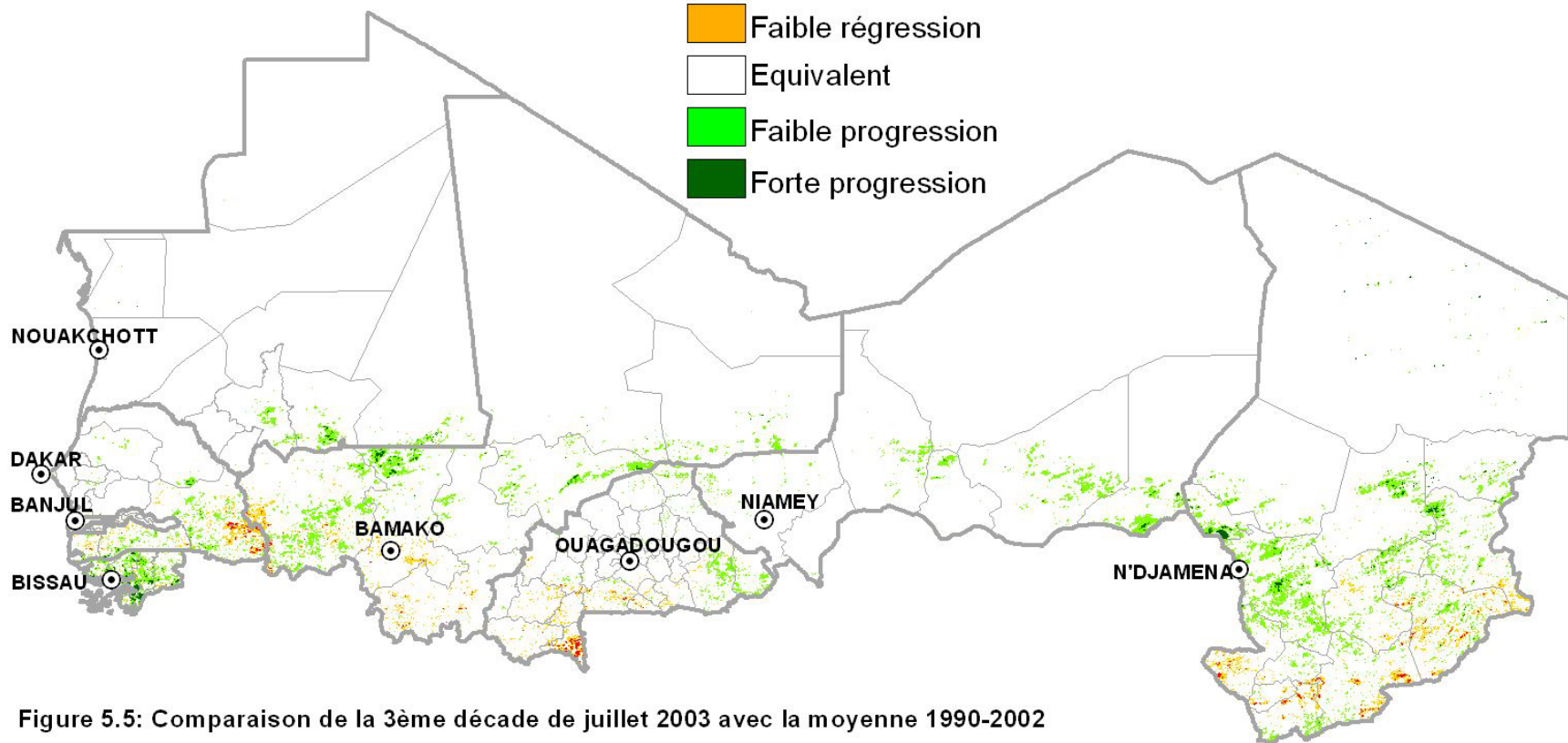


Figure 5.5: Comparaison de la 3ème décade de juillet 2003 avec la moyenne 1990-2002

© Agrhymet, Niamey Niger, juillet 2003, sources: NOAA-LAC - Agrhymet



Assistance to producers

- **Recommendations on sowing dates in Mali**
 - Starting from may, rainfall thresholds are given to farmers every dekad
 - Farmers raingauges
 - Other recommendations (weeding, fertilizer application, spraying, harvesting, etc...)
- **Assistance to herders in Niger (NGO APEL- ZP, Tahoua)**
 - Use of NDVI images to locate zones of abundant pastures
 - [Herders trained](#) in the interpretation of maps
 - Helped define new easily understandable map legends and document the maps with their known reference points (water points, valleys, etc...)
 - Initially, maps were transmitted through bus drivers
 - Later through RANET to local community radio



