Transitioning Cereal Systems to Adapt to Climate Change

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Perceptions and Management of Soil Quality: A Translational Approach

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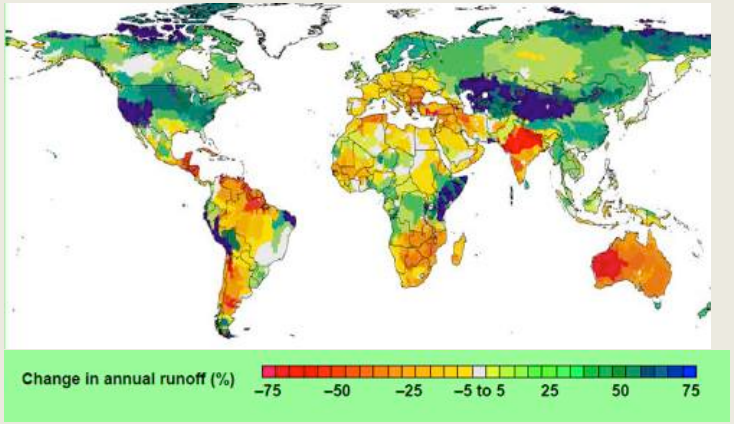
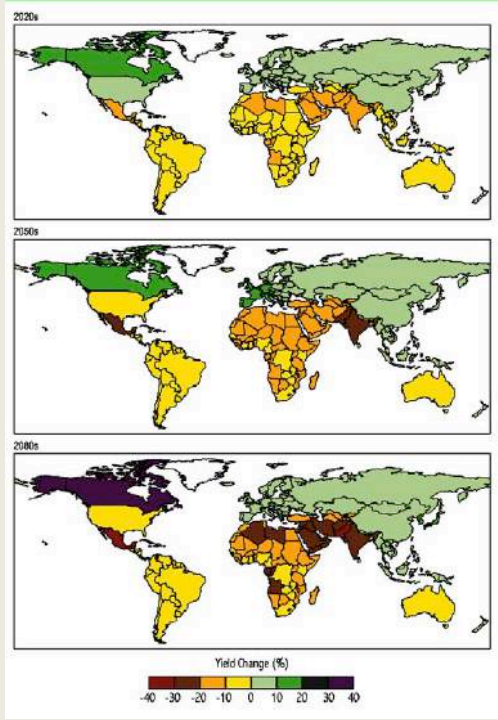
SOIL DEGRADATION AND CLIMATE CHANGE

- **Soil degradation can be accelerated or mitigated by several factors (e.g., climate, soil resilience, landscape factors, management practices).**
- **Due to variation in these and socio-economic factors, the impacts of climate change on soil quality will not be uniform across all agricultural regions**
- **These impacts are predicted to have more severe negative implications for food production in food-insecure countries (Parry et al., 1999; Fuhrer, 2003).**



Changes in runoff from current to 2080s



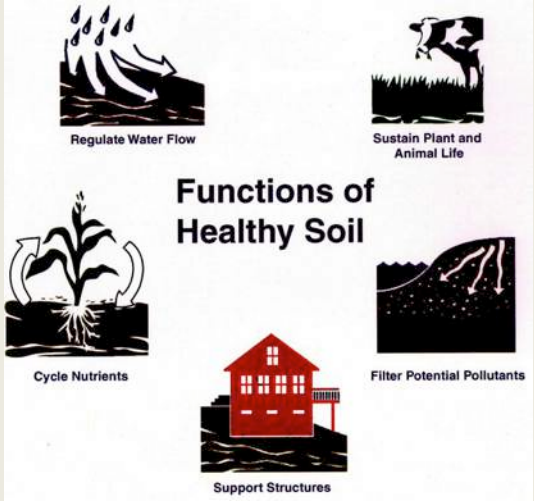
Changes in average crop yields for wheat , maize and rice

