Kenya Agricultural & Livestock Research Organization

Use Case: KALRO Farmer Information Platform

Boniface Akuku

Director ICT-KALRO
Chairperson, CODATA
Agriculture Data, Knowledge for learning and innovation Group Task Group

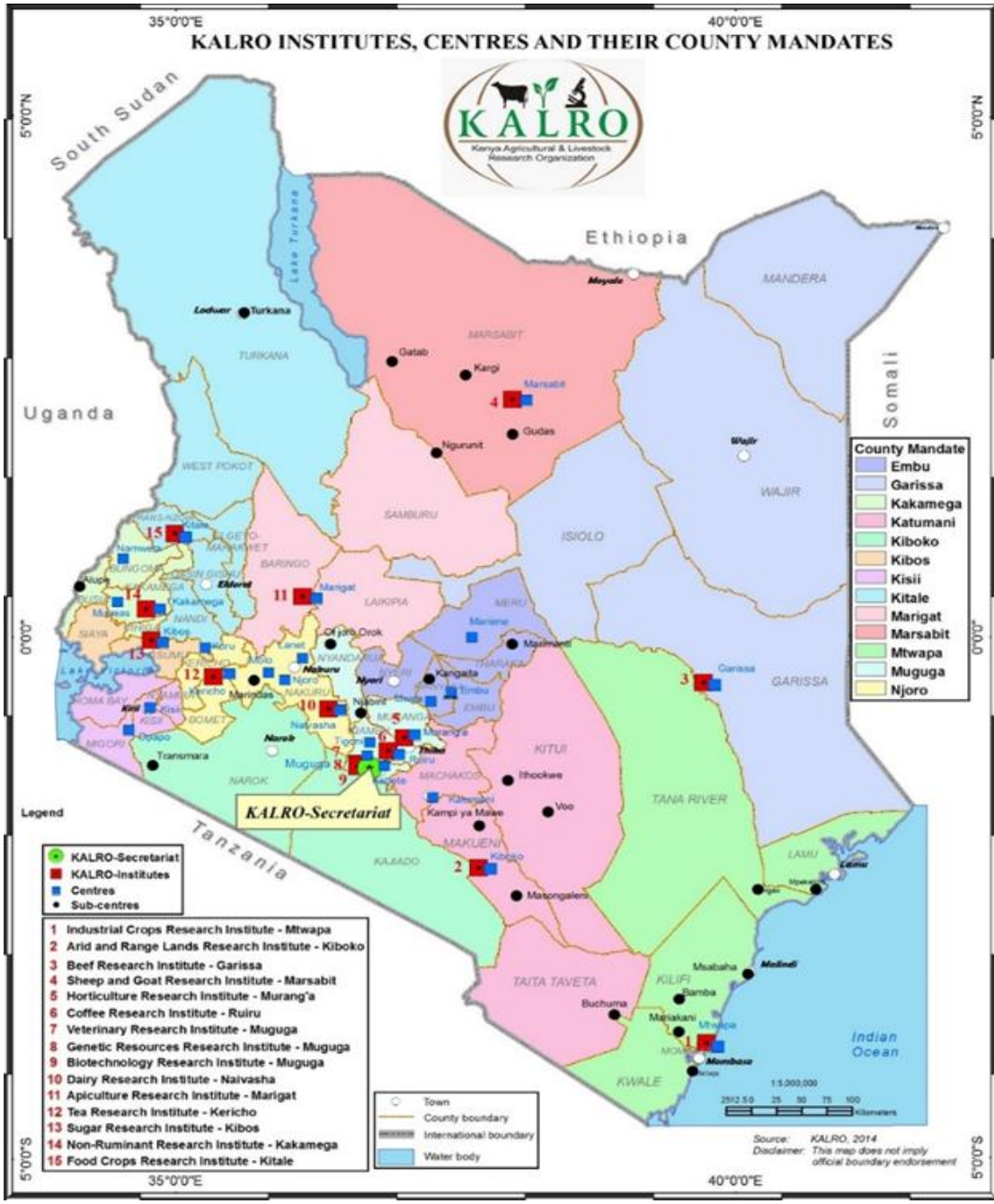
Open Data for Agriculture and Nutrition Workshop
4-5 October, 2017
Training

KALRO Institutes and Centres

KALRO has 16 Institutes, 51 Centers

Mandate

- To promote, streamline, co-ordinate and regulate agricultural research in Kenya;
- To expedite equitable access to research information, resources and technologies and promote the application of research findings in the field of agriculture



CODATA

- **CODATA: Committee on Data of the International Council for Science (ICSU)**
- Promote global collaboration to improve the availability and usability of data for all areas of research
- Supports Open research data Principle
- Advance interoperability & usability of data
- Promote intelligence open or FAIR principle on Research Data
- Promote policy, technological and cultural changes essential to make research data more widely available and more usable,
- Advance ICSU's mission of strengthening international science for the benefit of society.

Challenges facing Agricultural Research Data Management

- Majority of African farmers are not able to make sense from the agricultural data sets as generated
- Access to agricultural Research data is problematic, yet "hidden hunger afflicts 2 billion individuals globally" (FAO,2013)
- African farmers are "Agricultural research data + Knowledge deficient"
- Translating research data & information into usable forms beyond scientific publications remains a challenge
- "Data *& Knowledge loss phenomenon*"
- Shortage of Data scientists

Agricultural Research industry is undergoing a transformation to address its major challenges:

- Agricultural productivity is low and falling
- Spending on agricultural research in Africa is stagnant
- Private sector research will not fill the gap

There is a lot of focus on Agricultural Research Data to drive change.

Rapid adoption of agricultural technologies simply accelerate our current problems?

The Agricultural Research industry is at a crossroads.

How do we move Scientific Research forward?

There is need of urgent knowledge based transformation initiatives

Specific challenges facing agricultural research data management in Africa

Simply developing agricultural technologies is not enough

Most of today's agricultural research data & information environments have not adapted to the rapid global changes & demands

Information is "trapped" in paper and very little is interconnected to the rest of the Research forum ecosystem.

Data and information management strategies become outdated as new technologies are discovered

Researchers and communities are not properly prepared to integrate & incorporate new data management tools into daily life.

Standardize ICT infrastructure, simplify information sharing and reduce data management costs

Emerging socioeconomic issues facing Agriculture

>100,000 death

Hunger

1.46m IDPs & 0.8m refugees

The World Today is faced with numerous socioeconomic challenges due to emerging issues such as climate change hence the need for predictive analytics

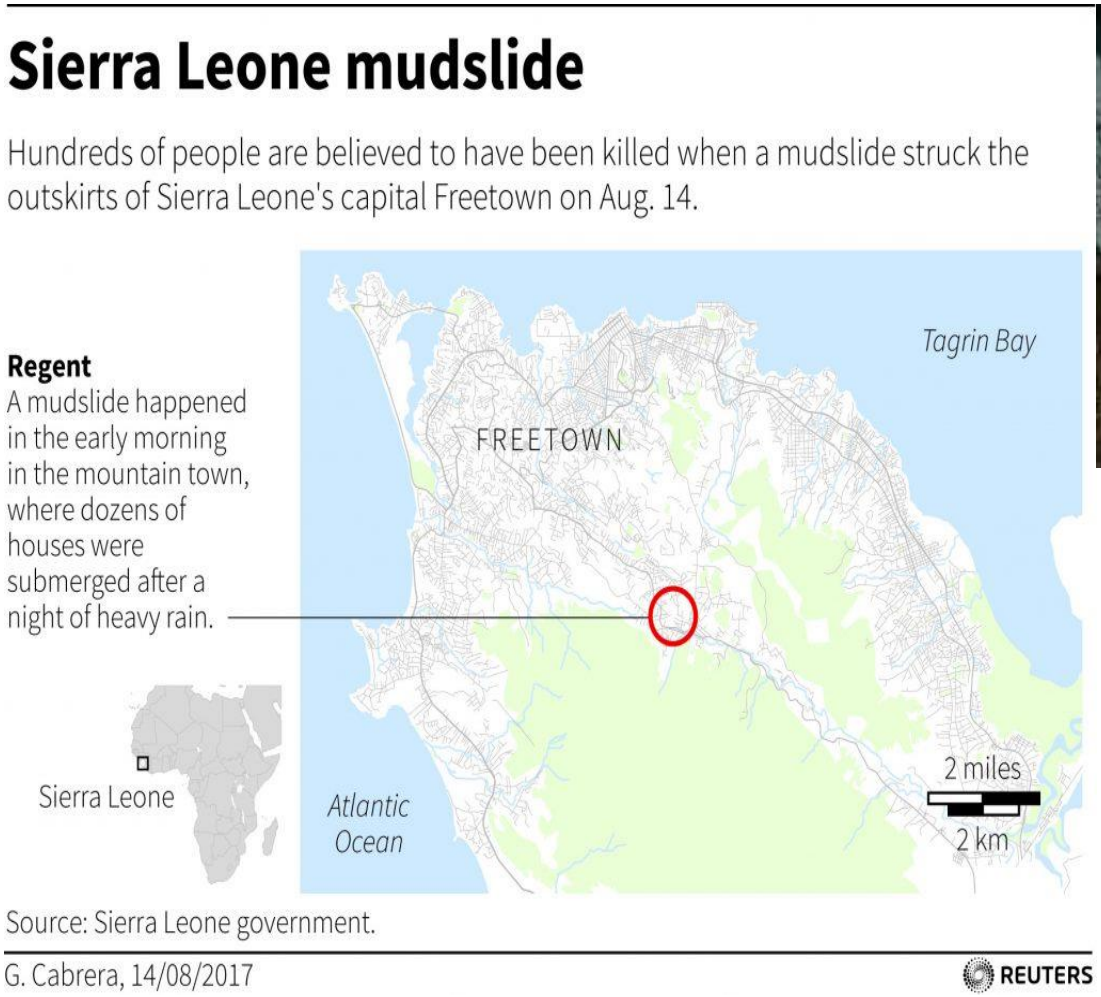
Recent successful application of Data analytics- Hurricane Irma USA

