Innovations and Solutions in Sustainability Science for Dryland Areas

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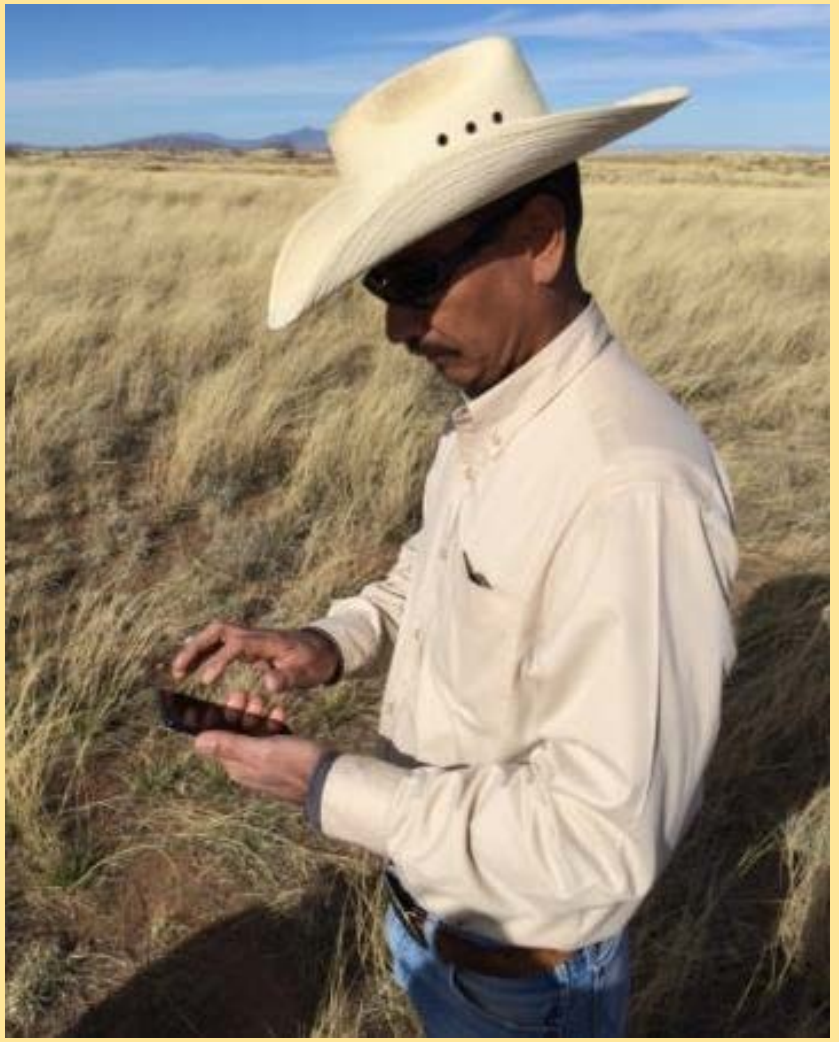
USDA-ARS Research Unit @ The Jornada, Las Cruces NM USA

Advancing Sustainability of US-Mexico Transboundary Drylands: A Binational Workshop
San Luis Potosi MEXICO – 4 May 2018

Title slide photo: “Criollo” cattle on the USDA-ARS Jornada Expermental Range near Las Cruces, New Mexico. Recently bred from desert-adapted stock from Copper Canyon.

- The technology - overview
- Demonstration
- History (a binational story)
- Opportunities
  - Use it
  - Join us
- A model for future initiatives?



