Comparing Farmer Perceived Soil Quality And Measured Soil Quality In Tanzania: Do They Align?

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Outline

- Motivation: Agricultural Yield Gaps
- Theory: Identifying Causes of Yield Gaps
- Methods, Data, and Findings:
  - Comparing conceptions of “Soil Quality”
  - Comparison of Measured and Perceived Soil Quality
- Conclusion

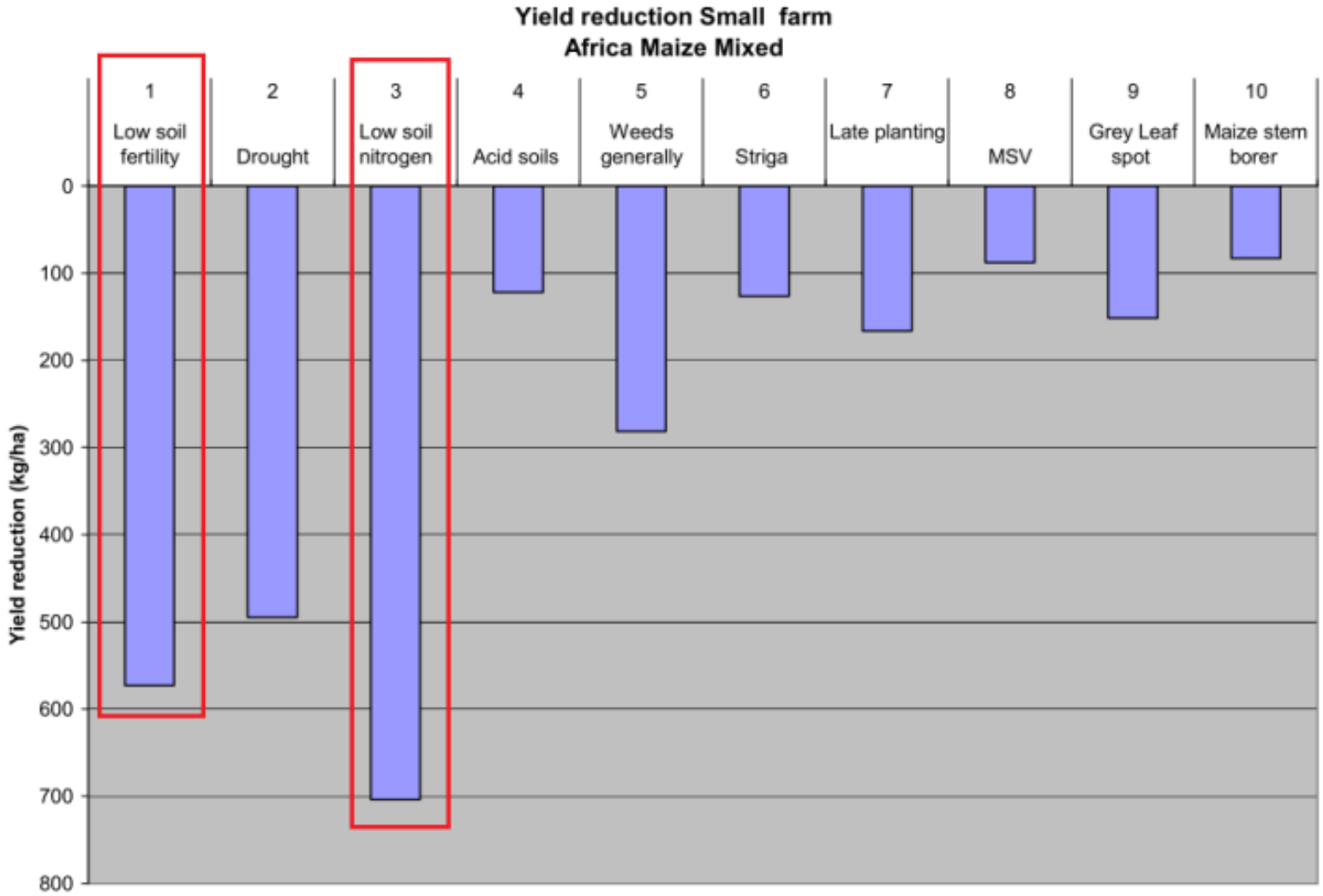
Defining Agricultural Yield Gaps

- "Yield Gaps" - discrepancies between potential agricultural yields and actual agricultural yields.
- Estimated mixed-maize small farm production in Sub Saharan Africa:
  - Potential yields (Theoretical): 5 -10 tons/ha
  - Actual yields: 1 - 3 tons/ha
- Tanzanian maize production:
  - Potential yields (90^{th} Percentile): 2 tons/ha
  - Actual median farmer yields: 0.66 tons/ha

Addressing Agricultural Yield Gaps

- Programs encourage: fertilizer use, soil conservation, composting, crop cover use, and other techniques.
- Lower than expected adoption rates.
- Potential explanations for variation in adoption: farmer education level, age, farm size, land tenure, and many others.
- No universal consensus has emerged.