A man passes his son Skylar over to a rescue worker as they are evacuated on an airboat from their apartment complex after it was inundated with water following Hurricane Harvey on Aug. 30, 2017 in Houston

Volunteer rescuer workers help a woman from her home that was inundated with the flooding of Hurricane Harvey on Aug. 30, 2017 in Port

The person is carried to dry land by volunteer rescuers after his neighborhood was inundated with the flooding of Hurricane Harvey on Aug. 31, 2017 in Beaumont, TX

Recent cases of non- application of Data analytics- Sierra Leone mudslide and flood left more than 1,000 dead.



Kajiado, Kenya 2017- Unused data on climate prediction

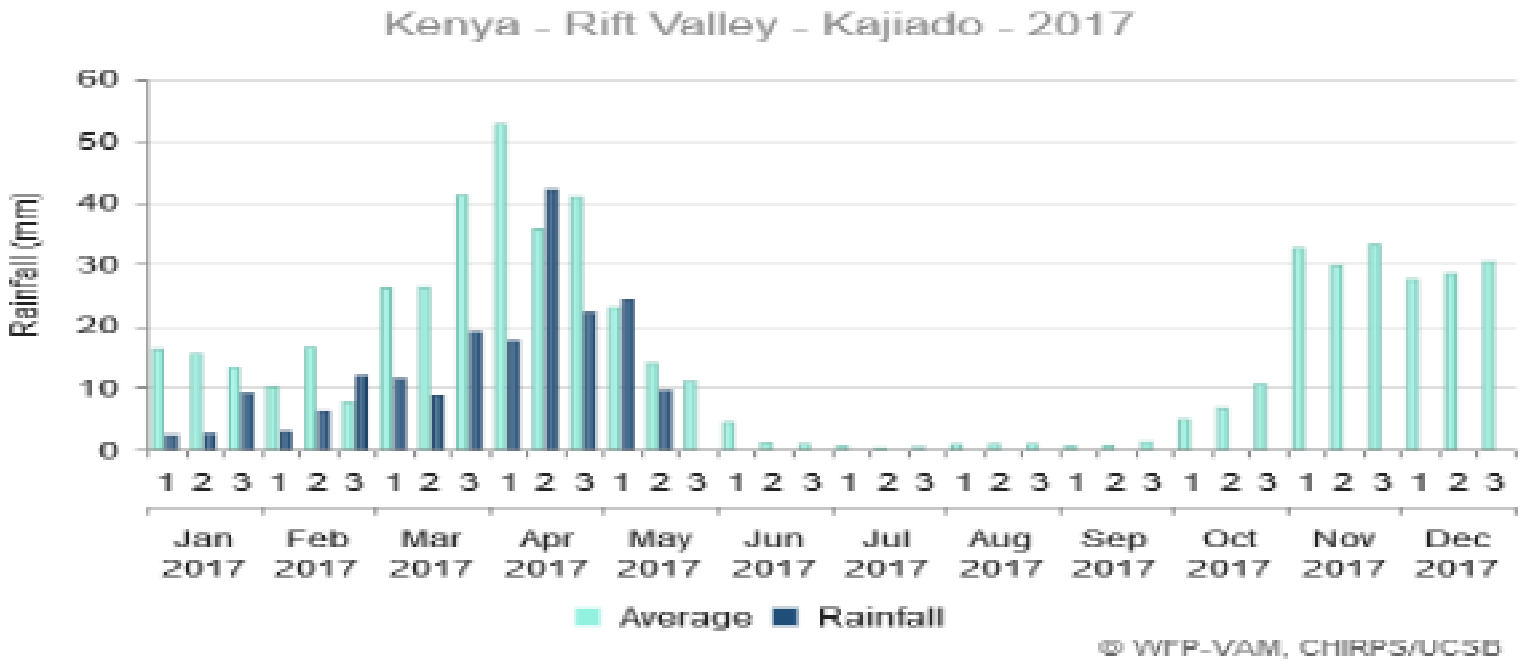
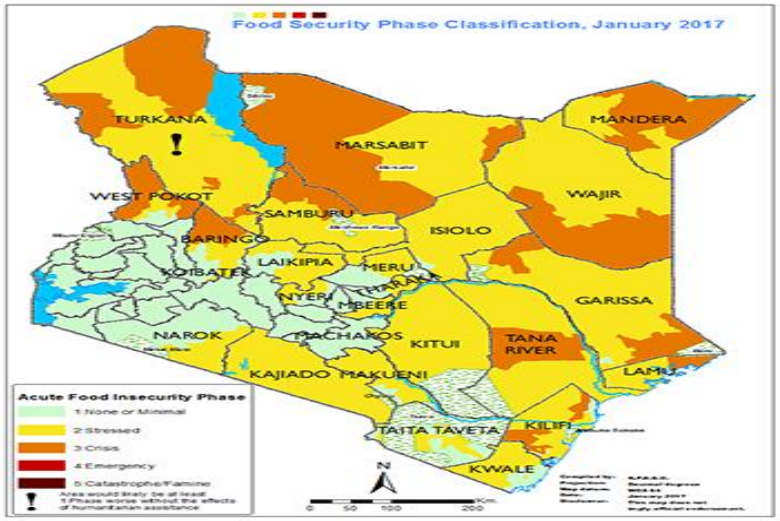


Figure 1: Rainfall performance for Kajiado County

Data source: World Food Programme; May, 2017

Need for Capacity Building in Data Science- the case of Kajiado, Kenya 2017



There is need to prioritize intra- and interoperability within and between organizations to enable information sharing with farmers & communities

Introduction and Definitions

- Use case: A list of actions or steps that outlines how a user or an actor uses a system to achieve a goal. Actors be humans or systems.
- Innovation: How we have translated ideas or inventions into knowledge products and service by creating value for our customers mainly the farmers.
- Data science: Extracting knowledge or insights from data into various forms (structured or unstructured).
- Data mining: Discovering Knowledge from datasets (e.g. identification of patterns or relationships to solve problems through data analysis.

The concept of Data

- Science is built on data: its collection, analysis, publication, reanalysis, critique, and reuse.

- Data provides the evidence for the published body of scientific knowledge, which is the foundation for all scientific progress

- The more data is made openly available in a useful manner, the greater the level of transparency and reproducibility
- The more efficient the scientific process becomes, to the benefit of society

Better Research starts with better Data Management

KALRO's thinking is to connect *farmers & Stakeholders* to the right *information* and knowledge to create **Data-driven Research** and accelerate innovation.

The KALRO Approach: 1. Delivering Data-driven Research

Re-examine & Re-engineer Agricultural Research Approaches and Processes.

Build a Future-Ready ICT Platform that supports tomorrow's Researching and Stakeholders demands & Needs.

