

# Soil Health Insights

From the 2015

## Ethiopian Soil Campaign

የአፈር ደህንነት ግንዛቤዎች



2015

International  
Year of Soils

*Healthy soils for a Healthy Life*  
ጤናማ አፈር ለጤናማ ህይወት



# Soil Health Insights

*from the*

## 2015 Ethiopian Soil Campaign

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However, the contents of this publication do not reflect the official opinion of IASS, or any of the other organizations that contributed to the contents, and mention of any product does not constitute an official endorsement of that product.

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# Contents

Foreword.....	v
Publication Contributors .....	vi
Acronyms.....	vii
Introduction .....	1
1. What is soil? .....	1
2. International Year of Soils 2015 .....	3
3. The Ethiopian Soil Campaign .....	4
4. Objectives of this Publication .....	5
Part One – Overview of the Ethiopian Soil Campaign.....	7
1. The Ethiopian Soil Campaign Program .....	9
1.1 The major strategies of the Soil Campaign .....	10
1.2 Timeline of events .....	11
1.3 Summary of Outcomes.....	16
1.4 Lessons Learned .....	18
Part Two – Insights on Soil and Soil Management .....	21
2. Promoting and Understanding Soils.....	23
2.1 Ethiopia Stakeholders’ Workshop: Transforming Soil Health and Fertility Management for Sustainable Increased Agricultural Productivity .....	23
2.2 Soil Health, Fertility Challenges, and Responses.....	26
2.3 Rethinking Soils .....	31
2.4 PressConference.....	34
2.5 Kick-off of Soil Week.....	35
3. Soil Management &(Inter)national Policy .....	40
3.1 The Role of Land and Soils in Agenda 2030 .....	40
3.2 Soil in the Ethiopian National Development Agenda .....	41
4. Conservation Agriculture .....	42
4.1 Push-Pull Technology’ .....	42
4.2 Low Tillage Conservation Agriculture Technology with <i>Aybar</i> BBM and <i>Silet Deger (Berken Maresha)</i> .....	45
5. Nutrient Cycling.....	48
5.1 Compost and Urban Waste Management .....	48
5.2 Vermicomposting .....	50
5.3 Farming with Bioslurry .....	51
5.4 Nutrient Cycling at Genesis Farms in Debre Zeit.....	52
5.5 Soil and More Nutrient Cycling .....	53

5.6 Fertile Grounds Initiative (FGI): Creating markets for Soil fertility.....	54
6. Innovative Soil Management Practices .....	57
6.1 Biochar as an Indigenous Fertilizer.....	57
6.2 Biofertilizer .....	58
6.3 Effective Microorganisms (EM) .....	60
6.4 Integrated Soil Fertility Management (ISFM+) .....	62
7. Soil Education and Research.....	66
7.1 Holeta Agricultural Research Center .....	66
7.2 Fertilizer and Pesticide Research, (HoA-REC&N).....	67
8. Soil Testing and Mapping .....	70
8.1 Soil Mapping and Fertilizer Blending (ATA) .....	70
8.2 CASCAPE Soil Mapping .....	72
8.3 National Soil Testing Center (NSTC) .....	73
8.4 Environmental Protection Authority .....	73
Part Three - Country-Wide Awareness Raising.....	75
9. Experiences Shared at Regional Events .....	77
9.1 Aksum .....	77
9.2 Bahir Dar .....	78
9.3 Debre Berhan.....	79
9.4 Debre Markos .....	80
9.5 Dessie.....	82
9.6 Jimma.....	83
9.7 Mekele/Wukro .....	84
9.8 Pastoralist Land Health Workshop .....	86
9.9 Wolayita Sodo.....	86
10. Radio Outreach.....	89
11. Radio Highlights.....	91
12. Running for Soil Health.....	93
Part 4 – Wrap-up and Next Steps .....	94
13. Wrap up the International Year of Soils .....	96
14. Surveying Success of the Soil Campaign.....	98
15. The Way Forward .....	101
16. Thanks to Organizers and Contributors.....	103



## Foreword

The Ethiopian Government remains highly committed to promoting soil health and fertility, for the benefit of present and future generations of citizens.

Out of our steadfast dedication to the soil, the Ministry of Agriculture and Natural Resources chose to take advantage of the *International Year of Soils* to raise awareness about the importance of soils and healthy soil management in Ethiopia.

Soil fertility is an essential prerequisite for achieving the targets set forth by national development agendas, GTP2, CRGE and others, in terms of agricultural output and GDP growth. Hence, the *Ethiopian Soil Campaign* is just one of many initiatives spearheaded by the Ministry of Agriculture and Natural Resources to promote and safeguard soil health in Ethiopia. Other initiatives include scaling up sustainable land management (SLM), reclamation of acidic soils, improving the productivity of waterlogged soils, increasing capacity for climate-smart agriculture, integrated soil fertility management (ISFM) and, most recently, digital mapping of soils in the country's arable lands, for custom application of domestically blended fertilizers. Collectively, the result of these efforts is higher yields from the same land per season. Some of our programs, such as our community-based participatory watershed development to rehabilitate the degraded lands, are exemplary models being followed by other countries. The FDRE Ministry of Agriculture and Natural Resources, together with many partnering stakeholders, has so much to share in the area of soil health and fertility.

The *Ethiopian Soil Campaign* represented a special model of multi-stakeholder sharing and learning around a critical development issue of our time. Both the lessons shared and the way in which they were shared have relevance for future development work. Our commitment to soil health shall continue long beyond 2015, and it is with great pleasure that we share in this publication some of the insights from the 2015 *Ethiopian Soil Campaign*.



H.E. State Minister, W/ro Frenesh Mekuria  
Ministry of Agriculture and Natural Resources



Prof. Tekalign Mamo,  
FAO Special Global Ambassador  
*International Year of Soils*

### መቅደም

የኢትዮጵያ መንግስት አሁን ላለውና ለቀጣዩ ትውልድ ጥቅም ሲባል የአፈር ደህንነትና ለምነት እንዲጠበቅ በቁርጠኝነት እየሰራ ይገኛል።

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## Acronyms

AA EPA – Addis Ababa Environmental Protection Authority  
EPA – Environmental Protection Authority  
AAS – atomic absorption spectroscopy  
AAU – Addis Ababa University  
ABN – African Biodiversity Network  
AGRA – African Green Revolution for Agriculture  
AKLDP - Agriculture Knowledge Learning Documentation and Policy (of Tufts University)  
AKU – Aksum University  
APF – AgriProFocus  
ARARI – Amhara Region Agricultural Research Institute  
ATA – Agricultural Transformation Agency  
A-TVET – Agricultural Technical and Vocational Education Training  
B – boron  
BBF – broad bed furrow  
BD – Bahir Dar  
BNF – biological nitrogen fixation  
BoA – Bureau of Agriculture  
BOD – biochemical oxygen demand  
BoEPLA – Bureau of Environmental Protection & Land Administration  
CA – conservation agriculture  
CASCAPE – Capacity building for scaling up of evidence-based best practices in agricultural production  
CEO – Chief Executive Officer  
CGIAR – Consultative Group for International Agricultural Research  
COD – chemical oxygen demand  
CRGE – Climate Resilient Green Economy  
CRV – Central Rift Valley (of Ethiopia)  
CSA – Central Statistical Agency  
Cu – copper  
DA – development agent  
DAP – di-ammonium phosphate  
EIAR – Ethiopian Institute of Agricultural Research  
EM – effective microorganisms  
ESSS – Ethiopian Society of Soil Scientists  
ETB – Ethiopian Birr  
Ethio-SIS – Ethiopian Soil Information System  
FAO – Food and Agriculture Organization of the United Nations  
FC – fecal coliforms  
FDRE – Federal Democratic Republic of Ethiopia  
FGI – Fertile Grounds Initiative  
FRG – Farmers’ Research Group  
FTC – Farmers Training Center  
GC – gas chromatography  
GHG – Greenhouse gasses  
GIZ – Deutsche Gesellschaft für Inter-nationale Zusammenarbeit  
GTP2 – Growth and Transformation Plan Two  
H<sub>2</sub>O – water  
HARC – Holeta Agricultural Research Center  
HoA-REC&N – Horn of Africa, Regional Environment Center & Network  
HPLC – high-pressure liquid chromatography  
IASS – Institute for Advanced Sustainability Studies, Germany  
IFPRI – International Food Policy Research Institute  
ISD – Institute for Sustainable Development, Ethiopia  
ISFM – Integrated Soil Fertility Management  
IWM – integrated watershed management  
IYS – International Year of Soils



LCF – low cost farming  
LIFT – Land Investment for Transformation  
MDGs – Millennium Development Goals  
MoA – Ministry of Agriculture  
MoANR – Ministry of Agriculture and Natural Resources  
MoEFCC – Ministry of Environment, Forest and Climate Change  
N – nitrogen  
NGO – Non-Governmental Organization  
NPK – nitrogen, phosphorus, potassium  
NSTC – National Soil Testing Center  
P – phosphorus  
PLC – Private Limited Company  
PPT – Push-Pull Technology  
Q&A – question & answer  
S – sulphur  
SDGs – Sustainable Development Goals  
SIS – soil information system  
SLM – Sustainable Land Management  
SOM – soil organic matter  
SSA – Sub-Saharan Africa  
SWM – soil and water management  
T – tonne = 1000 kg  
TC – total coliforms  
TN – total nitrogen  
TOC – total organic carbon  
TP – total phosphorus  
TSP – triple super phosphate  
TVET – Technical and Vocational Education Training  
UA – urban agriculture  
UN – United Nations  
UNESCO – United Nations Educational, Scientific and Cultural Organization  
USA – United States of America  
USD – United States Dollar  
VAT – value-added tax  
WADU – Wolayita Agricultural Development Unit  
WED – World Environment Day  
WUR – Wageningen University Research  
Zn – zinc

# Introduction

## 1. What is soil?

Words are used in different ways in an attempt to capture the significance of soils. Some say soil is:

**“Life”** – an Ethiopian farmer.

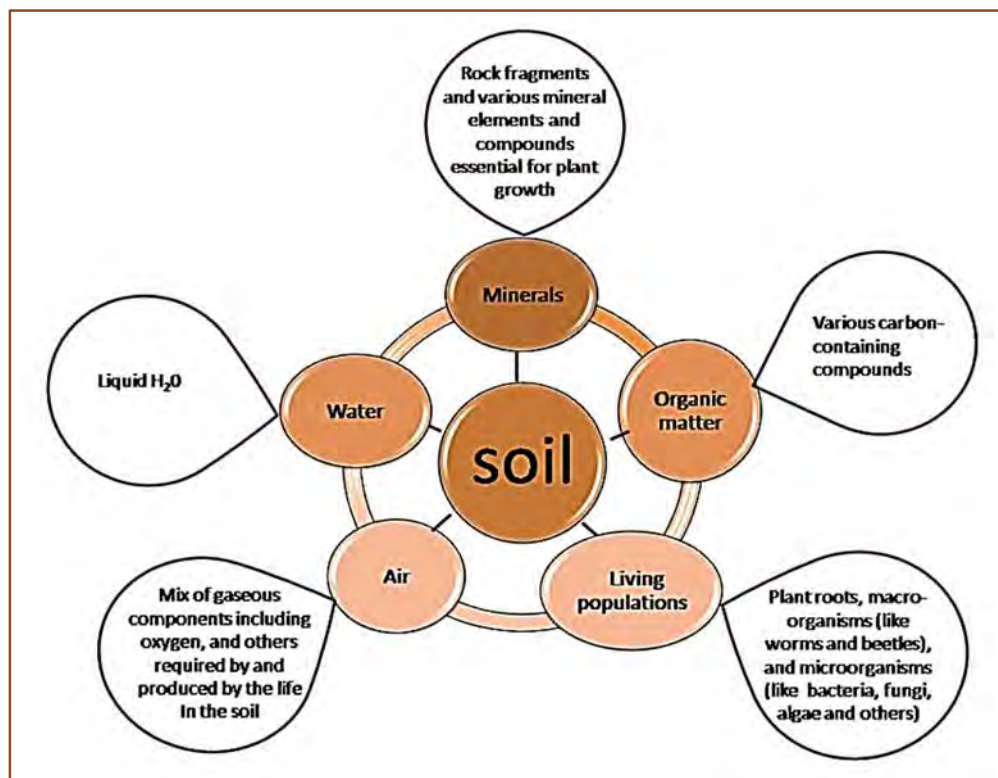
**“What man is made of and what man shall return to in the end”** – The Bible (Genesis 3:19) and the Qur’an (Surah 17: 17-18).

**“The Source of 95% of the food we eat”** – FAO

**“The cornerstone of food security and agricultural development”** – FDRE Ministry of Agriculture

**“My mother and my father”** – an Ethiopian farmer.

To a soil scientist, soil consists of four fundamental elements: rock or mineral particles, living things and dead organic matter, air, and water. Healthy soils, sometimes known as 'quality soils', are described as having favorable physical, chemical and biological functions<sup>1</sup>.



*Adapted from Holeta Agricultural Research Center presentation, Soil Week 2015*

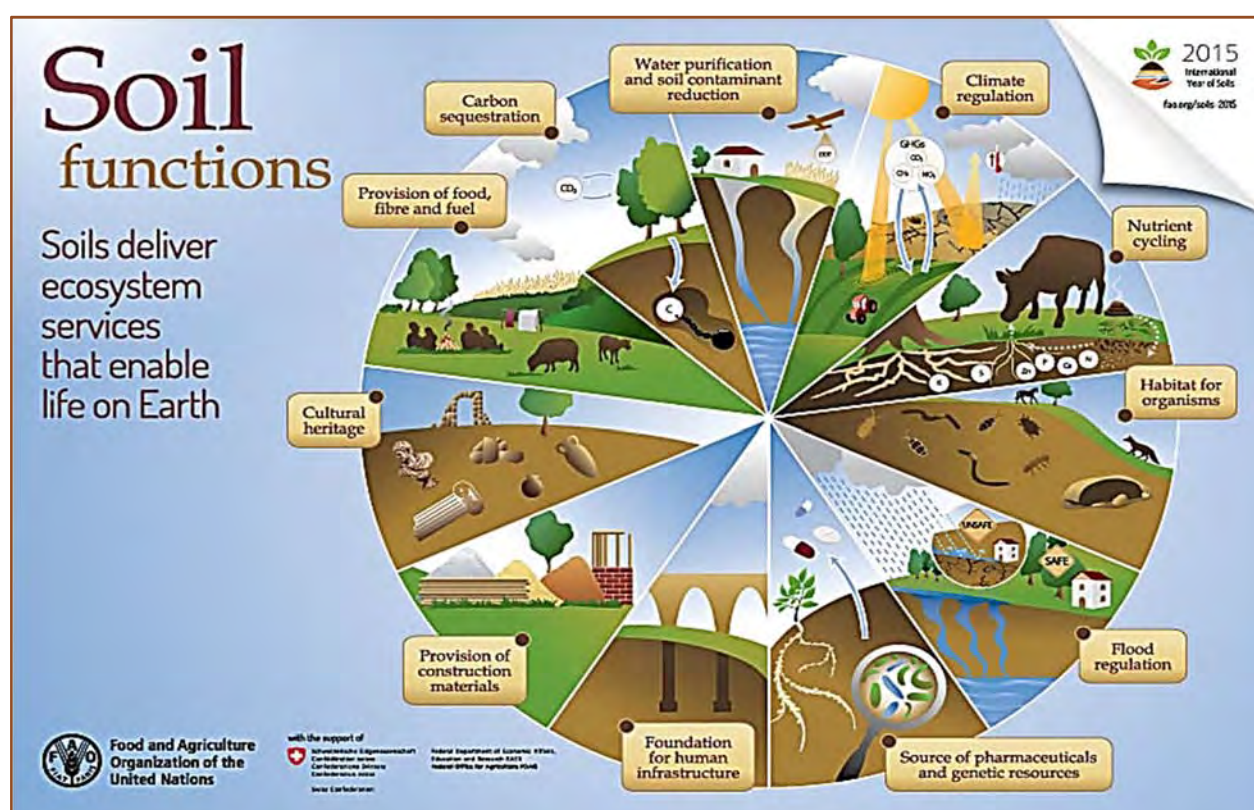
Physically, healthy soil does not have a hard pan or hard surfaces; it holds water well, drains well, and does not restrict root growth. Exhibiting good structure, physically healthy soil is soft and has well-

<sup>1</sup> Integrated Soil Fertility Management Technical Manual, Ministry of Agriculture, SLM Ethiopia, German Cooperation and GiZ, 2016

arranged soil particles, allowing for plant roots to grow easily, extract nutrients and access both air and water.

Chemically healthy soil has a rich base of the nutrients that plants require for growth, primarily nitrogen, potassium and phosphorus as well as elements such as zinc, copper, iron, chlorine, manganese, molybdenum and others, which are needed in small to very small amounts. These nutrients should not only be present, but in balance and available to the plant – for nutrients to be available, the acidity/alkalinity must be within the desired range, and there should be no problems of salinity or sodicity.

Biologically healthy soils have a vast diversity of living things in them – micro- and macro-organisms, as well as various plant roots interacting with one another and the other components of soil. A good store of non-living soil organic carbon, particularly humus, is required to provide the energy basis for all of the processes that occur in the soil. In biologically healthy soil, crop and other residues break down easily and both physical and chemical soil health is better.



Some farmers refer to the health of the soil as the “power of the soil”<sup>2</sup>. Healthy soils are fertile and produce high yields of good crops, and they also provide a wide array of other essential ecosystem services, for example, carbon sequestration and climate regulation, decomposition and cycling of chemicals and nutrients, water purification and flood control, a foundation for human infrastructure and a source of construction materials: healthy soil contains incredible biodiversity that is contributing to the development of human medicine and new genetic resources<sup>3</sup>.

<sup>2</sup> Integrated Soil Fertility Management Technical Manual, Ministry of Agriculture, SLM Ethiopia, German Cooperation and GiZ, 2016

<sup>3</sup> FAO 2015

A variety of processes can degrade soils, causing them to lose the functions that make them healthy and able to effectively provide multiple services. With soil degradation, crop yields fall, soil organic carbon is depleted, soil biodiversity decreases, the capacity to sequester carbon decreases, etc. Attention on and investments in soils and sustainable land management, however, can reduce and even reverse at least some of the processes of soil degradation.

## 2. International Year of Soils 2015

In September 2013, the 68th UN General Assembly declared the year 2015 as the *International Year of Soils*. In preceding years, it had become apparent that the world-wide rate of soil depletion was coming to jeopardize the capacity of farmers to meet the food needs for the projected global population of 20 billion by 2050. Furthermore, the loss of biodiversity and ecosystem services related to the loss of soil health – compounded by the impacts of climate change – amplified the urgent need to take immediate action to safeguard global soil resources.

Consensus was reached that awareness on the following fundamental truths about soil needed to be more widely appreciated:

1. Soil is an essential ingredient to healthy food and nutrition.
2. Soils store and filter water – improving food security and their resilience to floods and droughts.
3. Soils help to combat and adapt to climate change.
4. Globally, our soils are under major threat<sup>4</sup>.

With a view to reversing current alarming trajectories in soil conditions, these four global priorities for action were identified:

1. Minimizing further degradation of soils and restoring the productivity of soils that are already degraded in regions where people are most vulnerable.
2. Stabilizing global stores of soil organic matter, including both as soil organic carbon and in soil organisms.
3. Stabilizing or reducing global use of nitrogen and phosphorus fertilizer, while increasing fertilizer use in regions of nutrient deficiency.
4. Improving our knowledge about the state and trend of soil conditions.

If tangible progress in these areas is made, it would result in protection of and/or restoration of soil resources, the ecosystem services they provide, and the life they sustain<sup>5</sup>.

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<sup>4</sup> FAO <http://www.fao.org/soils-2015/resources/information-material/en/>, last accessed March 2016.

<sup>5</sup> FAO Status of the World's Soil, 2015.

### 3. The Ethiopian Soil Campaign

In homage to the UN declared *International Year of Soils*, and out of concern for the health of Ethiopian Soils, a visionary group of soil stakeholders led by the FDRE Ministry of Agriculture and Natural Resources joined together in 2014 to build the *Ethiopian Soil Campaign*. Adding to the momentum around soil health in Ethiopia, in May 2015, Ethiopia's own great soil steward, H.E. Prof. Tekalign Mamo was appointed as FAO Special Ambassador for the *International Year of Soils*.