Difficulties

- **The AGRHYMET Centre and its national components face several problems in implementing their activities**
 - ground data acquisition in member countries (obsolete equipment),
 - their timely transmission to central offices and to ARC
 - the small number of observation points (for spatial interpolation)
 - insufficient human resources with adequate training
- **Use of satellite images**
 - Development of models that use rainfall estimates from METEOSAT images (DHC-CP, ZAR and BIOMASS) or NOAA-AVHRR images



Perspectives / Challenges

- **Feb. 2001 regional workshop on how to assist producers**
 - Extend the seasonal forecast to starting and ending dates of the season
 - Extent hydrological forecast to inundated areas
 - extend agrometeorological advices to herders, forestry, and irrigated crops
 - design information bulletins for specific users
 - promote exchange among producers, etc.
- **Extend the yield forecasting model to other crops (carbon balance),**
- **Use real time phenological observations (LAI, crop height) to force the crop model** (digitization of the form 01 data sheet)
- **Enhance the satellite rainfall estimation procedure (MSG)**



Acknowledgements

- **AGRHYMET financial and technical partners**
 - USAID, EU, French, Italian and Danish cooperation agencies
 - WMO, FAO,
 - USGS, United States
 - CIRAD, IRD, France
 - IBIMET, Italy
 - DMI, Denmark