Emilio Gutierrez on the Santa Rita Ranch, Arizona

The technology:
Land-Potential Knowledge System

LandPKS
www.landpotential.org

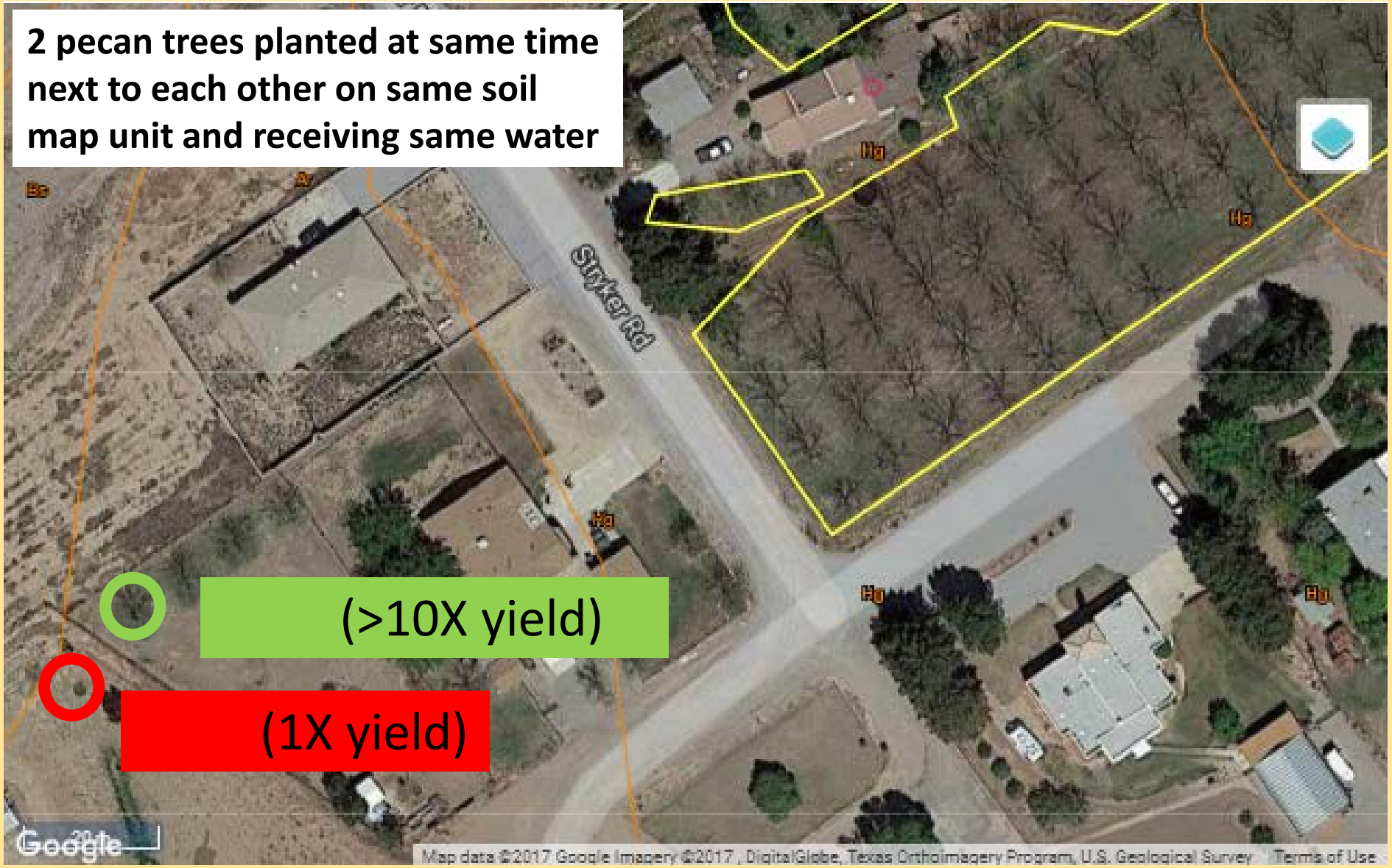
Download on the App Store

ANDROID APP ON Google play

- **Mobile app supported by cloud computing and storage**
- **Core function**: *point-specific* determination of sustainable land use-based on user inputs + phone/cloud-based databases & algorithms for *land-use planning and management (summer 2018)*
- **Additional functions/uses (primarily for small-medium farms)**
  - Rangeland monitoring and assessment
  - On-farm research
  - Remote sensing calibration/validation
  - Citizen science/K-12 education
  - Soil health monitoring and assessment (SoilHealth module late 2018)
  - Farm/ranch recordkeeping (LandManagement module late 2018)
  - Farmers/extension/consultants improve soil maps for precision agriculture (fertilizer, germplasm, etc…)
  - Improve sensor output interpretation (LandInfo module)
  - ***Ability to access management knowledge from similar types of land globally (2019)***