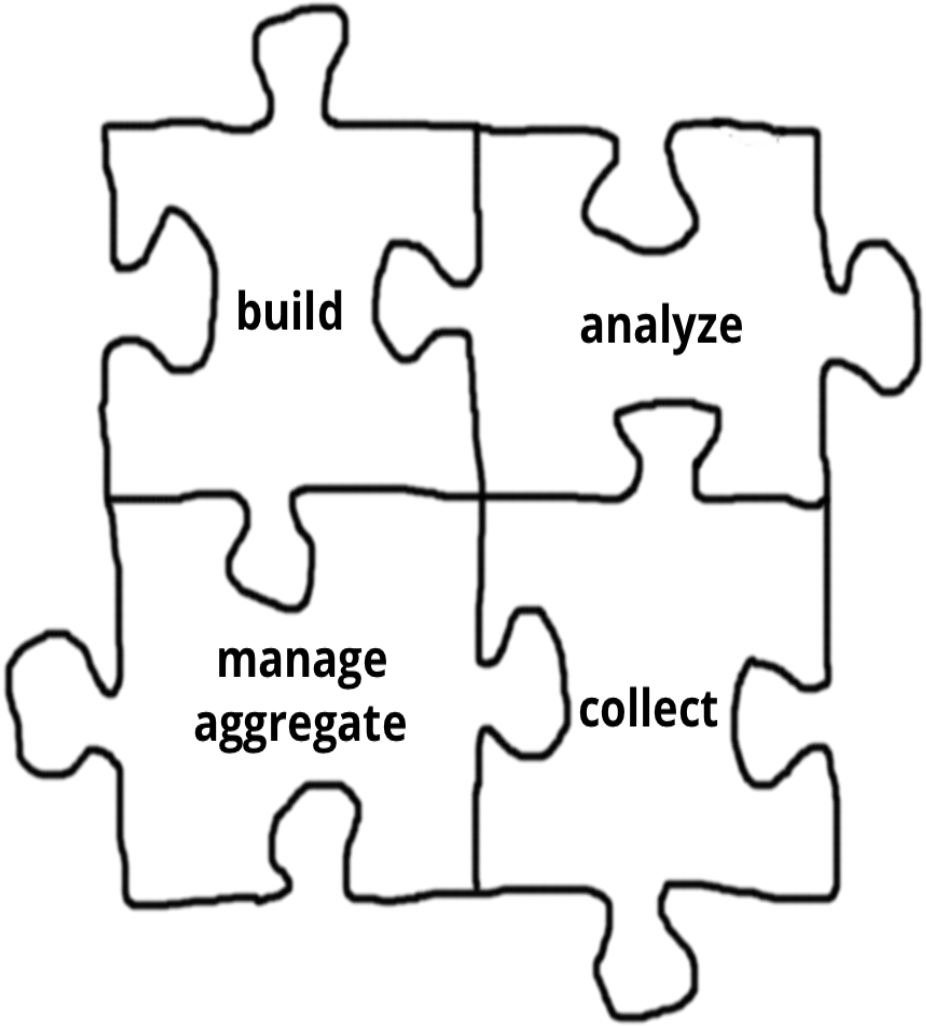
Empower Researchers, Stockholders and Farmers with technology and process.

Unlock information from the shackles of paper.

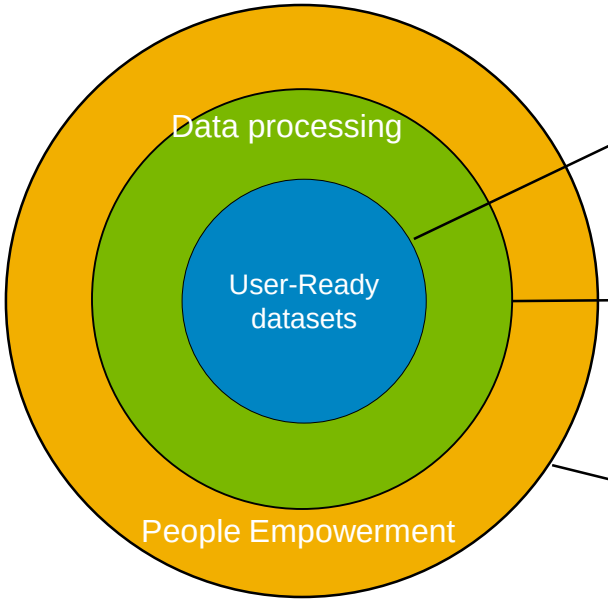
Unleash innovation to drive better Research outcomes & leverage cutting-edge technology.

2. Digitization of Research Data & Information Management

- **Design Tools in collection, analysis and management of agricultural research data** so it can be readily shared
- **Build tools, systems and maintain data in agricultural research**



3. Establishment of Data Management Framework



- Flexible, dynamic datasets through usable models
- Streamlined data management strategies
- A single integrated platform for data. information access, sharing, dissemination, collaboration, learning and networks

The approach builds the foundation for a system in which data and information is easily stored, simplified, and accessed & shared

Innovations:
4. Agricultural Research informatics concept

Information is interconnected so that it is available when and where it is needed to make decisions and innovate.

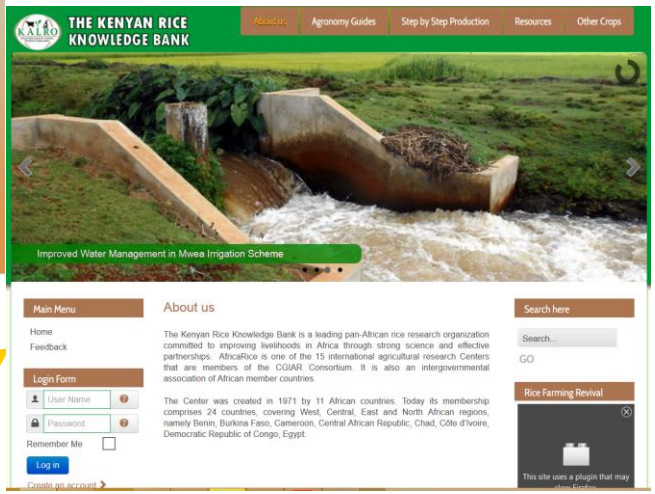
Data becomes knowledge that moves Research beyond theory to practical application.

Researchers and Stake-holders are empowered to take control of their own productivity by being connected to better information (processed data).

- This has created demand for new approaches in the management of agricultural research data, information & knowledge

