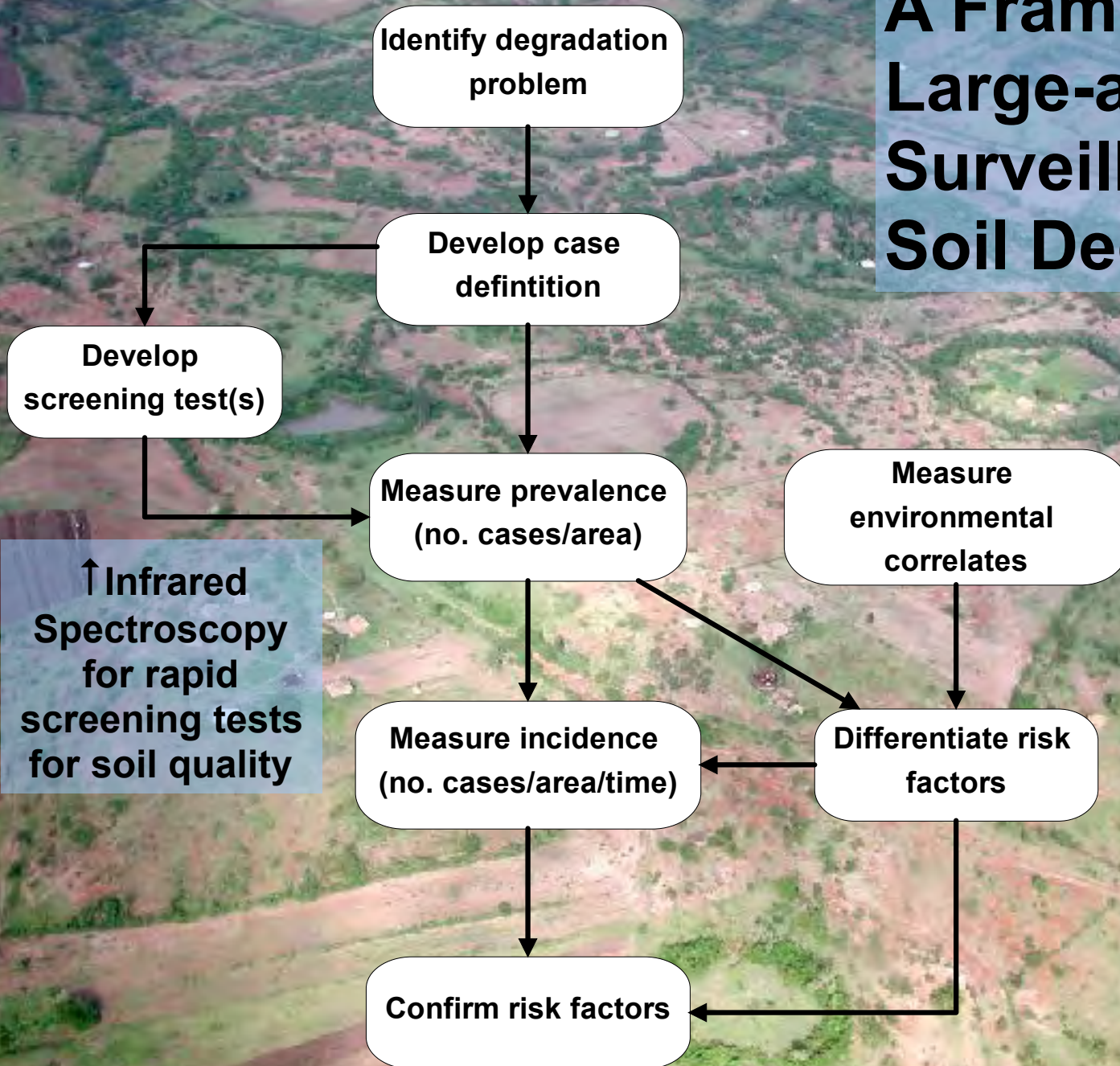# Land Degradation Surveillance

New tools for rapid diagnosis of soil health in support of increased agricultural production and environmental protection in Africa