The purpose of the *Ethiopian Soil Campaign* was twofold:

1. To **raise awareness** with the general public – including farmers and extension workers, bureaus of agriculture, and schools – about the functions of soil and the importance of sound soil health management.
2. To **create synergy** between stakeholders.

The campaign adopted the slogan *Healthy Soils for Healthy Lives* and hosted its official launch on World Environment Day, June 6, at Gulele Botanical Gardens. During this launch session, the campaign sent out the message of the importance of soil health in agriculture, water retention, food security, climate adaptation and biodiversity conservation.

#### **We protect our Soils, because:**

1. **Soil is Life!**
2. **Healthy soils are the basis for healthy food production and for healthy life!**
3. **Soils store water improving our resilience to floods and droughts!**
4. **Soils support our planet's biodiversity & host a quarter of the total species!**
5. **Soils help to adapt to climate change by playing a key role in the carbon cycle!**
6. **Soils are the foundation for vegetation: feed, fiber, fuel and medicinal products!**
7. **Good management & preservation of soil is essential for food security!**



*Launch of the Ethiopian Soil Campaign on World Environment Day at Gulele Botanical Gardens*



## 4. Objectives of this Publication

The objective of this publication is to document some of the key lessons learnt from carrying out the *Ethiopian Soil Campaign*. These lessons include:

- How the campaign was developed.
- Concepts and practices discussed and demonstrated during the campaign.
- Contact information for some of the individuals and organizations working with soils that were involved in campaign activities.

In Part One, the *Overview of the Ethiopian Soil Campaign*, the major elements of the campaign are described. The processes undergone to bring about each element of the campaign are discussed. It is hoped that this documentation would assist in the development of other multi-stakeholder campaigns for sustainable development, both within Ethiopia and beyond.

During the many events of the *Ethiopian Soil Campaign*, a vast array of concepts and technical details in soil fertility, soil health, and soil management were presented, demonstrated and debated. Part Two of this publication, *Insights on Soil and Soil Management*, shall attempt to record and share some highlights of these. It is hoped that the insights documented here will encourage practice of effective and sustainable soil management. Together with summaries of the key messages from selected campaign events, the contact information for event leaders is provided. For additional information and future collaboration, readers may contact contributors directly, and expand their soil health support network.

Part Three shares experiences from country-wide awareness raising activities.

Part Four outlines the wrap-up of the *International Year of Soils* in Ethiopia, evaluation of the campaign; it also offers suggestions for next steps that would keep the momentum of the campaign and enhance the awareness for future exchanges and collaboration for healthy soils.

### አፈር ምንድን ነው?

“አፈር ህይወት ነው” - አንድ ኢትዮጵያዊ አርሶ አደር

“ሰው የተሰራበትና በመጨረሻም ተመልሶ የሚገባበት” - መጽሐፍ ቅዱስ (ዘፍ 3:19) እና ቅዱስ ቁራን (ሱራህ 17:17-18)

“95 በመቶ የሚሆነው ምግባችን መገኛ” - የዓለም ምግብና እርሻ ድርጅት (FAO)

“የምግብ ዋስትናና ግብርና ልማት የማዕዘን ድንጋይ” - የኢ.ፌ.ዲ.ሪ ግብርናና ተፈጥሮ ሀብት ሚኒስቴር

“እናቴም አባቴም” አንድ ኢትዮጵያዊ አርሶ አደር

ለአንድ የአፈር ሳይንቲስት አፈር አራት ዋና ዋና ነገሮችን በውስጡ ይይዛል፡- የአለት ሰብርባሪ ወይም ሚኒራሎች፣ ህይወት ያላቸውና ህይወት የሌላቸው ተፈጥሮአዊ ነገሮች፣ ውሀ እና አየር፣ አንዳንዴ ለም አፈር፣ እየተባለ የሚጠቀሰው ጤናማ አፈር አስፈላጊ የሆኑ አካላዊ፣ ኬሚካላዊና ህይወታዊ ጥቅሞች እንዳሉት ይነገራል፡፡

ጤናማ አፈር ለምና ጥራት ያላቸው ሰብሎችን በብዛት ለማምረት የሚያስችል ነው፡፡ ከዚህም በተጨማሪ አንድ የካርቦን መጠጣና የአየር ንብረት ሚዛን ጥበቃ፣ ኬሚካሎችንና የምግብ ንጥረ ነገሮችን ማበላለትና



ዑደት ውስጥ ማስገባት፤ ውሀን ማጥራትና ጎርፍን መከላከል የመሳሰሉ የአካባቢን ስነምህዳር ጤንነት የመጠበቅ አገልግሎቶችን ይሰጣል። በሌላም በኩል አፈር የማንኛውም ለሰው ልጆች የሚያስፈልጉ መሰረተ ልማቶች ማረፊያ፤ የግንባታ ቁሳቁሶች መገኛ እንዲሁም የዘረመል ሀብትና መድሃኒቶች ምንጭ የሆነው ብዝህ ህይወት መገኛ ነው።

በጊዜ ሂደት አፈር እንዲከላ የሚያደርጉ ሂደቶች አሉ። እነዚህም ሂደቶች አፈሩ የተለያዩ አገልግሎቶችን ለመስጠት የሚያስችለውን ጤንነት የሚያሳጡት ናቸው። የአንድ አካባቢ አፈር ከተከላ ደግሞ የእርሻ ምርት ይቀንሳል፤ በአፈር ውስጥ የሚገኝ ተፈጥሮአዊ ካርቦን ይጠፋል፤ በአፈሩ ውስጥ የሚገኝ ብዝህ ህይወት ይቀንሳል፤ የካርቦን መጠጣ አቅሙ ይቀንሳል ወዘተ. . ። ይሁንና ለአፈር ደህንነት በሚሰጥ ትኩረትና በዘላቂ የመሬትና አፈር አጠቃቀም ላይ በሚደረግ ኢንቬስትመንት የአፈርን መከላከል መቀነስ ብሎም ማስቀረት ይቻላል።

### አፈርን የምንጠብቅባቸው ምክንያቶች፤

1. አፈር ህይወት ነው፤
2. ጤናማ አፈር ጤናማ ምግብ ለማምረትና ለጤናማ ህይወት መሰረት ነው፤
3. አፈር ውሀን በመያዝ ለጎርፍና ድርቅ የሚኖረንን ተጋላጭነት ይቀንሰዋል፤
4. አፈር የሁሉም ብዝህ ህይወት መሰረትና በምድራችን ላይ ካሉት የህይወት ዝርያዎች የአንድ ሶስተኛው መገኛ ነው፤
5. አፈር በካርቦን ዑደት ውስጥ ወሳኙን ሚና በመጫወት የአየር ንብረት ለውጥ ተጋላጭነትን ይቀንሳል፤
6. አፈር የዕጽዋቶች ሁሉ መሰረት ነው፤ የእንስሳት መኖር፣ ቃጫ፣ ማገዶ እና መድሀኒትነት ያላቸው፤
7. ጥሩ የአፈር አያያዝና ጥበቃ የምግብ ዋስትናን ለማረጋገጥ ወሳኝ ናቸው።

የዚህ ህትመት ዓላማ በኢትዮጵያ የአፈር ዘመቻ የተገኙ አንዳንድ ቁልፍ መልዕክቶችንና ትምህርቶችን በመረጃነት መያዝና ለሌሎች ማድረስ ነው። እነዚህ መልዕክቶችና ትምህርቶችም የሚከተሉትን ያካትታሉ፤

- ዘመቻው እንዴት እንደተጀመረና እንደተካሄደ፤
- በዘመቻው ወቅት ውይይት የተደረገባቸውና ለዕይታ የቀረቡ ጽንሰ ሀሳቦችና ተሞክሮዎች፤
- በዘመቻው ላይ ተሳታፊ የነበሩ በአፈር ላይ የሚሰሩ ድርጅቶችና ግለሰቦች አድራሻዎች

# Part One - Overview of the Ethiopian Soil Campaign

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የአፈር ዘመቻው አስተባባሪዎች ጥቅምት 23 ቀን 2008 ዓ.ም በጣይቱ ሆቴል ጋዜጣዊ መገለጫ አዘጋጅተው ነበር። የመክፈቻውን ንግግር ያደረጉትም ክብርት ወ/ሮ ፍሬነሽ መኩሪያ፣ የግብርናና ተፈጥሮ ሀብት ሚኒስቴር ሚኒስትር ዴኤታ ነበሩ። በመቀጠልም ፕሮፌሰር ተካልኝ ማሞ፣ የአለም አቀፍ የአፈር ዓመት ልዩ አምባሳደር፣ አቶ ሞሀመድ ሳልህ በተባበሩት መንግስታት የእርሻና ምግብ ድርጅት (FAO) ምክትል ተወካይ፣ ወ/ሮ የለካ ደ ኑይ የአግሪ ፕሮፎክስ ኢትዮጵያ ተወካይ እና የኢትዮጵያ የአፈር ዘመቻ አስተባባሪ ኮሚቴ አባላትና እንዲሁም አርቲስት ስለሺ ደምሴ (ጋሽ አበራ ሞላ) እና አርቲስት ሙኒት መስፍን ስለዘመቻው አብራርተዋል።

*“በዓለማችን ላይ ከሚገኘው ብዝሃ ህይወት ሩብ ያክሉ በአፈር ውስጥ ይገኛል”*

*“አንድ ሴንቲ ሜትር አፈር ለመፍጠር ከ1000 አመታት በላይ ይፈጃል። ይህንን ጠራርጎ መሬቱን ባዶ ለማስቀረት ግን ጥቂት ቀናት ወይም ሰአታት ይበቃሉ። እስካሁን የዓለም አንድ ሶስተኛ የሚሆነው አፈር ተሸርሸሯል።”*

*“በሚሊዮኖች የሚቆጠሩ ኢትዮጵያውያን ህይወት በቀጥታ በአፈር ላይ የተመሰረተ ነው።”*

*“እናም ጥያቄው የሚሆነው ‘አፈራችንን እንዴት እናድናለን?’ ሳይሆን ‘እራሳችንን እንዴት እናድናለን?’ ነው።”*

*“የኢትዮጵያ መንግስት የአፈር ዘመቻውን የዓለም አቀፍ የአፈር አመት ውስጥ እንዲሆን ስላደረገ እንኩዋን ደስ ያላችሁ እንላለን።”*

*“በዘላቂ ልማት ግቦች ልማት ዘላቂ እንዲሆን ድንበሩ የተገደበ መሆን የለበትም የሚል ግንዛቤ ተይዟል። በመሆኑም ልማት አፈርን ጨምሮ የተፈጥሮ ሀብቶቻችንን የረጅም ጊዜ አቅም የሚያጎለብት መሆን ይኖርበታል።”*

*“የዘላቂ ልማት ግቦች ግብ 15.3 በልማት ውስጥ የመሬትና አፈር አስፈላጊነትን የሚያስገነዝብ ነው።”*

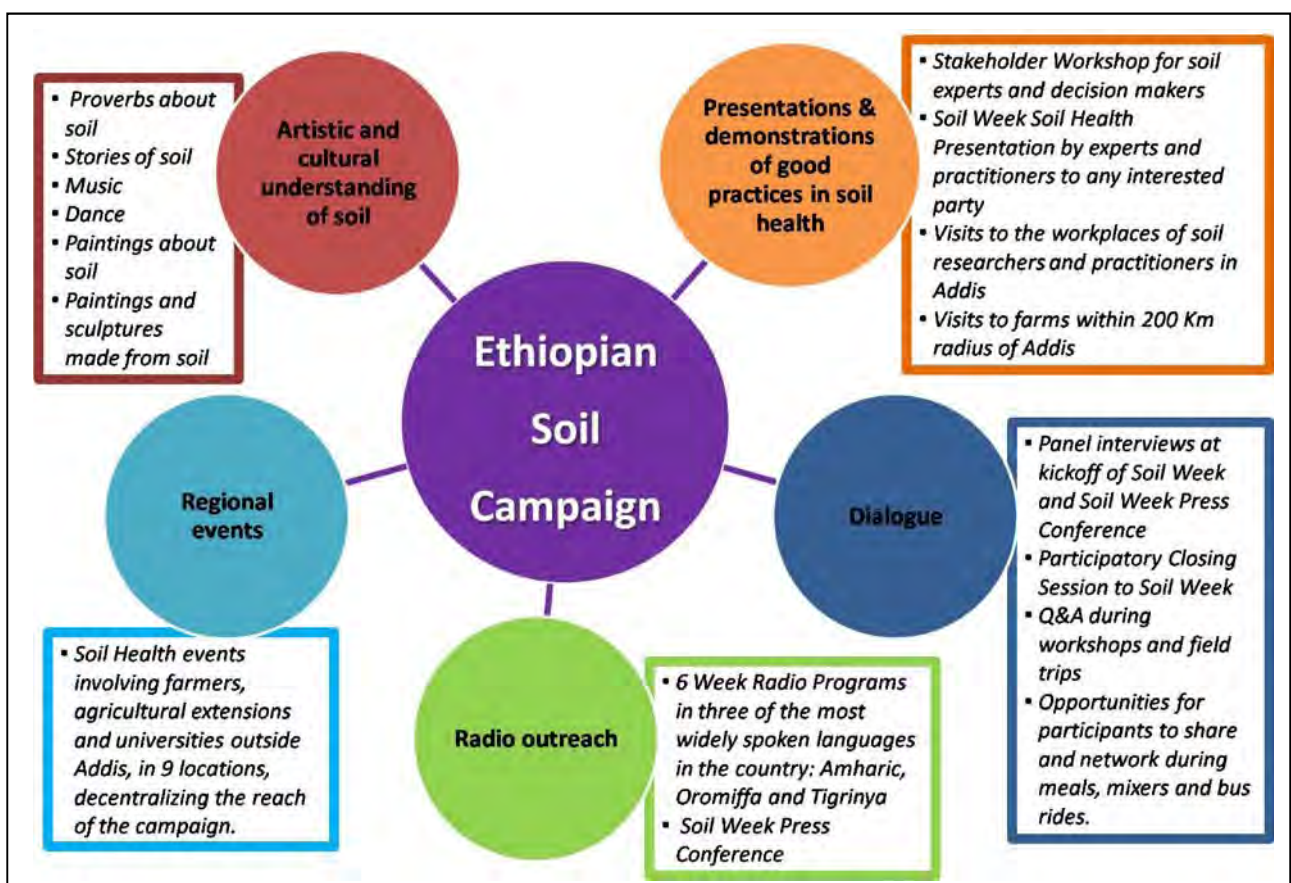
*“በሄራዊ የአፈር ዘመቻም የግብርና ምርታማነትን ለመጨመር ቅድሚያ የምንሰጠው ነገር ሆኗል።”*

# 1. The Ethiopian Soil Campaign Program

Government, various organizations and individuals have been working with, for and around soil in Ethiopia for millennia. As concerns about soils mount, more awareness about soil issues, and more capacity for implementing good practices in soil health are becoming increasingly needed. So in 2015, coinciding with the UN *International Year of Soils*, tens of hundreds of soil stakeholders across Ethiopia came together in dozens of different events to share insights about the status of Ethiopian soils, and good techniques for soil management. These events collectively have come to be known as the *Ethiopian Soil Campaign*.

The *Ethiopian Soil Campaign* had humble beginnings, starting with a handful of professionals and soil practitioners uniting to host a couple of educational soil-related events in an appointed “Soil Week” in October 2015. However, it soon became apparent that a single week of events would be hugely inadequate to address the great urgency of Ethiopian soil health concerns and the vast scope of soil issues and initiatives in Ethiopia, or to involve significant numbers of the numerous soil stakeholders in the country. Therefore, the Government of Ethiopia, spearheaded by the Ministry of Agriculture and Natural Resources, decided to take advantage of the *International Year of Soils* to establish a nation-wide campaign to raise awareness and synergy around soils.

The *Ethiopian Soil Campaign* involved various efforts to promote learning and networking among a diversity of stakeholder groups; stakeholders targeted included top decision makers, soil experts, soil researchers, farmers, agribusiness entrepreneurs, students, and interested public.



The Major Elements of the Ethiopian Soil Campaign

## 1.1 The major strategies of the Soil Campaign

The major strategies for engaging different stakeholders in the *Ethiopian Soil Campaign* can be grouped as follows:

1. Artistic and cultural understanding of soils, building on traditional and creative ways of understanding, celebrating, using and caring for soils.
2. Presentations and demonstrations by different experts and practitioners about soil and good practices in soil management.
3. Formal and informal dialogue around different concepts and practices associated with soils and development.
4. Radio outreach, in different languages, mainly targeted towards rural farmers.
5. Regional events outside of the Addis Abeba area, to share insights and build synergy for soil health using a variety of media (presentations, demonstrations, dialogues, etc.) in various locations.

Different events were designed to connect the various stakeholder groups. For example, the radio outreach and regional events were the most successful at engaging farmers and extension workers, whereas the Addis Abeba-based soil week (presentations, visits, demonstrations, panel discussions, etc.) was effective in involving decision makers in government, experts from research institutes, and students. Cultural celebrations were successful in helping people from all backgrounds to appreciate the significance of soils in society and everyday life.

Spaces in different events were created to address two very different needs: 1. sharing the basic and well established foundations of soil science and soil management, and 2. sharing divergent viewpoints in soil concepts and practice, where there is less consensus and more controversy.

<p><b>Sharing on the basic and well established foundations of soil science and soil management.</b></p> <p>Topics included:</p> <ul style="list-style-type: none"> <li>• What soil is.</li> <li>• Why soil is important.</li> <li>• Established principles for reduction of soil degradation.</li> </ul> <p>The <b>rationale</b> behind sharing the well-established principles: All stakeholders of the soil should have a good foundation of basic soil knowledge; many disregard the significance of soils, have little knowledge of the nature of soil, and/or lack information about principles to reduce soil degradation.</p> <p><b>Best ways to share this information:</b> Radio outreach, campaign bulletins, presentations, demonstrations, etc.</p>	<p><b>Sharing of divergent viewpoints where there is less consensus and more controversy.</b></p> <p>Subjects such as:</p> <ul style="list-style-type: none"> <li>• The difference between “soil health” and “soil fertility.”</li> <li>• Best technology for a productive and sustainable farming system in different agroecologies in Ethiopia.</li> </ul> <p>The <b>rationale</b> behind discussing these areas of less consensus: so that different stakeholders might start to understand the viewpoint and reasoning of the others, thereby expand their awareness of different ways to see and solve soil-related problems.</p> <p><b>Best ways to share different viewpoints:</b> formal dialogue in panel presentations, a wide diversity of presentations and demonstrations, Q&amp;A sessions after presentations and demonstrations, informal dialogue in bus trips, coffee breaks, etc.</p>
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*Different techniques for handling well established and more controversial areas in soil science and soil management*

## 1.2 Timeline of events

The temporal order of the most significant *Ethiopian Soil Campaign* developments, from general groundwork to execution of events, can be found in the table below.

Time-line	Development	Significance to the Soil Campaign	Insights for campaign organizing
February	<b>Soil professionals develop vision to organize an “Ethiopian Soil Week”</b> to raise awareness about the importance of soil in Ethiopia, see demonstrations of soil management in practice, and honor the <i>International Year of Soils</i>	Team interested to organize soil health events was formed. Many individuals from this initial group would remain leaders in the Campaign’s Organizing Committee throughout the year.	The team of professionals initially met at an AgriProFocus Soil Platform meeting: it was helpful to have this platform for stakeholders to share ideas.
March and April	<b>Development of</b> <ul style="list-style-type: none"> <li>• <b>concept note</b></li> <li>• <b>first flyer and brochure</b></li> <li>• <b>budget</b></li> <li>• <b>list of possible sponsors</b></li> </ul>	The concept note and the brochure made it possible to officially involve the institutions that are important in Ethiopia in the field of soil health management.	Early in kind and financial contributions made the development and printing of these materials possible: the contribution of these “seed” resources paved the way for others to follow.
April	<b>The Berlin soil week attended</b> Four prominent soil scientists based in Ethiopia visited the Soil Week in Berlin: Prof. Tekalign (then State Minister MoANR), Dr. Hailu Araya (ISD), Dr. Georg Deichert (GIZ) and Dr. Eyasu Elias (CASCAPE Program)	Prof. Tekalign nominated as one of the 2 Global Ambassadors for the <i>International Year of Soils</i> . Direct interaction between visionary soil experts from Ethiopia and sympathetic institutions helped to garner international support for campaign’s activities.	International recognition of Ethiopian soil leader helped to increase official momentum for organizing around soils in Ethiopian government ministries.
May	<b>MoANR governs various Sustainable Land Management Programs</b> in Ethiopia, which are implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in collaboration with many national and international partners	Involvement of GIZ in, and its contributions to the campaign strengthens inter-agency collaborations for soil health.	It is necessary and effective to involve influential stakeholders.
June 6	<b>Launch of the Ethiopian Soil Week</b> in Gulele Botanical Garden on World Environment Day (WED).	Media publicity on the issues of soils.	Positive cross-generational collaboration for soil health achieved by involving students, mainly from Hope University.