Examples of ICT: Innovations & Interventions

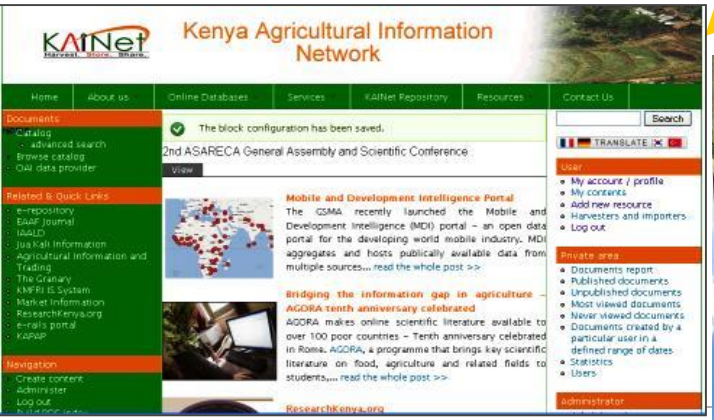
ASAL K-Hub & mobile Apps



KALRO ONLINE PLATFORMS

KALRO e-Mimea Clinic

Kenya Rice Knowledge Bank

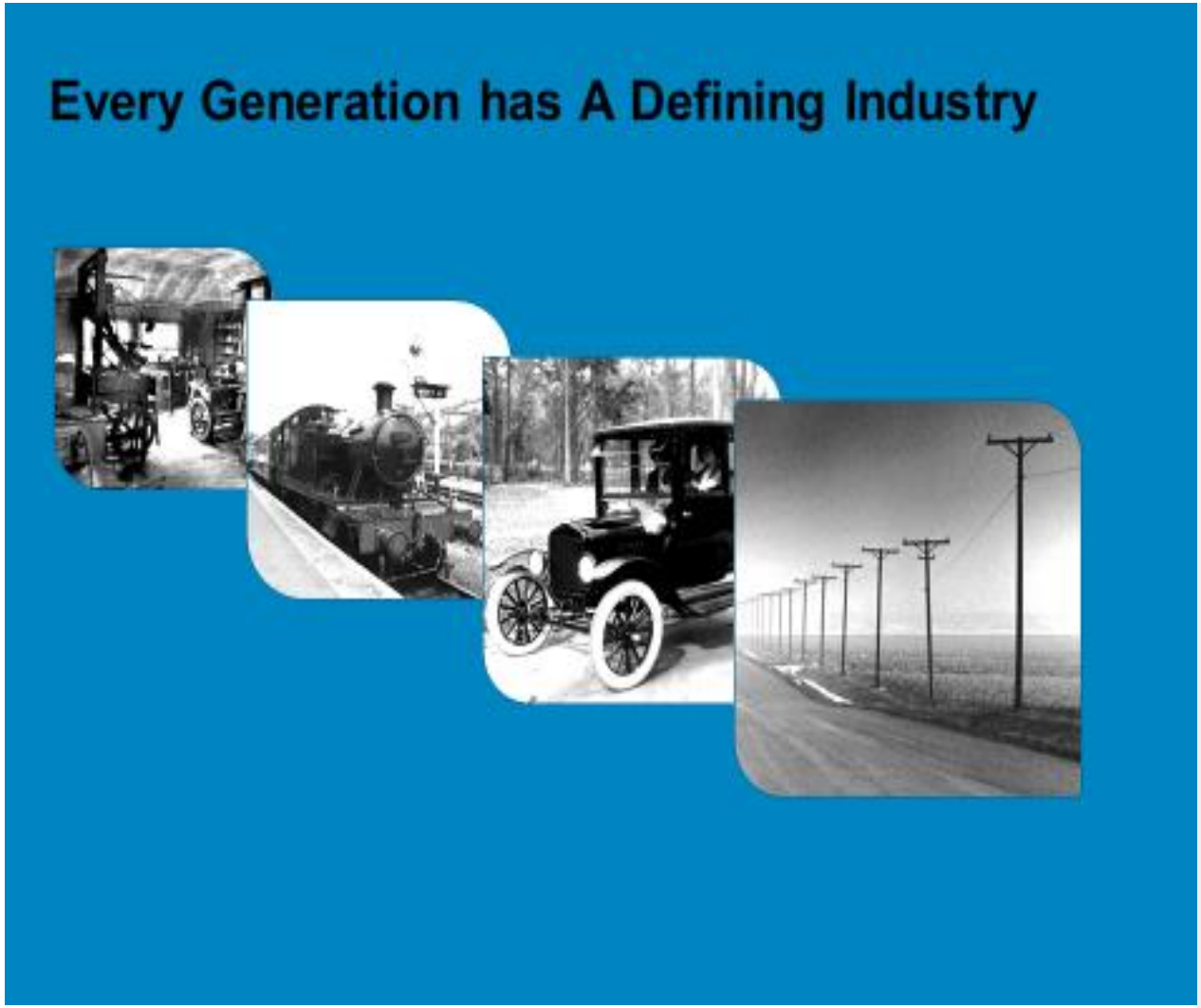


Kenya Agricultural Information Network

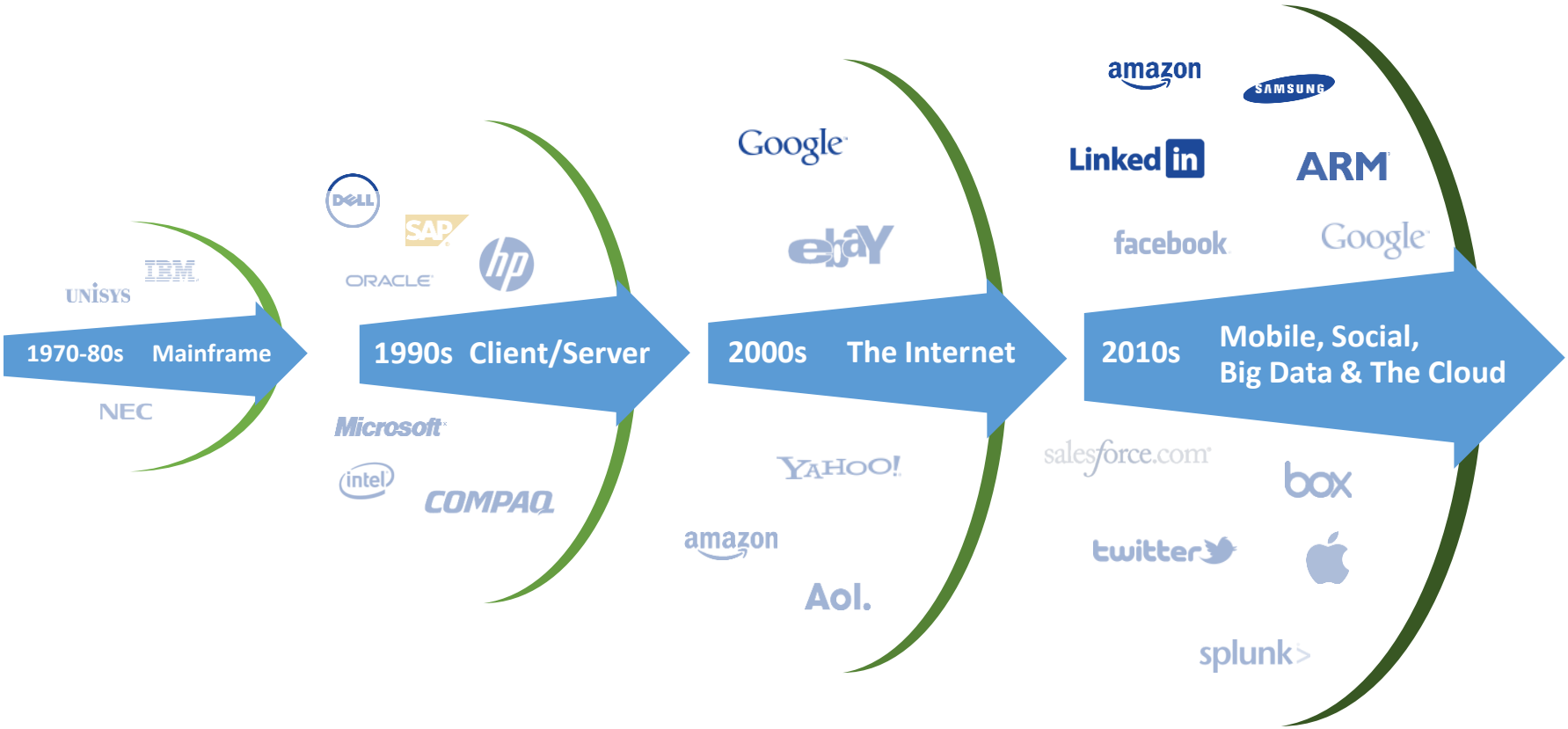
Agro-weather Tool

Kenya Pollination Information Network

5. Development of Big Data Solution for Agricultural Research... in Progress



Why?



Every Generation has a defining industry

Big Data …

- Big Data Analytics provide sufficient prospects to determine previously unthinkable insights from data sets.

- Generating insightful trends and intelligence for competitive decision-making process.

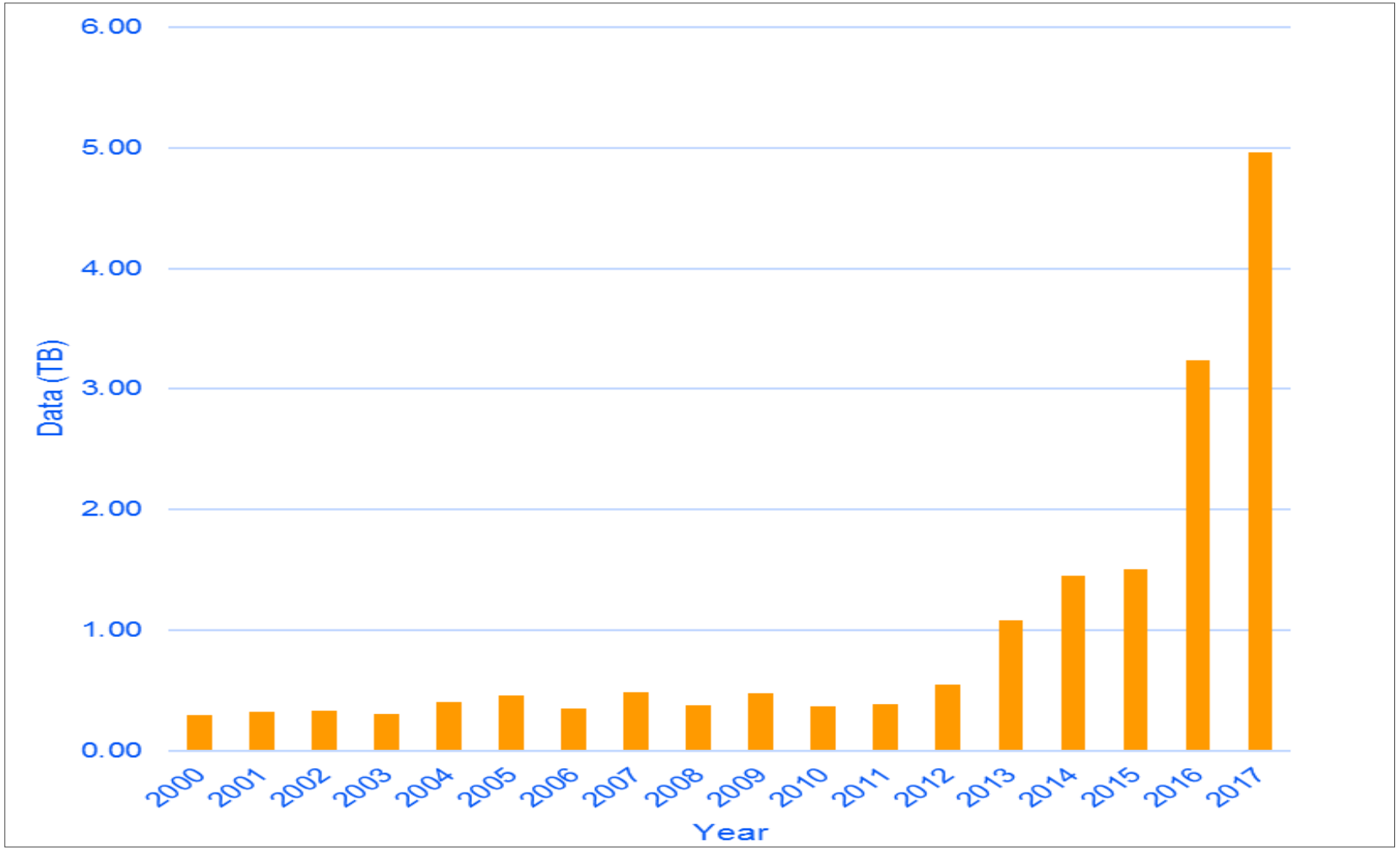
Data analysis forms in agricultural research

- Descriptive Analytics: Is the most used analytic technique that summarizes data into reduced, more useful pieces of information, usually presented in a reporting tool, for ease of use and availability.