Keith D Shepherd, Markus G Walsh, Thomas Gumbricht
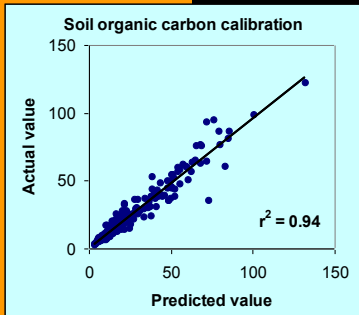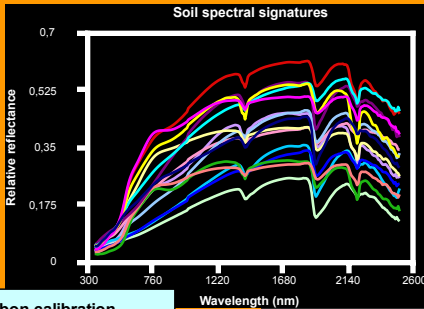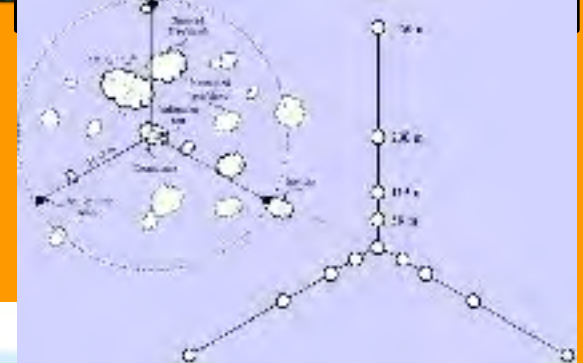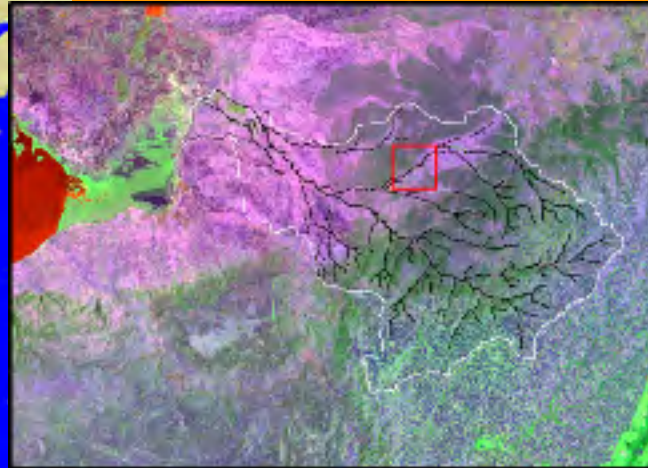*World Agroforestry Centre (ICRAF), PO Box 30677-00100, Nairobi, Kenya*

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

A Framework for Large-area Surveillance of Soil Degradation

Identify degradation problem

Develop case defintition

Develop screening test(s)

↑Infrared Spectroscopy for rapid screening tests for soil quality

Measure prevalence (no. cases/area)