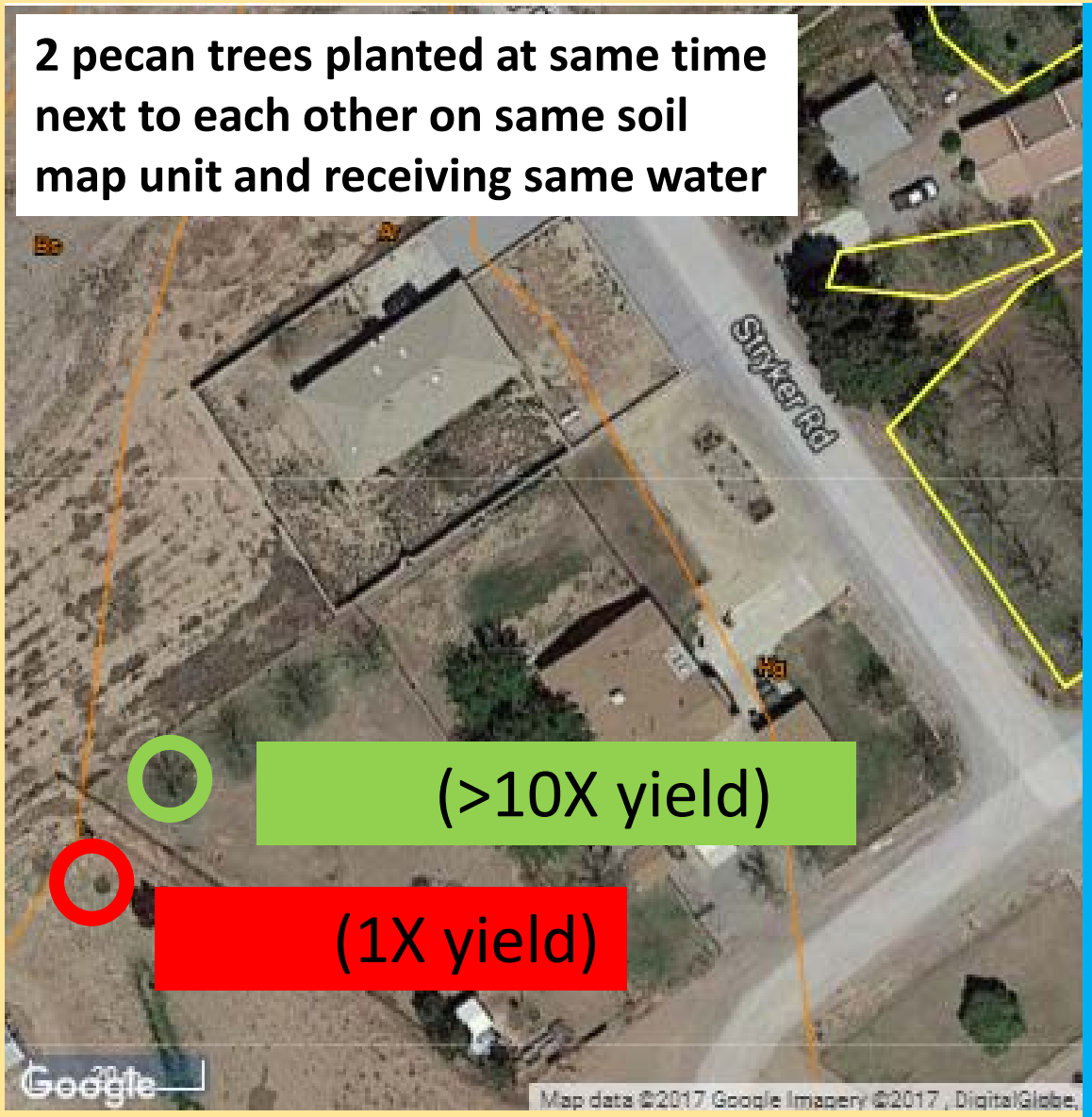
Core function:

Site-specific land use planning and management



Core function:

Site-specific land use planning and management



1. Phone location → *possible* soils (mid-2018)
2. Dig a hole
3. Determine soil texture using simple guide (+ color mid-2018)
4. Upload
5. Algorithms calculate soil properties (now) identify soil (mid-2018)
6. Soil linked to data + knowledge

Core function:

Site-specific land use planning and management

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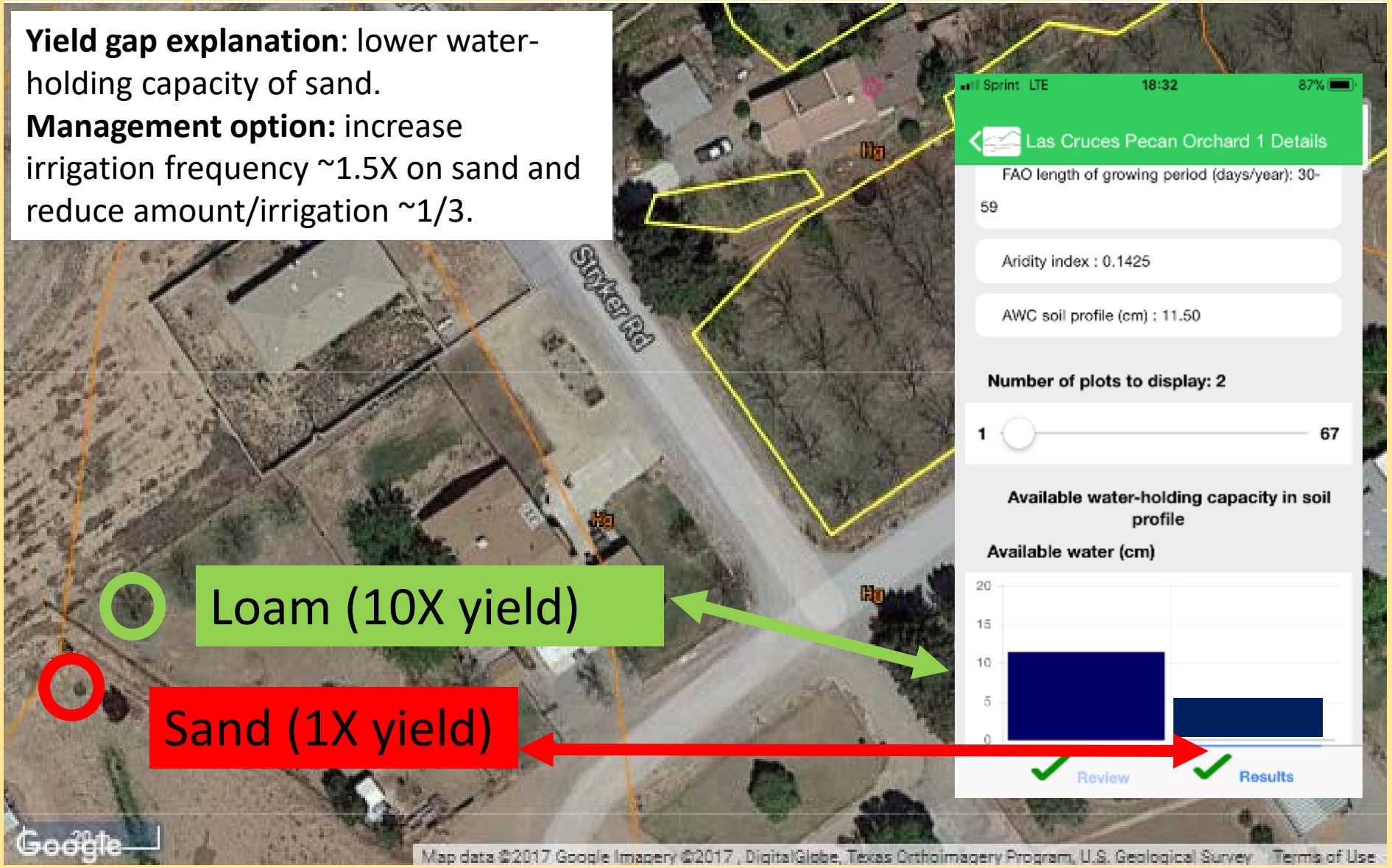


Core function: match land use with its potential AND/OR target management inputs to maximize ROI