- Predictive Analytics: Uses historical data to predict the future summarizing what happened in order to forecast the likelihood of an action or event happening in future.

- Prescriptive Analytics: Used to prescribe an action and establish the cause to enable decision making and take action based on information provided. i.e. "causality"

6. Towards Data Cubes: Land imaging data in Kenya



7. Managing Climate Data: Generating Advisories- using Artificial Intelligence and Machine Learning Algorithms

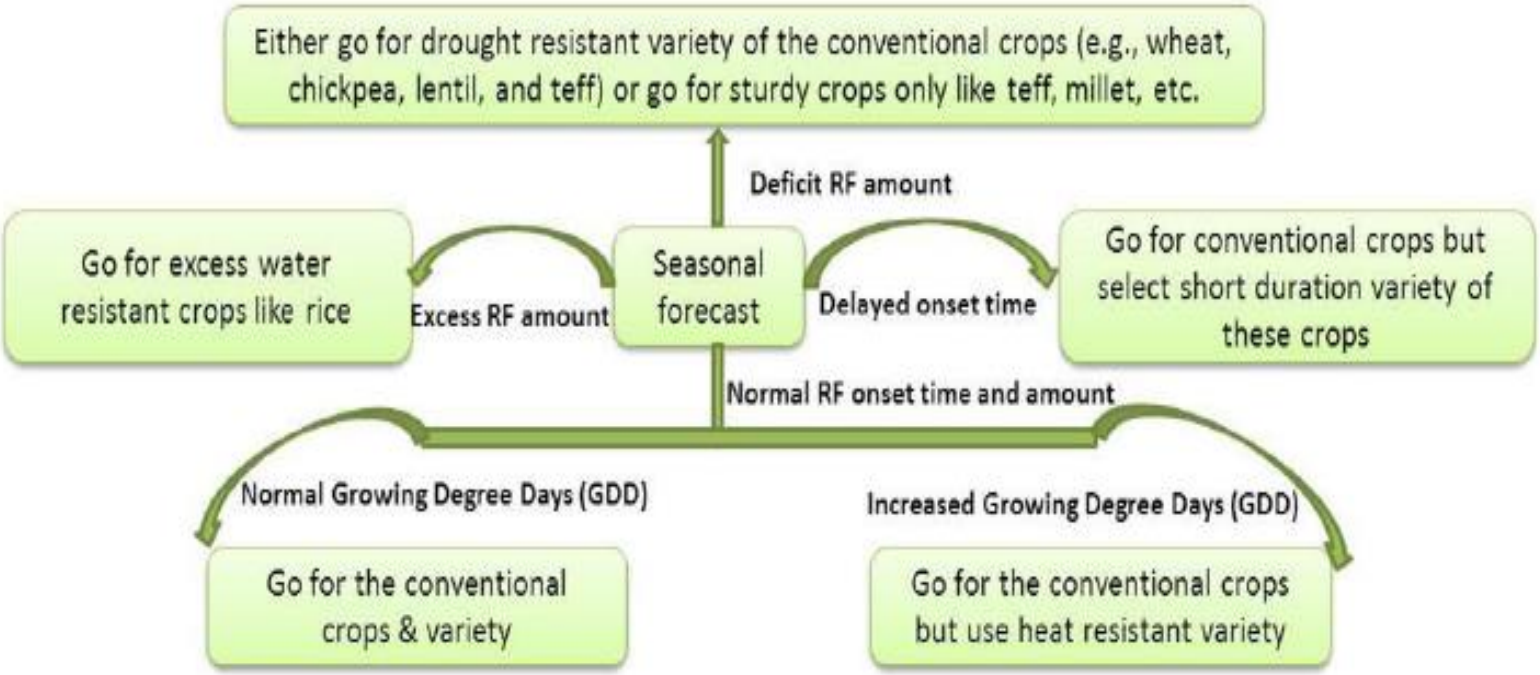
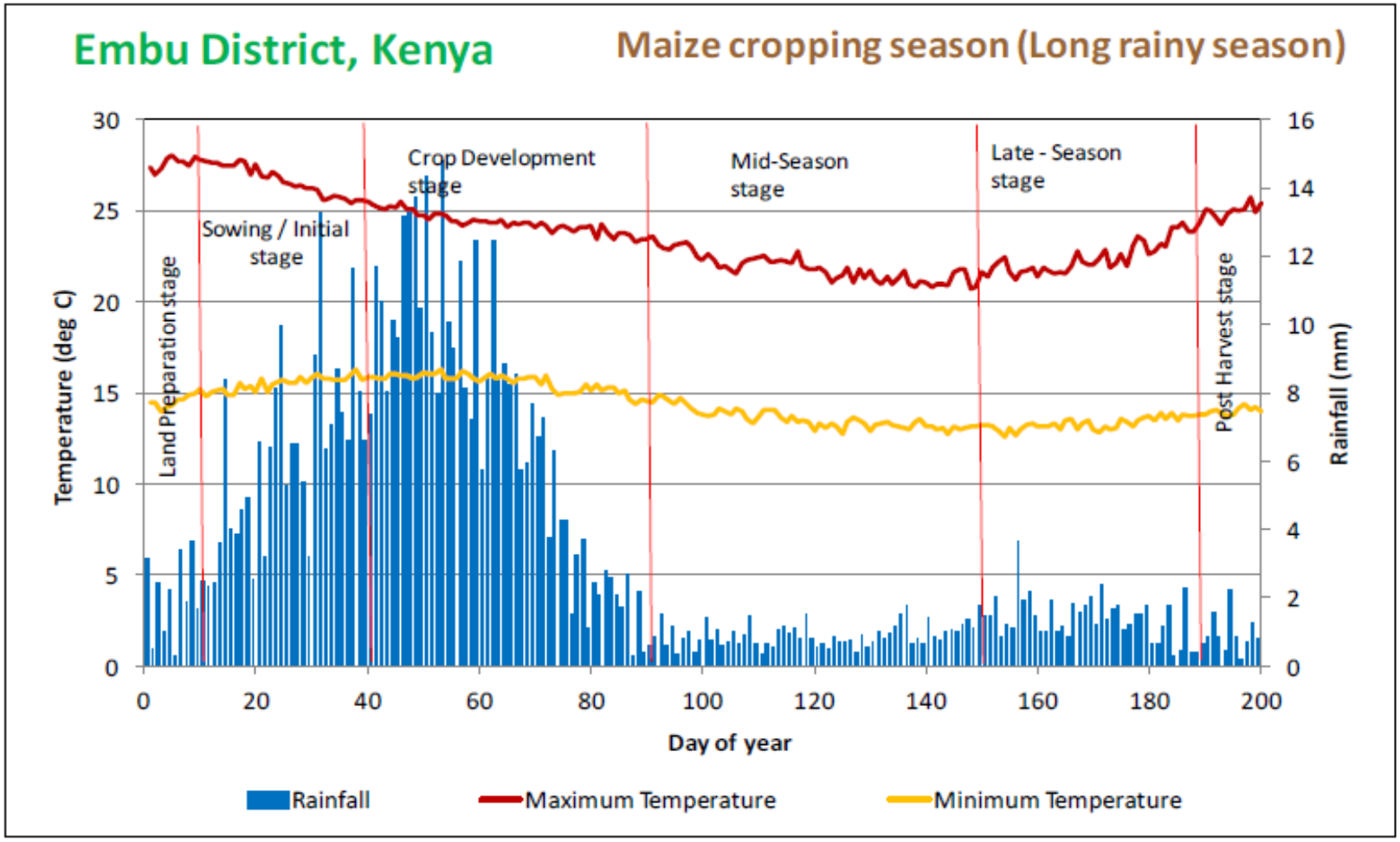
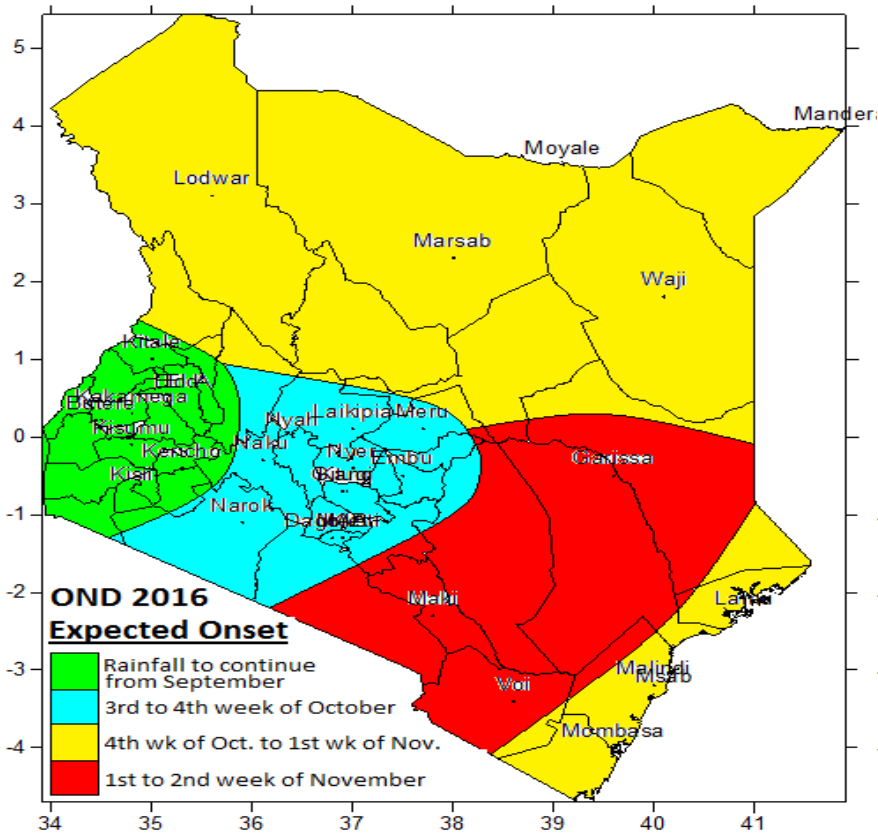