Time-line	Development	Significance to the Soil Campaign	Insights for campaign organizing
June	<b>The State Minister of the Ministry of Agriculture appoints a Chairperson of the Organizing Committee of the <i>Ethiopian Soil Campaign</i></b> , Ato Mesfin Berhanu, to be supported by Dr. Tesfaye Ertebo.	<b>Now officially a national campaign</b> , the scope of planned soil activities drastically increased beyond a week of Addis-based events.	The Ministry of Agriculture chairperson officially invited all relevant Ethiopian government institutions to appoint a representative to participate in the Soil Campaign Organizing Committee.
August	<b>Five subcommittees for the <i>Ethiopian Soil Campaign</i> were installed</b> , for the different activities to be done in the two months leading up to the Soil Week.	Campaign organizing focus shifts from the big picture rational for soil awareness and synergy development, to the nuts and bolts of event organizing.	Importance of analyzing the steps and components needed to carry out an effective campaign.
August – October	<b>Extensive behind the scenes campaign preparation</b> <ul style="list-style-type: none"> <li>• Radio program development</li> <li>• Preparing soil week events</li> <li>• Design of banners and T-shirts</li> <li>• Developing registration systems</li> <li>• Dissemination of invitations</li> </ul>	Laying the groundwork for successful soil events.	This preparation involved the dedicated and coordinated work of many parties, and plenty of time. Unanticipated delays in soil week dates served as a blessing to complete the extensive preparation work to high quality.
October	<b>Addis Ababa University Event on soils</b> , invitations to the public were broadcast over the radio.	Awareness about soil issues raised on public radio and in academic circles.	Event not organized by the Soil Campaign Organizing Committee, but parallel, and important in raising awareness and momentum around Ethiopian soils.
November 4	<b>Press Conference</b> in Taitu Hotel with the MoANR State Minister H. E. W/ro Frenesh Mekuria, Prof. Tekalign Mamo and FAO Assnt. Rep. Dr. Hassen Ali present.	Public awareness on soil issues.	Press conference included top officials, top experts, and celebrities to help grab public attention.

Time-line	Development	Significance to the Soil Campaign	Insights for campaign organizing
November 5-6	<b>Stakeholder Conference</b> , organized by Prof. Tekalign Mamo with support of Tegbaru Bellele of ATA.	Excellent engagement of high level experts and decision makers from various countries and different Ethiopian regional states contributed to awareness and synergy. Outcomes included informed recommendations to improve soil management.	Another parallel activity not organized by the Soil Campaign Organizing Committee directly. It was very important to have different events tailored to different stakeholder groups.
November 16	<b>Launch of Soil Week</b> Speeches, innovative displays, panel discussions and cutting of an educational soil cake layered like a real soil profile.	Expert speakers successfully brought participants up to date with current trends in soil issues globally and locally.	Beautiful setting, insightful presentations, memorable quotes and prestigious speakers helped to start Soil Week events with lots of positive energy and excitement.
November 16	<b>Cultural celebration of soil at National Theatre</b> Gashe Abera Molla and his band were a great success. Stories, paintings and poetry also moved participants.	Proverbs, stories and music helped experts and lay-people alike, appreciate the significance of soils in Ethiopian culture, such as in daily life, food traditions, cultural events, and even religious practices.	Creative presentations allowed for successful engagement of lay people on concepts of the multiple important roles of soils. Exposure to creative arts perhaps helped campaign participants (lay and expert) to open their minds to look at soils in a new way. These events added to the excitement around the campaign events of the week to come.
November 17	<b>Workshops on Soil</b> at Hope College of Business, Science and Technology	Morning and afternoon sessions with 6 well attended workshops on topics such as global and national soil policy, nutrient cycling, soil mapping, innovative soil amendments, and conservation agriculture. Good technical information shared, good networking opportunity.	Student volunteers did a lot of work to help the day run smoothly. The spacious premises were appropriate and contained some demonstrations for discussion. Campaign-assisted transportation from multiple locations aided attendance.

Time-line	Development	Significance to the Soil Campaign	Insights for campaign organizing
November 18	<b>Farm visits:</b> In Ziway, Debre Zeit, and Holeta. Soil professionals, farmers and fieldworkers met at demonstration sites to observe soil management in practice.	<b>In the field, the content of the campaign moved from the abstract to the tangible.</b> Effective knowledge transfer: demonstration is one of the most important ways of learning.	Linkages to these soil practitioners proved to be an essential part in the effectiveness of the campaign.
November 19	<b>Visits to various soil-related workplaces around Addis Abeba.</b> Discovery of what soil related institutes are found in Addis.	Important visualization, conversation and networking.	It is observed that participants like to share their own lessons learnt, their own knowledge and experience, in a group, more than simply listening to presenters; this is also more effective for learning and for synergy.
November 19	<b>Wrap up of soil week.</b> Closing remarks. Comments on the most important issues raised, where future work needs to be done.	Participants came up with the most important topics or recommendations on soil health management in Ethiopia for the coming years.	It was positive to take in the intensive soil learning and sharing experience, and then to collectively look to the future.
November 2015 to February 2016	<b>Regional Events:</b> Sharing and networking around soil health in 9 different locations outside of Addis Abeba.	Learning and networking sessions in different regions involving farmers, field workers, regional bureaus of agriculture and extension workers, universities, research institutions, and students.	The involvement of universities as organizers was effective since they have a budget for extension and community work. Demonstration in the agro-ecological areas in which farmers lived and worked was the best learning method for all involved.
December 4	<b>Ethiopian Soil Science Society Conference</b> at EIAR	Scientific papers presented on soil related issues. This event was organized by the ESSS, not by the <i>Ethiopian Soil Campaign</i> . However, the parallel nature added to the momentum around soils in the campaign.	Important sharing and networking, primarily between researchers and academics.

Time-line	Development	Significance to the Soil Campaign	Insights for campaign organizing
December 5 Soil Day	<b>Celebration of the <i>International Day of Soils</i></b> at EIAR	Speeches from experts, collection of feedback on the Soil Campaign from participants, and presentation of the first edition of the new magazine, <i>Wegele</i> , an Amharic version of Farming Matters. The first issue of <i>Wegele</i> was all about Soil.	Hugely positive feedback from campaign participants. <i>Wegele</i> magazine shall be disseminated through the Ministry of Agriculture Bureaus of Agriculture, and campaign participants were encouraged to contribute.
January and February 2016	<b>Radio programs broadcast</b>	6-week series of radio programs broadcast nationwide in Amharic, Oromiffa and Tigrinya.	Successful in reaching many farmers. Easy-to listen to 'radio-magazine' received lots of great feedback from listeners. Many would like such radio programs on soils to continue.
January 26	<b>Reflection session</b>	Organizing Committee evaluated the celebration of the <i>International Year of Soils</i> in Ethiopia	Decision to disseminate insights from the Ethiopian soil campaign Suggestions for future soil health work.
March – August	<b>Reporting</b> on the <i>Ethiopian Soil Campaign</i> and publication of the Report	Preparing a user-friendly set of insights from the campaign, not just for funders, but as a tool to aid the learning and synergy so that progress made may continue after the campaign is over.	Networks and insights developed in the campaign will be relevant in the future. It is important to document them for future reference.

## 1.3 Summary of Outcomes

The *Ethiopian Soil Campaign* stretched into a year of events, from February 2015 up until February 2016. Thousands of people were reached by the messages of the campaign, and hundreds had the chance to meet and interact with others on issues of soils.

Event	Number and type of stakeholders reached
▪ Start of the soil campaign, June 6 in Gulele Botanical Garden	60 visitors
▪ Q&A on TV by Prof. Tekalign	Public television viewers
▪ Public lecture on IYS, AAU by Prof. Tekalign (100 students)	100 students, academics and members of the public
▪ Press conference soil campaign Nov. 4	30 members of the public, 6 media houses
▪ IYS Stakeholder workshop, with Prof. Tekalign; Nov 5-6	70 members of government and research institutes
▪ Soil Week – 1st day afternoon opening with officials, institutions, sponsors	250 invited guests
▪ Soil Week – 1st day evening cultural celebration of soils: opening with Gash Abera Molla and Munit Mesfin	800 members of the public
▪ Soil Week – 2nd day: workshops	80 professionals and students
▪ Soil Week. – 3rd day: field visits	300 farmers, professionals and researchers
▪ Soil Week – 4th day: visit locations	105 professionals and students
▪ Soil Week – 4th day afternoon: wrap up of the soil week with prioritizing for future work on recommended topics	80 campaign participants (professionals, institutions, students).
▪ Ethiopian Society of Soil Scientists Conference	125 professionals
▪ World Soil Day	100 professionals, soil practitioners, students
▪ Regional events in Mekele/Wukro, Axum, Dessie, Debre Berhan, Debre Markos, Bahir Dar, Jima, and Wolayita Sodo: Pastoralists came together to share in Addis Ababa.	720 farmers, professionals, members of government, representatives of research institutes
▪ Wrap-up meeting of the soil organizing committee to discuss the outcome and follow up on December 17, 2015.	10 organizing committee members
▪ Weekly Radio Program in all regions in three languages, from January 1 to February 15	An unquantifiable multiple of thousands of farmers reached.
▪ Soil campaign publication, August 2016	1,000 copies distributed to farmers and extension workers reached through the Ministry of Agriculture and Natural Resources extension system.

In summary, the soil campaign directly engaged 3,780 individuals from different stakeholder groups, including members of government, professionals, farmers, researchers, academics and students. Additionally, the radio outreach is thought to have reached multiple thousands of people. The campaign impacted the people it reached in different ways: some became more **aware** of the significance of soils and interventions that they might take to improve soil health and fertility; many learned of the soil related work done by other stakeholders, and came away with **new relationships** and even new **networks** that they can draw on and align with in their present and future soil-related initiatives.

We believe that the momentum around these events in some way contributed to the attention for other soil-related activities organized by parties other than the campaign organizing committee in other places around the country (e.g. The Potassium Conference hosted by Dr. Wassie in Hawassa, Climate Smart Agriculture trainings lead by the Ministry of Agriculture, and other events of that nature).

Participants of Day 4 of the Ethiopian Soil week came up with the following prioritized list of recommendations for future soil and soil-related activities. (Priority ranking 1 through 7 for the 15 proposed recommendations is based on the number of votes given by event participants. Note that this is not a representative cross section of all stakeholders.)

Priority ranking	Recommendation	Number of votes in support of recommendation
1.	More research on and use of <b>organic &amp; bio-fertilizers</b>	10
1.	Include <b>soil health in primary education</b> and involve youth	10
2.	Adopt <b>"Climate Smart"</b> technologies and <b>conservation agriculture</b> techniques that are appropriate for Ethiopia	9
3.	Identify drivers and inhibitors for <b>adoption of proven technologies</b>	8
4.	Reach farmers through <b>farmer research groups</b> , joint experimentation, experience sharing	7
4.	Use <b>best soils for farming</b> not for urbanization	7
5.	More and strengthening of <b>(mobile) soil laboratories</b>	5
5.	<b>Communication tools</b> for research findings (media) and inclusion of the general public	5
6.	Improve/capacitate <b>extension workers</b> on integrated soil health management	3
6.	Integrate <b>private sector</b> in research and provision of extension services	3
6.	Strengthen <b>soil biology</b> by understanding of <b>soil systems</b>	3
7.	<b>National coordinated research program</b> for soil health management	2
7.	Continue the <b>knowledge exchange platform</b> of all stakeholders: NGO, Government, Entrepreneurs, Knowledge Centers	2
7.	Strengthen the <b>capacity of the research institutes</b>	2
8.	Secure <b>tenure rights</b> through policies	0



Some additional recommendations were added through personal communication to Soil Campaign Organizing Committee members, amongst them was that it is important to allocate more attention to pastoral land management.

At the closing of the international Year of Soil, a survey was taken of the success of the campaign in achieving stated objectives (for more information, please see results summarized on page 90). The Ethiopian Soil Campaign was very successful in achieving its objectives of creating awareness and fostering synergy around soil health. However, not all the campaign went smoothly as planned, and there are many organizing lessons in both the successes and challenges to the development of this campaign.

## 1.4 Lessons Learned

The following are the main lessons learned in the Organizing and Delivery of the Ethiopian Soil Campaign

### 1. *Official recognition, protocol and leadership*

Following the appropriate channels as well as involving all the relevant authorities is very important for ensuring the success of an undertaking like our campaign. The early leadership of the Ministry of Agriculture and Natural Resources, and the official invitations for stakeholder involvement that the Ministry issued were of central importance to the success of the campaign in involving critical stakeholders. The leadership of FAO in building international concern for soils in 2015 further aided in creating official recognition for the issues at hand.



Essential MoANR leadership came from Prof. Tekalign Mamo, former State Minister and *International Year of Soils* FAO Special Global Ambassador; State Minister H.E. W/ro Frenesh Mekuria, Mr. Mesfin Berhanu, and Dr. Tesfaye Ertebo.

### 2. *Diversity of events and outreach strategies*

It was really necessary and effective that the soil campaign had different activities for different types of stakeholders – different content, learning methods and networks were appreciated by the various stakeholder groups.

The decentralization of this campaign was very important for including a number of critical stakeholders outside of Addis Abeba. “Everything happens in the capital, but farmers working with soils are elsewhere,” it was commented. Events occurring in Addis Abeba had participation of very many decision makers, experts, and students, but very few farmers. The Campaign’s radio outreach and regional events were effective at reaching non-urban stakeholders of the soil. Ample transport expenses and per diem allowances offered in the independently organized stakeholder conference

(not by the Campaign Organizing Committee) allowed for the involvement of many soil stakeholders from regions outside of Addis Abeba.

Whereas the well-organized press conference did not yield very much publicity (for unclear reasons), the radio programs were hugely successful in reaching the public across a wide geographical area.

### **3. Budget considerations**

Every campaign needs a start-up budget! Start-up resources for this work came mostly from in-kind, volunteer contributions. An early donation from Tufts University/AKLDP was very significant because it was used to print materials, brochures, concept materials, etc., that made it possible to officially invite key stakeholders to become involved, and to solicit other much-needed funds.

Some strategic funding and support did not come through as expected or arrived much later. Fortunately, a diversity of other sources helped to cover the gap.

Lack of familiarity with the procurement processes of funder organizations resulted in delays of some events and payments. It is advisable to have a clear understanding of the necessary processes at the earliest possible time.

Frequently, officially assigned representatives of institutions did not show up to sub-committee meetings. It appears that they either had no time, or required a per diem and/or transportation costs to participate. Sub-committees consisted of passionate volunteer stakeholders, and representatives of committed organizations. For greater active organizing involvement, additional resources for organizers (at a minimum, reimbursement of transportation costs) would be helpful.

### **4. Coordination**

Early in the campaign, certain events were not well coordinated with other national environmental activities. For example, the Launch of the Soil Campaign on World Environment Day (WED), although successful in achieving its purpose, may have been more impactful if joined with other official WED celebrations at other locations. Later in the campaign, national stakeholder coordination improved, largely thanks to the Ministry Campaign Chairperson.

### **5. Handling delays**

The campaign experienced multiple delays to the originally planned schedule. Rather than being stopped by unanticipated delays, the campaign was successful in flexibly finding ways around circumstances beyond campaign influence. The delays sometimes cost the campaign the participation of certain key participants particularly those coming from outside of Ethiopia, and most notably, the IASS Director. To the surprise of many, however, these delays (e.g. in Soil Week, Regional Events and the Radio Program) sometimes worked to the advantage of the campaign, allowing for better planning and participation.

Campaign organizers learned to “go with the flow of things we cannot steer” – many things were beyond the control of the organizing committee, at most the committee could sometimes influence enabling circumstances.

### **6. Accommodating volunteers**

The campaign experienced many of the challenges associated with voluntary organizations. Because it was not a project but collaboration based on voluntary work, nobody (other than a few paid contractors) could be pressed into doing things. The *Ethiopian Soil Campaign* was successful because

it had a dedicated “pillar” or “engine” – a person who continues to trigger and pull the volunteer team towards its goals; Jelleke de Nooy from AgriProFocus served as an essential unifier and forward pushing force, preventing the ideas of the participants from being lost, and bringing different actors together to collaborate. When this “engine” was not around, there was a lull in organizing activities. Other “engines” to the campaign also played significant roles in bringing people together to collaborate for success, notably chairpersons from the Ministry of Agriculture. And similarly, when the Ministry was busy preparing the GTP2 to present to parliament in September, the campaign participants mobilized through the Ministry experienced a lull in organizing momentum.

### **7. *Selecting stakeholders to host events***

Events went especially smoothly when hosted at institutes that were themselves interested in the topic; such organizations often contributed resources, and assisted in planning. Times when this demonstrated itself positively included the December 5 celebrations at EIAR, Workshops on Day 2 of the Soil Week at Hope College of Business, Science and Technology, and the Regional Events hosted by Aksum University, Debre Birhan University, Debre Markos University, Jima University and Mekele University.

### **8. *Inviting participants***

For good attendance, it is imperative to start making a list of invitees at the very beginning of the campaign and inquire at organizations to share their network addresses with you! The Ethiopian Soil Campaign was moderately successful in this regard. On the subjects of interest, it is wise to make use of Bureaus of Agriculture that have extensive networks in the country.

Often email and telephone outreach to necessary stakeholders was not successful. However, going in person to various offices and waiting until the opportunity to share face to face was very effective in overcoming this communication obstacle.

### **9. *Promoting future soil learning and synergy***

The Campaign’s reporting subcommittee decided to design the report so that it would serve as a mechanism to account for the use of budget to the funders, but also as a tool that would help preserve insights and contacts shared amongst many different stakeholders of the soil during the *Ethiopian Soil Campaign*. It is important to encourage synergy and understanding even after the campaign events are over.

## Part Two - Insights on Soil and Soil Management

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### **“Soil Health” vs. “Soil Fertility”**

Throughout the campaign the concepts of “soil health” and “soil fertility” were compared, contrasted and discussed. Some participants tended to use the terms interchangeably. Others found great distinction in the terms.

Participants generally agreed that soil fertility generally refers to productivity – ability to produce large quantities of healthy crops and vegetables, and support healthy communities of people. Availability of plant nutrients in the soil is one important part of soil fertility: e.g. nitrogen, phosphorous and potassium are some of the critical nutrients limiting soil fertility in many places.

Others looked at soil fertility more holistically, and considered it to be the general plant habitat required to continuously achieve high quality yields. This more holistic view of soil fertility – stretching beyond plant nutrients and into concepts of biotic interactions, nutrient cycling processes, mineral, gas and liquid relationships, etc. – was labeled by others as, “soil health.”

Not all participants may have the same definition for soil fertility and soil health, but all agreed that holistically healthy soils tend to be fertile soils.

### **የአፈር ደህንነትና የአፈር ለምነት**

የአፈር ዘመቻው በቆየበት ጊዜያት ሁሉ “የአፈር ደህንነት” እና “የአፈር ለምነት” በሚሉት ጽንሰ ሀሳቦች ተመሳሳይነትና ልዩነት ዙሪያ ውይይቶች ተደርገዋል። አንዳንድ ተሳታፊዎች ሁለቱንም ተመሳሳይ ሀሳብ ለመግለጽ እያተካኩ ይጠቀሙባቸው ነበር። ሌሎች ደግሞ በሁለቱ መካከል ብዙ ልዩነት አለ ባዮች ነበሩ።

## 2. Promoting and Understanding Soils

### 2.1 Ethiopia Stakeholders' Workshop: Transforming Soil Health and Fertility Management for Sustainable Increased Agricultural Productivity

From November 5 to 6, a conference was held at the Hilton Hotel in Addis Abeba, for select soil experts and decision makers representing the public sector, private sector, civil society, research and higher learning institutions, and renowned individuals in the soil health and fertility management initiatives of the country.

Opening speeches were given by Prof. Tekalign Mamo, the *International Year of Soils* FAO Special Global Ambassador, Dr. Mamadou Traore, Vice President of the African Society of Soil Science (coming from Burkina Faso), and Ato Mesfin Berhanu, representing Her Excellency the State Minister of Agriculture and Natural Resources.

