

# Land Potential Knowledge System: Sharing Local and Scientific Knowledge to Increase Land Productivity and Resilience



Lilian Ndungu<sup>1</sup>, Jeff Herrick<sup>2</sup>, Adam Beh<sup>2</sup>, Josh Beniston<sup>2</sup>, Hussein Farah<sup>1</sup>, Vincent L. Mtaroni<sup>1</sup>, Robinson Mugo<sup>1</sup>, Anastasia Wahome<sup>1</sup>, Dan Irwin<sup>3</sup>, Gwendolyn Artis<sup>3</sup>, Africa Flores<sup>3</sup>, David Kimiti<sup>4</sup>

<sup>1</sup>) Regional Centre for Mapping of Resources for Development, SERVIR E&SA, Nairobi, Kenya, <sup>2</sup>) US Department of Agriculture-Agricultural Research Services, The Jornada Experimental Range, New Mexico State, USA, <sup>3</sup>) SERVIR Coordination Office, NASA, Huntsville, USA, <sup>4</sup>) New Mexico State University, New Mexico State, USA

## 1. Rationale

In Africa, continued agricultural growth due to land expansion rather than increase productivity, has led to many challenges including a rapidly growing population, land degradation, soil erosion, declining soil fertility and climate change.

Available land must produce more food and pasture to meet the growing demand while preserving the available resources.

LandPKS is a suite of integrated, modular apps connected to cloud-based analytics and user-accessible cloud storage that will allow users to *access, share* and *interpret* global knowledge and information relevant to the *unique potential* of each piece of land

## 3. Approach

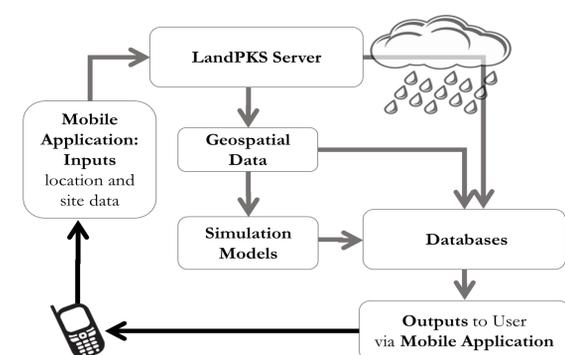


Figure 1: LandPKS data flow Schematic

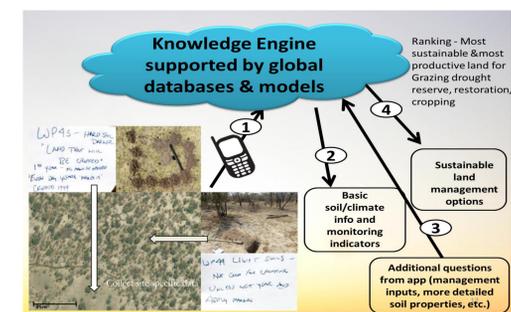


Figure 2: Using LandPKS- inputs, processing and expected current (2) and future outputs(3&4)

## 6. Results

LandPKS results include two mobile applications, a data portal and a data visualization tool

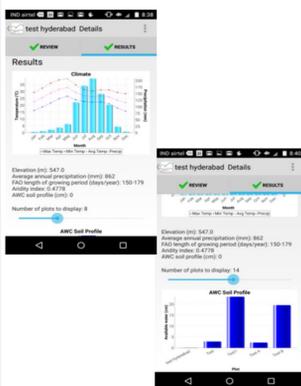


Figure 4: Outputs from LandInfo app which is used for site characterization and provides basic climatological summaries for plots.

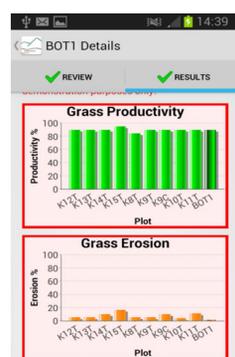


Figure 5: LandInfo Beta Version app providing grass and maize productivity and soil erosion risk

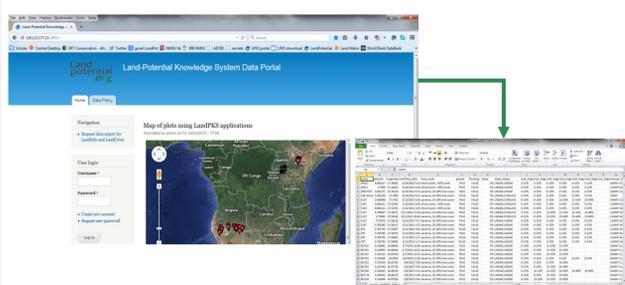
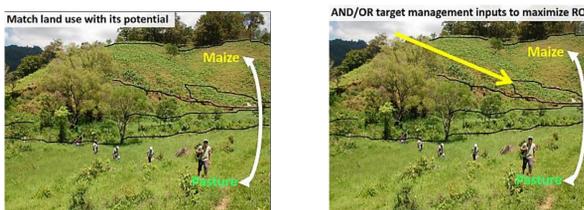


Figure 7: The Data Portal allows for data download based on recorder name. Data is output as .csv file and includes all user-provided data, climate, soils, and topography predictions

LandPKS considers the potential of the land based on climate, soils, and topography to support agricultural production, biodiversity conservation and other ecosystem services, and its ability to be degradation resistant and resilient.