Figure 2-9: Mechanism of pre-cultivation advisory (i.e., for selection of crop type and variety) being generated based on the seasonal rainfall and temperature forecast

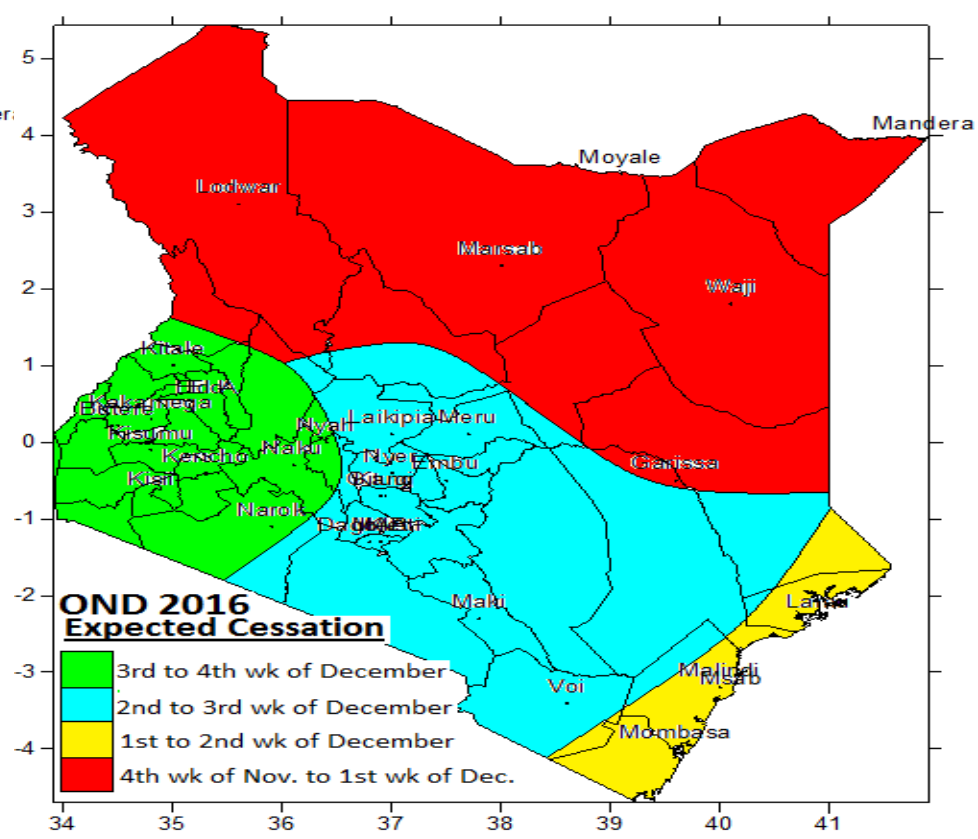
Example: Outcomes



Examples: GIS in Weather/climate data: October, November and Dec. (OND) 2016 Rainfall Outlook

