



Advanced**Potash**Technologies

Ultrapotassic syenites: an alternative K-source worldwide

Marcelo Oliveira, Albano Leite, Ingo Wender

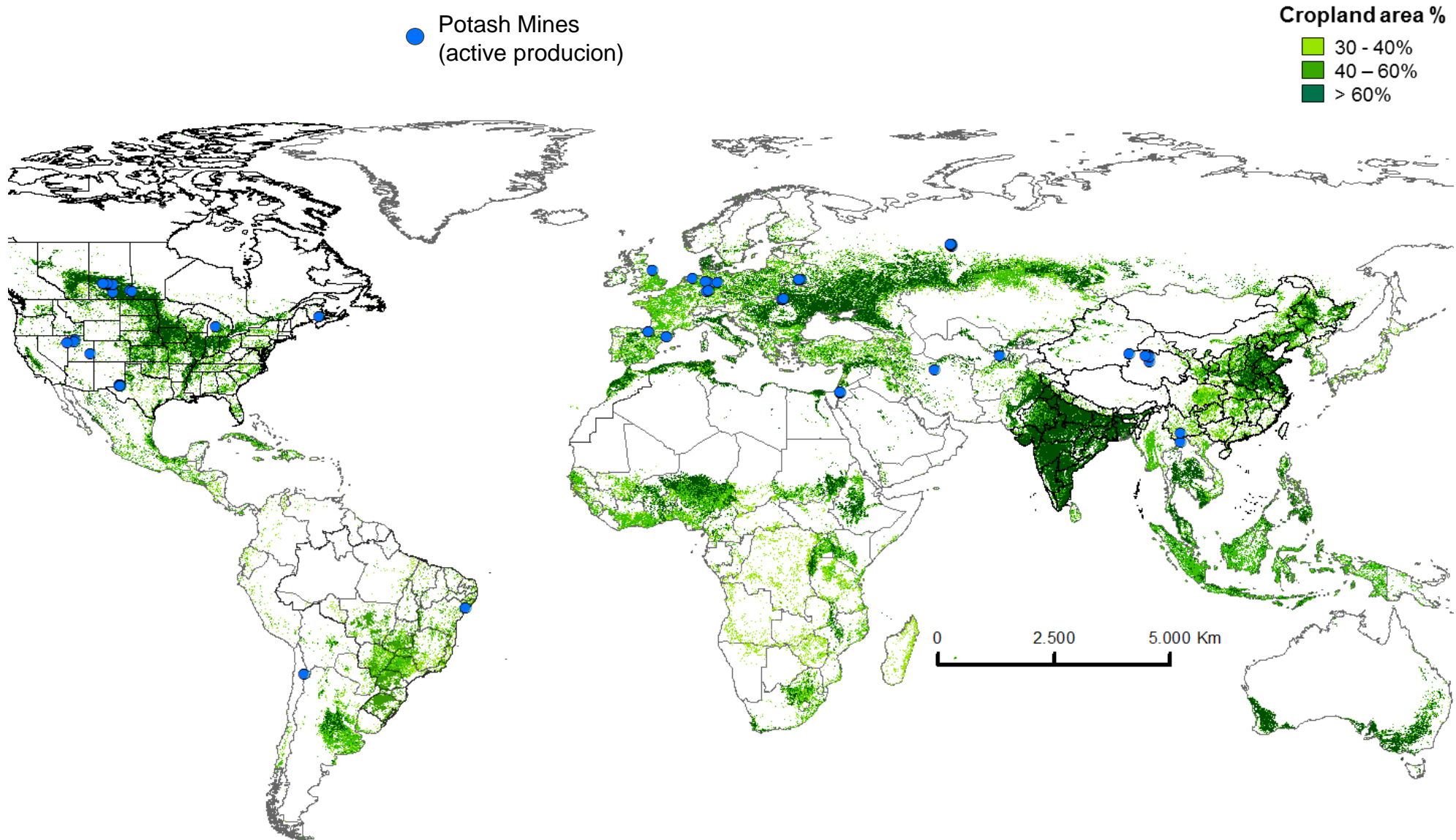
2IWAP, London, June 2017



***Potassium (K)
Fertilizers
Ready for Disruption***



Potash Mines

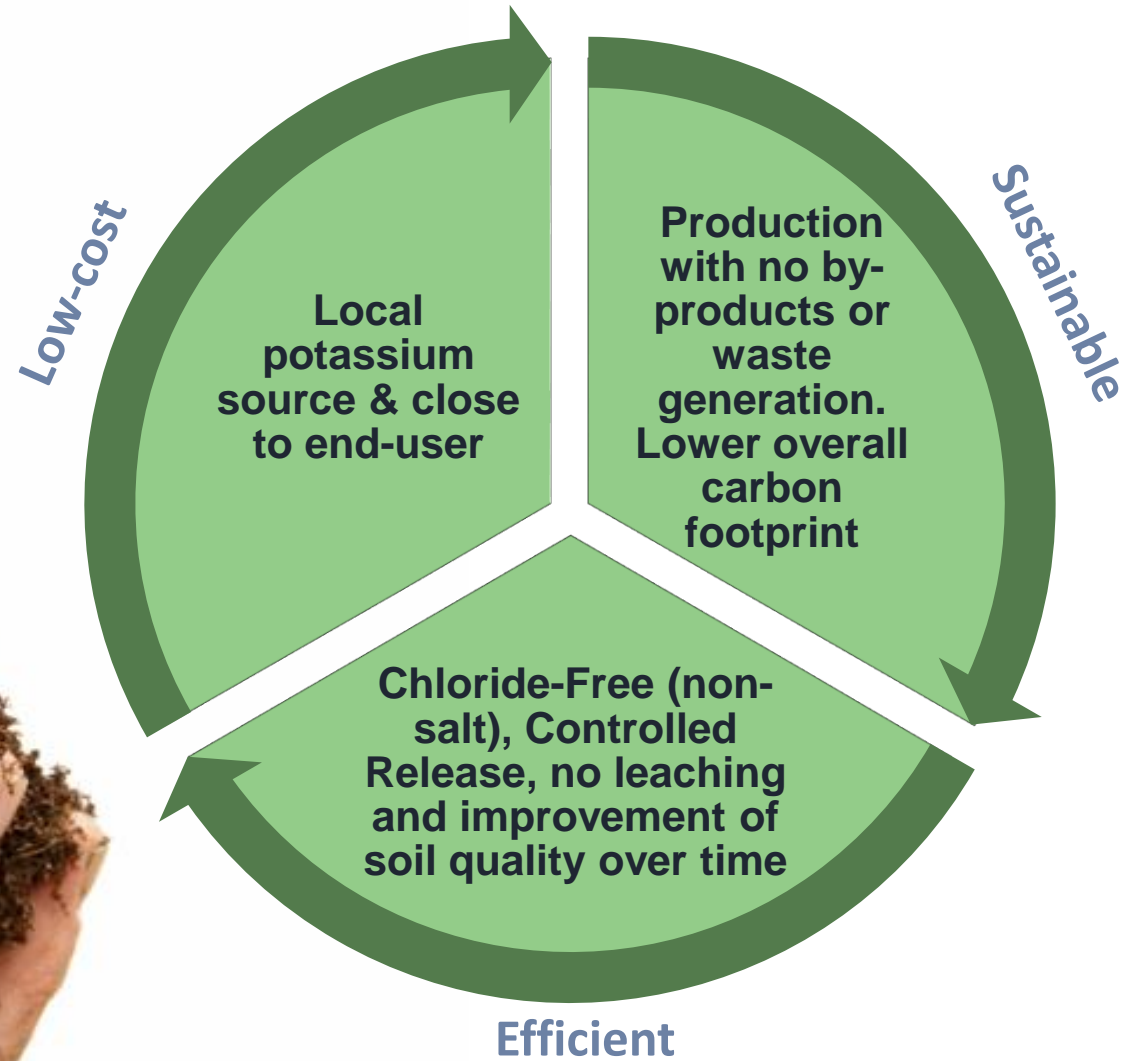


Source: USGS 2010

Unserved potash demand requires **new solutions**



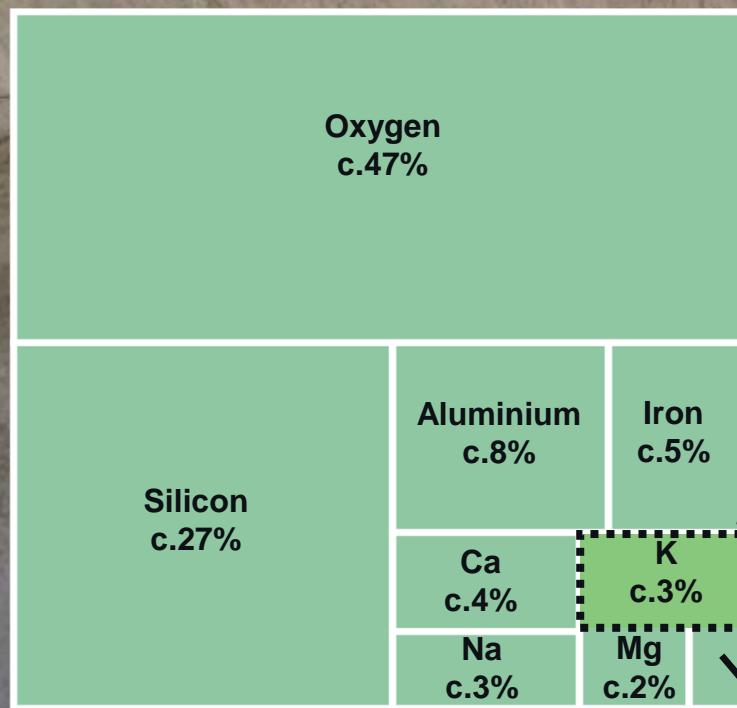
Demand for a New Potassium Fertilizer



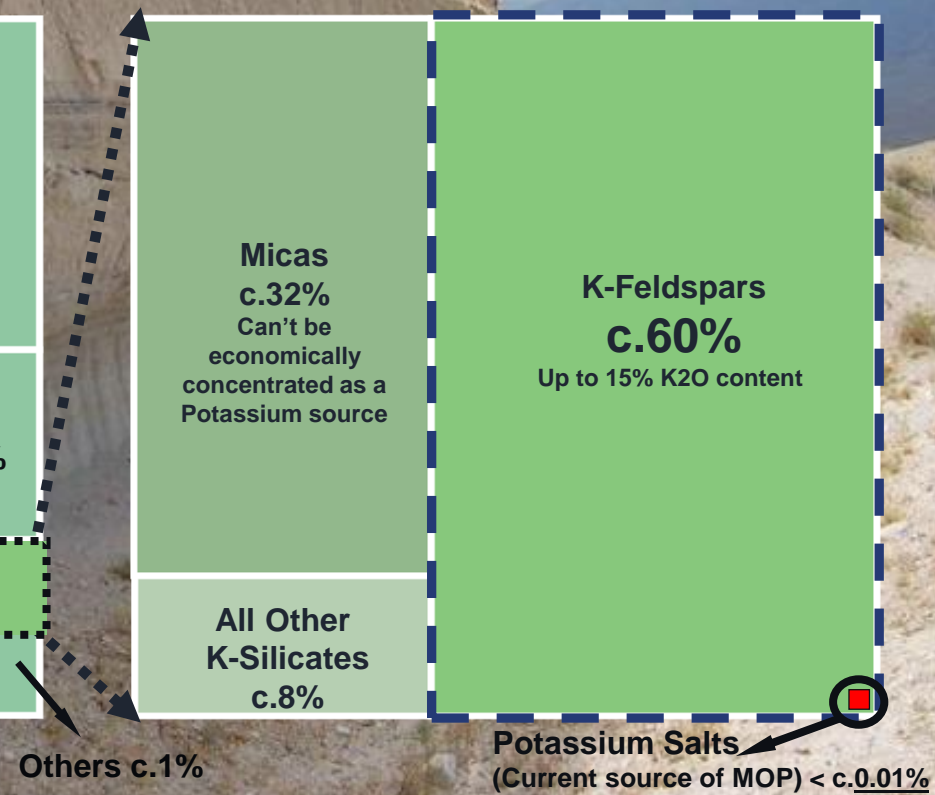
A new potassium fertilizer source

K-Feldspar is an abundant and chloride-free silicate mineral

Earth's Crust Composition



World's Potassium Distribution in Minerals





K-rich rocks

▶ **Sedimentary rocks:**

- Arcosian sandstones; low K_2O grade, high quartz contents;

▶ **Metamorphic rocks:**

- Mica schists: low K_2O grade (< 4 wt%), high quartz contents. Moderate K_2O grades (> 7 wt%) are very rare and low tonnage (< 10 Mton).

▶ **Igneous rocks:**

- Syenites: up to 15 wt% K_2O , large volumes, occur worldwide.
- Trachytes; more restricted