The first session discussed Soil Health and Fertility trends and implications for agricultural productivity. The second session was all about replenishment of soil health and fertility. The third and fourth sessions took on policy implications and networking. Immediate outcomes were compiled into a workshop resolution, the summary of which is reproduced below.

#### **Workshop Resolution Summary**

*Having come together on 5 and 6 November in recognition of the International Year of Soils, and cognizant of the fact that ever increasing land degradation is threatening soil productivity and food production in Sub-Saharan Africa (SSA), including Ethiopia, we declare the following:*

**We recognize** that soil fertility depletion is an increasing challenge to Ethiopian farmers, and understand that soils, like endemic plant and animal species, have started to become extinct. As for agriculture, food and crops from soils, crop productivity is the lowest in Sub-Saharan Africa by world standards and this will be a great challenge for the ever growing population. We know that soil is life and there is no life without soil. Soil formation is a very slow process that requires hundreds of thousands of years, and at the same time, soil can be lost entirely in a matter of a few hours, depending on the severity of erosion. 95% of the food that the world population consumes is grown on soils. Improving soil health will bring sustainable agricultural production. And we understand that soil fertility is a dynamic process that needs continuous monitoring and responsible measures. Understanding that soil is everything, and feeding both the soils and the plants is necessary. Soil is the second largest carbon sink, and it enhances climate change adaptation and mitigation.

**As for stakeholders,** recognizing that as long as there is agriculture, good soil care and monitoring soil health should be a continuous process by all involved.

**For civilians/farmers/schools,** it is important to realize that the current generation has the obligation of maintaining good soil health to leave it behind for the future generation, and soil is a public resource that requires attention and care by all citizens. Educational institutions have to take a key role to leverage improved livelihoods of the next generation.

**For Government,** it is significant that soil care and protection is cheaper than rehabilitating degraded soils. In many countries of the world the soil resource has been neglected by the policy bodies and



*relevant stakeholders, and that after a long silence, Ethiopia has started to take measures to address land degradation, improve the productivity of acid soils, vertisols and salt affected soils. Ethiopian citizens should have relevant and timely soil resource information. It is important to recognize that soil salinity is becoming a challenge to sustainable agricultural production as a result of the emphasis given to the development and intensification of irrigation scheme under smallholder and commercial farm levels in relation to the conservation activities. And in Ethiopia, the soil resource doesn't have a focused and responsible government institution.*

***For research institutions,** agricultural research has a great role in increasing crop production and productivity. The Ethiopian Academy of Science, different agricultural professional associations and specific societies have a great role in transforming the soil health and fertility management. Land use and land tenure system is not given adequate attention among the researchers and scientific community in the country.*

***And because of all this,** we, participants of the stakeholder workshop decide and declare that: We are committed to support the effort of the government in soil mapping and informed fertilizer recommendation efforts. We believe that **integrated soil fertility management** is the approach the country has to follow to improve soil health and attain food self-sufficiency. We believe that Government's support to natural resources management programme has to be strengthened. We believe that peoples' encroaching into marginal lands (due to population boom) and clearing forested areas by investors for the sake of crop cultivation should be monitored and controlled.*

***We therefore recommend attention to the following to bring about sustainable agricultural production:** policy, research, education, capacity building and extension services should focus on integrated soil and water management, and balanced nutrient management; integrated watershed management approach should be followed in soil health intervention strategies and initiatives; and addressing organic matter depletion.*

***We also recommend institutionalization of the following:***

- 1. Knowledge management, synergy and coordination between stakeholders to share responsibilities to work on a national soil health and watershed management programme in which each party is represented to fill in gaps; therefore, a Soil Health Consortium and Platform should be established and/or strengthened so that different stakeholders can exchange knowledge, experiences and demonstrate and make inventory of available resources.*
- 2. Expedite works related to "land utilization and administration" so that the land certification programs could become relevant and productive to support the agricultural production and productivity.*
- 3. There ought to be a "Lead institution" providing guidance and leadership. We believe coordinating activities of various national, international, bilateral and governmental, non-governmental and inter-governmental organizations involved in soil health, land and water management is a requisite.*
- 4. Developing a national soil information system is critically important for knowledge sharing to contribute to better decision and/or policy formulation and recommendations, and developing guidelines.*
- 5. Educational institutions have to revise their curriculum so that primary, secondary and higher learning institutions include soil health courses to shape the youth to maintain good soil health for future generations.*

**Instruments towards these shared objectives include:**

- The agricultural sub-committee of the parliament has to recognize soil as the driving force of GTP2.
- The impacts of ongoing government-led rehabilitation and sustainable land management initiatives have to be documented and fully realized, so as to support monitoring and impact assessment works.
- Transforming soil health and fertility management requires support from soil testing services. Hence, this service delivery by the various institutions / organizations (MoANR, EIAR, universities, and private sectors) needs coordination, guidance and capacity building.
- Sustaining a solution to avail credit system for input purchase to the farmers should be established and clustering should be put in place.



Workshop participants

Full report on the conference is available at [www.agri-learning-ethiopia.org](http://www.agri-learning-ethiopia.org)

Workshops and conference proceedings → Soil Health and Fertility Management (download)

ጥቅምት 25 እና 26/ 2008 ዓ.ም በሀገሪቱ በአፈር ለምነት እንክብካቤና ጥበቃ እንቅስቃሴዎች ዙሪያ መንግስትን፣ ማህበረሰቡንና፣ መንግስታዊ ያልሆኑ ድርጅቶችን፣ የከፍተኛ ትምህርትና የምርምር ተቋማትን እንዲሁም የግሉን ዘርፍ የሚወክሉ ባለሙያዎችና ውሳኔ ሰጭዎች ለመምረጥ አንድ ጉባኤ ተካሄደ። የዚህ ጉባኤ ተሳታፊዎችም የሚከተለውን መግለጫ አወጡ፤

የአፈር ለምነት መከላከል ለኢትዮጵያ አርሶአደሮች ከጊዜ ወደ ጊዜ እየጨመረ የመጣ ተግዳሮት ሆኗል። አፈር ህይወት ነው፣ ያለአፈርም ህይወት አይኖርም። አፈር የሚፈጥረበት ሂደት ደግሞ ዘገምተኛና በመቶዎች የሚቆጠሩ አመታትን ያህል ጊዜ የሚወስድ ነው። የተፈጥረው አፈር ለመጥፋት ግን የጥቂት ቀናት አንዳንዴም የመከላከል ህይወት ክብደትና ቅለት የሰጠው ጊዜ ብቻ ይበቃዋል። የዓለም ህዝብ ከሚመገበው ምግብ 95 በመቶው በአፈር ላይ የሚበቅል ነው። በመሆኑም የአፈርን ለምነት ማሻሻል ዘላቂ የግብርና ምርትን ለማግኘት ይረዳል። አፈር በብዙ ቶን የሚመዘን ካርቦንን መጦ ከአየር ላይ

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## 2.2 Soil Health, Fertility Challenges, and Responses



*Interview with Dr. Negash Demissie, Vice President of the Ethiopian Soil Science Society & Project Leader for AGRA Soil Health Project, coordinating Ministry of Agriculture's Integrated Soil Fertility Management (ISFM) Research.*

The most important thing in agriculture is to know your land and understand your soil. Everything comes from soil. Good seeds, improved livestock, or expensive equipment will all yield nothing if you don't have good soil. Keeping soils healthy – un-eroded, un-degraded, fertile and non-polluted, is essential for livelihoods.

The fourth component of soils, macro- and micro-organisms, is commonly ignored: however, it is one of the most significant indicators of soil health. Macro-organisms (e.g. earthworms and beetles) and microorganisms (e.g. bacteria and fungi) play very essential roles in helping plants to access the nutrients they need from the soil. While most of a soil's nutrients are found locked in complex chemical

substances that the plant cannot use, micro-organisms help to convert those compounds in the soil into forms that the plants can easily take up for healthy growth.

### ***How do we feed the soil?***

A plant can't take up nutrients directly, so if we want to feed a plant, first we feed the soil.

**1. Stop Erosion!** – The first step in soil health is ensuring that the soil is not exposed for soil erosion. Healthy soils are stable and un-eroded. In mountainous areas bench terracing helps to stabilize soils. In flat areas, soils must still be protected from wind and water erosion.

**2. Test the soil!** – Testing the soil in a lab is important. In the last 20 years, 15 soil labs have been established across Ethiopia so that farmers may know their soil condition. We test the soil to determine if it is fertile, non-fertile or problematic. After knowing the soil condition, proper soil improvements can be identified.

Two common soils types that can be problematic in Ethiopia are nitisols and vertisols. **Nitisol, or “red soil,”** common in Ethiopia, is typically a problematic soil because it tends to be very acidic, due to its high aluminum content. The pH of these common red soils is often less than 5, sometimes less than 4. As a result of this acid condition, nutrients tend to become chemically bonded into complex compounds that are inaccessible for plant use.

After Sudan, Ethiopia has the highest area coverage of **vertisol**, also known as **“black cotton soil.”** These clay soils are very high in nutrients; however, their management is problematic. They are easily water logged, causing roots to suffocate without oxygen so plants do not grow properly. In wet times they expand, in dry times they crack, causing excessive water loss; these cracks may open up to two meters wide, which can prevent cattle from crossing fields. Techniques for water management, such as broad bed furrows (BBFs), created either traditionally or in modern ways, can help to manage challenges, making cultivation of crops such as cereals possible.

**3. Improve soil fertility!** – When you want to improve soil fertility, there are different measures that can be taken: Soil conditioners may be added (e.g. lime to modify the acidity of the soil), or one can add nutrients. Every year plants remove nutrients from the soil. In healthy soils, removal and addition of nutrients is balanced to sustainably maintain optimal nutrient levels. Unfortunately, many farmers are not returning nutrients to their soils at the same rate that their crops remove them, and this results in low yields and loss of fertility.

**Adding nutrients:** When it comes to adding nutrients, there are a number of means by which this may be done. They are explained below:

- a) **Addition of chemical fertilizers**
- b) **Addition of organic fertilizers**
- c) **Addition of biological fertilizers**
- d) **Agronomic means**

**a) Addition of chemical fertilizers:** Many companies and many countries advocate for the addition of chemical fertilizers (e.g. European countries, USA, India and China). Since our country has no fertilizer industry, we import fertilizers with hard currency. In Ethiopia for the last 50 years we have imported urea, a source of nitrogen, and DAP, a source of nitrogen and phosphorus.

**Generally, our land is a living body. It has four main components:**

- 1. **Mineral components**
- 2. **Water**
- 3. **Air**
- 4. **Macro- and microorganisms**

**Just as a person would be sick if any of its organ systems was damaged or missing, the soil is not healthy if any of these four components is not present or healthy.**

Soil is a composition of many nutrients, 13 of which are essential for normal growth of plants. Nitrogen, phosphorus and potassium (NPK) are the most important, but others are required in small amounts, e.g. sulfur, zinc, boron, magnesium, etc. Hydrogen and oxygen are obtained from water.

When we want to add chemical fertilizer, there are different methods for doing so:

1. **Single** chemical fertilizers add only one nutrient. An example is urea, which adds only nitrogen.
2. **Straight** fertilizer, also known as double or triple fertilizers, adds two or three kinds of nutrients. An example is DAP, which adds nitrogen and phosphorus.
3. **Complex** fertilizers, also known as compound fertilizers, provide four to five different elements in bonded chemical compounds.
4. **Blended** fertilizers: these have a combination of nutrients that are mechanically, not chemically, combined together.

Recently, thanks to the Ministry of Agriculture and particularly Prof. Tekalign, Ethiopia started to import and test different blended fertilizers to assess the best blend for Ethiopian farms. In this extensive research, 10 blends were tested across over 100 different farm sites, and then the best blend for different areas was selected and formulated. Subsequently, the government has established blending companies in Mekele (Tigray Region), Bechu (Oromia Region), Bahir Dar (Amhara Region).

Appropriate application of chemical fertilizers is based on both agro-ecology of the crop and the soil type. Each plant variety requires a different optimal combination of nutrients, and research in this area is ongoing. Soil testing is essential in determination of site-specific nutrient amendments. Amongst other disadvantageous impacts, improper application of chemical fertilizers can reduce the populations of microorganisms in the soil, which can threaten overall long-run soil health.

The following barriers to fertilizer application in Ethiopia have been identified:

- **Availability** is a challenge, particularly as geographic distribution of our farmland is wide. Furthermore, fertilizers are being prioritized for only 4 main crops including maize, wheat and teff.
- **Cost** of fertilizer is often not affordable for farmers, some of whom have to get it through credit or loans which must be repaid in good harvest years. Studies do show that correct application of fertilizers does pay off, except in extraordinary cases (such as this year's extreme El Niño rainfall variability in quantity and distribution).
- **Lack of awareness.** Some farmers are not convinced of the benefits of chemical fertilizers, and are concerned about loss of potential future productivity.
- **Subsistence orientation.** The objective of some family farmers is to produce enough for their families to consume on an annual basis, rather than production for the market or for profit.

**b) Addition of organic fertilizers:** Natural organic fertilizers have many advantages: there is no need to import them as they can be made from local materials with available technology. They are low cost. They cause no pollution, they have a positive impact on the microbiology of soils, and they can help to manage organic wastes.

Major types of organic fertilizers include:

- Any type of **animal manure** (cow, chicken, goat and sheep dung, etc.)
- **Green manure:** turning over land to incorporate legume plants grown to fix nitrogen so they decay in the soil. This must be done before the plants start to set seed.
- **Compost:** controlled decomposition of selected organic waste materials by scientific means. Compost involves decay, but not all decay qualifies as compost; inputs must be selected and segregated and their breakdown controlled. Major composting techniques in use in Ethiopia are the pile method and the pit method, both advocated by the government for the last 7



years, and vermicomposting (making compost by the action of worms) which has only begun to be promoted more recently.

Use of organic fertilizers also has a series of barriers, amongst them,

- **Awareness** – there tends to be less extension work in the area of organic fertilizers.
- **Competition for resources** – many organic substances could be used by farmers for things other than agricultural input. Cow dung, for example is often used for fuel or construction, so to put it on the land has a direct opportunity cost. Measures such as fuel replacement would help to incentivize use of manure on soils.
- **Challenges in scaling up production** – the quantity of organic fertilizer production is low, and it is difficult to scale production up to levels that would meet all fertilizer needs.
- **Less research and recommendation regarding application of organic fertilizer specific to all soil types and all crops.** There is some information regarding optimal organic fertilizer application under different conditions, but there are many gaps.
- **Production of compost by pit and pile methods can be laborious**, requiring appropriate timing and equipment. It is also possible to have mild allergic impacts for some farmers. Therefore, many farmers are reluctant to engage in composting. Vermicomposting technology can make composting less labor-intensive for farmers. (Please see report on vermicomposting).

**c) Addition of biological fertilizers:** Biological fertilizers are special man-made microorganisms that are prepared in a lab. Among microorganisms, there are the highly beneficial, the intermediate ones, and the non-beneficial ones (the worst of which are responsible for soil-borne diseases). The most beneficial of soil microbes are those that provide functions such as nutrient fixing (e.g. nitrogen fixers), and those that are nutrient mobilizers, making inaccessible nutrients (such as zinc, phosphorus and sulfur) available for plants use.

All soils have many types of microorganisms, but the amount and proportion of microorganisms in any specific soil varies across soil type, climatic zone, location, etc. In the production of biofertilizers, the most beneficial microorganisms are isolated and replicated in a lab. These replicated beneficial microbes are then re-introduced to the soils.

In Ethiopia, research into local soil microbiology began in 1986. In 2000, Ethiopia began testing biofertilizers in the field. For almost 10 years now, Ministry of Agriculture's National Soil Lab and EIAR have been promoting biofertilizers amongst farmers. The most widely used and produced biofertilizer in Ethiopia is the rhizobium-based nitrogen-fixing variety. The National Soil Lab of the Ministry of Agriculture was the first institution to produce this biofertilizer. Now there are Ministry of Agriculture labs producing biofertilizers in Bahir Dar and Awasa; one private company, Menagasha Bio-Industry (MBI) is producing biofertilizer; and EIAR has biofertilizer production in Holeta and Debre Zeit.

Each crop has its own symbiotic strain of rhizobium. In Ethiopia 6 strains are produced for 6 crops: faba bean, chick pea, lentil, field pea, haricot bean (common bean), and soya bean.

Application of biofertilizer entails inoculating a sachet of bacteria into a medium in which they can multiply (lignite), then adding something sticky (for example, sugar) and mixing this concoction with warm water and the seeds to be planted. As the seed germinates, the bacteria attaches to the root and forms nodules where it gains access to the plants sugary energy source, and in return it allows nitrogen to be fixed and mobilized in such a way that it is difficult for the plant to do alone. Each 125-gram sachet of bacteria can cover a quarter hectare of legume crops. Studies show that in a year of legume cultivation, 60% of available nutrients from rhizobia are consumed by the growing plants, but 40% remain in the soil after the legume is gone, automatically rendering increased fertility to the land and the next crop. Agronomically, farmers are advised to keep rotation of crops, with ideally planting cereals after a season of legumes.



To date not more than 200,000 farmers have been reached with biofertilizers. In the future the government shall establish centers for multiplication of biofertilizers in Mekele, Bahir Dar, Hawassa, Dessie and Nekemte.

More research into biofertilizers is needed to expand its adaptation. New research on efficiency of biofertilizers is needed. More strains of beneficial microbes need to be identified and isolated, as it is best to have multiple biofertilizers per crop; one cannot expect that one type of biofertilizer would produce desired results across all soil types and environments. More budget, advocacy and extension work would also help to promote this technology into the future.

**d) Agronomic Techniques:** There are different techniques that contribute to a healthier soil, for example crop rotation, minimal tillage, push-pull, Intensive Root System, etc. We will explain the first two here.

**Crop rotation** is good for keeping the nutrient balance in the soil, as it prevents the same nutrients from being extracted at the same rates year after year by the same crops with constant nutrient requirements. Crop rotation provides the added benefit of natural pest control. Different crops are affected by different diseases. Planting the same crop year after year allows existing disease infestations to increase with each season that the crop is renewed. When a new crop is put on the same land, the new crop will not be affected by the existing infestation targeting the previous crop, and thus crop rotation can break the disease chain and prevent loss of yield and expense for use of pesticides.

Awareness and confidence in the benefits of crop rotation tends to be quite high amongst farmers. There are some barriers to crop rotation, however. For one, preferences in tradition and diet tend to be fixed. Cultural pressure and pressure from family to avail certain crops continuously can discourage farmers from practicing crop rotation. (For example, it is not uncommon to see teff planted year after year on the same land for reasons such as these.) Market demand for certain crops can create further incentives to plant the same crop time and time again. Nowadays, due to unpredictable weather patterns, crop loss can be prevented by planting crop varieties with fast maturation, however favoring the selection of fast maturing plants results in less diversity in the crops cultivated.

**Minimum tillage and zero tillage techniques** are good for soil conservation and also for retaining the moisture in the soil. These are conducted by applying herbicide to the land and then sowing seed, or sowing seed after plowing just once. Herbicides, however are an additional cost to farmers and are also toxic, and many communities in Ethiopia have a long tradition of extensively using the plow.

### **Summary**

A number of techniques for improving soil fertility exist, from soil stabilization, to soil conditioning, to multiple ways of adding nutrients to the soil. No single technique is best: Different techniques are best for different conditions of soil and land use. Therefore, knowledge of the condition of the soil in the specific place must be gathered, through erosion assessment and soil laboratory testing, before optimal soil fertility methods can be selected. Often, a combination of techniques can be simultaneously applied to maximize immediate and long term advantage.

Nowadays, many experts advocate integrated soil fertility management (ISFM) which combines many techniques – use of chemical fertilizers, organic fertilizers, and traditional practices, etc. – for optimal, sustainable land management.