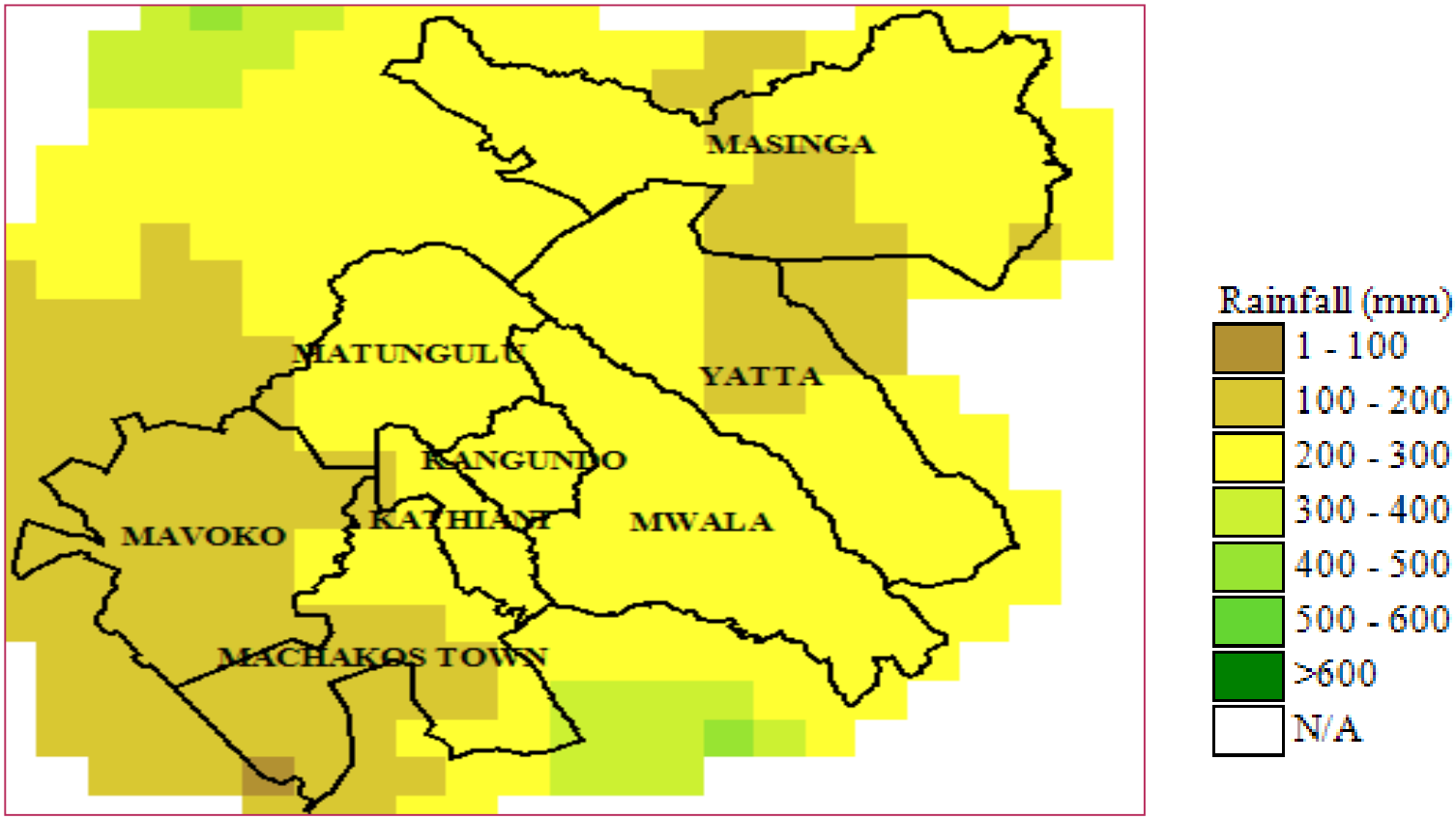


EXPECTED OND 2016 ONSET DATES

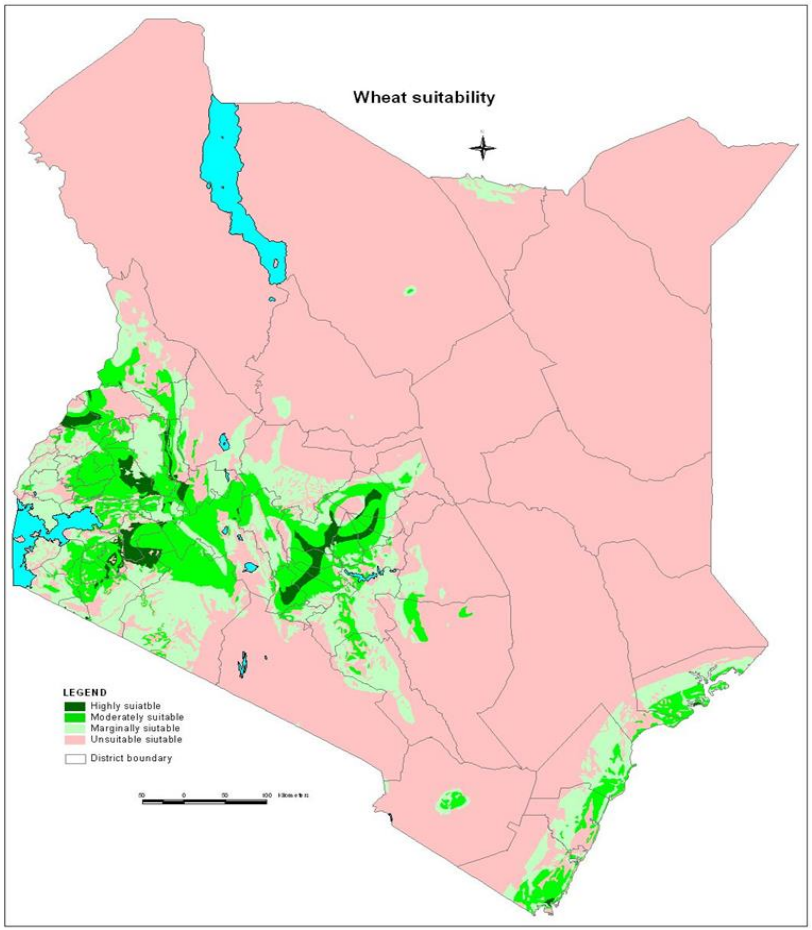


EXPECTED OND 2016 CESSATION DATES

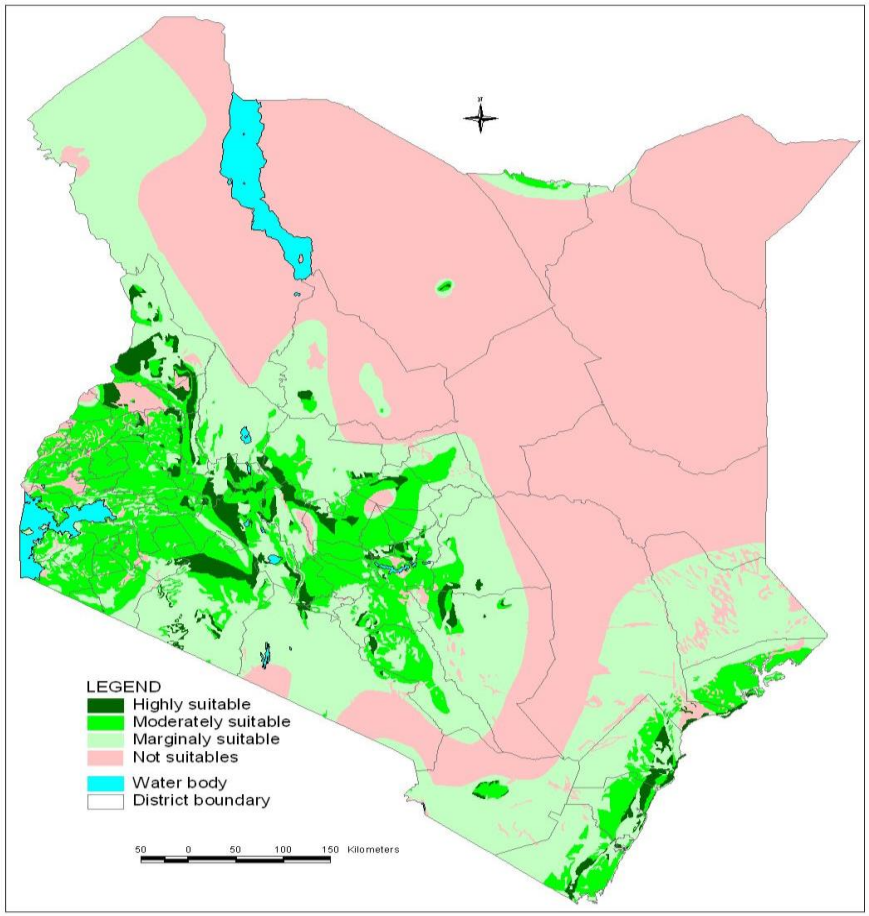
Example: MACHAKOS OND 2016 FORECAST



8. Crop Suitability Modelling and Assessment

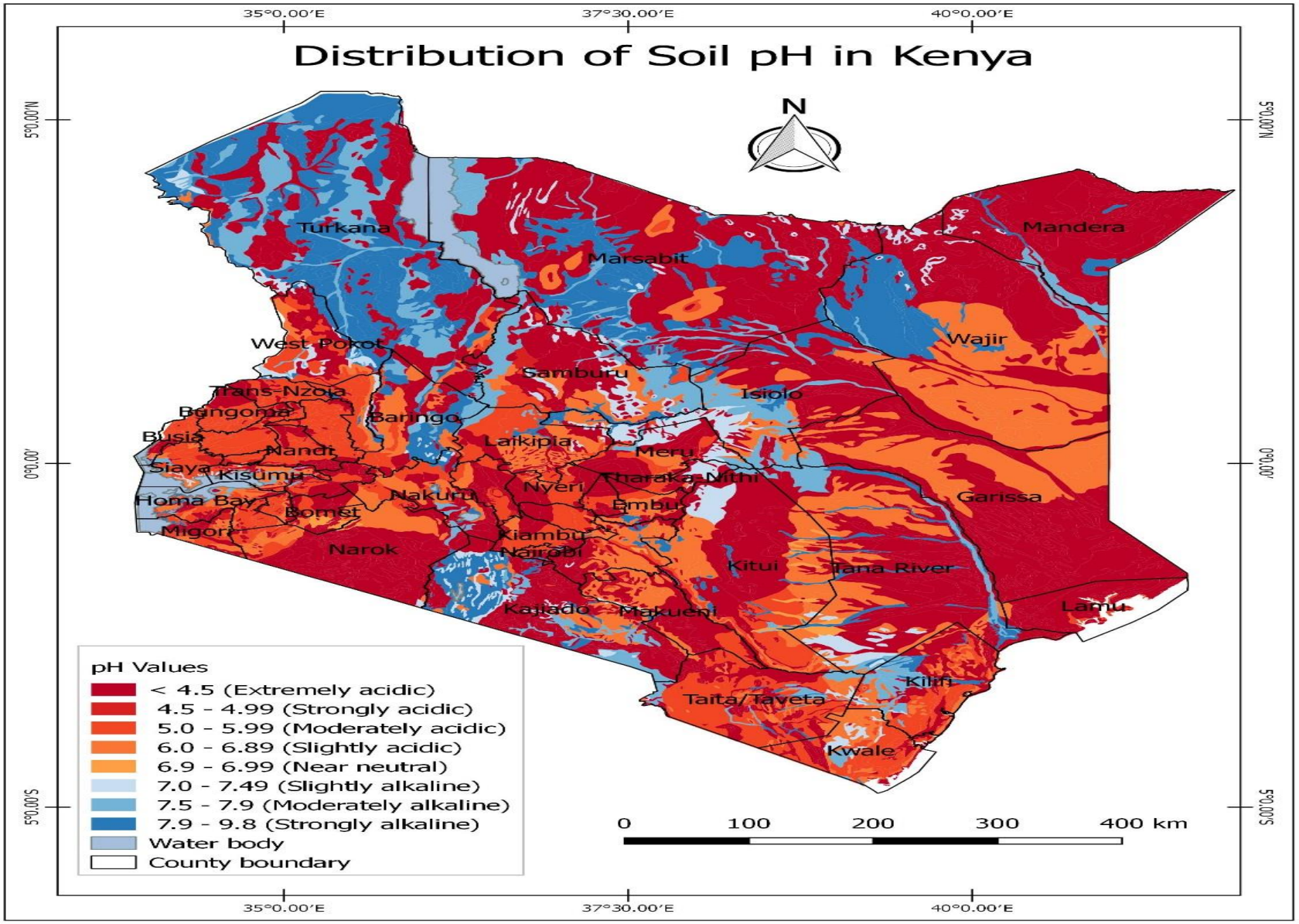


Suitability of Rain-fed wheat production in Kenya

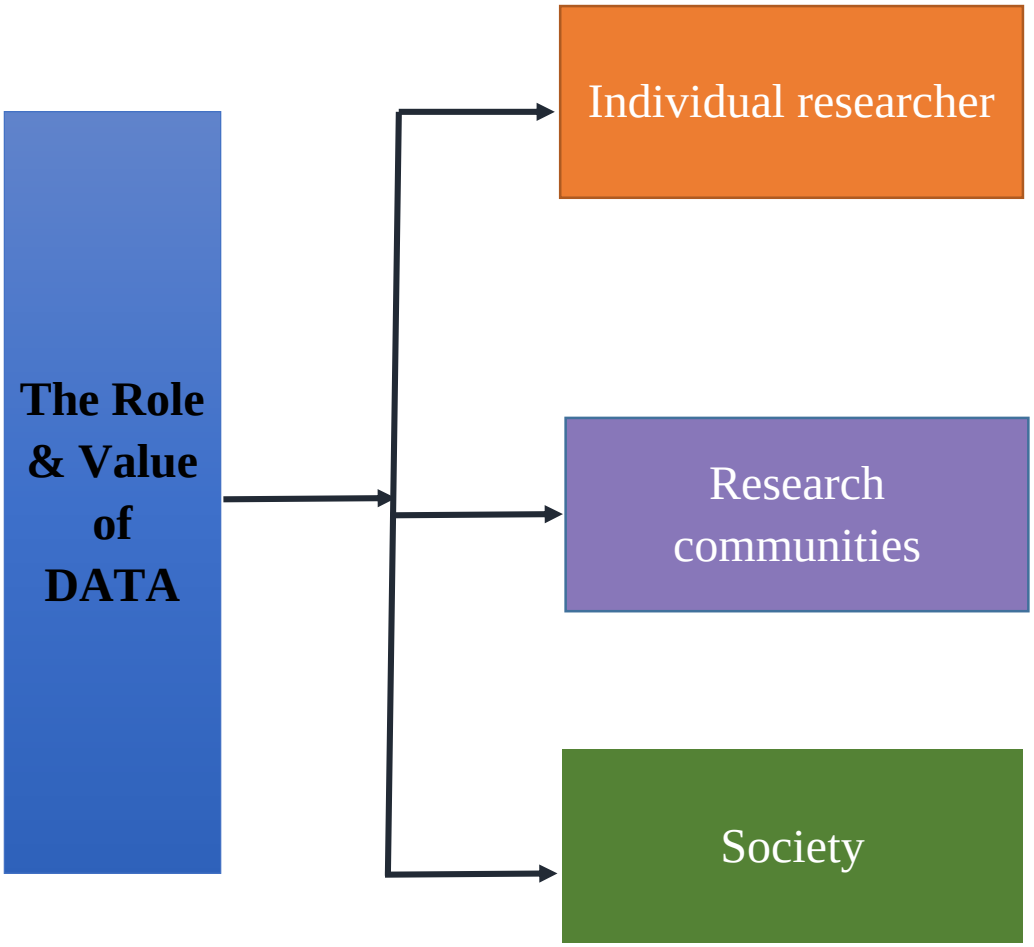


Suitability of Rain-fed Finger Millet production in Kenya

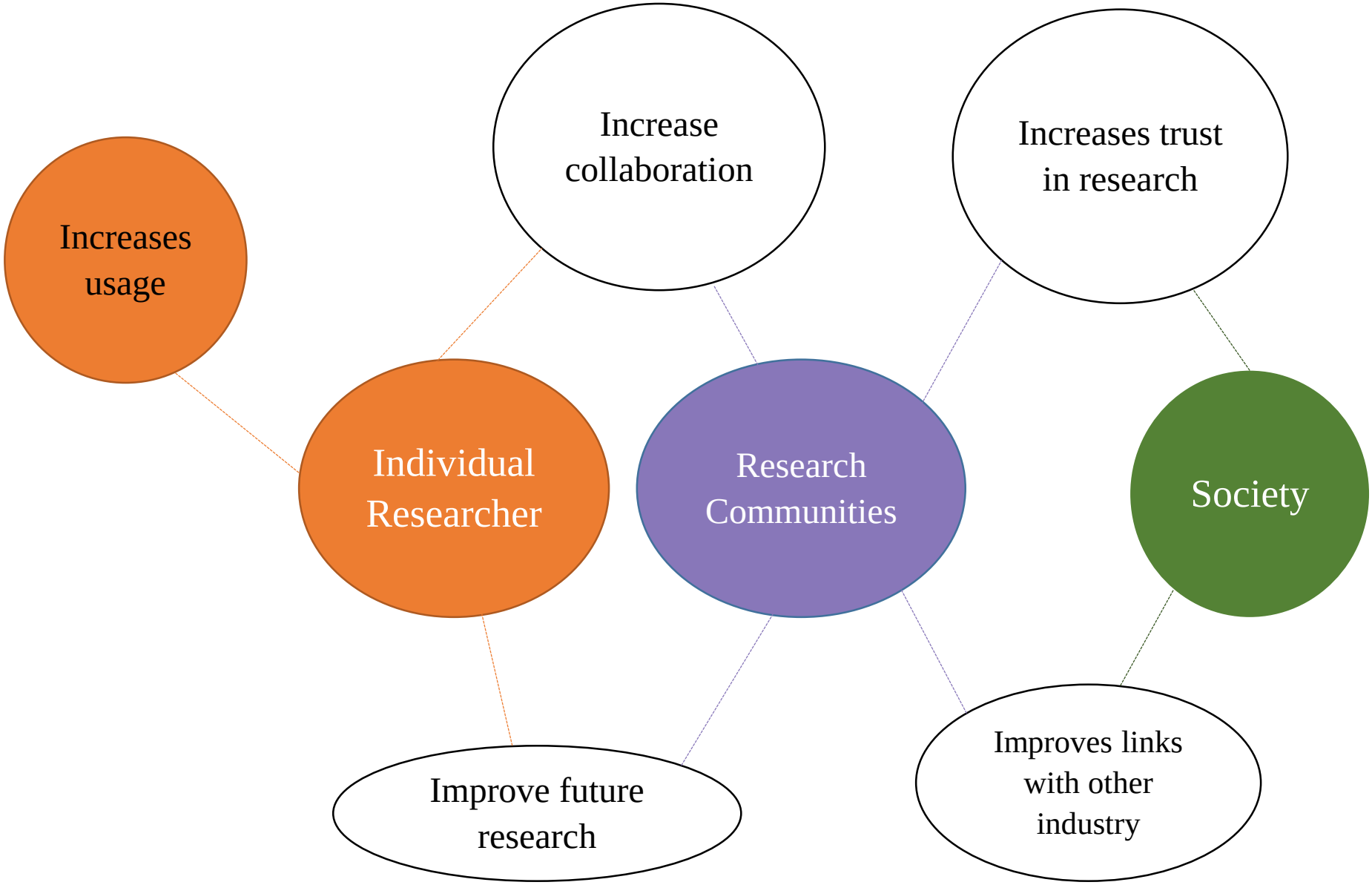
9. GIS & SOIL PH solutions



Conclusion: Role & Value of Agricultural Research data



The Role and value of making data open....



Researchable Problems

- “Despite the availability of various knowledge channels, to date most farmers and stakeholders do not have access to information on good agricultural practices (GAP)” (Kidake, *et al*., 2015).

- In Kenya, access, availability and management of agricultural research knowledge and information is “unsystematic”, and this has partly contributed to declining agricultural potential and food crises (Njeru *et.al.*, 2013)

- Access to research knowledge is problematic and do no t meet specific purposes for farmers at multiple stages (Aker, 2011)
- The role, value and effectiveness of ICT is often dismissed and unexplored by agricultural research scientists (Singh, 2006; Asiedu-Darko & Bekoe, 2014; Hussain, 2015).

ICT & Data in Agricultural Research..

- There is enough evidence to show that ICT is a well-established area with potential to provide methodical, theoretical and practical innovations and intervention for agricultural research challenges (Lee *et al.*, 2013).