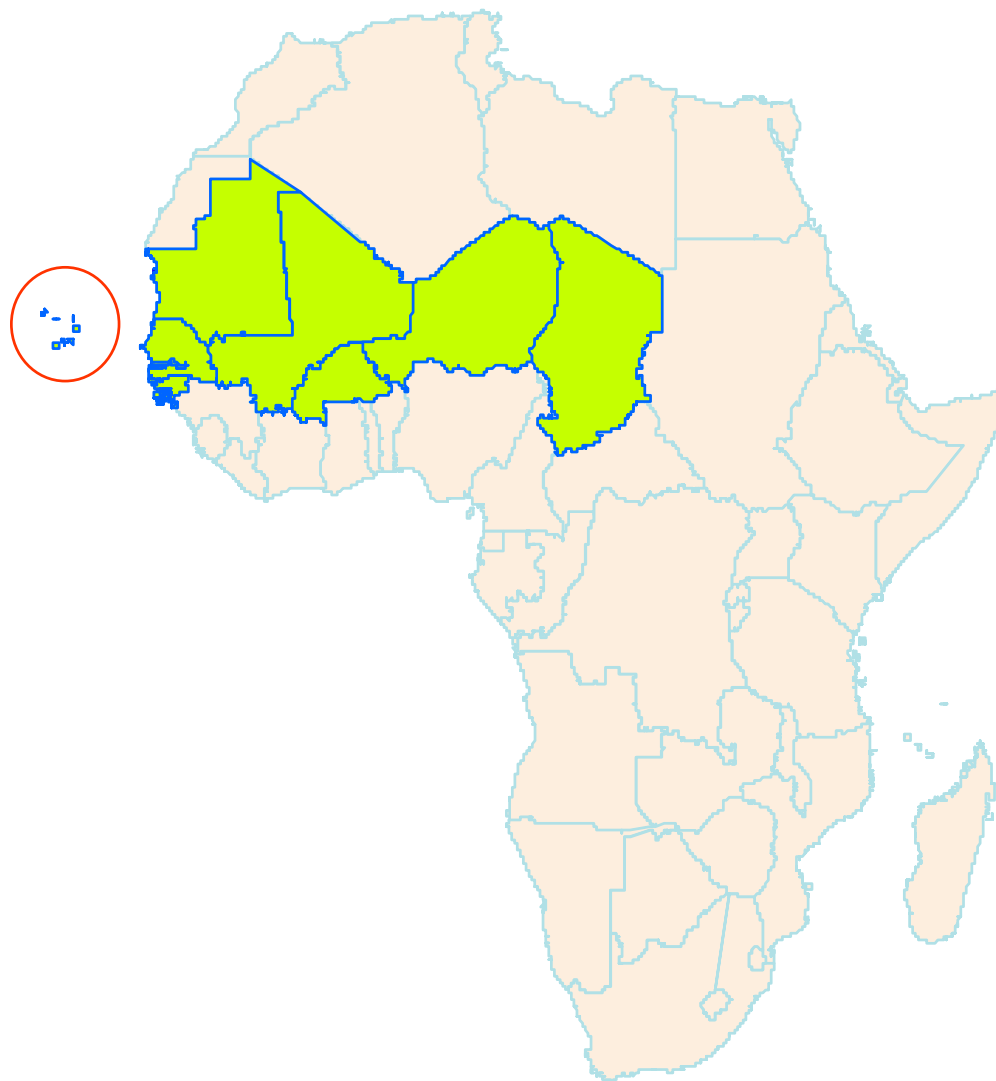


Thank you

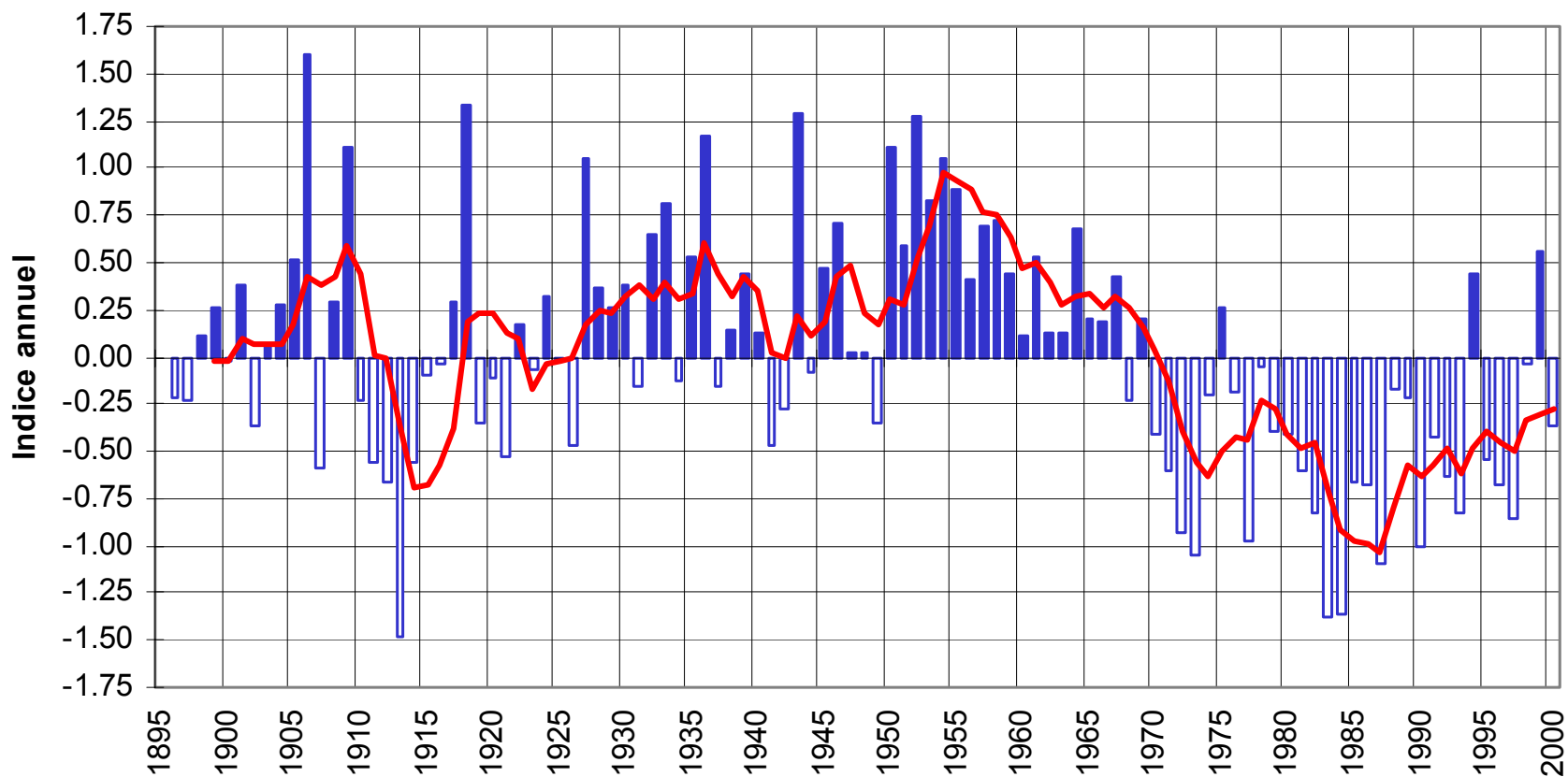
for your attention



CILSS countries