### **ጤናማ አፈር**

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ደህንነቱ የተጠበቀና ለም አፈር ከሌለ ጥሩ ዘር፣ የተሻሻለ የቤት እንስሳት ዝርያዎች፣ ወይም ውድ የእርሻ መሳሪያዎች ምንም እርባና አይኖራቸውም። ዜጎች ከድህነት ተላቀው የተሻለ ኑሮ

እንዲኖራቸው፤ ደህንነቱ የተጠበቀና ያልተሸረሸረ፤ ያልተከላ፤ ለምና ያልተበከለ አፈር ምትክ አይኖረውም።

አንድ እፀዋት በአፈር ውስጥ የሚገኙትን የምግብ ንጥረነገሮች የሚያገኘው ከአፈሩ ነው። ስለሆነም እፀዋቱ ተገቢውን ምግብ እንዲያገኝ መጀመሪያ አፈሩን መመገብ አለብን። ታዲያ አፈሩን እንዴት ነው የምንመግበው? 1. አፈሩ እንዳይሸረሸር መከላከል፤ 2. አፈሩን መመርመር 3. ለምነቱን መጨመር

አፈሩ ላይ የምግብ ንጥረነገሮችን የምንጨምርበት ከሆነም ይህን ልናደርግ የምንችልባቸው የተለያዩ መንገዶች አሉ፤

ሀ. ሰው-ሰራሽ ኬሚካል ማዳበሪያዎችን በመጨመር፤

ለ. የተፈጥሮ ማዳበሪያዎችን በመጨመር፤

ሐ. ህይወታዊ ማዳበሪያዎችን በመጨመር፤

መ. ሌሎች የስነግብርና ዘዴዎችን በመጠቀም

ከላይ የተመለከቱት መንገዶች እያንዳንዳቸው የየራሳቸው ጥቅምና ጉዳቶች አሏቸው።

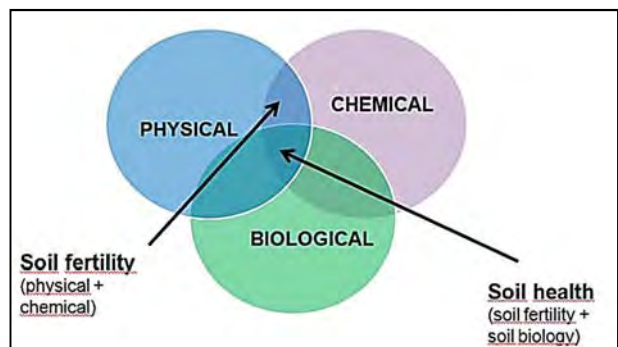
የአፈር ለምነትን ለማሻሻል የተለያዩ ዘዴዎችን መጠቀም ይቻላል፤ ከነዚህም ውስጥ አፈሩ እንዳይሄድ ይዞ ማቆየት፤ አፈሩን ማብላላት እና ማዳበሪያ መጨመርን መጥቀስ ይቻላል። እንከን የማይወጣለት ብቸኛ የአፈር ለምነት ማሻሻያ ዘዴ የለም። ለተለያዩ የአፈር አያያዦችና የመሬት አጠቃቀሞች የተለያዩ ዘዴዎችን መጠቀም ያስፈልጋል። ስለሆነም አንድን የአፈር ለምነት ማሻሻያ ዘዴ ከመጠቀም በፊት በዛ ቦታ ላይ ስለሚገኘው አፈር መረጃ በመሰብሰብ (በአፈር መሸረሸር ጥናት ወይም በቤተሙከራ በሚደረግ ምርመራ) ስለአፈሩ ሁኔታ ማወቅ ያስፈልጋል። ብዙ ጊዜ በቅርብ ጊዜና በረጅም ጊዜ የሚገኙ ጥቅሞችን ከፍ ለማድረግ ከአንድ በላይ የሆኑ የአፈር ለምነት ማሻሻያ ዘዴዎችን በጥምር መጠቀም የተሻለ አማራጭ ይሆናል።

በአሁኑ ጊዜ ብዙ ባለሙያዎች የአፈር ለምነትን ለማሻሻል ከአንድ በላይ ዘዴዎችን ያጣመረ የተቀናጀ የአፈር ለምነት ጥበቃ ዘዴ ማለትም ሰው-ሰራሽ ኬሚካል ማዳበሪያን፤ የተፈጥሮ ማዳበሪያን፤ ባህላዊ አሰራሮችን ወዘተ አቀናጅቶ መጠቀምን ይመክራሉ።

Dr. Negash Demissie, Ethiopian Soil Science Society Vice President and ISFM Technology Research Project Leader for AGRA Soil Health Project email: negash34@yahoo.com, tel:

## 2.3 Rethinking Soils

In a Soil Platform meeting leading up to the inception of the Soil Campaign, and also at a presentation during the November 5 Stakeholder Workshop, Dr. Georg Deichert distinguished between soil fertility (a combination of physical and chemical properties) and soil health (soil fertility plus soil biology).



In mainstream agriculture, soil is merely a chemical and physical entity, a medium for carrying plants and holding plant nutrients. Agricultural chemistry has been the dominant approach to soil fertility, and continues to guide the practices recommended to farmers. Yet, Dr. Deichert explained, agricultural science and practice ignore that the soil is a living system – and needs to be treated accordingly. Likewise, economic thinking considers soil to be a mere factor in production, with no attention given to its being a living entity that contains billions of organisms in just one handful. The speaker went on to provide some historical insight before presenting the components of soil systems (mineral elements, water, air, organic material) and their dynamics. In particular, he noted that the organic portion of soils includes both soil organisms and the various biological substances and processes that animate soil systems. Soil health is more than the abundance of certain chemicals, but is rather the effect of countless interactions among organisms and the substances on the surface and within the soil. By breaking down chemical components, the soil biota continuously replenishes the pool of nutrients that is available for plants and other biota. Plants, and especially roots, are themselves active participants in soil processes. He emphasized, therefore, that we should be aware that we are not fertilizing plants but rather nurturing the soil.

Dr. Deichert continued his presentation, outlining some principles in nature and guidelines for husbandry of the land:

- *In nature, soil is always covered* (ideally, plants cover the soil permanently)
- *There is always a diversity of plants* (at least two species should grow in a field)
- *There is always a cycle of nutrients* (all available organic matter should be returned to the land to increase the humus content of the soil)
- *Plants regulate the uptake of nutrients on their own* (this should not be disturbed by applying synthetic fertilizer)
- *Vegetation absorbs optimum sunlight* (cropping systems should permit optimal utilization of sunlight by vegetation)
- *Soil 'ploughs' or cultivates itself* (as far as possible, soil organisms, animals and soil aggregates should not be disturbed by tillage or other practices)
- *Life is interconnected* (self-regulating processes among interconnected species in the soil and plant community should be respected and, if possible, not disturbed)

"Sustainable agriculture is any principle, method, practice or philosophy which aims to make agriculture ecologically sound, economically viable, socially just, culturally acceptable and is based on holistic science."

From these principles, the speaker proceeded to explain the implications for soil systems thinking. The first of these was that many current standard agricultural practices have negative impacts on soil systems, with new cultivation methods bringing new problems. For example, plowing causes erosion, synthetic fertilizers cause unbalanced soil chemistry and biology, and some agrochemicals disturb the balance of soil biota and reduce biodiversity. At the same time, these practices do not address the basic causes of deteriorating soil systems.

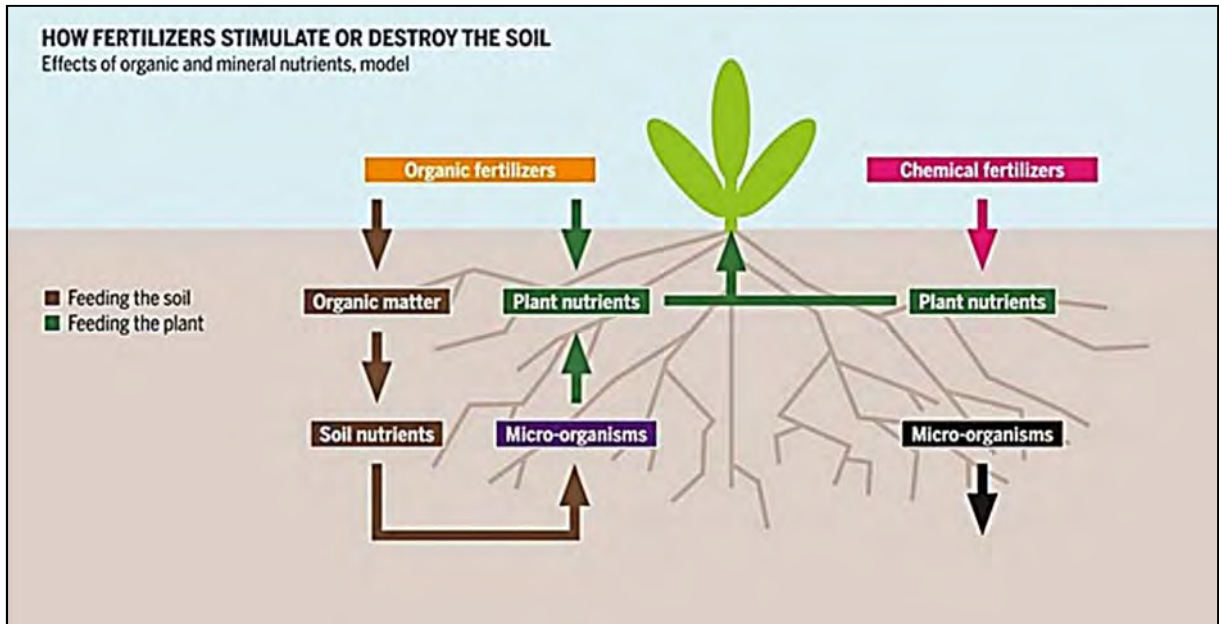
Biologically-based approaches, on the other hand, aim to improve conditions that will support sustainable and beneficial natural processes, thereby contributing to soil creation, solubilization and recycling of nutrients, improvement and stability of soil structure, and detoxification.

Further implications stemming from the above principles include that less humus means lower soil fertility, that while fertilizers are seen to be vital to increase food production, the long-term damage they cause to soil is often forgotten, and that producing and marketing nitrogen, phosphorus and potassium takes a lot of investment – hence the industry is dominated by big business.

From this analysis, the speaker moved to outline a final set of implications: the need for an orientation towards agro-ecological approaches and understanding of sustainable agriculture. Sustainable agriculture is any principle, method, practice or philosophy which aims to make agriculture ecologically sound, economically viable, socially just, culturally acceptable and is based on a holistic science.

While synthetic fertilizer is like a medicine against a disease that acts primarily against the symptoms, compost basically maintains a healthy soil.

In conclusion, therefore, Dr. Deichert emphasized that the underlying principle of soil fertility management is to ‘feed the plant’, but soil health management is to ‘feed the soil, not the plant’.



Soil Processes of Chemical and Organic Fertilizers, IASS Soil Atlas

#### ከጤናማ አፈር የተፈጥሮ መርሆዎች መግር

ዘላቂ ግብርና የግብርና ስራን ከአካባቢ ስነምህጻር ጋር የተስማማ፣ በኢኮኖሚ አዋጭ የሆነ፣ ማህበራዊ ፍትህን የማይቃረን፣ በማህበረሰቡ ባህል ተቀባይነት ያለውና ሁሉን አቀፍ በሆነ ሳይንሳዊ አሰራር ላይ የተመሰረተ ለማድረግ ያለመ የግብርና መርህ፣ ዘዴ፣ አሰራር ወይም ፍልስፍና ነው።

ዶ/ር ዳይቸርት የመሬትን አያያዝ ሊመሩ የሚችሉ አንዳንድ ተፈጥሮአዊ የአፈር ባህሪያት መርሆዎችን እንደሚከተለው አብራርተዋል።

- አፈር በተፈጥሮ ሁሉም የተሸፈነ ነው፤ (ተፈጥሮ አፈርን በቋሚነት የምትሸፍነው በዕጽዋት ነው)
- አፈርን የሚሸፍኑ ዕጽዋቶች ሁሉም ብዝሃነት ይታይባቸዋል (በአንድ አካባቢ ላይ ቢያንስ ሁለት አይነት ተክሎች ይገኛሉ)
- ሁሉም በአፈር ውስጥ የሚገኙ ንጥረነገሮች ዑደት ይኖራል፤ (የአፈርን ብስባሽ ይዘት ለመጨመር ሁሉም በእጽዋቱ ከሚወሰዱት የአፈር ንጥረነገሮች አብዛኛው በተለያዩ ሁኔታ ወደአፈሩ መመለስ ይኖርባቸዋል)
- ዕጽዋት የሚወስዱትን የንጥረነገር መጠን በራሳቸው ይቆጣጠራሉ (ሰው ሰራሽ የኬሚካል ማዳበሪያን በመጠቀም ይህን ከሚያዛባ አሰራር ልንቆጠብ ይገባል)
- ዕጽዋት የጸሀይ ብርሀንን በበቂ ሁኔታ ይስባሉ (በአንድ ማሳ ላይ የምናበቅላቸው የሰብል አይነቶች የጸሀይ ብርሀንን በበቂ ሁኔታ የሚስቡ መሆን ይኖርባቸዋል)
- አፈር እራሱን በራሱ ይኮተኩታል (በተቻለ መጠን በአፈር ውስጥ የሚገኙ ደቂቅ ህዋሳት፣ እንስሳትና የአፈር ስብስቦች አፈሩን በመቆፈር ወይም በሌላ ስራ መረበሽ የለባቸውም)
- ህይወት እርስ በርስ የተያያዘ ነው (በአፈር ውስጥ በሚገኙ ህይወት ያላቸው ነገሮችና በእጽዋት ዝርያዎች መካከል ያለው ግንኙነትና መስተጋብር በተቻለ መጠን ሊከበርና በተፈጥሮአዊ አሰራሩ እንዲቀጥል መተው ይኖርበታል)

Dr. Georg Deichert, email: Georg.Deichert@giz.de, tel: 011-646-3302



## 2.4 PressConference

On November 3, 2014, the Soil Campaign held a Press Conference at the Taitu Hotel. The introductory speech by Her Excellency W/ro Frenesh Mekuria, State Minister for Ministry of Agriculture and Natural Resources, was followed by Prof. Tekalign Mamo, Special Global Ambassador for the International Soil Year; Mr. Mohammed Salih, the UN-FAO Deputy Representative; Mrs. Jelleka de Nooy, representing AgriProFocus Ethiopia and the Ethiopian Soil Campaign Organizing Committee; and Artist Sileshi Demissie (Gash Abera Molla) and Musician Munit Mesfin.

Her Excellency W/ro Frenesh Mekuria and Professor Tekalign discussed recent activities spearheaded by the Ministry of Agriculture on soil health. A notable accomplishment is the establishment of the soil fertility mapping project, which allows for application of site-appropriate blended fertilizers.

Crucial questions from the public and media reporters in the audience: **"How can you speak of soil if we are facing a severe drought and famine period?"** and, **"All of this is nice talk for Addis Ababa, but how do you reach the farmers?"** The panelists, led by Professor Tekalign, explained the connection between soil health and climate resilient agriculture, pointing to the fact that less water is required for healthy soils to be fruitful. Also, the different components of the Soil Campaign in the Regions were described.

FAO Deputy Representative. Mr. Mohammed Salih, said, "FAO will continue to support effective actions for the sustainable management and protection of soil resources: a) Strengthening initiatives in connection with the SDG process, b) Supporting the post 2015 agenda, and c) Advocating for rapid capacity enhancement for soil information collection and monitoring at all levels." Gash Abera Molla mentioned other aspects of soil that are as important as food production for our everyday life: soil is being used for house building, for making clay vessels to hold water and food. "We come from soil and we return to soil". Altogether, the importance of soil, for healthy food and healthy life was shared. The press conference was successful in achieving a print article and radio coverage in two languages.



Key press conference organizers Daniel Dentamo, Ministry of Agriculture and Natural Resources Public Relations Senior Expert, email: danldntm1@gmail.com, tel: 0912035143, and Munit Mesfin, email: munit.mesfin@gmail.com, tel: 0912210881

## 2.5 Kick-off of Soil Week

“Soil Week” was celebrated from November 16-19 as a concentrated week of activities within 100 km of the Addis Abeba, focused on knowledge sharing and network building to enhance soil health.

On Monday November 16, the Soil Week was launched at the National Theatre, with speeches in the afternoon by dignitaries and experts to invited guests, followed by an evening cultural program open to the public, celebrating the importance of Ethiopian soil, with songs, dances and poems. The National Theatre was greened with 100 tree seedlings for the occasion.

Distinguished speakers explained the global and local status of soils and efforts to protect soils.



### **Highlights of the Keynote Speeches**

**Dr. Hassen Ali (FAO Assistant Representative)** said that “The multiple roles of soils often go unnoticed. Soils don’t have a voice; they are our silent allies for food production. We must recognize them.

“We look to the importance of healthy food systems for life. The health of the food system starts with soils. Soils host a quarter of the world’s biodiversity, and they help us in climate change mitigation as they sequester carbon. Healthy soils help us to be resilient to flood and drought. It can take more than 1000 years to create one centimeter of topsoil, but this can be quickly degraded by erosion. One third of our soils have already been degraded.

“The campaign and soil week mean a lot for Ethiopia. They provide us with a good platform for advocating the importance of soil. Let us use them wisely. Soil has been in the news, and awareness is rising thanks to the campaign; let us continue this. The International Year of Soils is ending, but our work to advocate for healthy soils and healthy lives is just beginning”

***“Soils host 1/4 of the world’s biodiversity.”***

***“It can take more than 1000 years to create 1 cm of topsoil, but this can be quickly degraded by erosion.***

***One third of our [global] soils have already been degraded.”***

***“The lives of millions of Ethiopians depend directly on the soil.”***

**Dr. Tewolde Berhan Gebre Egziabher (Ministry of Environment and Forest)** reminded us that the lives of millions of Ethiopians depend directly on the soils. He demonstrated the willingness of Ethiopians to mitigate many environmental threats, citing examples of local initiatives to address issues from climate change and deforestation to soil health: Ethiopians are committed to the Climate Resilient Green Economy strategy for development; forest coverage in the country is increasing; and efforts are being made to increase use of techniques such as composting to increase soil health.

Dr. Tewolde discussed the fact that Ethiopians have the constitutional right to decide what they want to do in managing their environment, which has released the constructive effort of people to manage their natural resources and health, using local knowledge as well as new technologies to become effective farmers and pastoralists.





***"The question is not, 'how do we save the soil?' but rather, 'how do we save our lives?'"***

"Ladies and gentlemen, we humans are made of the soil and we end up in the soil. Let us therefore celebrate the year of the soil with intense feeling," advised **artist Sileshi Demissie, 'Gashe Abera Molla' (singer, songwriter, and director of the Yamiral Hageray Band)** who moderated this session. "The question is not, 'how do we save the soil?' but rather, 'how do we save our lives?' Today will be our day of awakening, to prevent great disaster in this world."

**Dr. Anne Flohr (Institute for Advanced Sustainability Studies, Potsdam, Germany)** heartily congratulated the Government of Ethiopia for putting together the soil campaign in the timeliness of the Year of Soil. "It was marvelous to see the banners and posters announcing the soil week all over the city. It is extremely encouraging for us to see that Ethiopia is now the second country that has set up a soil week. We need more of these kind of events so that 2015 can go down as a decisive point at which the world turns towards more sustainable development."

*"Congratulations to the Government of Ethiopia for putting together the Soil Campaign in the timeliness of the Year of Soil!"*

The 2030 agenda and the SDGs are meant to become our roadmap in designing policies by governments and also private sector/civil society to transform our world. The SDGs build very much on the MDGs in which the government of Ethiopia has made such progress. The goals are a great aspiration for the way we steer this planet. The SDGs recognize that development has to take place within the planetary boundaries in order for it to be sustainable. As such, development must maximize the long-term capacity of our natural resources, including soils.

*"The SDGs recognize that development has to take place within the planetary boundaries in order for it to be sustainable. As such, development must maximize the long-term capacity of our natural resources, including soils."*

Target 15.3 of the SDGs is a global recognition of the importance of land and soils in development. In fact, the health of soils actually underpins most of the integrated SDGs, including food security, agricultural sustainability and climate action. Goal number 7, about access to secure, clean energy relies on biomass and therefore on soils. Goal 11, about sustainable cities requires us to rethink the position of soils, making cities places where the soils can live. The health of soils is an integral determinant of the success of all of the integrated SDGs. However, there are many challenges associated with safeguarding land and soils, not least issues such as dealing effectively with soil degradation and equitably with land ownership.

Achieving the SDGs will require a new way of governing our planet. We need to look at the SDGs in an integrated way that takes into account the linkages and tradeoffs between the different goals and targets. It will not be easy to achieve them. A lot of mutual learning exercises will be required, and this Ethiopian Soil Week will be one of the places where this learning will take place. I am honored to be part of it.