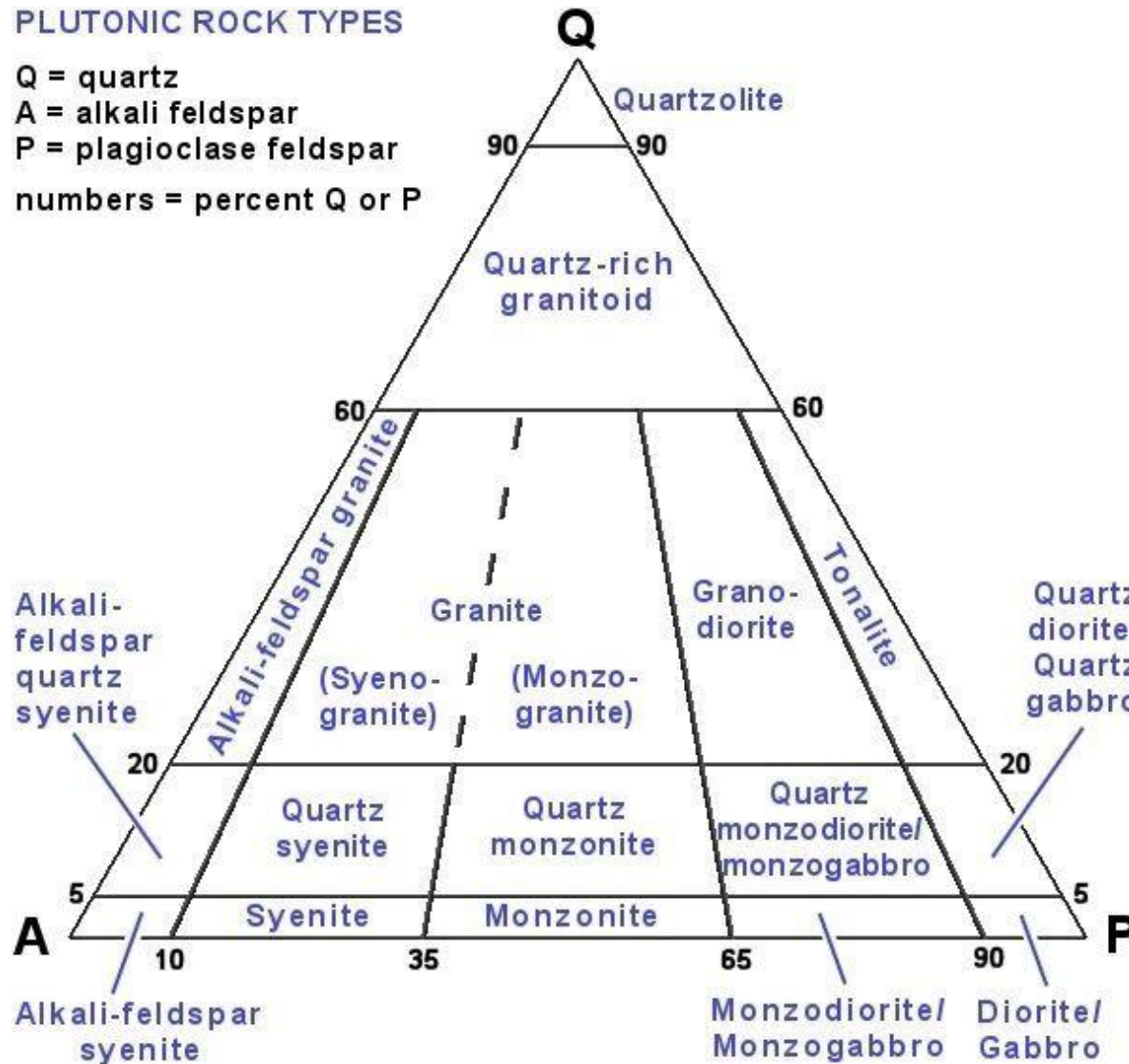
New exploration model

- ▶ Syenite was not an ore before APT;
- ▶ Occurrences and main characteristics;
- ▶ **Petrology:**
- ▶ **Geomorphology:**
- ▶ **Geophysics.**

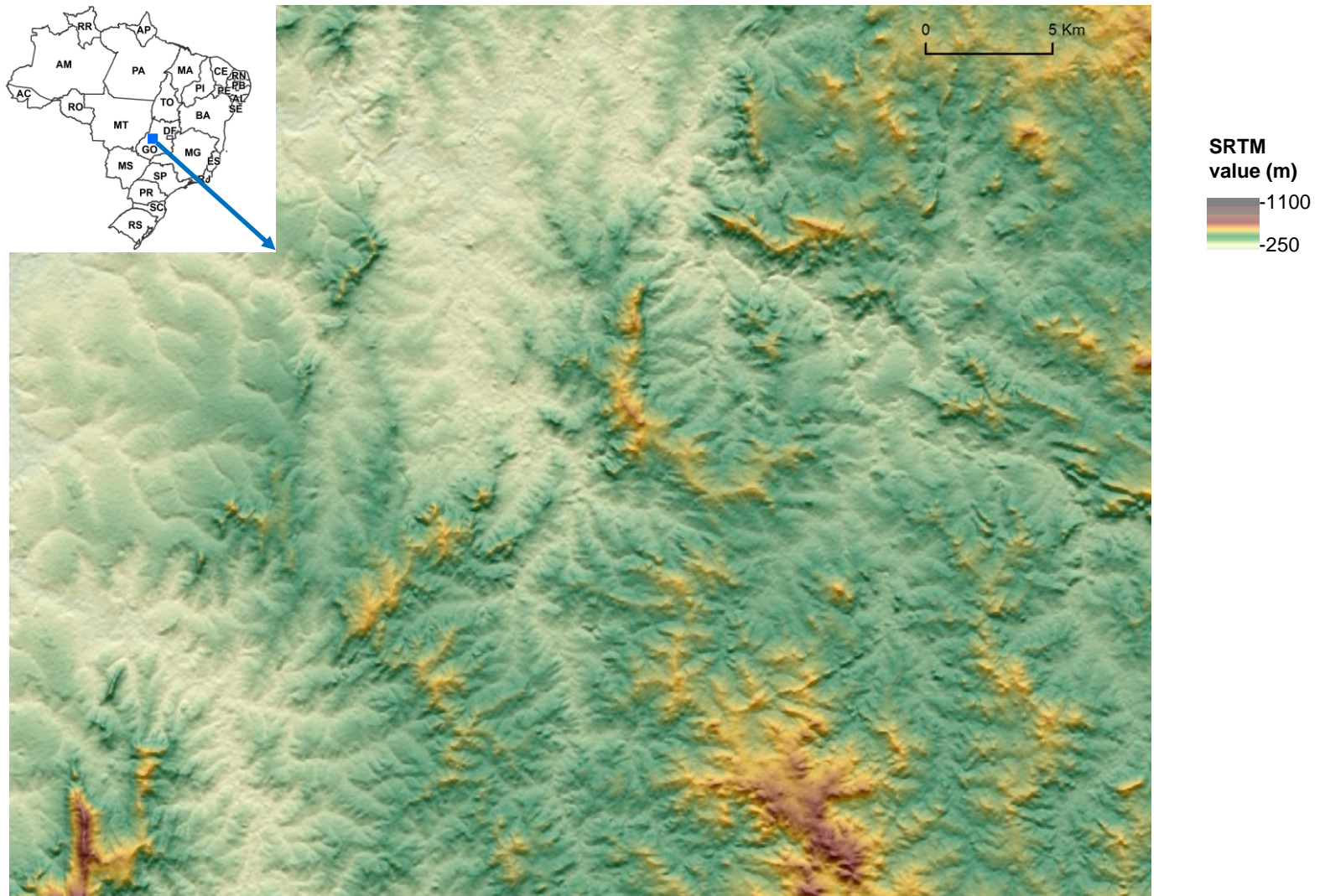
Petrology - Genesis

PLUTONIC ROCK TYPES

Q = quartz
 A = alkali feldspar
 P = plagioclase feldspar
 numbers = percent Q or P