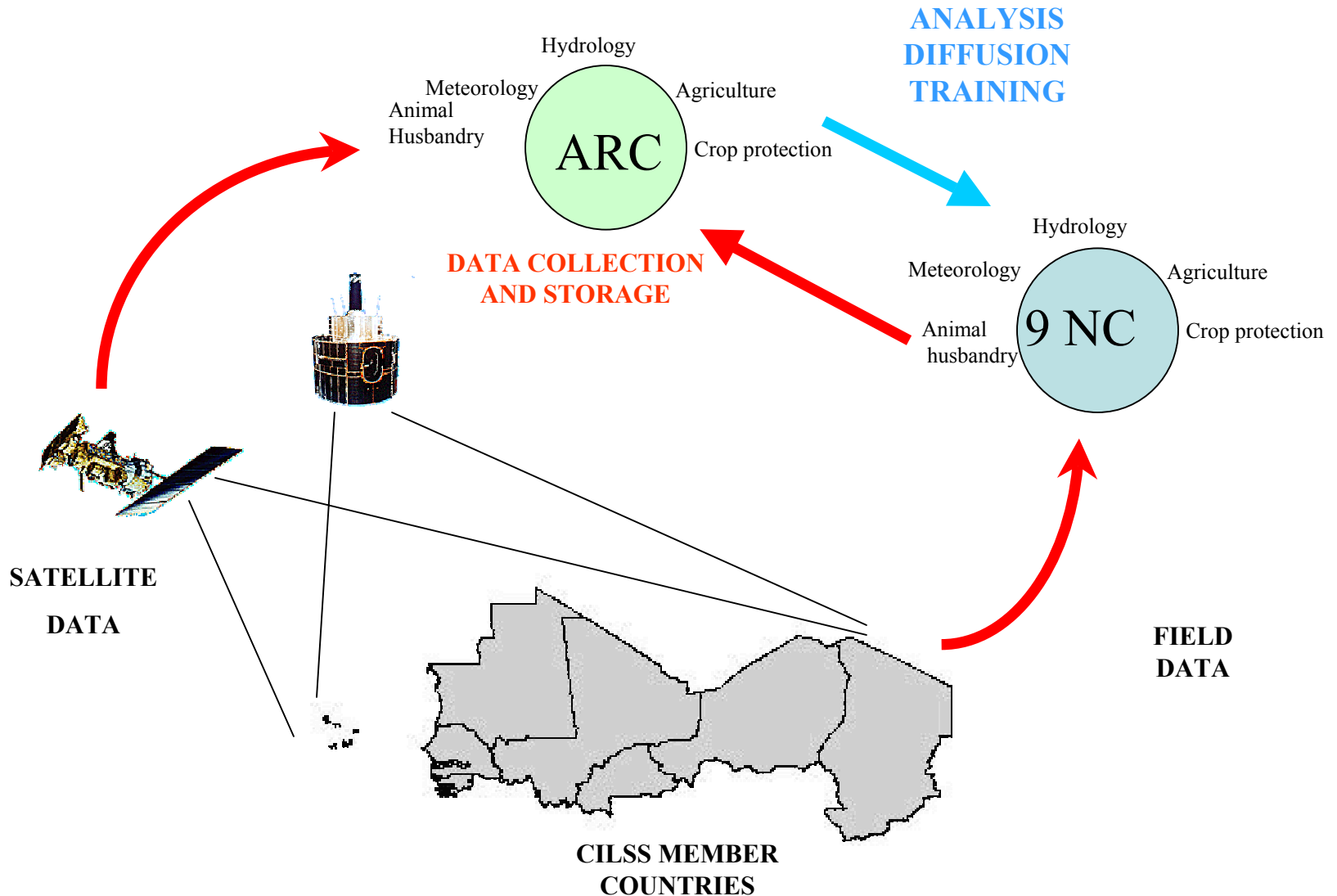


The Sahel droughts





AGRHYMET operating scheme



www.agrhymet.ne

Assistance to herders