***"The national Soil Campaign is within our priority to increase agricultural productivity."***

**Ato Mesfin Berhanu (Ministry of Agriculture and Natural Resources)** explained “The national Soil Campaign is within our priority to increase agricultural productivity. Without healthy soils we cannot produce enough healthy food. The soils are being depleted at an alarming rate, aggravated by climate change, water problems and salinity. We suffer from depleting soil fertility and low fertilizer use as compared to international levels. These are urgent reasons to help protect our soils, therefore we are here to celebrate the Ethiopian Soil Campaign, to raise awareness and inspire stakeholders.”

“The Ministry is highly committed to sustainable land management to maintain the soil for current and future generations and improve food security. Participatory watershed development, rehabilitation of acid soils, soil mapping, etc. are just some of the many soil health management initiatives spearheaded by our government. We are currently scaling up the best practices. The Ministry has been working with ATA on developing soil maps to make sure that farmers can use the right types of fertilizers; we have also started to prepare blended fertilizer within the nation. Techniques in conservation agriculture and integrated soil management practices are being promoted through our vast extension service. Increasing numbers of students are now enrolled in research institutes all over the country.”

“An ultimate goal of this campaign is to make the different stakeholders work together. (e.g. TVETs need to get the information that is available with the other stakeholders in order to be successful.) We hope also to align activities for good soil health management practices in Ethiopia. We have invited other ministries, NGOs and international delegations to participate in various initiatives and events throughout the year in this International Year of Soils.”

“Already many professionals have started collaborating, and a press conference has been organized by the Ministry of Agriculture and Natural Resources. More will and should be done. I hope that one day we will make sure that we have a soil component in all of our programs like the way we have included gender mainstreaming in all programs nowadays.”

Ato Mesfin gave thanks to the many partners of the campaign, and declared the Soil Week officially open.

### ***Soil Cake***

A half-meter-tall “Soil Cake” (envisioned by Tegbaru Bellete, coordinated by Waltenegus Wegayehu and prepared by München Bakery) was layered and decorated to represent soil, and cut to honor the launch of Soil Week. Dr. Wassie of Hawasa University explained the soil profile represented in the Cake:

“Below the plant and animal life on the surface of the land we have the ‘surface soil’, ‘topsoil’ or **A horizon**, which is full of nutrients, organic matter and air. Below the A horizon is the **B horizon**, or subsoil, that has less nutrients than the A horizon, but some from upper horizons. B-horizons will become A-horizons in time. Below the B-horizon is the **C-horizon**, mostly large pieces of the parent rock from which it is formed, and some soluble compounds. Below the C-horizon is **bedrock** – unweathered rock at the base of the soil profile.”



### ***Panel Discussion***

A Panel Discussion, moderated by Adrian Cullis of Agriculture Knowledge Learning Documentation and Policy (AKLDP), Tufts University, forwarded Q&A with soil experts: Dr. Anne Flohr of Institute for Advanced Sustainability Studies, Dr. Eyasu Elias of the Ethiopian Soil Science Society, Dr. Eshetu Bekele of Adama University, Sue Edwards of Institute for Sustainable Development and Dr. Wassie Haile of Hawassa University.



Moderator, Dr. Adrian Cullis



Major questions raised to panelists:

- How did you first become interested in the soil?
- What practical things can we do to help the Soil in Ethiopia, as non-farmers?
- Where is there progress? What success stories can we share?

"From soils we get energy, shelter, food and water." Soil is a public resource and everybody has to take care of it. Not only for now, but for the future."

"Microorganisms are in the soil because they get food, shelter there – soil is not subjected to high fluctuation of temperature, air, or water. Because of this, we can get more organisms in the soils than in any other environment.

Microbes do a lot of diversified work in the soil, regulating temperature and water and generally helping plants to grow. The presence of microorganisms is highly depending on soil organic matter. For healthy microbial diversity, it is important to maintain carbon in the soil."

"The biggest problem as I see it is urbanisation. 60% of humanity now lives in an urban setting. We are smothering our good soils under development without considering that we need that soil to feed this urban population. We must also consider what we [urbanites] are doing with our organic wastes: They came from the soil, and we are not returning them to the soil! I call upon the local government to institute waste separation; All organic waste should go back to the land as organic compost. We have to establish a system that we have had before, to give all waste back to the soil. Addis Abeba has to become a model for modern urban and sustainable cities.

- Sue Edwards

"Many of the 169 targets of the SDGs put pressure on soils because soils are needed for production... If we invest in soils it brings us closer to the achievement of the SDGs."

- Dr. Anne Flohr

Soil is the source of 90% of our pharmaceuticals

ATA is leading a project to map the fertility status of different regions in the country. With Wageningen University, CASCAPE is also mapping soil types. The "blanket approaches" to fertilizer application have been misleading and inappropriate. The past 3-4 years' research and academic community have been very active in improving our knowledge of the specific needs of specific soils in different places. Including the extension community and farmers in this research is exemplary and impactful. Dr. Eyasu Elias

I received an international award for research on potassium in Ethiopia. **Ethiopian soils indeed need potassium.** In the last 40 years, rain, erosion, deforestation, growing of grain all have been depleting potassium. A potassium conference will be held next week in Hawasa University. Dr. Wassie Haile



### ***Evening Cultural Program***

The objective of the evening of performances at the National Theatre was to celebrate soil with the general public in an artistic way, appreciating the role of soils in our social and cultural context in Ethiopia. To this end, the following beautiful program was arranged:

- A traditional big band, with musicians, singers and dancers.
- Songs about soil, nature, and our heritage, in Amharic and other languages, by well-known musician Gashe Abera Molla.
- Poetry from Lemin Sisay.
- Stories about Ethiopia and her soils from Mohammed Kassa.
- Artists on site prepared paintings about what soil meant to them, and these paintings were presented to the audience at the end of the show.

The evening program was moderated by the well-known singer and songwriter, Munit Mesfin, who is the daughter of one of the most senior Ethiopian soil scientists, Prof. Mesfin Abebe.



## 3. Soil Management & (Inter)national Policy

### 3.1 The Role of Land and Soils in Agenda 2030



Carolin Sperk, IASS,  
Potsdam, Germany

Carolin Sperk, from IASS, Potsdam, Germany, gave a presentation about the Post-2015 and SDG Process. Agenda 2030, adopted in New York in September 2015, consists of 17 sustainable development goals (SDGs) with 169 sub-targets. These goals are intended to continue the development work concluded in the MDGs in 2015.

The general SDG objectives are: “To end poverty and hunger everywhere; combat inequalities within and among countries; build peaceful, just and inclusive societies; protect human rights and promote gender equality and the empowerment of women and girls; and ensure the lasting protection of the planet and its natural resources.” Collectively, the SDGs are, “a plan of action for people, planet and prosperity. [They] also seek to strengthen universal peace in larger freedom... through global partnerships.”

Goal 15 has particular emphasis on land and soils, aiming to, “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”

Target 15.3 has the vision to, “By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.”

To achieve the SDGs, integrated work is necessary. At a glance, it appears that some of the targets of the SDGs may be in competition with one another (for example, increasing agricultural output, and restoring degraded soils). Vast expansion of croplands will be required to meet the increasing demands for food and energy; this may be at odds with the conservation of non-agricultural terrestrial ecosystems. By maintaining the health of the soils, we can help to satisfy competing objectives, as maintaining soil health allows for increased output from existing soils.



Soil is the biggest interface of integration between the different SDGs: soil, if non-degraded can absorb 20,000 tons of carbon a year, which is very significant (more impactful than trees) in terms of carbon sequestration and the global climate challenge. Soils are the source of food, energy and materials

necessary to reduce poverty, etc. There is a big concern that land availability may not meet the requirements of various development needs (increasing food output, source of biomass energy, source of biomass materials as inputs for industry and direct consumption, area for urban construction, protection of ecosystems, and services of climate change mitigation). Maintaining soil health helps to increase the output from available land, and thereby reduces the conflict around competing land uses. Healthy Soils can store 4000 billion tons of carbon - more than the forests of the world. Our treatment of soils provides both a great opportunity and a risk in terms of climate change.

Fostering supportive (or 'enabling') conditions and collaboration (local, national and global) are the prerequisites necessary for achieving the SDGs.

Presenters: Carolin Sperk, IASS, Potsdam, Germany, email: carolin.sperk@iass-potsdam.de  
Dr. Anne Flohr, IASS, Potsdam, Germany, email: anne.flohr@iass-potsdam.de  
Dr. Girum Getachew, email: girumgetachew.alemu@iass-potsdam.de

## 3.2 Soil in the Ethiopian National Development Agenda

Soil Health is also an important consideration in the Climate Resilient Green Economy (CRGE) Strategy, adopted by Ethiopia in 2011, setting the ambitious targets for Ethiopia to achieve both carbon neutral and middle income status by 2025.

Soil health is a fundamental prerequisite for sustained output in the agricultural sector, which contributes more than any other sector towards employment and GDP (GTP2). Furthermore, healthy soils emit less greenhouse gasses and actually sequester carbon, while having the added benefit of greater agricultural productivity.

"In the tropics, land use change through soil organic matter degradation is the #2 source of carbon dioxide emissions, next to combustion of fossil fuels. Less healthy soils emit more carbon into the atmosphere, whereas in healthy soils the carbon can actually be sequestered through different biological, physical and chemical processes, which prevents escape into the atmosphere. Therefore, soil has a vital role to play with regard to the global climate issue.

*Dr. Eshetu Bekele*

### Discussion focused on soil management and the national and international development agendas

Dr. Tesfaye (Ministry of Agriculture) raised some ways in which the CRGE is already being implemented, which goes a long way to addressing many of the concerns of the new SDGs. Rainwater harvesting and irrigation are just two aspects of the very complex development associated with implementing the CRGE in the agricultural sector. Dr. Kassahun (Hope College of Business, Science and Technology) mentioned the Millennium Development project and the need to plan in an integrated way.

**Take home lesson:** Health of soils is connected to every aspect of development. We must work together in synergy to achieve national and global sustainable development targets.





“በምድር ወገብ አካባቢ በሚገኙ ሀገራት በአፈር ተፈጥሮአዊ ለምነት መከላከል ሳቢያ የሚከሰት የመሬት አጠቃቀም ለውጥ ከሚቃጠል ነዳጅ ዘይት ቀጥሎ ሁለተኛው የካርቦን ልቀት አመንጭ ሆኗል። በጤነኛ አፈር ውስጥ በሚካሄዱ ልዩ ልዩ አካላዊና ኬሚካላዊ መስተጋብሮች ካርቦኑ ወደ አየር ውስጥ ከመለቀቅ ይልቅ እዛው አፈር ውስጥ ተይዞ የሚቆይ ሲሆን በተቃራኒው ጤነኛ ያልሆነ አፈር በውስጡ የያዘውን ካርቦን በብዛት ወደ አየር ውስጥ ይለቃል። ስለሆነም አፈር ከዓለም የአየር ንብረት ለውጥ ጋር በተያያዘ የሚጫወተው ሚና ወሳኝ ነው።”

## 4. Conservation Agriculture

**Conservation agriculture**(CA) as defined by the Food and Agriculture Organization (FAO) of the United Nations is, “a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment,” (FAO 2007).

**Agriculture** according to the New Standard Encyclopaedia is “one of the most important sectors in the economies of most nations”. At the same time **conservation** is the use of resources in a manner that safely maintains a resource that can [continue to] be used by humans. Conservation has become critical because the global population has increased and more food needs to be produced every year (New Standard 1992), but land is finite and limiting.

Conservation agriculture entails maintaining an ecological balance between what we want and what nature gives us in our farming systems. Soil is a living system, and we must keep it healthy. This can involve minimization of soil disturbance, such as plowing, that can cause loss of nitrogen, water and soil structure, etc., keeping cover on the soil to retain soil moisture where rainfall is limiting, allowing animals to contribute to soil fertility by giving their dung, etc. Conservation agriculture is both very old being based on farming methods developed over millennia without the use of chemicals, and new being based on improved scientific understanding of plant/soil interactions. There are many different practices that are in fact forms of conservation agriculture. A few interesting ones were discussed during the Soil campaign.

### 4.1 Push-Pull Technology’

One newer method in conservation agriculture is *Push Pull Technology* (PPT). PPT was developed by ICIPE in Kenya in the 1990s to improve the productivity of maize grown by smallholder women farmers by controlling stem borer pests and striga weed through growing 2 companion plants with the crop. At the same time, it provided the farmers with improved forage for dairy cows and goats. Larvae of stem borers, as the name implies, live and feed inside the stems of maize and sorghum where they cannot be reached by pesticides. These pests reduce the yield of the crop by 50% or more. Striga is a parasitic weed that attaches itself to the roots of its host and extracts the nutrients and water it needs from its host. Striga infestation can result in complete crop failure.

The 2 companion crops in PPT are a legume called *Desmodium*, Green Leaf or Silver Leaf varieties, grown between the rows of the crop, and a forage grass, either Napier or *Brachiaria*, grown around the border of the crop. Plants and insects communicate among themselves by giving off volatile chemicals: this is an exciting new branch of agricultural science called chemical ecology. *Desmodium*

gives off chemicals that ‘push’ female stem borer moths out of the maize or sorghum field. Napier and *Brachiaria* give off chemicals attracting or ‘pulling’ the female moths to go and lay their eggs on the forage grass. But when the eggs hatch and the larvae start to feed, they get stuck in the hairs and sticky ‘glue’ produced by the grass and die. So the crop is protected and the yield increases while the farmer gets good quality forage for her/his animals.

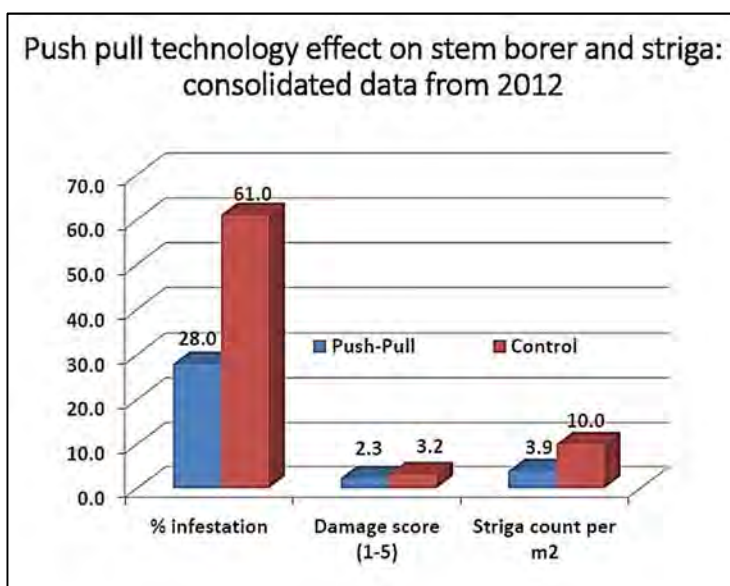
The farmer has the added advantage of not having to use toxic chemicals, while

the *Desmodium* is also a perennial plant that can provide cover for the soil suppressing weeds in the growing season and retaining moisture during dry periods.

Working with farmers on the one hand and scientists in analytical laboratories on the other, icipe soon also found out that the *Desmodium* causes suicidal germination of striga seed. Keeping *Desmodium* growing in a striga infested field for up to 5 years, cleans the soil in the field of striga seed.

To best convey the concept behind PPT, Sue showed a short documentary developed by her organization on the application of the technology in Ethiopia. She also had workshop participants engage in an active and participatory role play, with different trainees pushing and other trainees pulling designated “pests” from the crop to the grass. Workshop participants said that these multimedia teaching methods were, “helpful in clarifying the concept”.

In a follow-up visit to the ISD office, Dr. Hailu gave additional information on the advantages of PPT for farmers. He pointed out that:



*Desmodium* had been found to control another parasitic weed, *Orobancha*, that can attack tomato, potato and several other crops; *Desmodium* is leguminous and fixes nitrogen so keeping it as a cover crop increases the fertility of the soil; Farmers are also using the strong rooted *Brachiaria* grass to stabilize soil bunds between fields, while both grasses can help control soil and water runoff from fields.

*Desmodium* is covered in sticky hairs that trap ants and farmers are using it as a cover crop in fruit orchards to

expose scale insects and other pests to predators, normally driven away by ants.

Starting with 3 farmers and 4 FTCs in 2011, there were about 600 farmers in Tigray and South Wollo using PPT in 2014. Feedback from farmers and extension workers using PPT has been overwhelmingly positive.

PPT users observed moisture retention in the soil over dry periods and after the rains end. They were happy to have a ready source of animal feed, particularly the *Desmodium*, in the growing season when grazing is restricted, and again in the dry season. Although often skeptical of the benefits of PPT, as it requires less dense crop spacing to make way for the intercrop, once farmers try it, they continue with the technology. However, the seed is difficult to come by. Extension workers observed that the 1:5 model farmer to neighbors is an effective means of promoting PPT.

As explained by Dr. Hailu in the November 19 Campaign visit to the ISD office, Ethiopia is facing many challenges with respect to sustainable agricultural development, and so ISD works together with farmers to promote a wide variety of sustainable agricultural practices. In addition to promoting PPT, ISD also promotes use of compost, bioslurry, and biofertilizer, all of which result in stronger roots & stems, deep green leaves and more cobs for maize. ISD also makes a priority of documenting and sharing good practices in sustainable agriculture that have been developed and used with success by farmers themselves, e.g. estimation of maize yield based on stem size; sex identification of chicks by observation of egg shape; onset farming practices to withstand the impacts of climate variability, and integrated soil and water management, as done by the farmers of Konso.

Working together with farmers is essential for ISD: the organization works through farmer field schools, farmer training centers, celebration of lead farmers etc. ISD includes farmers in their research, and this puts them in the best position to both contribute to and apply research findings.

“Ethiopian farmers do not sit and wait until someone comes and solves their problems: they are always working to solve their problems by themselves.”

*Dr. Hailu Araya*

## **Discussion**

Participants wondered about how marginalized people can be included in the extension of these technologies (e.g. PPT), and how to manage the high labor demand for some of the technologies (e.g. composting).

Dr. Hailu reiterated the need to involve farmers at every level, from innovation, to experimentation, to implementation in their communities: it is important to work together.

The way forward: Farming is hard work. Farmers are committed and innovative. We need to help farmers use and share the tools and techniques for sustainable agriculture.

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## 4.2 Low Tillage Conservation Agriculture Technology with *Aybar* BBM and *Silet Deger* (*Berken Maresha*)

Dr. Melesse Temesgen is an agricultural engineer who has worked with farmers for over a decade to produce easily-adopted conservation agriculture technology. In the soil campaign he made a presentation at Hope College of Business, Science and Technology on November 17, and on November 19 the Soil Campaign paid a visit to the factory (around Addisu Gebiya) where he and 100+ employees produce low-impact ploughs that have many advantages for farmers and soils.

### **Conservation Agriculture and Conservation Tillage**

The Principles of Conservation Agriculture (CA) are action-based: they entail minimum soil disturbance, permanent soil cover, crop rotation. Definitions of CA are modified based on practice rather than abstract objectives. Conservation agriculture aims to minimize loss of soil organic carbon, soil moisture, soil erosion, and reduce pest and disease infestations in crops and livestock, as well as reduce the energy and time required by farmers to have successful agriculture.

Land degradation involves loss of soil organic carbon and aggravates soil erosion caused by soil inversion and plowing at high speed, plowing at uniform depth leads to soil erosion and hardpan formation, plowing up and down the slope accelerates loss of soil and water.



Conventional tillage practices involve challenges in preparing the soil in time for the critical, limited sowing and planting period given unpredictable rains and requirements for repeated plowing. Conservation tillage involves minimizing land degradation resulting from soil disturbance. No tillage is one method. Low tillage is another.

Traditional land preparation with the *maresha* plough creates V-shaped furrows with unplowed strips of land between them, requiring extensive repeated plowing and cross-plowing to prepare an appropriate seed bed (particularly for crops like teff that require a very fine seed bed). Clods form as soil is pushed with blunt wooden wings, further necessitating repeated plowing. Extensive time is spent re-plowing already plowed soil. High draft power is required to prepare a fine seedbed.

The main objective of Dr. Melesse's PLC is to produce affordable, reliable and easy-to-adopt equipment that are helpful in improving agricultural work, by facilitating the practice of conservation agriculture. The two products are variations of the traditional Maresha:

#### **1. The *Aybar* Broad Bed Maker (*Aybar* BBM)**

- Good at producing broad bed furrows, which are important for water management in soils, particularly vertisols, which are prone to water logging.
- This *Aybar* BBM has advantages over other BBM technology because its design allows it to create wide broad bed furrows with very low draft power – one ox is enough!
- The reason is the shape of the blade, which slices through the soil, causing it to turn on itself to create broad bed furrows. In this process the structure of the soil is maintained.