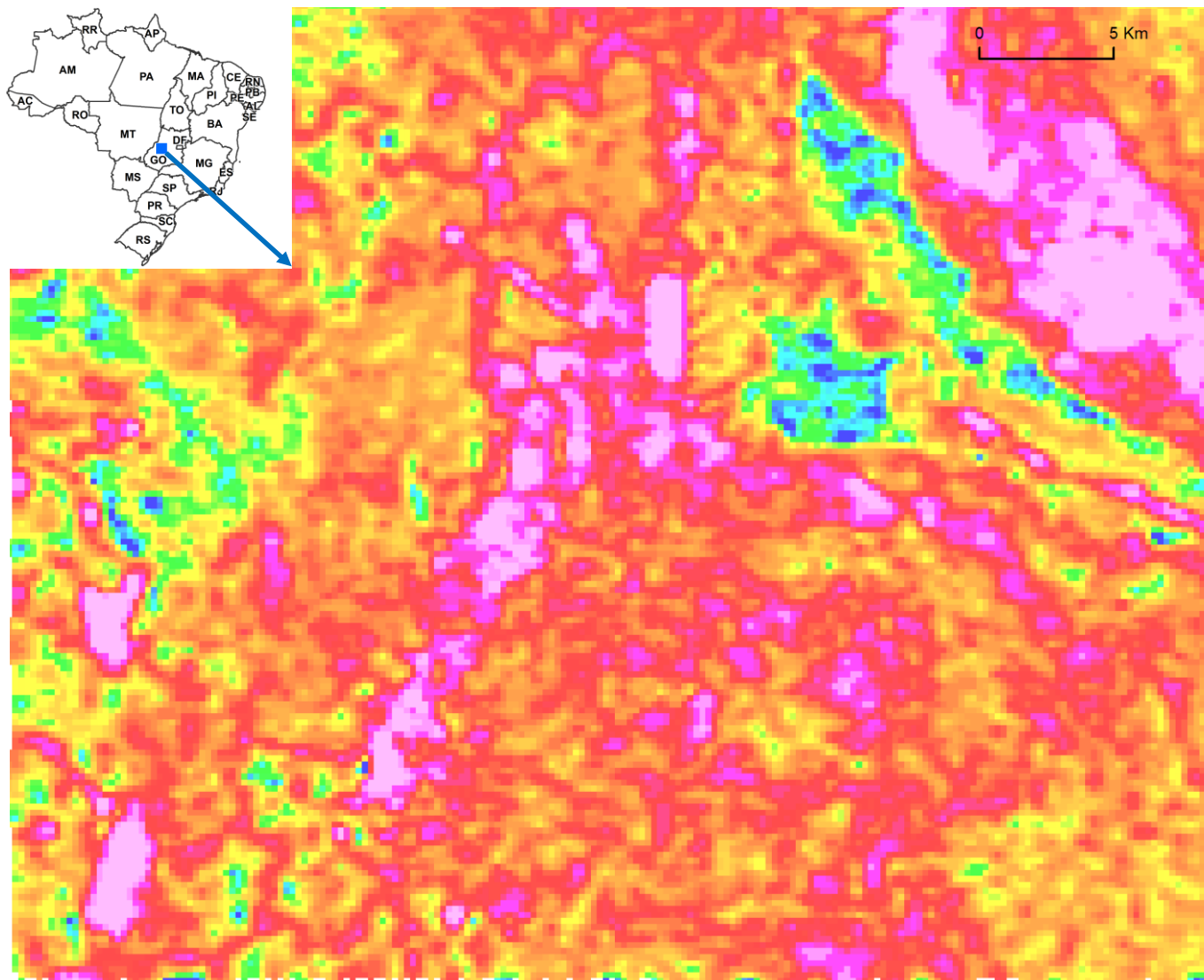
Geomorphology



Source: SRTM: NASA / INPE 2010; APT

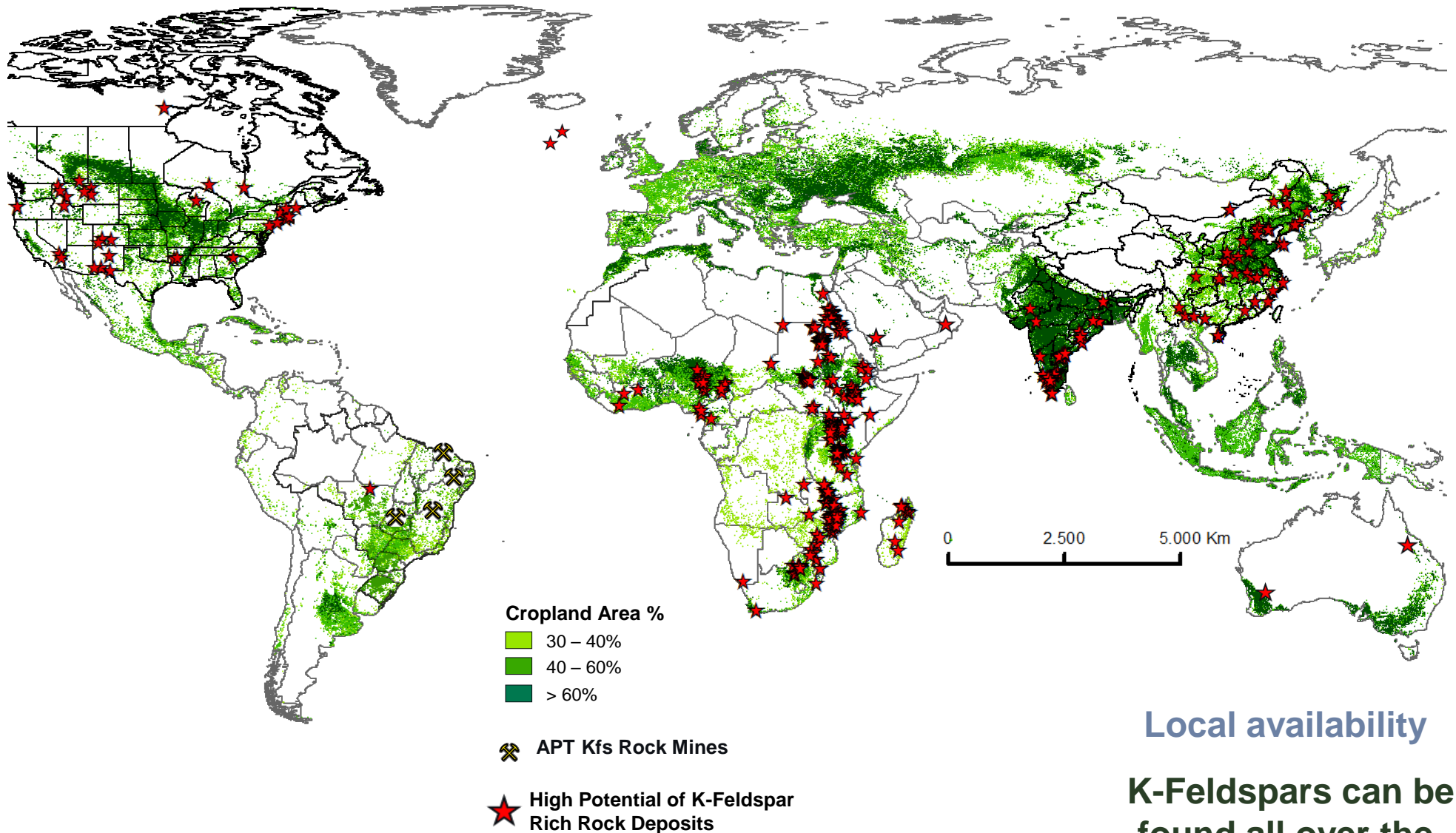


Gamma K



Source: CPRM 2012; APT

APT's model + Desktop study



Local availability

K-Feldspars can be found all over the world

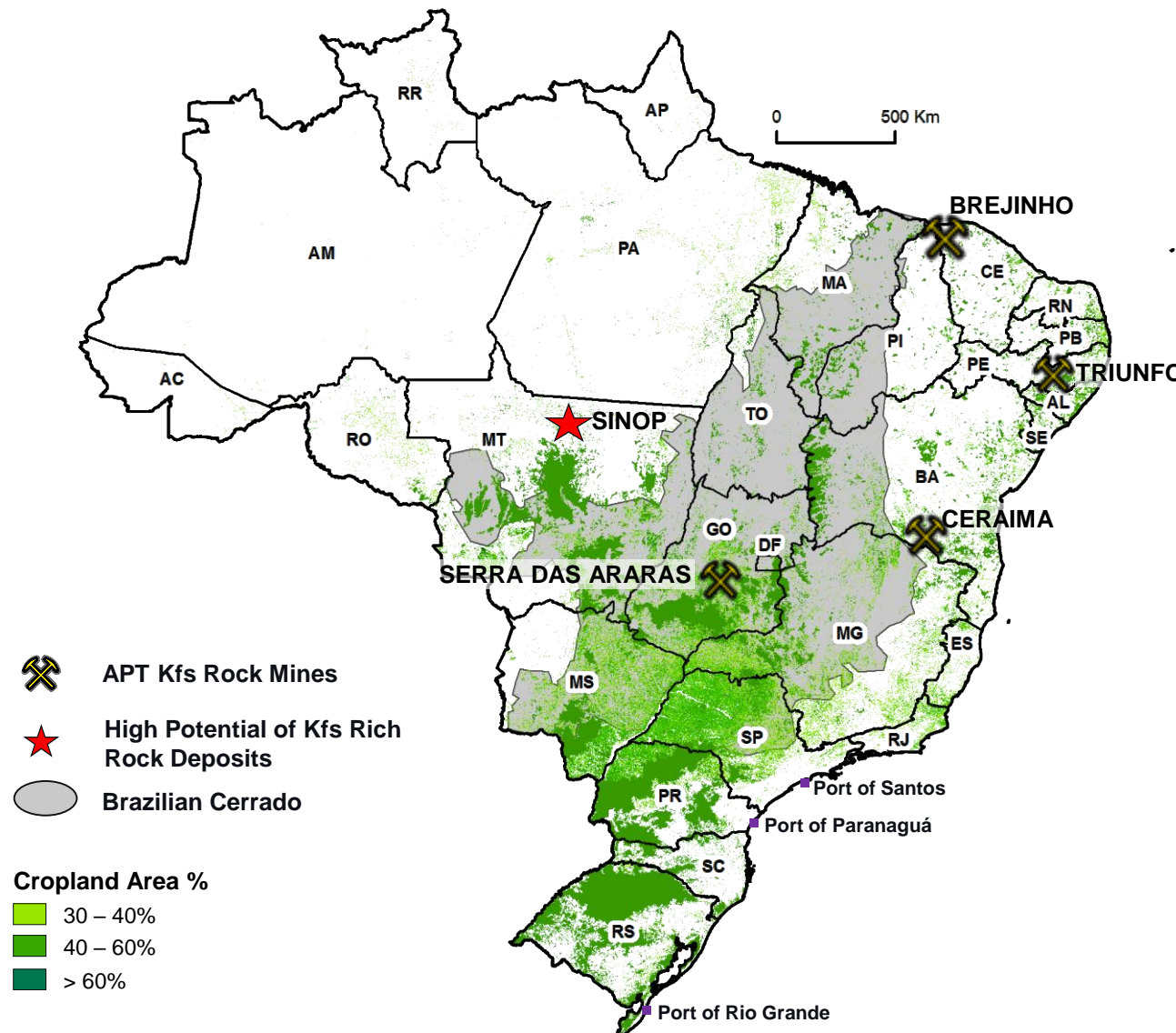
Source: *Cropland Area*: IIASA-IFPRI (GEOWIKI);

K-Feldspar Rich Rocks: Location of Kfs rich rock deposits based on general public information and proprietary geological data. Research is non-exhaustive. Occurrence