Measure environmental correlates

Measure incidence (no. cases/area/time)
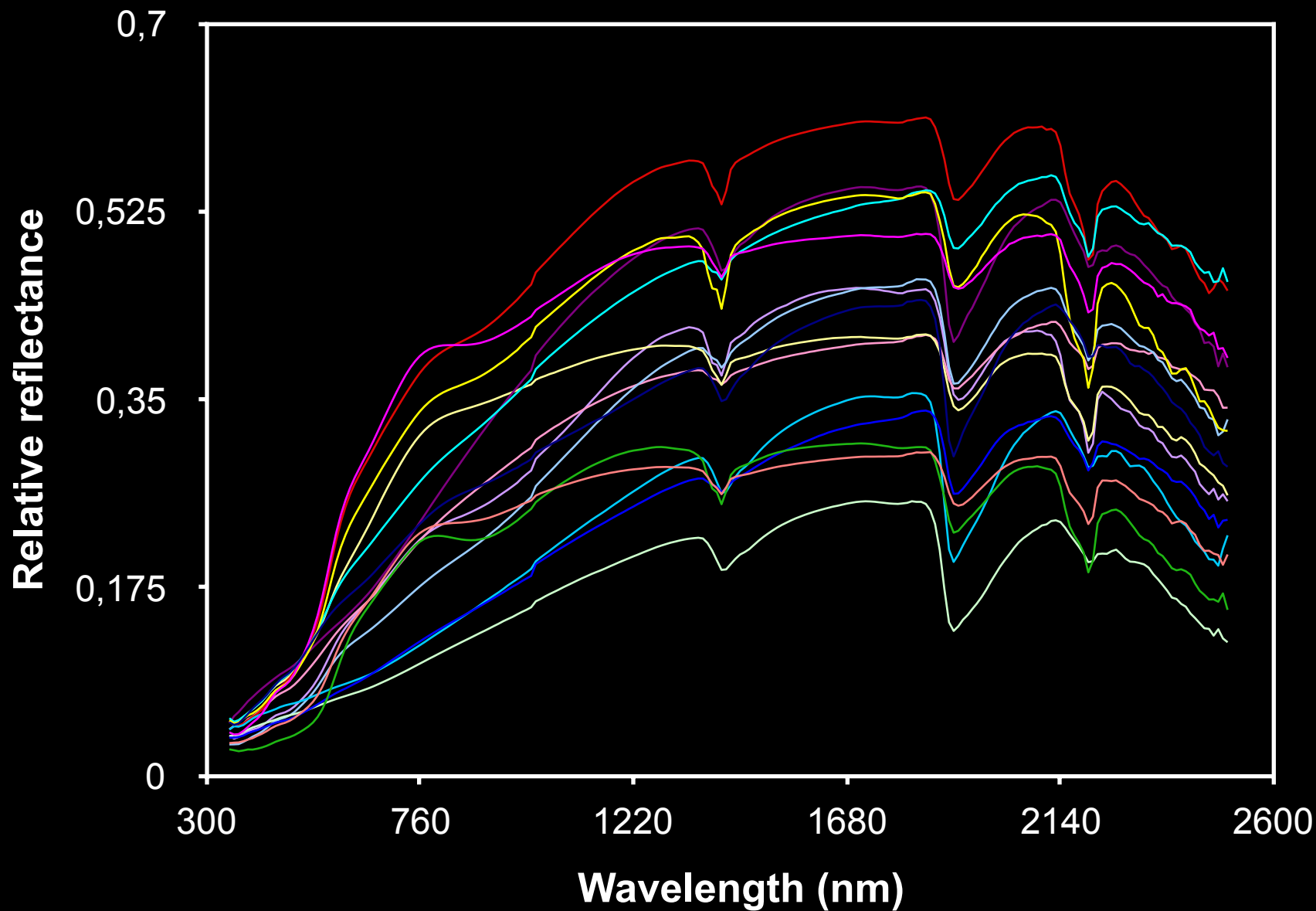
Differentiate risk factors