Input Modules

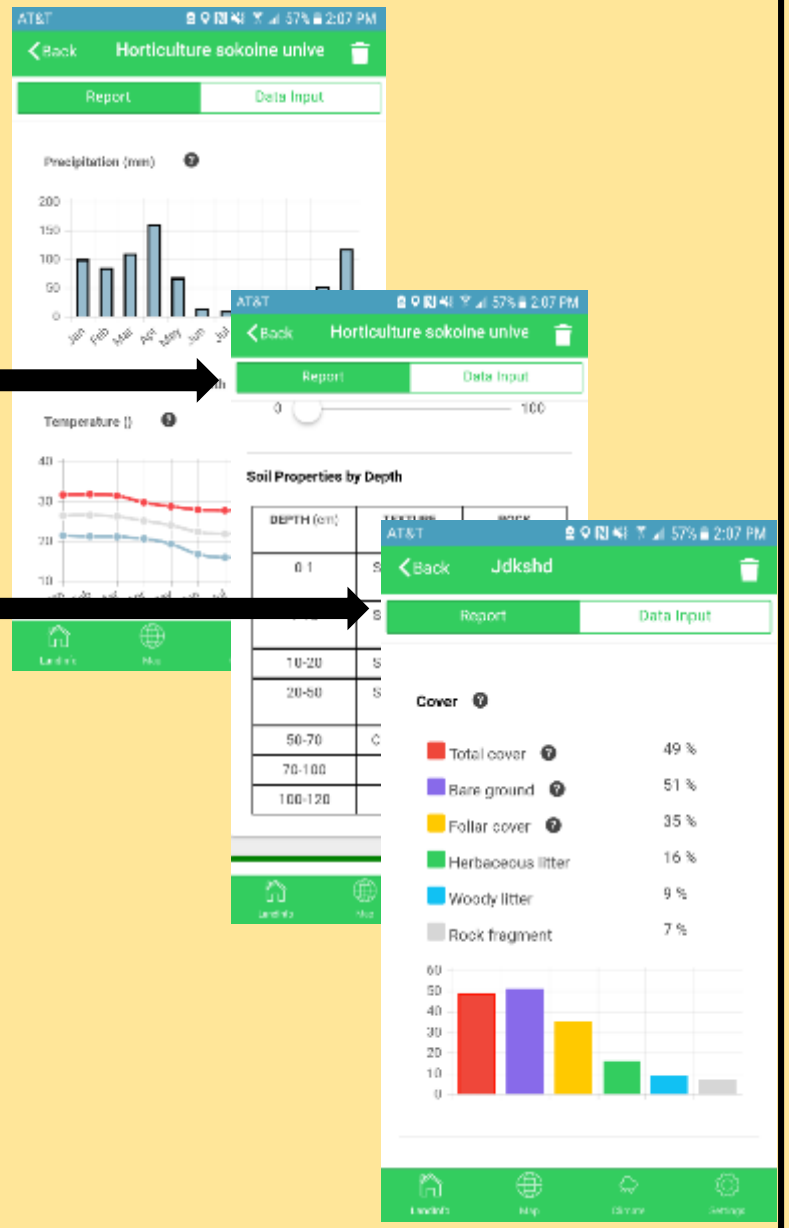
Location ->
Climate (+ soils)

LandInfo
Inventory (SoilID coming soon)

LandCover
Vegetation Monitoring

Future Modules
Soil Health
Land Management

Results



Data stored on LandPotential.org

Input Modules

Location ->
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LandInfo
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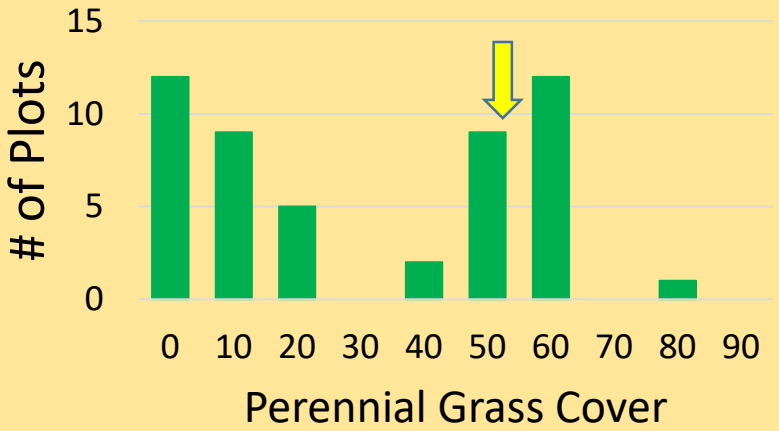
BIG DATA!

Number of plots in the Gravelly Ecological Site with X% Perennial Grass Cover



Data stored on LandPotential.org

Results

Live
Demo

Free app:

LandPKS

Download on the App Store

ANDROID APP ON Google play

To use, login with a gmail or linked account.
Data portal and more @ LandPotential.org.
Feedback: contact@landpotential.org