Identifying Causes of Yield Gaps

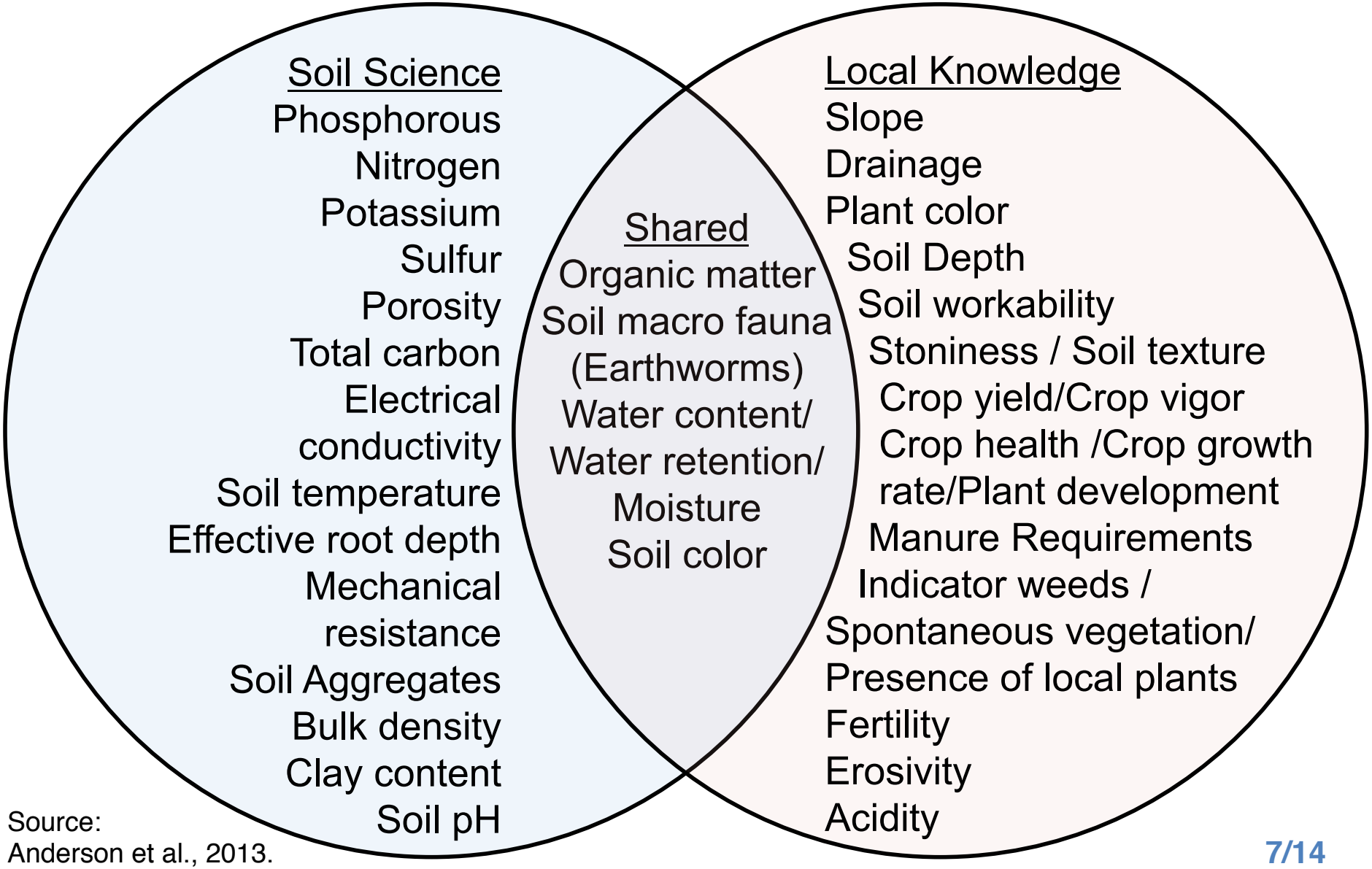


Source: Gibbon et al. 2007. Beyond Drought Tolerant Maize: Study of Additional Priorities in Maize Report to Generation Challenge Program.

Do Soil Quality Assessments Align?

- Adoption of soil improvement techniques is lower than expected.
- Experts believe low soil quality drives yield gaps.
- Adoption of new techniques requires awareness of a problem.
- Do farmer and soil scientist assessments of soil quality align?

Comparing Conceptions of "Soil Quality"



Source:
Anderson et al., 2013.

Measured Soil Quality

Soil Qualities	Soil Characteristics (HWSD)
Nutrient availability	Soil texture, soil organic carbon, soil pH, total exchangeable bases
Nutrient retention capacity	Soil Organic carbon, Soil texture, base saturation, cation exchange capacity of soil and of clay fraction
Rooting conditions	Soil textures, bulk density, coarse fragments, vertic soil properties and soil phases affecting root penetration and soil depth and soil volume
Oxygen availability	Soil drainage and soil phases affecting soil drainage
Excess salts.	Soil salinity, soil sodicity and soil phases influencing salt conditions
Toxicity	Calcium carbonate and gypsum
Workability (constraining field management)	Soil texture, effective soil depth/volume, and soil phases constraining soil management (soil depth, rock outcrop, stoniness, gravel/concretions and hardpans)

Source: Fisher et al., 2008.