of K-feldspars in areas other than those researched so far is highly likely.

APT Kfs Deposits in Brazil

Comments

- ▶ APT developed Kfs mines close to all major agricultural areas of the Cerrado region



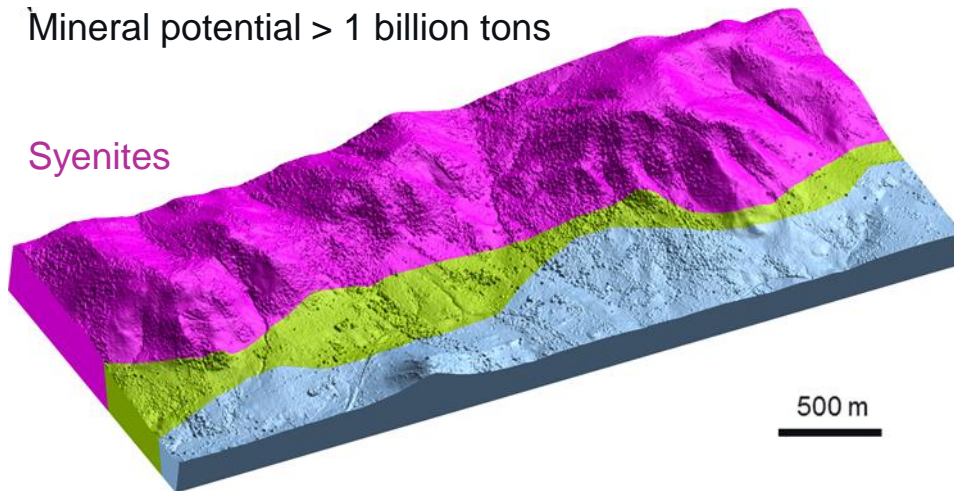
Source: IBGE 2007 - Census of Agriculture, 2006 collected data; Embrapa 2013 – System for Agriculture Observation and Monitoring (SOMABRASIL), 2011's Crops; APT Analysis

Triunfo Project

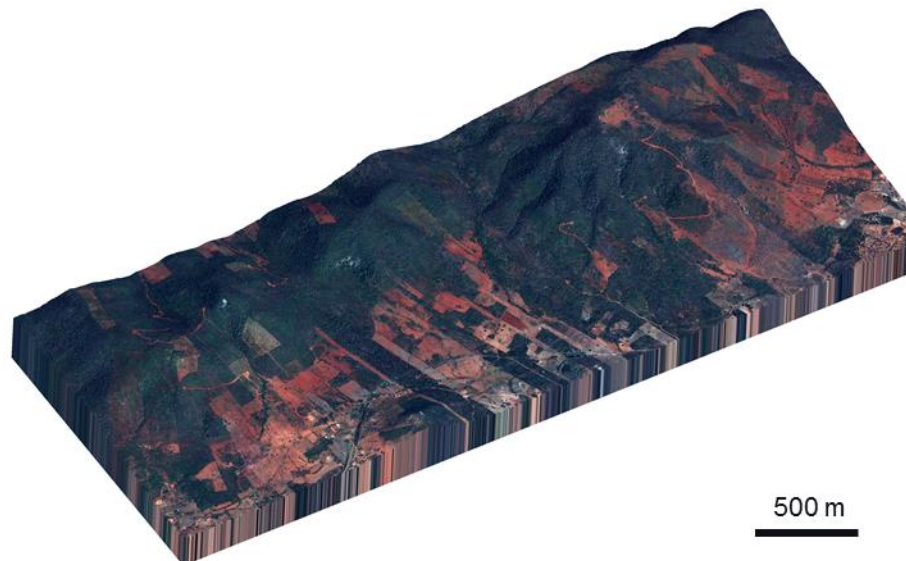
Triunfo Project – 3D Geological modelling