https://LandPotential.org/

Algorithms

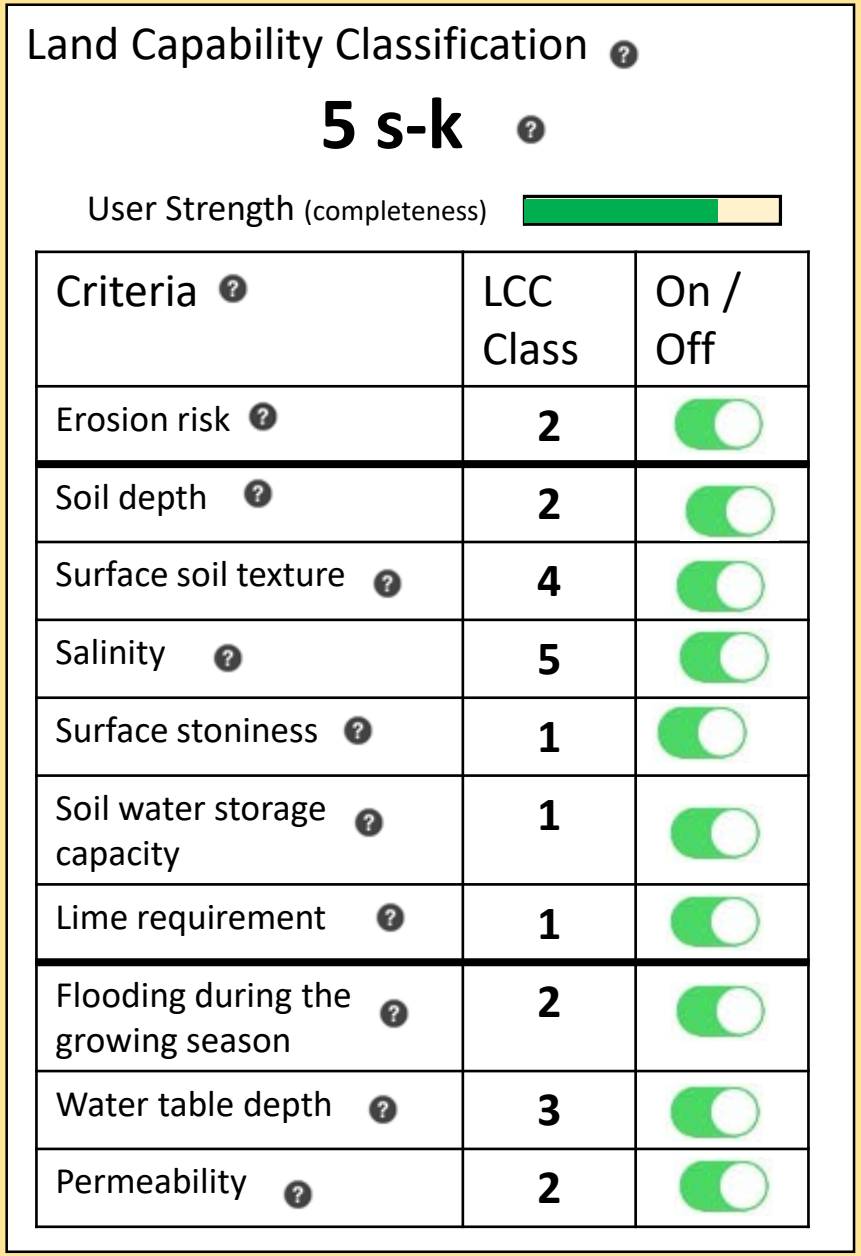
On-phone (no connection needed)

- Soil available water holding capacity
- Infiltration
- Land Capability Classification*
- Soil color (from camera)*

Cloud

- Soil identification*

*Coming mid-2018



Additional function (2019): *Ability to access management knowledge from similar types of land globally (2019)*

Similar soils and climate = similar potential. This allows global sharing of innovations

Shallow soil over calcium carbonate “pan” (SW USA).

Similar soil and climate – some surface soil remains (Kunene, Namibia)

- **History (a binational story)**

2004-2009

ARIDnet Latin America (with Elisabeth Huber-Sanwaald & Jim Reynolds)

Identified need for rapid access to ***locally relevant*** knowledge (soil/climate-specific)

2006

ESA conference (Merida): *Ecology in an Era of Globalization: Challenges and Opportunities forEnvironmental Scientists in the Americas*

Proposed "Ecological Knowledge System"

2013

Initial funding from USAID for development and pilot implementation in Africa

A strategy for ecology in an era of globalization

Jeffrey E Herrick[1*] and José Sarukhán[2]

Globalization of labor and capital can increase the rate and extent of global environmental degradation, while enhancing the ability of ecologists to respond rapidly and collaboratively to mitigate these impacts. Nevertheless, ecological research remains focused at local and regional levels, with collaboration limited by national borders and funding. New initiatives are required to increase the utility and availability of environmental research to natural resource owners, managers, and policy makers in the public and private sectors, whose decisions affect land and other forms of natural capital. We propose a four-part strategy to increase the effectiveness of ecological science in addressing environmental issues in an era of globalization: (1) develop an Ecological Knowledge System, (2) increase our ability to anticipate, identify, and rapidly address new research needs, (3) increase the number and diversity of participants in all phases of research and decision-making processes, and (4) increase the flexibility of funding sources.