Soil Quality Perceptions

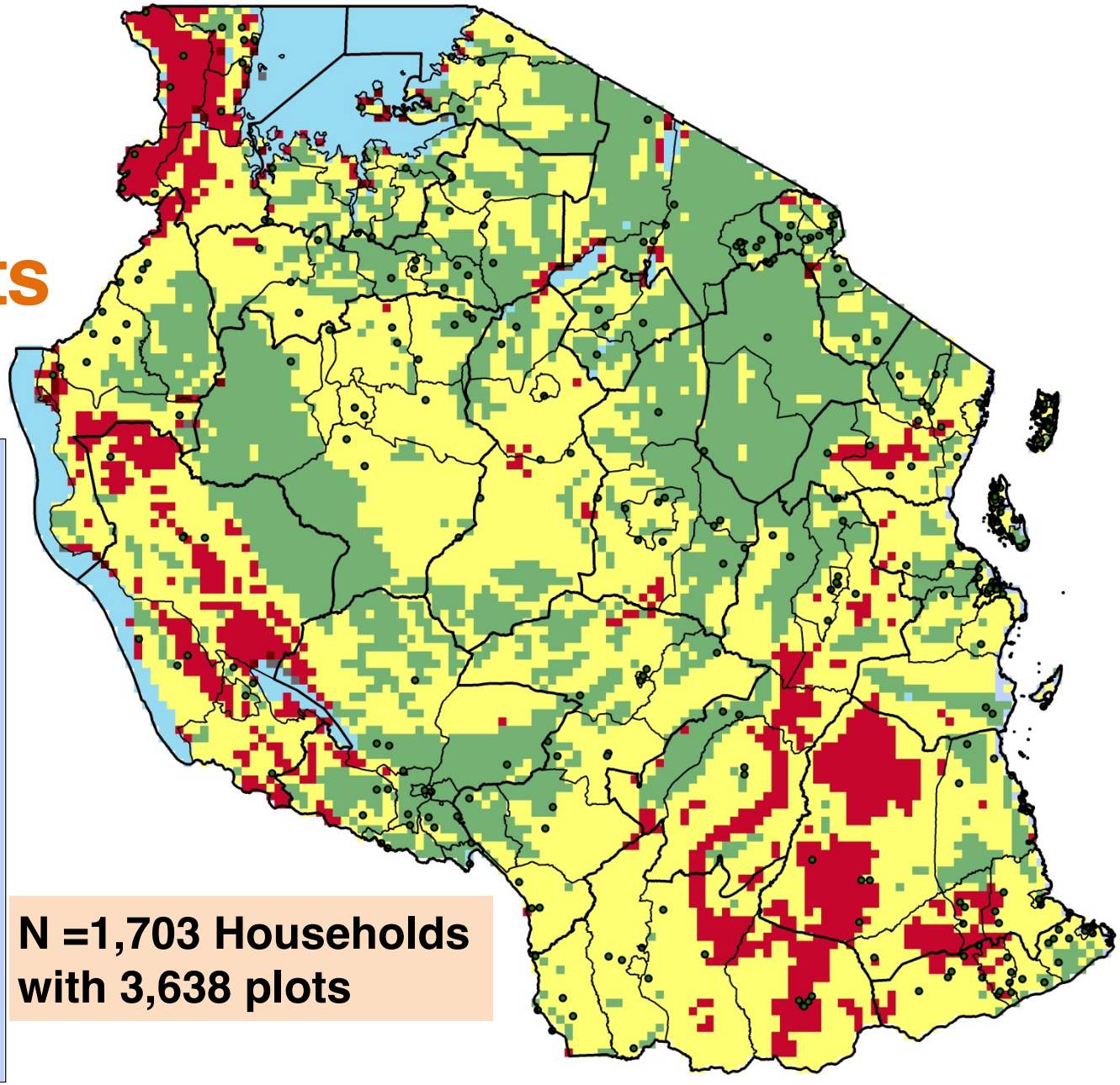
- Tanzania National Panel Survey – Integrated Survey on Agriculture (TZNPS)
  - Nationally representative
  - 3,280 households
  - October 2008 and October 2009

Soil Quality Questions:

- How do you know the quality of your soil?
  - Response options: “Scientifically tested” (0.59%), “Own experience” (97.95%), and “Other” (1.46%)

- What is the soil quality of this plot?
  - Response options: “Good” (50.8%), “Average” (44.26%) or “Bad” (4.95%)