Confirm risk factors

Land Degradation Surveillance – continental to field scale

Infrared Spectroscopy for Rapid Soil Characterization

Soil spectral signatures
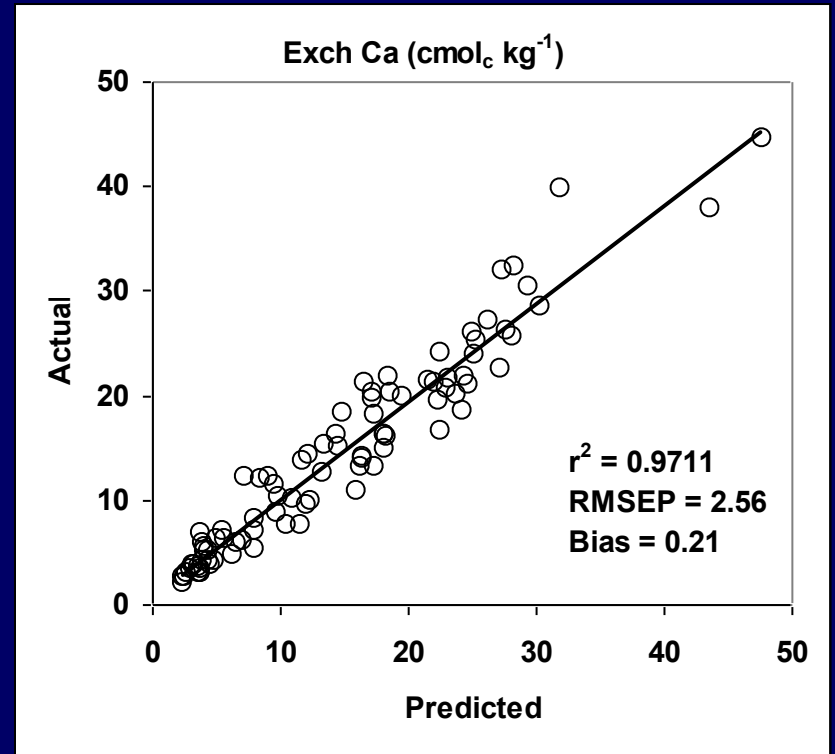

Wavelength (nm)

Relative reflectance

0,7

0,525

0,35

0,175

0

300   760   1220   1680   2140   2600

W Kenya soils

Cross-validated predictions

Organic C (%)

r^2 = 0.949
RMSEP = 0.63
Bias = -0.017

Exch Ca (cmol$_c$ kg^{-1})

r^2 = 0.9711
RMSEP = 2.56
Bias = 0.21
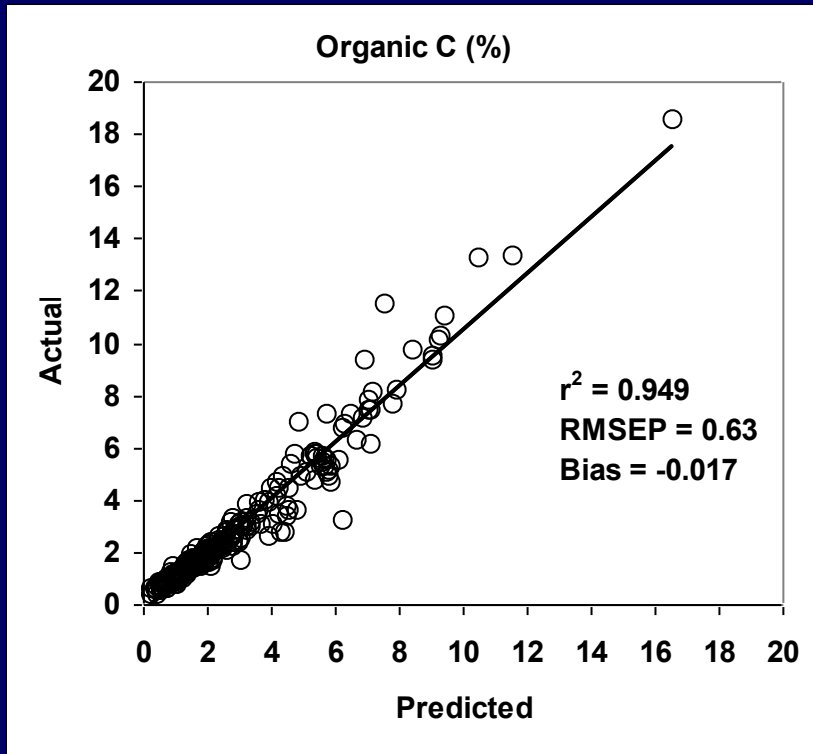
Rapid testing and diagnosis for Anticipatory Management of Soil Health