La globalización de la fuerza de trabajo y del capital puede aumentar el índice y el grado de degradación ambi-

***Front Ecol Environ* 2007; 5(4): 172–181**

Key success

Maximize non-financial partnerships to minimize administrative overhead and maximize incentive to create a product *that will be used*

USAID FROM THE AMERICAN PEOPLE
USDA ARS
NM STATE
NRT NORTHERN RANGELANDS TRUST
SORALO South Rift Association of Land Owners
ISRIC
University of Colorado Boulder
AFRICAN TECHNOLOGY POLICY STUDIES NETWORK
World Agroforestry Centre
MICHIGAN STATE UNIVERSITY
Food and Agriculture Organization of the United Nations
CIAT International Center for Tropical Agriculture
RCMRD
NRCS
Colorado State University
THE JORNADA
British Geological Survey
GLOBAL SOIL BIODIVERSITY INITIATIVE
Centre for Ecology & Hydrology
International Institute for Applied Systems Analysis
IIASA
WOCAT

Opportunities

Use it

- Sign up for updates at LandPotential.org
- Download the app - provide feedback to contact@landpotential.org
- Add value to your own (web) applications requiring soil or vegetation information by automatically accessing user inputs through LandPKS API
- We are always happy to write letters of support for projects planning to use it

Join us

- Collaborate on development of version linking to Mexican regional-national soil maps (mid-2018 version will use HWSD globally (and US Soil Survey in US)
- Collaborate on development of data portal/interpretation tools

Questions? Comments?

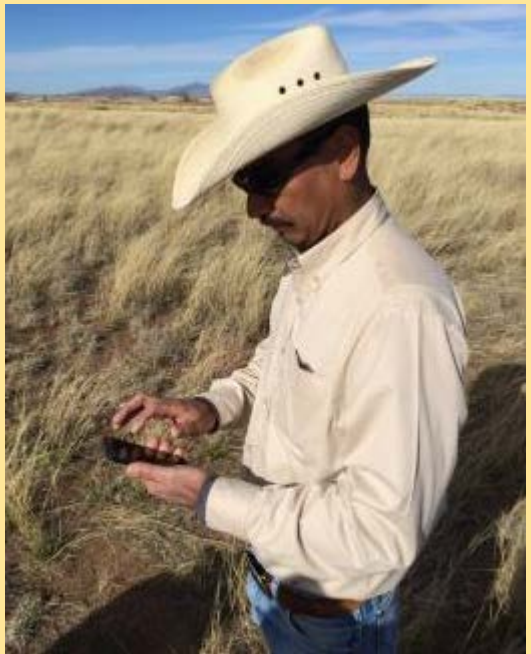
A model for future initiatives?

- Analysis and management of both system-defined problems *and* problem-defined systems* require:
  - Common data/information/knowledge-bases (or interoperable bases)
  - Rapid access to the data/information/ knowledge that is *relevant* to the social-ecological landscape**
- Simple tools that incentivize data collection through:
  - Access to knowledge/information
  - Gamification