- ICT is as suitable interventions and innovation for achieving equitable access and utilization of agricultural research knowledge.

- It is further argued that use of ICT in AR4D can ensue effective management of agricultural research knowledge leading to increased agricultural production (World Bank, 2011, Hussain, 2015)
- ICT an interventions and innovation for achieving equitable access and utilization of agricultural research knowledge
- Agricultural research scientists have cynical perception on sharing of data leading to unexplored ICT opportunities and resources

Conclusion:

- **I have seen an evil thing *"while we are starving for knowledge, we are drowning in information"***

- ***There is need for* data scientists, ICT Innovations and Interventions**

- Africa must invest in capacity building in data science, predictive data analytics and timely reporting to help realize the impact change to livelihood

Acknowledgement

- The financial assistance from our valuable partners - for research studies and development of Knowledge management systems, tools, Mobile Apps, Knowledge management strategies and policies

KALRO
Kenya Agricultural & Livestock Research Organization

NATIONAL MUSEUMS OF KENYA
WHERE HERITAGE LIVES ON

ASAL
Agricultural Productivity Research Project

ICSU

CODATA

THE WORLD BANK

FAO
FIAT PANIS

UN environment

gef

Questions/Discussions

- How can open data concepts and activities help agricultural organization create 'Information Driven Research?
- What areas should agricultural research prioritize to enable efficient sharing of research information & knowledge with its stakeholders ?
- How can open data support strengthening the already weak research-extension-farmer linkages ?