Other broad bed furrow-making plows available involve horizontal pushing of the soil to produce broad beds. This horizontal pushing not only requires high draft power (at least 2 strong oxen), but it also damages the structure of the soil.

## **2. *Silet Deger* (also known as the *berken maresha*):**

This tool decreases loss of carbon, nitrogen, water and other nutrients from the soil by reducing the number of times a field must be plowed and cross-plowed.

This *deger* makes a U-shaped furrow which is good for water infiltration and root growth, whereas the traditional *maresha* makes a v shape so there is high runoff and the soil is opened up for more evaporation, erosion and loss of nutrients such as organic carbon.



Both of these products can be fitted to the *mofer* of the traditional ox-drawn plow, and therefore are easily adopted by farmers.

## **Questions and Answers**

**Question:** Are the prices affordable?

**Answer:** The price of one *silet* plough / *berken maresha* is 239 birr including VAT.



**Questions:** How can local farmers access this technology? Especially because it is costly.

**Answer:** Economies of scale, source of materials, and quality control are very important to consider. To reduce the cost and maximize the benefit of this technology, we have a large operation for producing high-quality equipment in Addis, where the raw material inputs are available at the best prices, where we can train a number of people to produce them to high quality, and check the quality of each piece before it is taken for distribution. We take quality very seriously because we know that if a remote farmer

misses the planting season because of a faulty piece of plowing equipment, that farmer may not be close enough to a distribution center to replace the plow before missing the rains required for planting, and therefore a poorly made piece of equipment could result in loss of a season's crops. We inspect products at each phase in production and terminate staff who repeatedly miss the standard.

**Question:** How can we increase yield by using the *silet deger*?

**Answer:** This *deger* reduces land degradation, and therefore maintains the fertility of the soil, which impacts on the size of yields. Furthermore, this efficient *deger* reduces the unplowed areas between furrows that do not take seed, and this allows for more, better spaced plants per hectare.

**Question:** The farmers make terraces for this year and again for the next year new terraces. Why don't the scientists help them?

**Answer:** You are quite right to say that terraces are incredibly energy intensive yet a very important soil and water conservation structure in the vast slopping areas of Ethiopian farmland. Actually, the *silet deger* is a great technology for maintaining terraces: one of the reasons that terraces have to be

prepared year after year is that every year the oxen destroy terraces and bunds during cross-plowing. But with the *silet deger* one needs only plow once, along the terraces, and there is no need to cross plow against them. Plowing along the terraces (with the contour) has the added advantage of increasing water infiltration into the soil at the point of rain contact, rather than guiding the rainfall to flow towards the lower terrace in the cross-furrow, which can actually further damage the terrace.

### Lessons learned

- It is good to decrease plowing by using new technology, in order to reduce loss of carbon from soil and soil disturbance.
- Ethiopian farmers are money minded in adopting new technology.
- The *silet deger* and *Aybar* BBM are good tools for controlling surface runoff in different conditions (slopes and soil types).
- In different areas there are varied structures being used for soil conservation.

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የሳቢና ገፊ ቴክኖሎጂ ጥቅሞች፡

- የሰብሉን ግንድ በመቦርቦር እንዲቀነጭርና እንዲሞት የሚያደርጉትን ጸረ ሰብል ነፍሳት አንዱ ሰብል በሚያመነጨው እነሱ የማይፈልጉት ኬሚካል እንዲገፉና ሌላ ተክል በሚያመጩ መልካም መዳከር እንዲሳቡ በማድረግ ወደሰብሉ እንዳይቀርቡ የምናደርግበት ዘዴ፤ በዚህ ዘዴ ተባዩን የሚስበው ተክሎች በማሳው ጠርዝ ላይ ይተከላሉ፤
- እንደ አቀንጭራ የመሳሰሉ የሰብሉን ምግብ የሚሻሙ አረሞችን እንከላከልበታለን፤
- እነዚህ ጸረሰብል ነፍሳትን ለመከላከል የምንጠቀምባቸው ተክሎች (ለምሳሌ ዴስሞዲየም) ስራቸው ናይትሮጅን የመያዝ አቅም ያለው በመሆኑ የአፈርን ለምነት ይጨምራሉ፤
- ለተባይ ስበት/ግፊት የምንተክላቸው ተክሎች የጸሀይ ብርሀን በቀጥታ ሰብሉ ላይና አፈሩ ላይ እንዳያርፍ ስለሚሸፍኑ የእርጥበት ትነትን ይቀንሳሉ። በተጨማሪም የአፈር መሸርሸርን ይከላከላሉ፤
- ለተባይ ስበት/ግፊት የምንተክላቸው ተክሎች ለከብት መኖር ይሆናሉ፤
- ሌሎች ተባዮችም ወደማሳው እንዳይጠጉ ይከላከላሉ፤ አንዳንድ አርሶአደሮች ለምሳሌ ጉንዳኖችን ከአትክልት ማሳ እንደሚያርቁ ሪፖርት አድርገዋል።

የዚህ አይነቱ ቴክኖሎጂ እንደ በቆሎና ማሻሻል የመሳሰሉ የአገዳ ሰብሎችን ከተባይ ለመከላከል ውጤታማ መሆኑ ታውቋል። ተባይ የሚገፋው ተክል (ዴስሞዲየም) ከነዚህ ሰብሎች ጋር ተቀላቅሎ ይዘራል በማሳው ጠርዝ ላይ ደግሞ ተባዮቹን የሚስበው ባለመልካም መዳከር ሳይ ይተከላል።

### የማንበር

የማንበር ግብርና መርሆዎች በድርጊት ላይ የተመሰረቱ ናቸው። አፈሩን በቋሚነት የሚሸፍኑና በማፈራረቅ የሚዘሩ በመሆኑ በአፈሩ ላይ የሚያስከትሉት አለመረጋጋት አነስተኛ ነው። የማንበር ግብርና መገለጫዎች ከማይጨበጡ አላማዎች ይልቅ በተግባር ተሞክሮ ላይ በመመስረት የሚሻሻሉ ናቸው። የማንበር ግብርና አላማ በአፈር ውስጥ የሚገኘውን የተፈጥሮ ካርቦን ልቀትና የውሀ ትነት እንዲሁም የአፈሩን መሸርሸር መቀነስ ነው። በተጨማሪም በሰብልና የቤት እንስሳት ላይ የሚከሰቱ በሽታና ተባይን በመከላከል የአርሶ አደሩን ጉልበትና ጊዜ መቆጠብና ውጤታማ ግብርና እንዲኖር ማድረግ ነው።



## 5. Nutrient Cycling

### 5.1 Compost and Urban Waste Management

This presentation was given by Mr. Waltenegus Wegayehu, an environmental engineer who has been creating compost from municipal waste in Addis for over 5 years.

Nutrient cycling from urban waste is critical for soil health. The substances that are found in our organic wastes originally came from the soil, and they need to be returned to the soil so that other useful things (food, fiber, fuel, etc.) can be grown from the soil. Almost all soils benefit from the addition of compost, which adds nutrients, improves soil structure, and introduces good microbes to the soil.



*The components that are required to make compost (ISD 2011).*

#### **Preparing compost from urban waste – Heap Composting Walta Style**

The microorganisms in the soil that make compost need most of the things that humans need to be healthy: air, water, food, shelter and care.

1. **Sort organic wastes:** remove all non-biodegradable or toxic materials from the waste stream. Nitrogen rich substances (e.g. kitchen waste such as onions and potato peelings, fresh grass clippings, generally identified as 'Green' material) should be differentiated from carbon rich substances (dried leaves, dried grass, etc., also generally known as 'Browns').
2. **Lay some bulky pieces of wood or bamboo on the ground in a 1m<sup>2</sup> area** where you plan to build your pile: these big materials allow air to pass in and out of the pile for healthy aerobic bacterial action.
3. **Put down a layer of "browns," then a layer of "greens" then a layer of old compost or soil** (to introduce the microorganisms that will cause decomposition), **gently water the pile with a watering can** (until the pile is damp, but not so wet that water drips out when you squeeze the material), **and then repeat this "lasagna" layered sequence until you have a pile about 1m<sup>3</sup> high.** A pile less than 1m<sup>3</sup> will not get hot enough to kill all the pathogens and weed seeds present in the organic waste. Ideal ratio of browns to greens is about 70% browns, 30% greens. It is advisable to add some more bulk materials (large wood and bamboo) sticking out from different areas higher in the compost pile to make sure that oxygen will keep moving through it.
4. **Turn the pile weekly** for aeration, and during the process, add more water if necessary. After 4 to 6 weeks, your compost will be mature.
5. **Sift the compost** with a 1cm<sup>2</sup> wire sieve (you can make this with wire at home) to remove undecomposed large materials.
6. **Bag or apply the compost to the land, and cover it immediately.**

The workshop contributed towards creating a discussion platform among the different stakeholders in the Solid Waste Management, experts in water and sewerage, health science, agriculture, environmental protection and urban development areas.

### **Discussion**

- It was observed that the most difficult and challenging parts of the pilot project were awareness creation, source separation and achieving compost application.
- The participants recommended that the pilot project should be supported to continue by any means as we are at an early stage of good solid waste management: we should make this pilot project into a major project.
- Participants from different institutions showed great interest in implementing the SWM and UA and EM concept of the pilot project in Addis Ababa.
- It was observed that there is a big potential concerning the SWM and UA issue at the Universities in different regions of Ethiopia as they produce a huge amount of solid and liquid waste from their cafeterias, student dormitories and staff accommodation.
- New methods for upgrading the SWM and UA process like enriching compost with synthetic fertilizer and shortening of composting period by using effective microorganisms (EM) should be considered.
- It was recommended that vegetable production in the urban agriculture process should be supported professionally: i.e. which vegetable, when to plant it, which soil, rotation time and production according to market demand.

Waste is a resource!

Waste is money!

Throwing out waste is throwing away energy. Using compost from waste, we can keep our soils healthy.

Nutrient cycling from urban waste is critical for soil health.

*WaltenegusWegayehu*



### **Take home messages / next steps**

- Waste is money! Throwing waste is throwing away energy. Using compost, we can keep our soils healthy.
- We have to train others about good waste management.
- We have to keep/protect our soil from degradation by using compost.

Waltenegus Wegayehu, email: [walta7@yahoo.com](mailto:walta7@yahoo.com) tel: 0911826948

## 5.2 Vermicomposting

“Verm” means “worm” and vermicomposting is compost production through the action of worms.

Earthworms are polite, gentle little animals with no eyes, no teeth and no bones. As such they are totally harmless to people, and to living plants. All that is needed for vermicomposting is an appropriate variety of earthworm, storage bins, and crop and food waste.



Worldwide, vermicomposting is a well-established technology. This technique has been used for a very long time in countries such as Cuba, India, the Philippines, USA, Canada and Australia.

In Ethiopia the first vermicomposting occurred in Gonder, in a small project run by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in 2007. Prior to that, the Ambo Phytopathology Research Center had been working with Russian earthworms, not for composting, but for their antibiotic and insecticidal role in plant disease control. In 2012, EIAR started working on vermicomposting technology using the earthworm species *Esinia fetida*, which is a specialized earthworm excellent in compost production. To promote the vermicompost technology, they have been multiplying the earthworms, training farmers in their use, and distributing starter earthworms to farmers. To date over 1,000 worms have been distributed to 100 farmers around Ambo, Jima and Debre Zeit.



In the beginning, researchers were worried about cultural acceptance of worms in the Ethiopian context, which is different from India or China where people have no problem with worms. Surprisingly, farmers accepted the vermicompost method beyond wildest expectations. “Where were you until now?” The farmers demanded, happy to be free of the laborious manual turning of the other composting methods they had been trained in previously. Enthusiastic farmers successfully designed and crafted and made their

own bins specifically for vermicompost, out of locally available materials.

Worms are helpful not only for making compost, but they may also be used for fish bait, in chicken feed, and in Canada they even use worms for preparing juice! Expansion of this promising technology in Ethiopia requires more multiplication of worms and more trainings in their use.

Dr. Negash Demissie, Ethiopian Soil Science Society Vice President and ISFM Technology Research Project Leader for AGRA Soil Health Project, email: [Negash34@yahoo.com](mailto:Negash34@yahoo.com), tel:

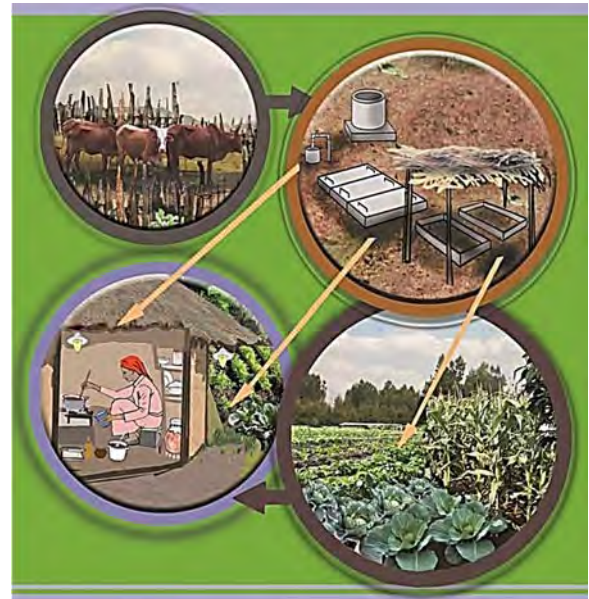


## 5.3 Farming with Bioslurry

On November 18, Ato Girma Shibru showed his farm and home-based biogas/bio-slurry operation to a visiting delegation of 50 participants in the Ethiopian Soil Campaign.

**Biogas** typically refers to a mixture of different gases, primarily methane, produce by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant materials, sewage, green waste or food waste. It is a renewable energy and, in many cases, exerts a very small carbon footprint. The energy in biogas is used for cooking, lighting, heating water, and even generation of electricity. The bi-product of biogas production is bioslurry, which is a fantastic agricultural input.

**Bioslurry** is generally incorporated into the soil before planting, or after dilution with water, sprayed directly onto vegetables and fruit crops during the growing period.



### Questions raised

- Are there risks to using biogas?
- Why don't you start to put methane in a cylinder for storage?
- While using the cow dung for making compost it is apparent that you can get the best out of it. Is any benefit from the dung lost when the dung is turned to biogas and bioslurry?
- Are the microorganisms problematic?

### Take home messages

Biogas makes the environment green. Participants learned how biogas is generated and used for energy purposes. Energy from biogas is completely carbon neutral – when biogas is burnt it releases carbon fixed from the atmosphere by growing plants. Bioslurry helps plants to be ample and fertile, growing well and again fixing lots of carbon from the atmosphere.

### Future directions

Only 40 families in his area are using this technology: Awareness creation is necessary to increase use. It would be ideal to try to learn and implement pipe networking for delivery of biogas over a larger area.

***Biogas gives clean energy for a clean and green environment!***

***Bioslurry, the bi-product of biogas production is a great natural fertilizer for the soil and plants. It also involves re-use of precious water resources.***

Ato Girma Shibru, Telephone: 09-11-06-59-82, Debre Zeit

## 5.4 Nutrient Cycling at Genesis Farms in Debre Zeit

On November 18, 2015, fifty participants of the Ethiopian Soil Campaign visited Genesis Farms, a 40 ha agribusiness operation in Debre Zeit. This is a large farm cooperative that has a total of 450 employees. It is now run by Ethiopians: it was founded by a Dutch and American group. This farms' products show the incredible potential that can be achieved when people work together, and when nutrients from animal husbandry and growing plant are used to support one another.



Genesis Farms have large production facilities where they grow a wide variety of vegetables, some of which are not normally consumed in Ethiopia. These are also poultry units, a dairy farm, fruit orchards, as well as flowering plant and tree nurseries. The vision of the project has had a positive impact on local development, and gave campaign participants ideas about integrated, cooperative farming for the future.

Genesis Farms processes fresh milk from their own dairy cows and also that from local farmers. From the milk, they produce a variety of dairy products: packed milk, yoghurt, Gouda cheese, table butter, hair butter, and local cheese. Genesis farms prepares and markets poultry products (eggs and chicken meat) from their own poultry operations and those of partner farmers. Genesis farm grows and sells a wide variety of vegetables and flowers, some of which are specially packaged before sale: beans, cabbage, carrot, celery, cucumber, zucchini, eggplant, herbs, leek, onion, tomato, spinach, broccoli, beetroot, squash, radish, pepper, lettuce.



Genesis Farm has a biogas digester and mixes the bioslurry with water that is fed to the crops through a drip irrigation system. The sustainably keeps their soils healthy and fertile.

Genesis Farms, P.O. Box 1565, Debre Zeit, Ethiopia,  
Tel: (+251) 0114339157 or (+251) 0114333766,  
Website: [genesisfarmsethiopia.com](http://genesisfarmsethiopia.com)

## 5.5 Soil and More Nutrient Cycling

On Wednesday, November 18<sup>th</sup>, Mr. Hussen Ahmed showed 50 visiting Soil Campaign participants and 15 area farmers the nutrient cycling work that he is doing in his social enterprise to compost the waste from the floriculture businesses in the Ziway area.

Using the Windrow composting technique, large volumes of floricultural waste (mostly flower stems) are mechanically turned and transformed into an agricultural input (compost) with the capacity to provide soil organic carbon, improve soil structure, and also add some other nutrients to soils. Flower farms are amongst the buyers of the finished compost, and Soil and More is working to increase farmer purchase of the product.

Soil and More recently drilled a borehole to satisfy the water requirement of the composting process, as well as other business needs. Trees have been planted on the periphery of the compound according the “4F principle”: satisfying needs for Food (a range of fruit trees), Fuel, Fodder and Fencing in their selection of species planted. In the future, the company has a vision to serve as a sustainability training center, and expanding its range of socially responsible goods and services.

After a tour of the windrow composting system, the family of Hussen prepared a festive lunch for all visitors, and a discussion and demonstration of the nutrient flows from Africa to Europe, and from Rural Ethiopia to Urban Ethiopia was then held in both English and Oromiffa.

One of the conference participants, Dessalegne Firew from Tena Kebena, reported very favorable outcomes after using compost donated by Soil and More in a tree planting initiative in Addis.

*Mr. Tegbaru Bellele demonstrating the flow of nutrients from rural Ethiopia to urban areas, and explaining the urgent need to return nutrients (such as the soil organic matter in compost) to rural farms.*



*Campaign participant standing beside windrows of composting biomass*

“Farmers tend to be concerned about the possibility of our product containing chemicals from the synthetic fertilizer and pesticide in the floriculture waste that is used as an input for our compost. However, lab tests show that our product has chemical content within the EU standards for agricultural inputs.”

*Mr. Hussen Ahmed,  
CEO, Soil and More*



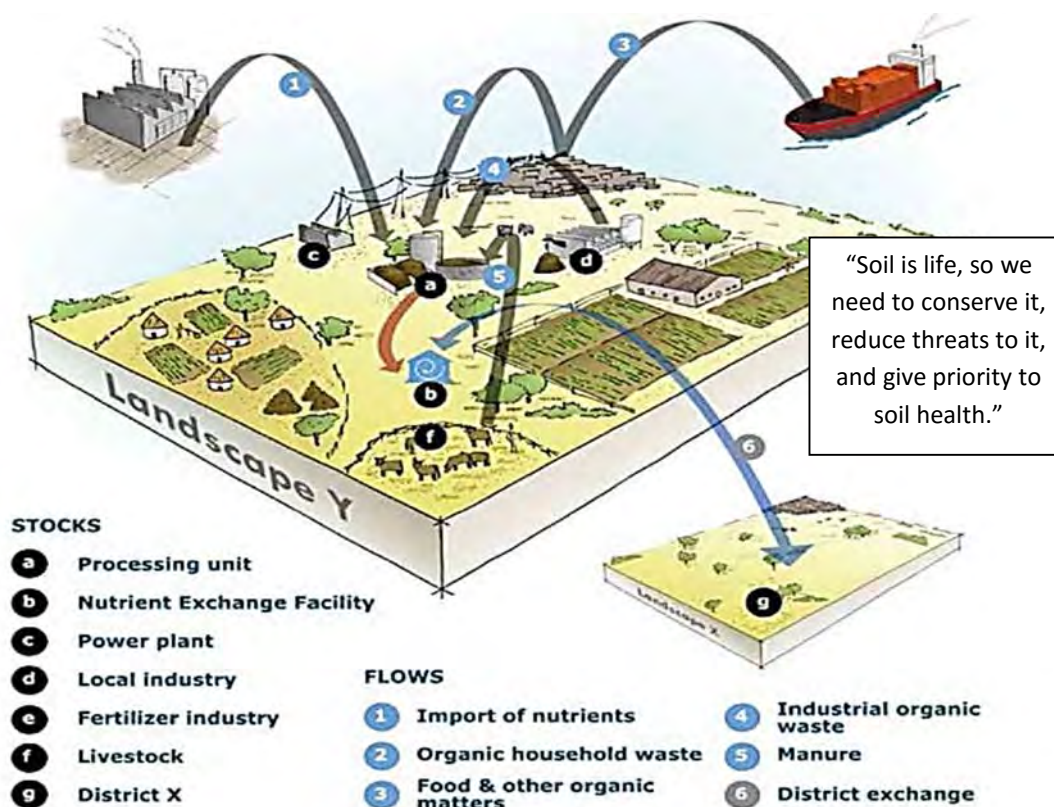
Hussen Ahmed, Soil & More, Ziway, email: [hussen.ahmed@gmail.com](mailto:hussen.ahmed@gmail.com) tel: 0911523940.