Parry and Rosenweig, 2004

DEFINITION OF SOIL QUALITY/HEALTH

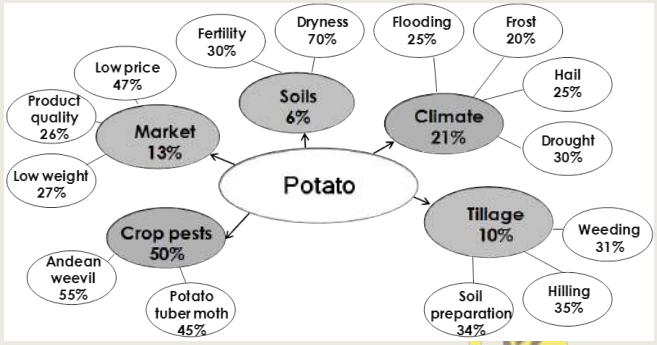
“The fitness of a specific kind of soil to function within its surroundings, support plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation.”

NRCS



COMMUNITY SOIL HEALTH ASSESSMENTS

- **A participatory process in developing qualitative soil health monitoring procedures locally has considerable educational value and opens up communication among farmers and between farmers and other agriculture professionals.**
- **Has resulted in a better understanding of community priorities and the development of soil quality score cards based on easily observed soil properties and plant growth.**