Mineral potential > 1 billion tons

Syenites

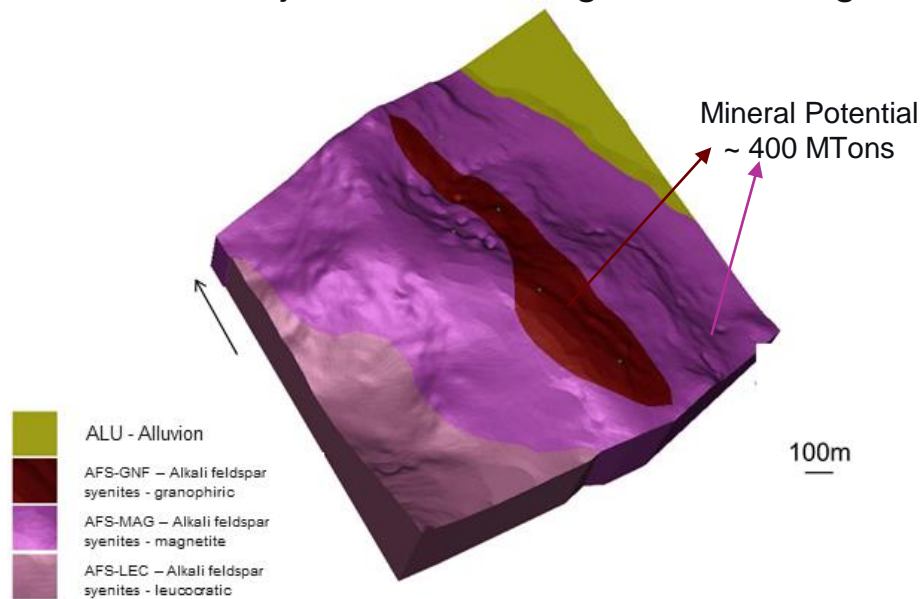


Triunfo Project – Google Earth image



Ceraíma Project

Ceraíma Project – 3D Geological modelling



Ceraíma Project – AFS-GNF



Ceraíma syenitic complex

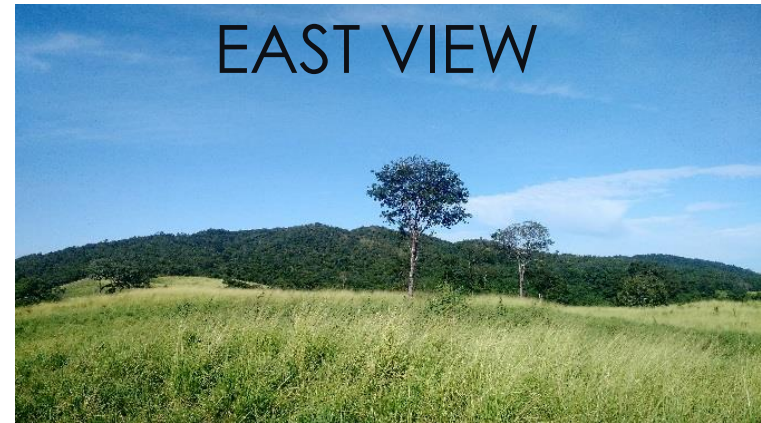




Serra das Araras Project - North



15.2% K_2O
64.2% SiO_2



1.7Km



14.2% K_2O
64.5% SiO_2



1.1Km



Serra das Araras Project - North