Evaluation of Land Potential

### LandPKS Activities

- ▶ Northern Rangelands Trust (NRT)(Kenya) -Identifying and prioritizing areas for restoration of perennial grasses and monitoring
- ▶ Vital Signs- Site characterization for their integrated system for monitoring ecosystem services
- ▶ Namibia- Rangeland Health Assessment, Bush encroachment assessment and biomass estimation
- ▶ Polytechnic of Namibia - Vegetation health monitoring and as learning aid
- ▶ Capacity Building of different user groups in using the apps
- ▶ USAID (PRIME) project in Ethiopia

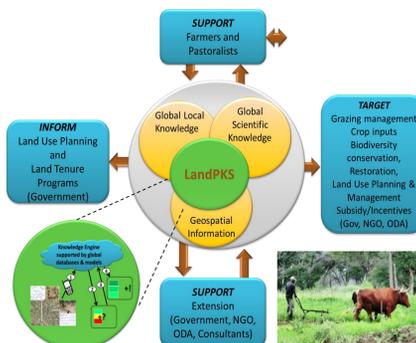


Figure 3: LandPKS envisioned roles in different sectors

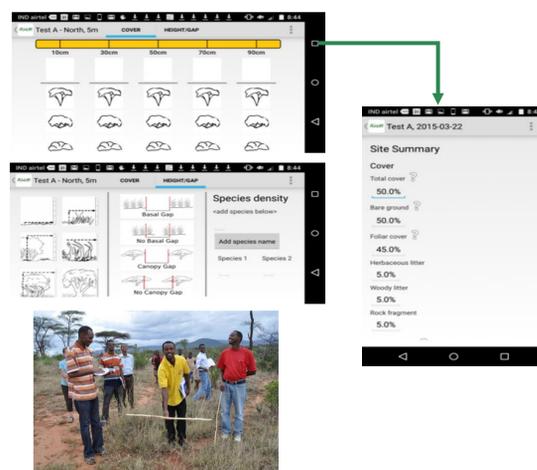


Figure 6: LandCover app is a vegetation monitoring tool that provides data collection on plant species and density, canopy and basal gaps and other information and provides summaries as outputs

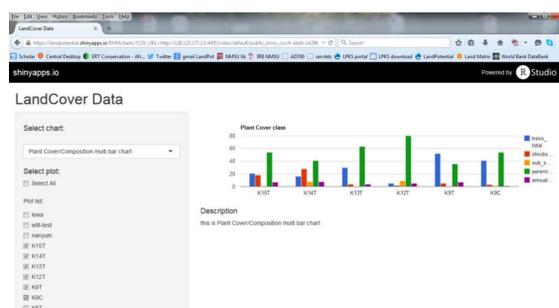


Figure 8: Data Visualization in Google Shiny (R-powered)- Basic graphical displays of monitoring indicators from Land cover App(bare ground, foliar cover, plant composition, gap %, species density)

## 2. Objectives

- ▶ Co develop the LandPKS Knowledge engine and Android based data collection tools together with selected developers
- ▶ Develop tools that will provide an estimate of the best use of the land (productivity) optimizing for both agricultural/livelihood production
- ▶ Build capacity of stakeholders in understanding the Land Potential and in future, provide sustainable land management options
- ▶ Connect users around the globe and allow them to share knowledge on working sustainable land management

## 4. Data Sources

- ▶ SRTM 30m Elevation data
- ▶ NCEP (National Centres for Environmental Prediction) Reanalysis Wind Data
- ▶ Harmonised World Soil Database and AFSIS soil database
- ▶ Climate - SLATE 100 year weather database, CRU and AGMERRA
- ▶ GAEZ (FAO) soil and productivity datasets
- ▶ AfSIS/ ISRIC Soil grids

## 5. Outcomes/Anticipated Impacts

Successful implementation of the project will lead to:

- ▶ **Improved capacity** of the ministries of agriculture and extension workers, stakeholders, farmers and other agriculturalists to better predict the productivity and resilience of land to promote sustainable and optimum methods of land use and better land management practices.
- ▶ **Improved cooperation** among extension workers and communities resulting in their ability to better address culturally-specific land management concerns.
- ▶ **Improved capacity to identify sites for prioritization and monitoring** of restoration for forage production, habitat suitability, settlement location resulting in sustainable land management practices and realization of the lands potential hence better results.



LandPKS Capacity building through training and field exercise

## 7. Project Partners

- ▶ Food & Agriculture Organization (FAO)
- ▶ International Livestock Research Institute (ILRI)
- ▶ National Commission for Knowledge and Use of Biodiversity (CONABIO)
- ▶ Natural Resource Conservation Service (USDA-NRCS)
- ▶ New Mexico State University
- ▶ Northern Rangelands Trust
- ▶ United Nations Convention to Combat Desertification (UNCCD)
- ▶ World Agroforestry Centre (ICRAF)
- ▶ World Overview of Conservation Approaches and Technologies (WOCAT)
- ▶ Mercy Corps

## 8. Project End Users

- ▶ Agricultural and rangeland management sectors and extension workers
- ▶ Scientists
- ▶ Ministries of Agriculture, lands and resettlement
- ▶ Civil societies and NGO field officers engaged in conservation efforts
- ▶ Institutions of Higher Learning
- ▶ Students and Researchers



LandPKS community capacity building exercise in Samburu, Kenya