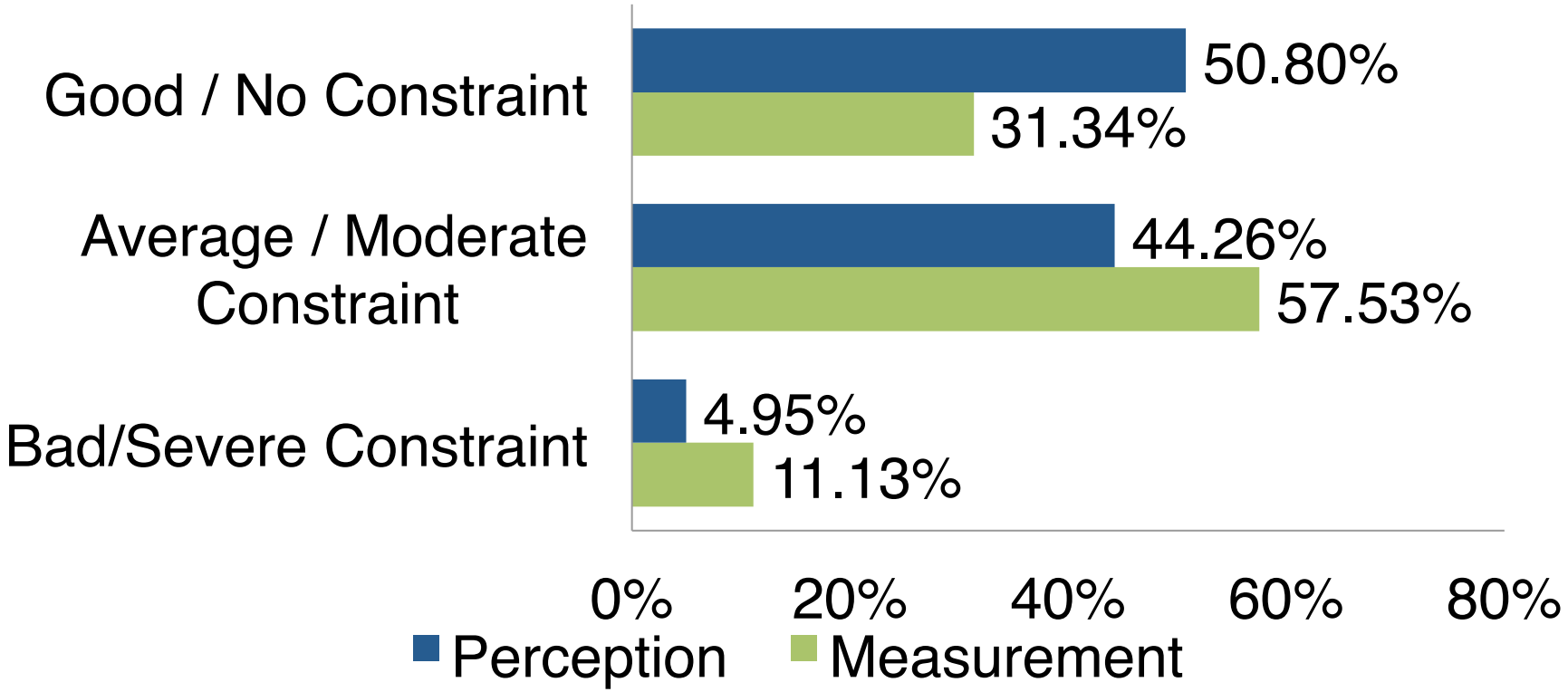
Linking Soil Quality Assessments



N =1,703 Households with 3,638 plots

Data Sources: Fisher et al. 2007; GADM 2011; ILRI 2011.

Comparisons of Perceptions and Measurements



In general, soil quality perceptions are higher than measurements.

Cross Tabulation of Soil Perception and Measurement (Nutrient Availability)

Measurement / *Perception*	**No or Slight Constraint**	**Moderate Constraint**	**Severe Constraint**	**Total**
Good	536	**1,065**	**247**	1,848
Row %	29.00	**57.63**	**13.37**	100.00
Average	563	918	129	1,610
Row %	34.97	57.02	8.01	100.00
Bad	41	110	29	180
Row %	22.78	61.11	16.11	100.00
Total	1,140	2,093	405	3,638
	31.34	57.53	11.13	100.00

Pearson chi2(4) = 41.0382 Pr < 0.000

Strong mismatch between measurement and perception.

Mismatch between measurement and perception.

Conclusion and Continued Research

- In general soil quality perceptions are than measurements.
- In our sample, 39.61 percent of plots have perceptions higher than measured assessments and 19.63 percent have perceptions lower than measurements.
- Low adoption of soil improving activities could be linked to a mismatch in soil quality assessments.
- Are mismatches driven by different comparatives in use by farmers and researchers?

Thank You!

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- Questions or comments?