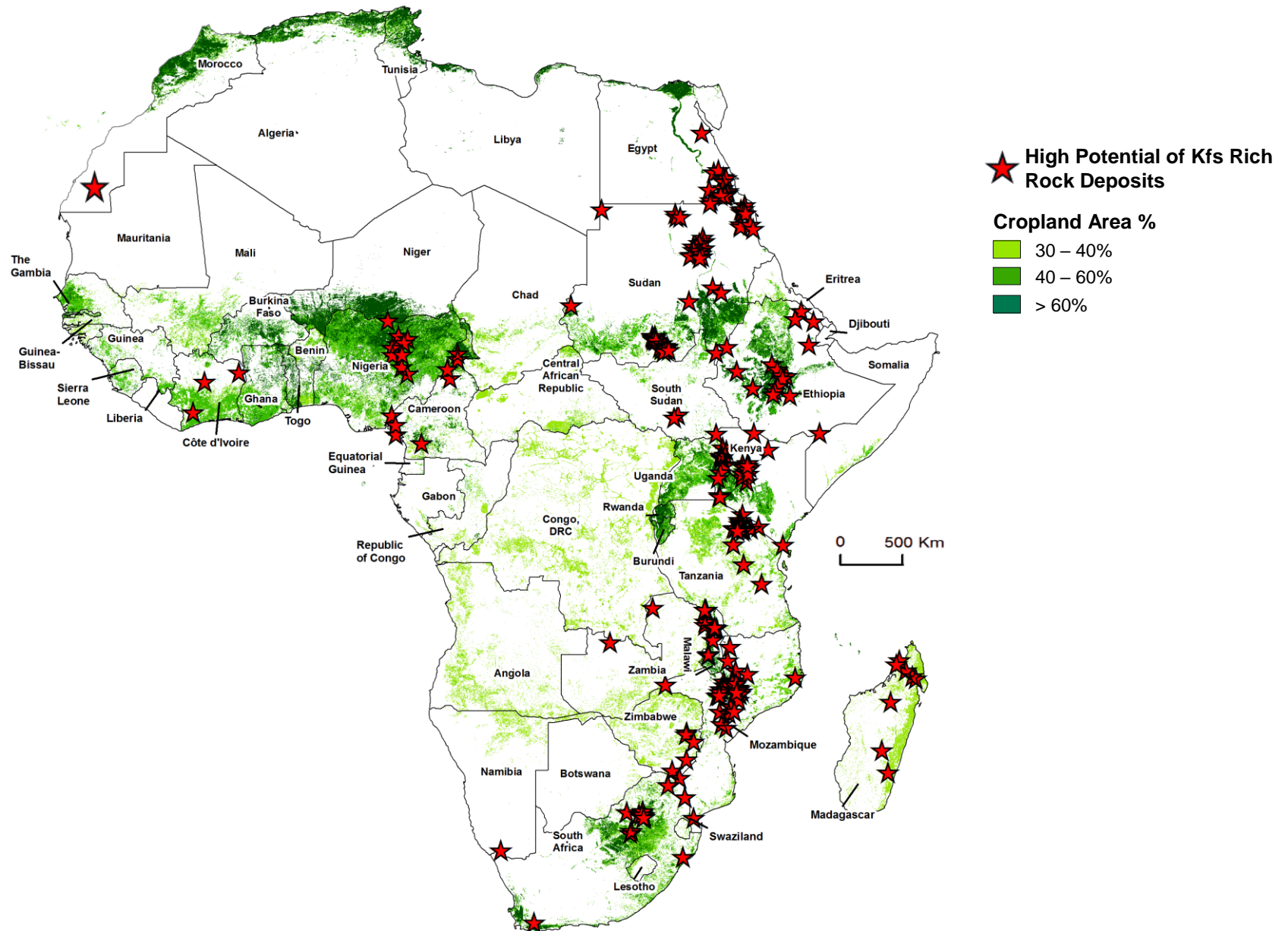
14.7% K_2O
62.7% SiO_2



13.0% K_2O
60.7% SiO_2

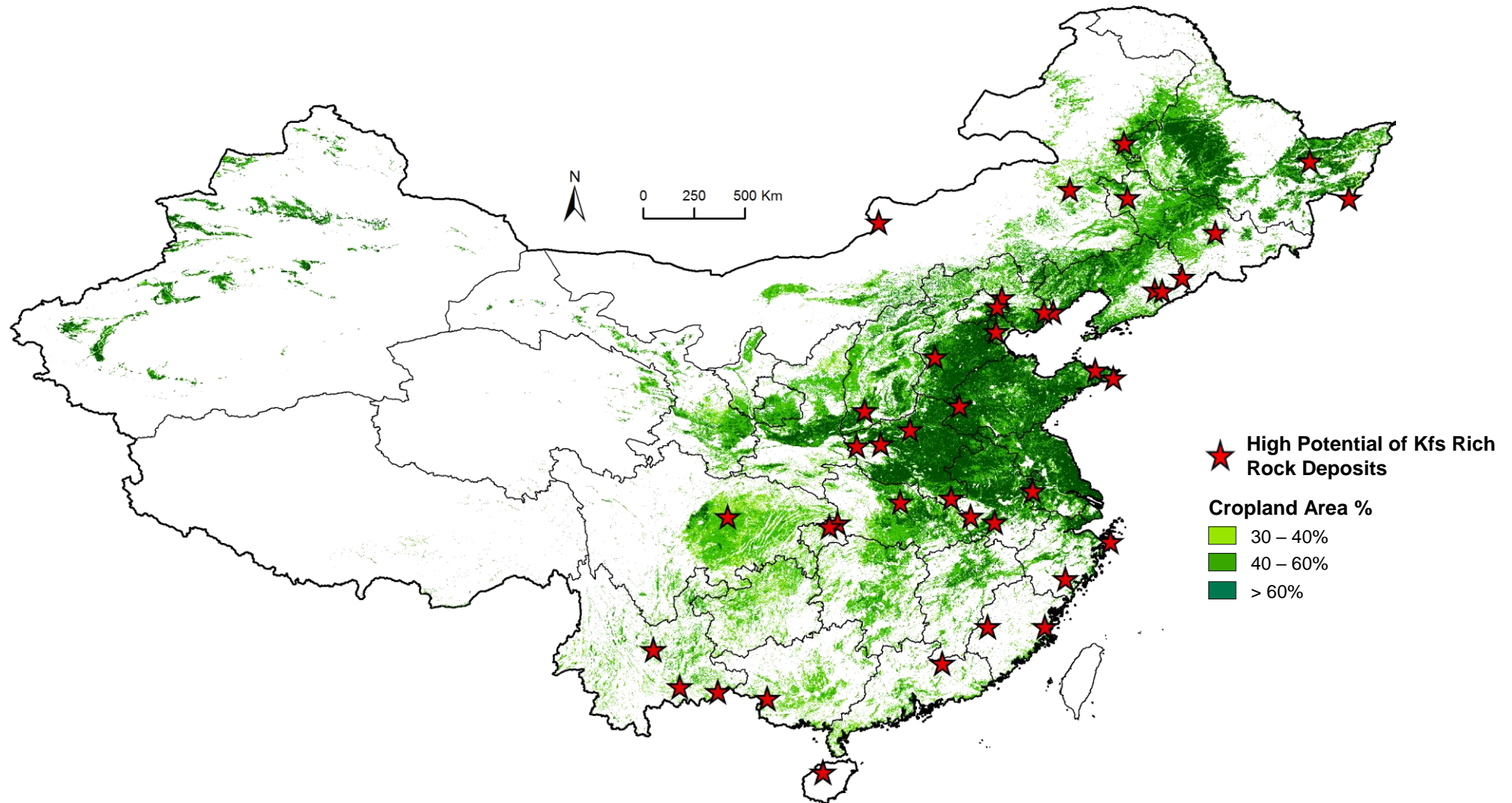


African Continent – High Potential Kfs Opportunities



Source: Cropland Area: IIASA-IFPRI (GEOWIKI); K-Feldspar Rich Rocks: Location of Kfs rich rock deposits based on general public information and proprietary geological data

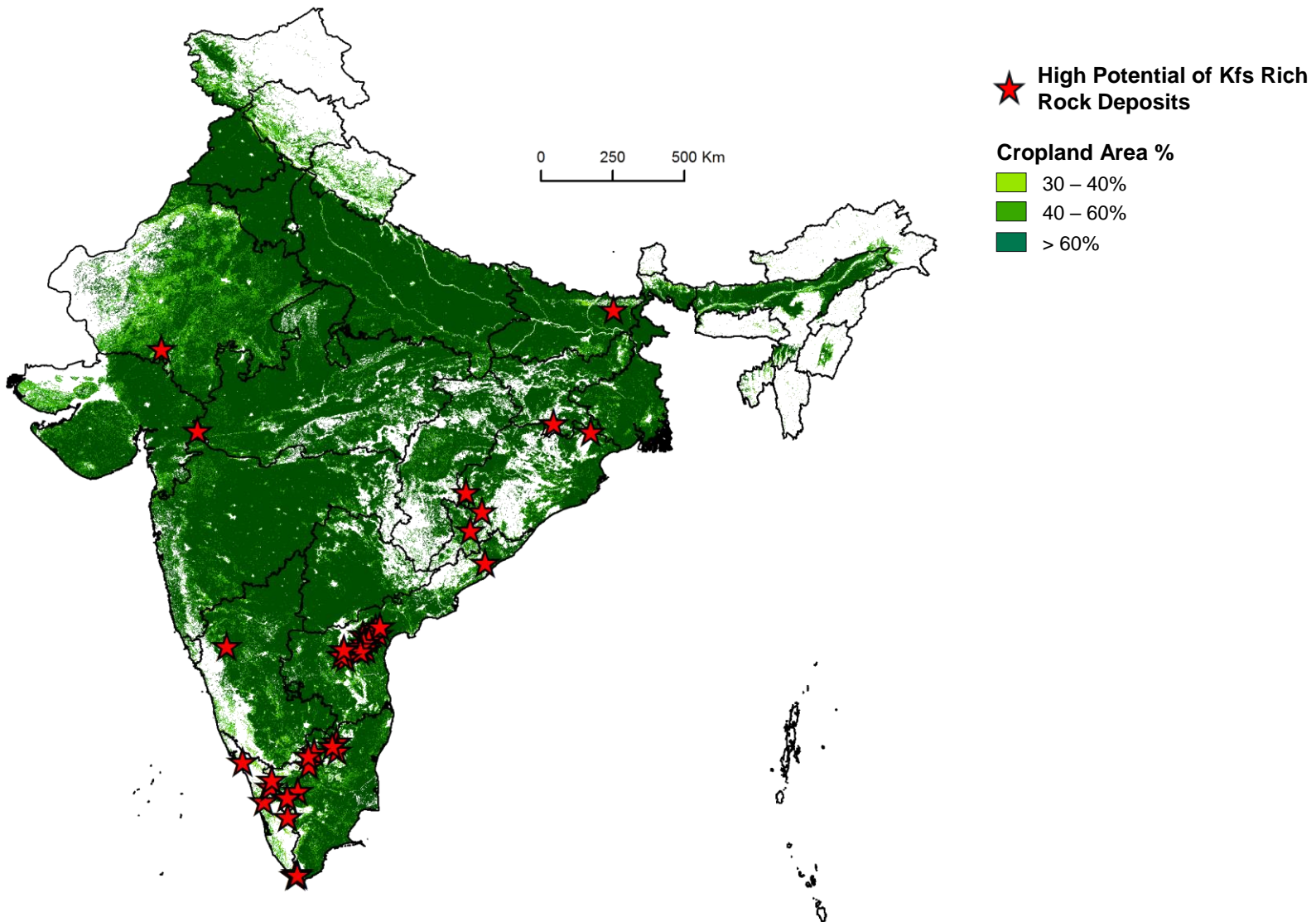
China – High Potential Kfs Opportunities