*Hallie Eakin

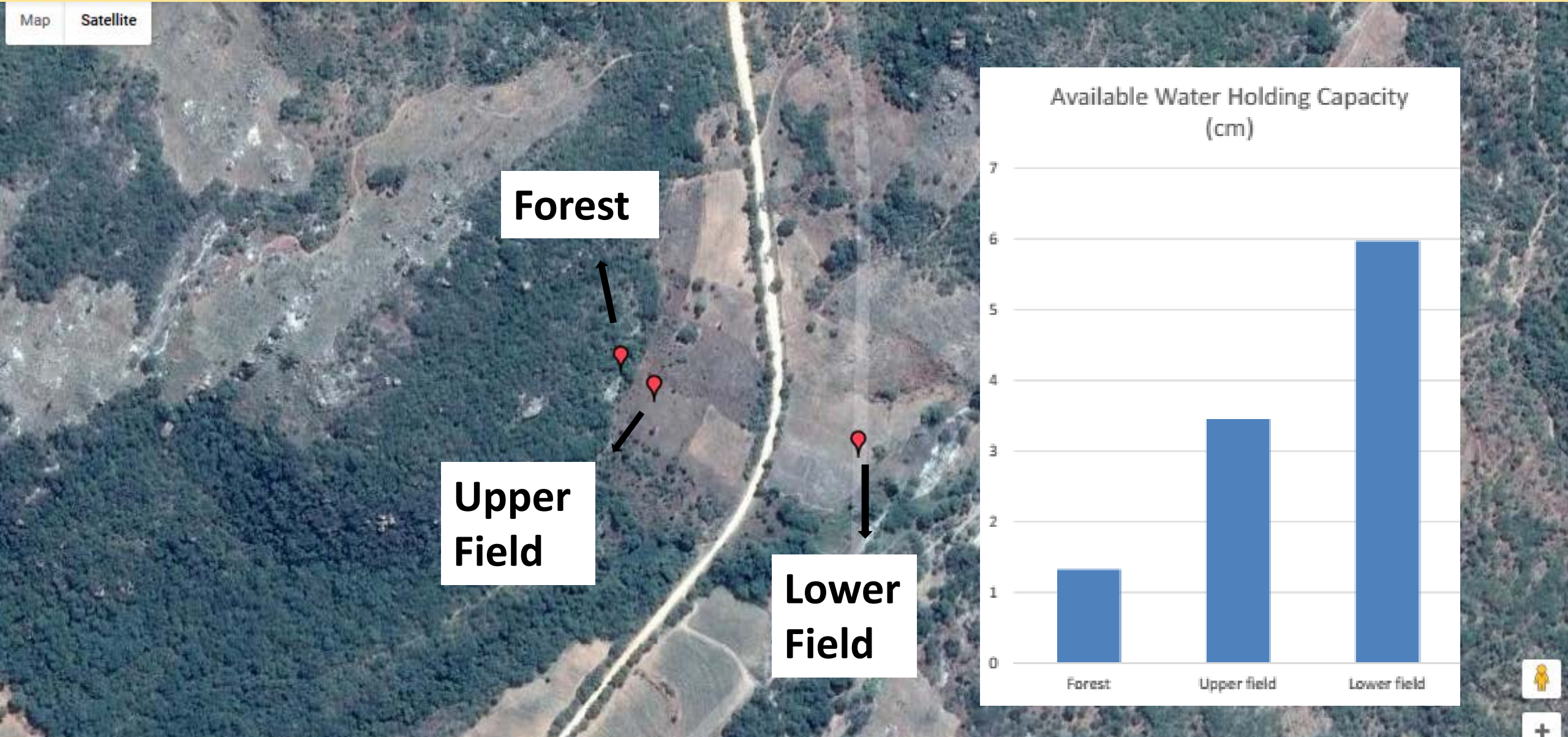
** sensu Jorge Moran Escamilla “a landscape is a representation of practices and processes that explain different social relations and physical structure in a specific space and time” (Escamilla, J.D.M., 2014. Paisaje urbano y desastres. *Quid 16. Revista del Área de Estudios Urbanos*, (4), pp.186-223)

Technologies for people … and the land, water and energy on which we depend

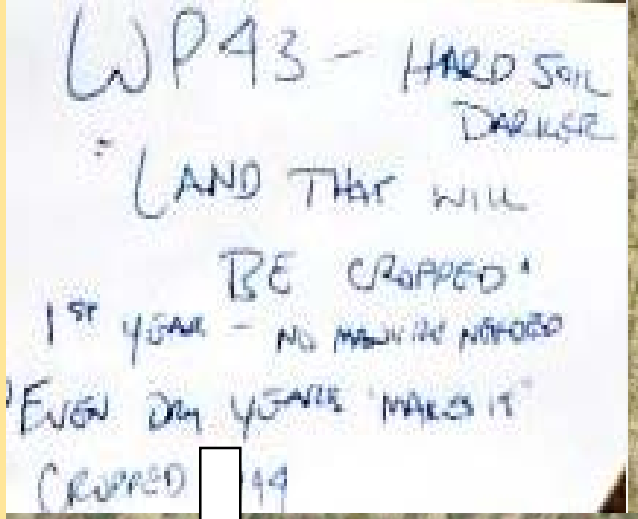


Extra slides showing variability in land potential in a small area (the first one from Tanzania includes current LandPKS output information, graphed)

Nyamihuu, Tanzania



Northeast Namibia



All mapped as same soil or group of soils: LandPKS links management directly to the <u>field-identified</u> soil (identified using algorithms with user-input + cloud-based info).