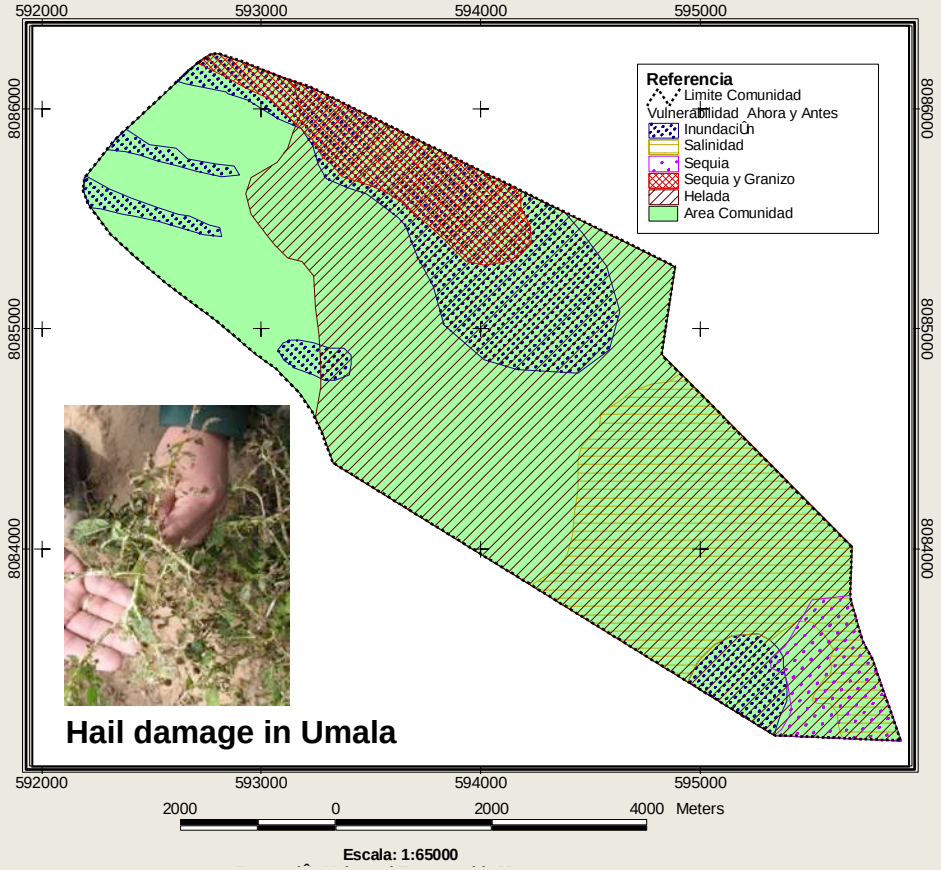


LOCAL SOIL CLASSIFICATION

Vinto Coopani community (Relative high elevation)			
Soil type	***Native name***	***Characteristics***	***Changes in use over time***
1.White soil	Pajre oraque	Soft soil; spiny plants grow in it.	**Before it was used for agriculture** and now it is not.
2.Clayey soil	Ňeq'e oraque	The surface soil can be cultivated but with erosion the soil becomes hard like cement	The soil used to be much stronger but it has been washed away.
3.Sandy/clayey soil	Jach'oca	The soil has both clay and large stones	The moisture content is decreasing and there are more rocks.
4.Hard clay soil	Karpa	Has clay that is used for making ceramics.	It has become less fertile.
5.Sandy soil	Saj'e	Little soil on surface and below has gravel. Dries out quickly and is a very good for production.	Used to be **more fertile because it was maintained in fallow longer.**
6.Black soil	Chiar laqa	The clay is neither hard or soft	Used to be more fertile because it was maintained in fallow longer.
7.Fine sand soil	Laqa Oraque	Good soil with the color of skin; it has very fine sand	It appears to have more rocks.