Forest

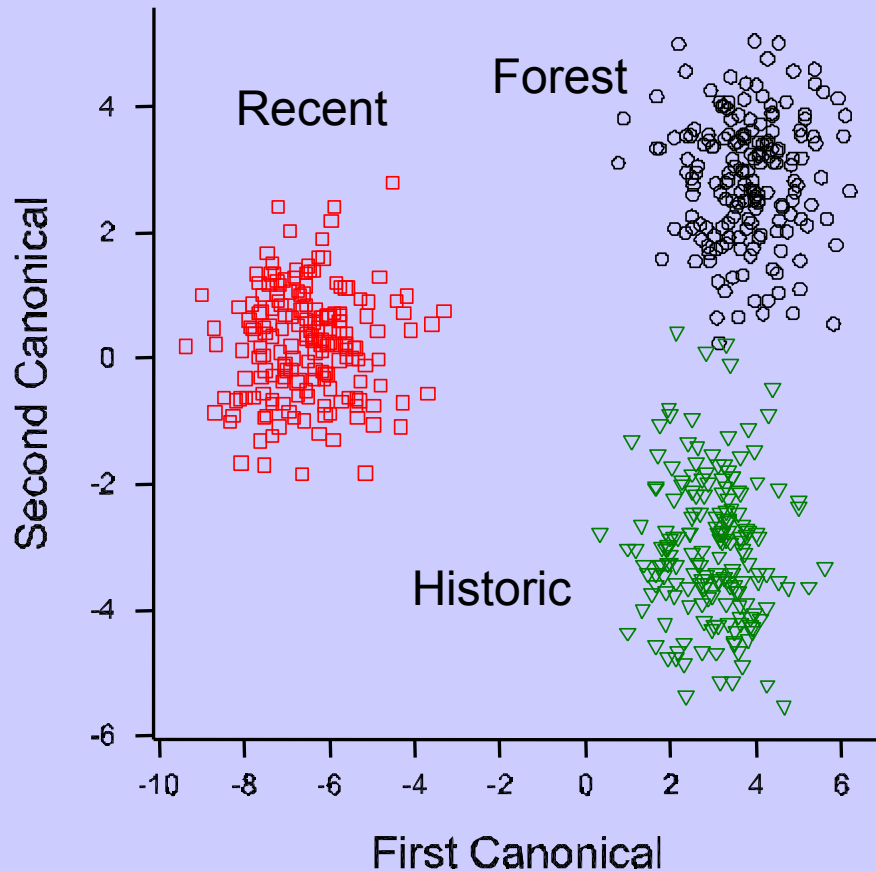Recent

Spectral classification of <u>soils</u> converted from forest to maize-based systems

Out of 579 samples 94% were correctly classified.

Historic

Rapid testing and diagnosis for Anticipatory Management of Soil Health

Spectral classification of <u>plants</u> grown on soils converted from forest to maize-based systems

Out of 548 samples, 94% were correctly classified.

Infrared spectroscopy

- **Overcome current limitations in developing country laboratories for rapid analysis of soils, plants, forages, tree products, and organic ameliorants.**

- **Provide reliable information on soil constraints to tree, crop and livestock production and soil degradation over large areas by calibration to remote sensing information.**

Regional Capacity Building

- Infrared spectroscopy lab in Mali as regional resource

- Regional soil spectral libraries and calibrations for soil properties

- Regional training course and training materials in land degradation surveillance and infrared spectroscopy

- Web site as a training resource

Sensing Soil Quality

Helping to increase the efficiency of research and development for sustainable land use

Web site Google: Sensing Soil Quality