Source: Cropland Area: IIASA-IFPRI (GEOWIKI); K-Feldspar Rich Rocks: Location of Kfs rich rock deposits based on general public information and proprietary geological data



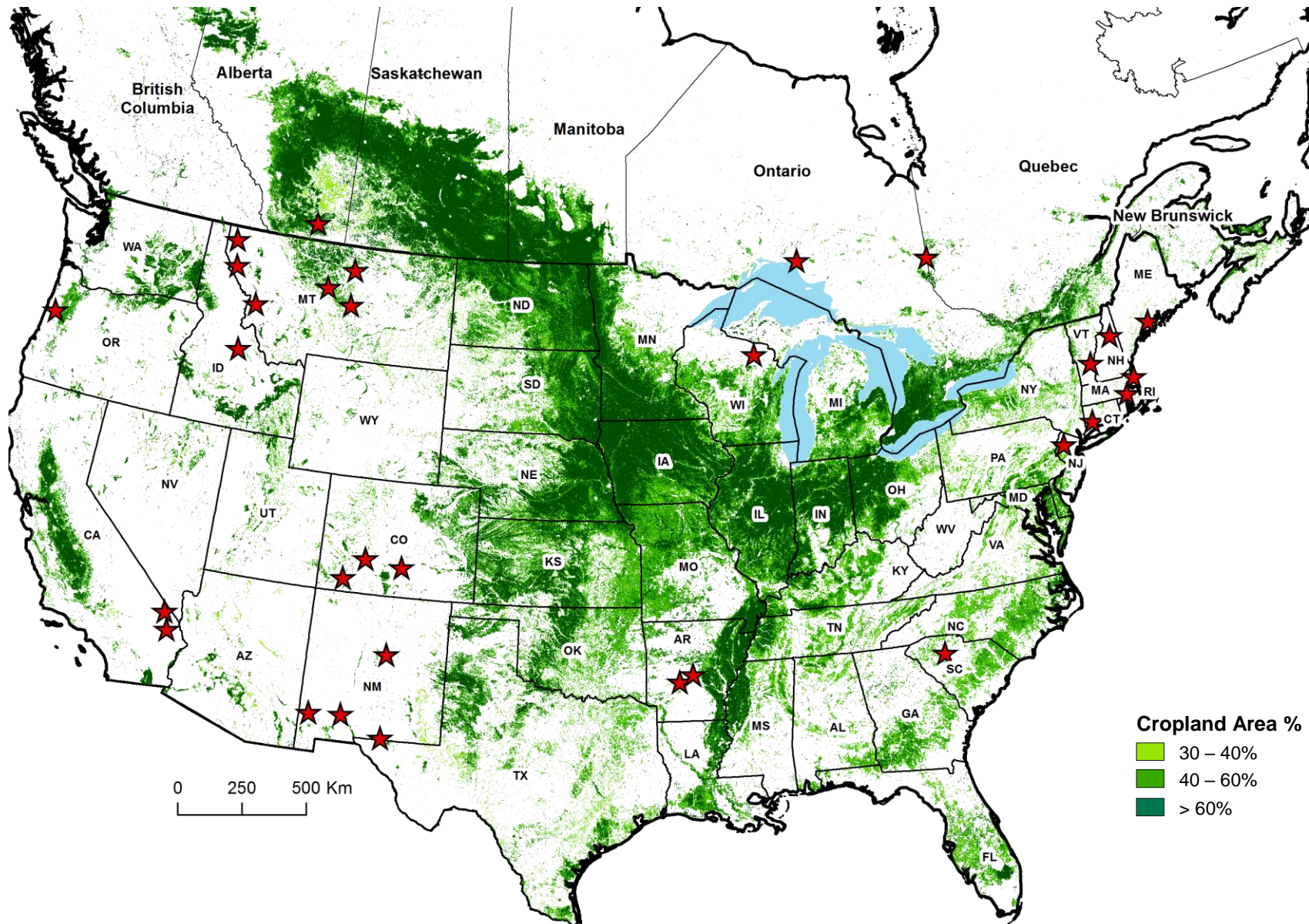
India – High Potential Kfs Opportunities



Source: Cropland Area: IIASA-IFPRI (GEOWIKI); K-Feldspar Rich Rocks: Location of Kfs rich rock deposits based on general public information and proprietary geological data



North America – High Potential Kfs Opportunities



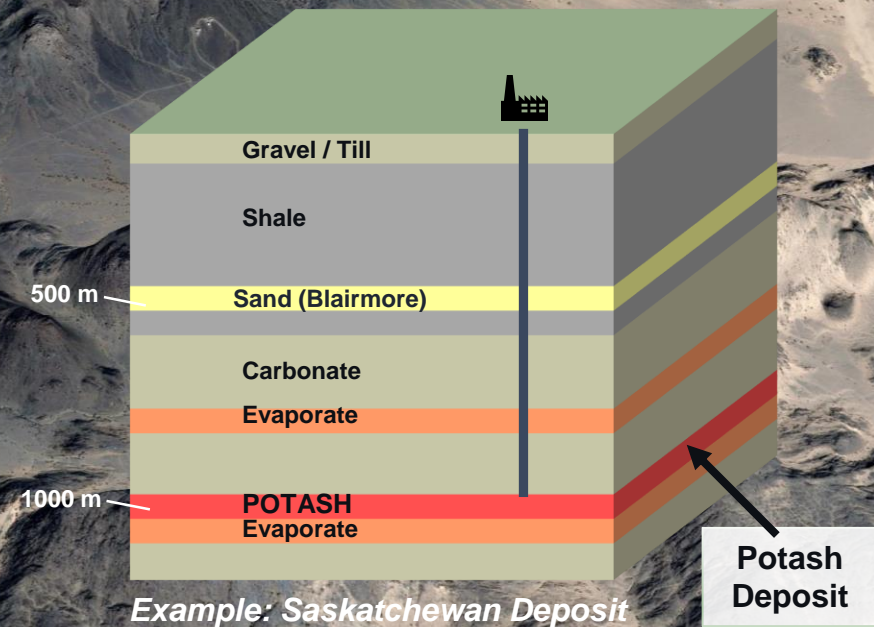
Source: Cropland Area: IIASA-IFPRI (GEOWIKI); K-Feldspar Rich Rocks: Location of Kfs rich rock deposits based on general public information and proprietary geological data

No need for complex and expensive deep mining operations

Example of Kfs Deposits – Brazil



Typical Potash Evaporite Deposits





Advanced**Potash**Technologies

info@advancedpotash.com