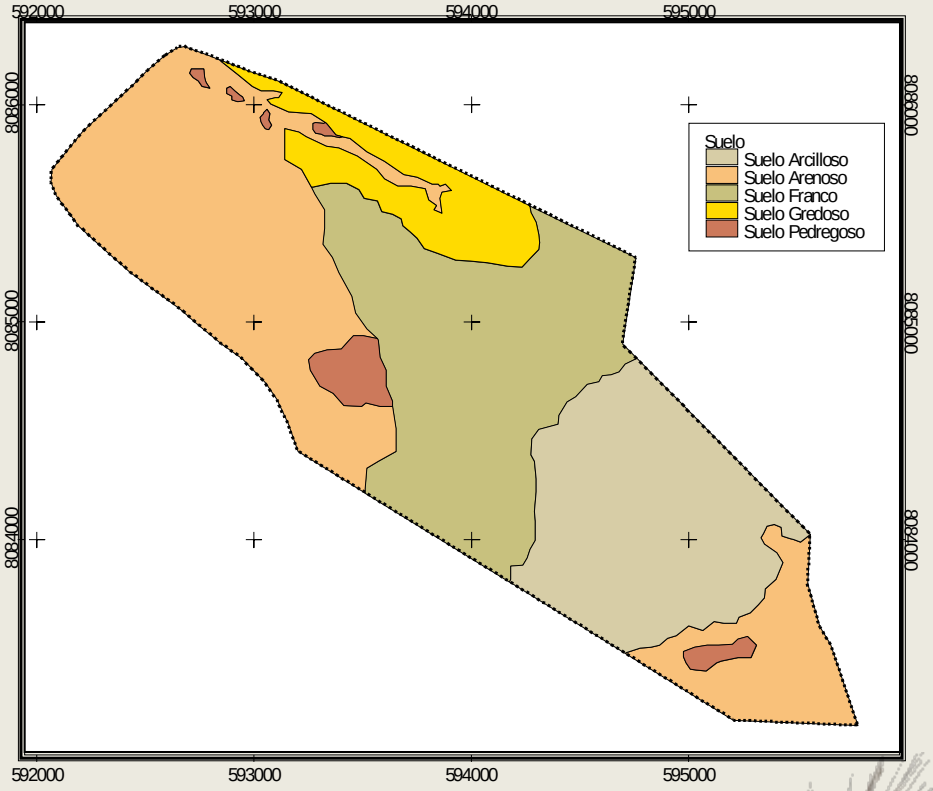
COMMUNITY PERCEPTIONS OF SOIL RESOURCES AND PROBLEMS

Vulnerability Map for San José de Llanga

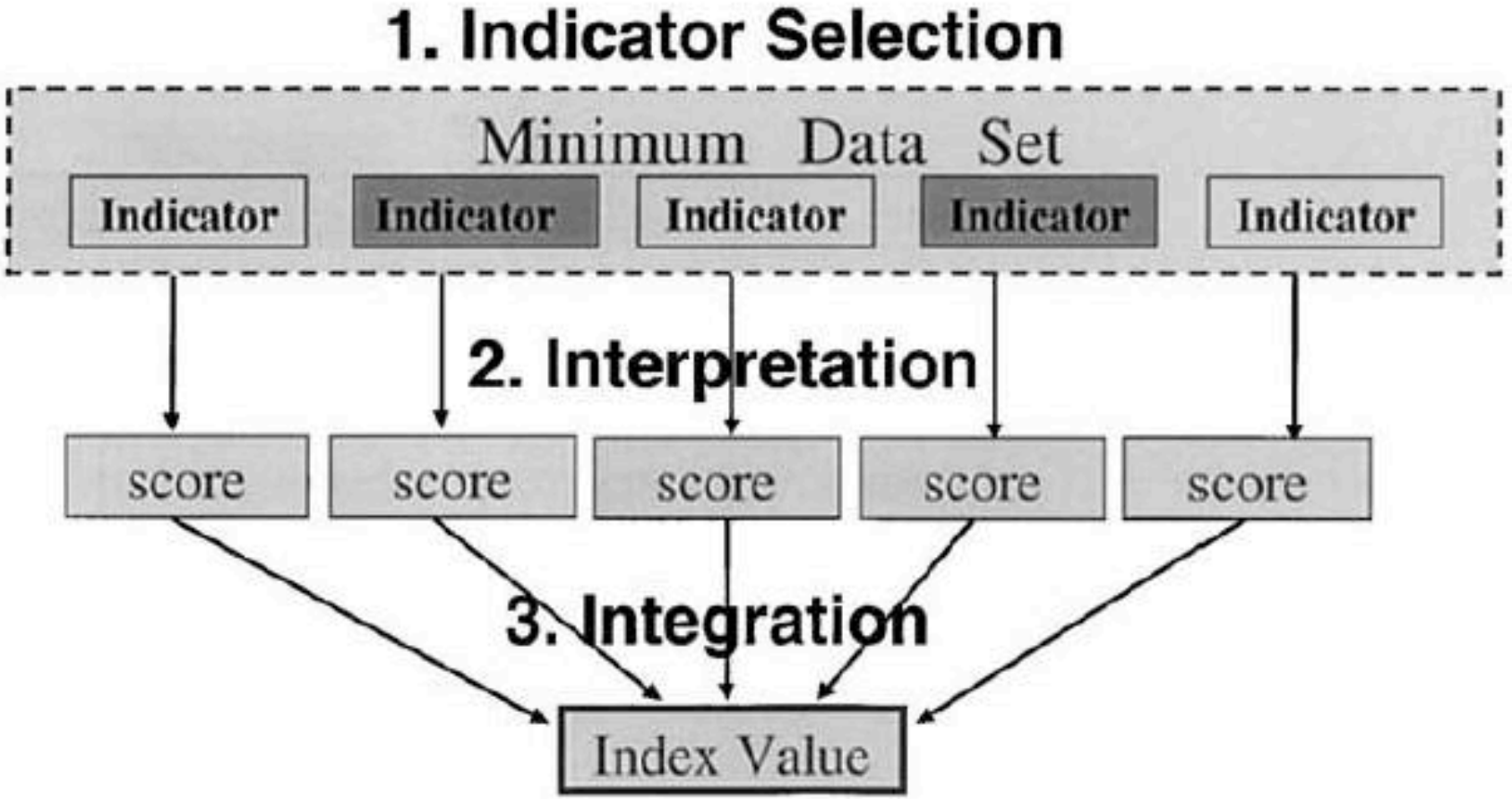


Hail damage in Umala

Soil Map for San José de Llanga



SOIL QUALITY ASSESSMENT FRAMEWORK



Andrews et al., 2004

LOW-COST FIELD METHODS

Labile C Determination Using $KMnO_4$ (Weil, 2003)

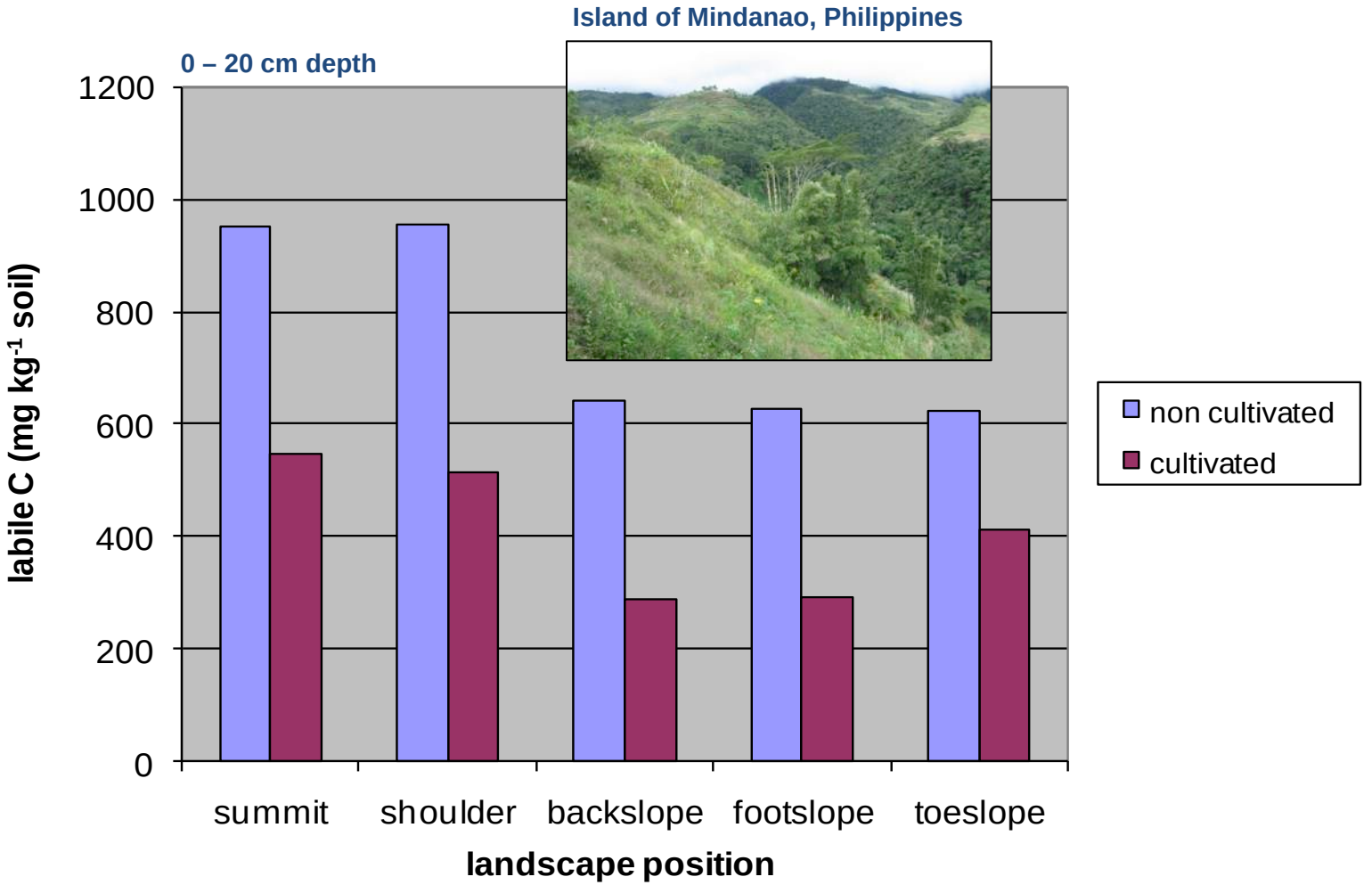
- **Hand-held field spectrometer – 550 nm**
- **Field chart**
- **Relatively low-cost, rapid and portable**

Solución $KMnO_4$ después de agitarlo con el suelo			
Pobre	Regular	Bueno	Excelente
>0 – 0.25	>0.25 – 0.50	>0.50 – 0.75	>0.75 – 1.0
Escala del Indice de Calidad de Suelos			

Tabla de campo sobre Calidad de Suelos

USE OF FIELD TEST

Comparing labile C (mg C kg^{-1} soil) by using $KMnO_4$ test between non-cultivated and cultivated land with different landscape position



CONCLUSIONS

- **Climate change and socioeconomic factors in many regions have led to changes in soil and management practices that have generally reduced soil quality in many food-insecure countries.**

- **For effective translational research, interdisciplinary approaches that include community soil health assessments and development of low-cost field-based tools and appropriate management recommendations with community feedback may be instrumental in improving local adoption in food-insecure countries.**

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