## 5.6 Fertile Grounds Initiative (FGI): Creating markets for soil fertility

On November 17, presenters Anniek Elmans and Dr. Wassie Haile discussed their work to create markets for inputs to maintain soil fertility in Ethiopia.

Recognizing that unlocking the potential of our soils requires more efficient use of our nutrients, The Fertile Grounds Initiative (FGI) was designed to coordinate nutrient cycling between different actors at various spatial scales. FGI identifies nutrient stocks (sources, e.g. livestock farms, fertilizer industries, etc.) and flows (e.g. household waste, manure, imports, etc.) and seeks to connect the sources and users all the way down the value chain for better productivity and healthier soils.



FGI seeks to increase the practice of integrated soil fertility management (ISFM), which involves application of both chemical and organic fertilizers to the soil: it recognizes that ISFM requires access to fertilizer inputs. The work of FGI is to address problems of limited soil fertility and nutrient availability by improving linkage with areas where nutrient excess results in problems, turning waste streams into economic assets.

Presently FGI is active in Ethiopia, Uganda and Burundi. In Ethiopia, FGI has proof of concept case studies in Ziway in collaboration with *Soil and More* and in Adet, in collaboration with the *Land Investment for Transformation (LIFT)* program.

### Comments

Creating awareness amongst organic waste makers (households and industries) and to end users (farmers) is very important so that our communities can produce and use compost.

Compost making needs to reach a high temperature, about 60°C, to remove all pathogens and weed seeds. To reach this temperature the right carbon-nitrogen ratio and water must be combined, and then the temperature monitored. Note: to monitor the temperature it may not be necessary to use a thermometer - many farmers use a stick, insert it into the compost and after a few minutes remove the stick - if it is almost too hot to be comfortable holding with one's hands, the compost has reached the right temperature!



*Excessive nutrients in organic industrial (top) and municipal (bottom) wastes*

*Agricultural fertility amendments applied where needed in agriculture*

#### **Next steps for FGI**

- a) Finalizing the proof of concept case studies – this includes completion of analysis of compost quality at case sites, and the impact that use of compost has on fertility at sites of application.
- b) Scaling up the practice of creating markets for fertility.
- c) Raising awareness about ISFM and available sources of soil nutrients.

#### **Next steps for participants from lessons of FGI**

- We can all be involved in raising awareness about returning nutrients to the soils.
- Creating awareness to separate wastes at the household level is needed.
- In urban areas we are at the heart of organic waste buildup: we have a problem with excess organic waste. We need to distinguish the biodegradable and non-biodegradable waste from our home by making different garbage containers in the home and sorting upon disposal.
- We can all prepare compost in an easy way, we don't need an international manual to do so! The input material is important, but those trained in making compost should teach others.
- Compost benefits all of us, especially our local farmers.

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Dr. Wassie Haile, Hawassa University, [wassiehaile@yahoo.co.uk](mailto:wassiehaile@yahoo.co.uk), 0911905463.

[www.fertilegroundsinitiative.info](http://www.fertilegroundsinitiative.info)

### የከተማ ቆሻሻ መልሶ መጠቀም

ከከተማ የሚወጣ ቆሻሻን ወደ ማዳበሪያነት በመቀየር ወደ አፈር እንዲመለስ ማድረግ ለአፈር ጤንነት እጅግ ጠቃሚ ነው። በተፈጥሮ ቆሻሻዎች (ኘላስቲክ ነክ ያልሆኑና በስብሰው ከአፈር ሊዋሀዱ የሚችሉት) ቀድሞም ከአፈር የተገኙ በመሆናቸው ለቀጣይ ህይወት ምግብና ማደጊያ እንዲሆኑ ወደአፈር መመለስ ይኖርባቸዋል።

ከሞላ ጎደል ሁሉም የአፈር አይነቶች ላይ ኮምፖስት ቢጨመር ጥሩ ነው። ኮምፖስት ለአፈሩ የምግብ ንጥረ ነገሮችን ይጨምራል፤ የአፈሩን አወቃቀር ያሻሽላል፤ ለአፈሩ ህይወት የሚሰጡ ደቂቅ ህዋሳት እንዲኖሩ ያደርጋል።

ኮምፖስትን የሚፈጥሩ በአፈር ውስጥ የሚገኙ ደቂቅ ህዋሳት የሰው ልጅ ጤናማ ሆኖ እንዲኖር የሚያስፈልጉት ነገሮች ሁሉ፣ ማለትም ውሀ፣ አየር፣ ምግብና መጠለያ እንዲሁም ክብካቤ ያስፈልጋቸዋል።

### የአፈር ውስጥ ትላትሎች

የአፈር ውስጥ ትላትሎች አይን፣ ጥርስ፣ አጥንት የሌላቸው ትናንሽ ትሁት ፍጥረታት ናቸው። በመሆኑም በሰውም ሆነ በእንስሳትና በተክሎች ላይ ምንም አይነት ጉዳት አያስከትሉም።

ኮምፖስት ለማዘጋጀት የሚያስፈልጉ ነገሮች በማጠራቀሚያ ዕቃ ውስጥ የአፈር ትላትሎችንና የግብርና ተረፈ ምርቶችን አመጣጥኖ መጨመር ብቻ ነው።

### ባዮጋዝ

ባዮጋዝ ለንጹህና አረንጓዴ አካባቢ መኖር ወሳኝ ሚና የሚጫወተውን ንጹህ ሀይል የሚያመነጭ ነው።

ከባዮጋዝ በሒላ የሚገኘው ዝቃጭ ደግሞ ባዮስሊሪ ይባላል። ይሄ ደግሞ ወደማሳ ሲወሰድ ለአፈሩና ለሰብሉ የተፈጥሮ ማዳበሪያ ይሆናል። በተጨማሪም ውድ የሆነውን የውሀ ሀብት ደጋግመን ጥቅም ላይ ለማዋል ያስችለናል።

### የለም መሬት ንቅናቄ (Fertile Grounds Initiative)

የለም መሬት ንቅናቄ የተትረፈረፈ የአፈር ለምነት ያለባቸውን ቦታዎች የአፈሩ ለምነት ከቀነሰባቸው ቦታዎች ጋር ለማገናኘት የሚረዳ አሰራር ነው። በዚህም የቆሻሻ ክምችትና ንጥረነገር ብክነት ችግርን በማስቀረት በመጨረሻም የአፈሩን ለምነት በመጨመርና ብሎም የግብርናው ምርት እንዲጨምር በማድረግ የህብረተሰቡን ኑሮ እንዲሻሻል ያደርጋል።

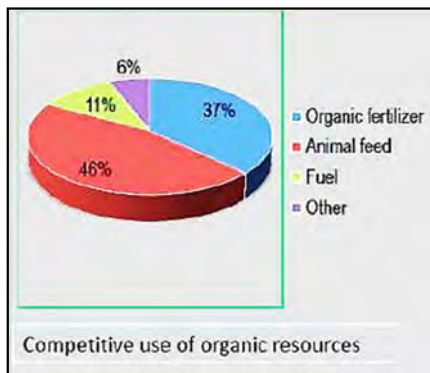


## 6. Innovative Soil Management Practices

*Healthy soils lead us to peace, stable life, and food security*

### 6.1 Biochar as an Indigenous Fertilizer

Biochar is a product of heating biomass in the absence of air, or with limited air, to above 250 °C. It is made in a process called "charring" or "pyrolysis", also used to produce charcoal. However, the material is different from charcoal in that it is used as a soil amendment, or in broader environmental management. Production of biochar requires a kiln and agricultural waste. Different biomass sources for producing biochar in Ethiopia include coffee husk, bones and other farm residues. Bones add phosphorous, and bone char can be the best source of phosphorus.



Due to competing uses for carbon-rich substances, declining

"Through charring of bones, it would possible to offset 28-58% of Ethiopia's annual phosphorus imports, [which are] worth USD 50-150 million."

levels of carbon are found in many Ethiopian soils. Application of biochar returns much-needed carbon to the soil.

Phosphorus is a limiting soil nutrient in vast areas of Ethiopian soils. Because of this, application of phosphorous rich fertilizer is promoted in many agricultural areas, and phosphorus fertilizer

is being imported for application in fertilizer blends. Through charring of bones, it would possible to offset 28-58% of Ethiopia's annual phosphorus imports, worth USD 50-150 million.

For optimal agricultural impact, the process of producing biochar can be modified to prepare "targeted biochar" appropriate to the soil type, agricultural residue and production constraints. Optimal application of biochar should be modified for the specific soil needs of the area.

Composting with biochar has shown a number of added benefits, such as enhanced nutrient cycling, suppression of plant pathogens, acceleration of decomposition, etc.

Feedstock	Temp. and time		Temp. and time		Temp. and time		Temp. and time		Temp. and time	
	550°C for 1 hr		400°C for 1 hr		350°C for 1 hr		350°C for 20 min		400°C for 2 hr	
	PH (H <sub>2</sub> O)	PH (KCl)	PH (H <sub>2</sub> O)	PH (KCl)	PH (H <sub>2</sub> O)	PH (KCl)	PH (H <sub>2</sub> O)	PH (KCl)	PH (H <sub>2</sub> O)	PH (KCl)
Coffee husk	10.7	10.4	11.02	10.6	10.5	10.07				
Sugarcane residue			10.0	9.5			10.9	10.2	9.5	8.9
Wheat straw					8.8	7.6	10.4	9.2		
Prosopis			9.2	8.0			8.0	6.7		

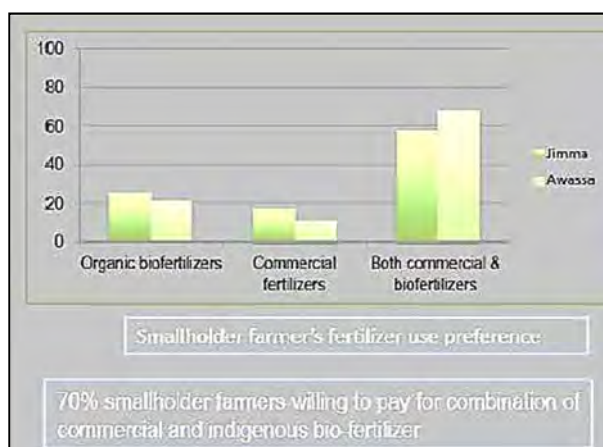
**Questions:** In discussion, participants asked about the work done to engage farmers in the use of this technology, and what kind of response communities had towards biochar?

### Response to question

- Research from Jima University shows that farmers are willing to pay for organic soil amendments like biochar.
- Efforts to prepare and apply biochar and biofertilizer in an integrated manner have been used.
- Networking: Jima and other central universities are working together to conducting research on biochar in Ethiopia, to establish an African biochar network.



*Biochar stove demonstration session*



Researchers are working hard to disseminate the technology. Some of the technology dissemination efforts include:

- Research trials run by researchers and managed by farmers.
  - Field days for the community to observe the effect of using biochar.
  - Biochar stove demonstrations
- Reception has been largely positive.

Dr. Berhanu Belay, Jima University, email: [berhanubelay@yahoo.com](mailto:berhanubelay@yahoo.com), tel: 0917550730

## 6.2 Biofertilizer

Biofertilizer has a tremendous potential to increase productivity of Ethiopian soils. To learn more about this technology during the Soil Campaign, a presentation was made by Dr. Asfaw at Hope College of Business, Science and Technology on November 17.

On November 19, a group of Soil Campaign participants went to visit Dr. Asfaw's biofertilizer producing company, **Menagesha Biotech Industry Plc**. Biofertilizers supply nutrients to plants through biological agents.

**In Ethiopia, biofertilizers** (*Rhizobium*, various cyanobacteria and a few other strains of fungi) are used to increase nutrient flow to pulse crops, and subsequently increase pulse yields, and often increase the nutrient content of the soil in the process.



*Biofertilizer inoculated plant on the right – stronger roots (with nodules), thicker stem*



Food grain legumes are very important crops in the country. They form an essential source of dietary protein for many, and, according to the CSA survey of 2008, they are #2 crop group in the country in terms of area of land allocated to their cultivation. Most farmers spare fertile soil for the production of cereal crops while pulses are grown in marginal types of soil, usually for crop rotation. As a result, the yield for most pulse crops in Ethiopia is low and ranges between 500-900 kg/ha. Whereas the average yield potential of these crops is about 1760 Kg/ha-1. Pulse crops form an essential part of the dietary requirement for most Ethiopians, and are grown mostly by smallholder farmers under rain-fed conditions.

**Use of biofertilizer** can have a great impact on pulse crops resulting in generally healthier plants and, in turn, can naturally add nitrogen to nitrogen-depleted soils. The beginnings for the study of biofertilizers in Ethiopia dates back to the first teaching of micro-biology in the senior universities, in the early 1970s; Research on biofertilizers specifically started as early as 1982 by Amare Abebe on Haricot Bean. To date, Ethiopian biofertilizer research has focused mainly on inoculants for highland pulses. The MoANR and the Ethiopian Institute of Agricultural Research (EIAR) continue biofertilizer research to this present day.

**Symbiotic fixing of nitrogen** is the result of a delicate balance between a higher plant and a specific species of microorganism. It is important to properly understand the optimum conditions for this fixation in order to provide full benefit to plant. These conditions include:

- Good soil structure (aerated soil)
- No deficiency of molybdenum or boron
- Small amounts of nitrogen compounds in the soil
- Presence of a sufficient number of specific and effective *Rhizobium* strain
- Favorable plant development conditions (climate, farming methods, adapted varieties, absence of disease)

In short to the greatest extent possible, factors limiting legume development must be eliminated to obtain adequate



atmospheric nitrogen fixation. If these conditions are met BNF (biological nitrogen fixation) is the best solution for our second largest food crop group (legume crops) production in our country.

It is also wise to understand that biofertilizer is not limited to *Rhizobium* but also includes many other genera of bacteria and cyano-bacteria.

At Menagasha Biotech Plc, biofertilizer for legume crops is produced. The carrier media carries about 125 million rhizobia. This is sold to farmers at ETB 40.00 per packet.

#### **Advantages of rhizobia**

- ✓ As a result of high nitrogen fixation, yield is increased by 300%, from 10t/ha to 30t/ha.
- ✓ No negative effects on the environment.

### Challenges

- Biofertilizer works very well for many pulses, but we have not identified biofertilizers that work for cereal crops.
- It is challenging to get the raw materials for production of biofertilizers.
- Awareness in government and also the distribution system needs improvement.
- Additional working space and capital would assist with the growth of biofertilizer production at the Plc.

### Questions raised by participants

- How much awareness about biofertilizer is there, and is the distribution system effective?
- Did you plan to have your agri-dealers work based on commission?
- Did you do soil tests for farmers?
- Did you plan to produce other products for cereal crops?

### Discussion

- Biochar and biofertilizers should not be considered as alternatives but we better use them with other sources of fertilizer to enrich the soil.
- Inoculation with different microorganisms (e.g. Rhizobia and cyanobacteria) can increase soil nitrogen content.

### Take home message

Biofertilizer is an environmentally friendly fertilizer. It is effective in terms of crop output. Farmers observe that biofertilizer helps to add crop resistance to diseases and pests. Biofertilizer is easy to transport and efficient to use. However, awareness and promotion amongst farmers is needed to increase the uptake of this technology. The combined application of biochar and biofertilizer and inorganic fertilizer enhance soil fertility, increases production and productivity.

### Steps for the future

- Work with public offices to promote the products
- Explore opportunities and government-owned soil lab materials to produce at large scale.

Dr. Asfaw Hailemariam, Menagesha Biotech Industry Plc., asfawhailemariam@yahoo.com,  
0911411318

## 6.3 Effective Microorganisms (EM)

Microbiology is a hugely significant, although often overlooked, component of healthy soil. The population of microorganisms in six tea-spoons of soil is comparable to the total number of people on Earth.

From a human point of view, some microorganisms are harmful (e.g. disease causing pathogens), most microorganisms are neutral (neither good nor bad), but many microorganisms are beneficial.

Effective microorganism technology (or “EM” for short) is a concentrated mix of naturally existing beneficial microorganisms (mainly yeast, phototropic bacteria, and lactic acid bacteria), many of which are used in the preparation of everyday food and beverages (bread, yoghurt, cheese, beer, wine, etc.), and found in abundance in healthy forest soils. EM has many applications in nutrient cycling and nutrient mobilization in agriculture.

When EM is incorporated into the composting process, it generates compost in a very short time (45 days); this compost has been tested and found to be high in nitrogen and free from pathogens.

EM has been applied to organic waste for purposes of impact mitigation. In some parts of the country, huge accumulations of coffee husk can cause problems in terms of the area they occupy, the foul odor they produce, and the detrimental impact on the health of surrounding water bodies, as effluent impacts the BOD. When Mr. Gideon's team applied EM to compost the solid waste, and put EM in the surrounding water bodies, huge improvements were observed in terms of reduction in volume of solid waste and production of compost, drastic reduction in odor, and improvement of water quality in terms of reduction in murkiness, scum and foul smell.

When EM is mixed with animal feed (such as grain and straw) a day or two before it is eaten, the animals benefit from the pre-digestive action of microorganisms, and gain more nutrition from the same quantities of food.

EM technology was developed in Japan.

**Take home message:** micro-organisms are the main engines in compost making, and they make it possible for plants to access nutrients from the soil. Healthy soil contains a good balance of positive microorganisms. We can augment the levels of positive bacteria by adding microbial amendments like EM.



Spraying EM on a landfill to control odor and pathogens

### Discussion

**Questions:** Who knows about the product and how is it distributed in the community?

**Answer:** More research, outreach and awareness is needed!

**Question:** How does EM work in different soil types?

**Answer:** All soil types require a healthy microbiological content; therefore, we understand the effect to be positive.

**Question:** Is EM toxic? Are there any negative side effects?

**Answer:** Not toxic. We can make it at home, with molasses, sugar and water.

**Question:** What is the role of EM in composting?

**Answer:** Microorganisms decompose organic waste, producing compost. Some may be concerned that the microorganisms break down too much carbon, which is important in Ethiopian soils.

### Next steps

- Student research and papers on the subject of EM application in Ethiopia are needed.
- EM production, marketing and awareness ought to be increased.
- Participants from different institutions showed great interest in implementing the SWM with UA and EM as in the pilot project in Addis Ababa.
- EM should be practiced and the application documented in long-term field trials. One of the participants, a student of Hope University volunteered to do the research.

Presenter: Gedion Shone, email: [walieji2@gmail.com](mailto:walieji2@gmail.com) or [gedion.shone@gmail.com](mailto:gedion.shone@gmail.com),  
tel: 0911930006 or 0114339406,

## 6.4 Integrated Soil Fertility Management (ISFM+)

Integrated soil fertility management (ISFM+) involves integration of a series of techniques designed to strengthen the health of the whole soil system, and thereby increase agricultural output. In appreciation for the whole system, physical, chemical and biological parameters of soil health are maximized.

ISFM involves increasing nutrient and biomass retention at the farm level. A goal of ISFM is Increased Agronomic Use Efficiency of Inputs (i.e., more output per unit of input). This is achieved through crop / field specific application of inputs, (decision support tools help to ensure this), and use of optimized combinations of component technologies.

**Techniques for maintaining and maximizing the benefit from nutrients at farm-level include:**

- **Reduction of nutrient and biomass losses**
  - e.g. by reduction in burning of agricultural residues and dung
  - Collection and application of urine and biogas slurry to the land
- Use of crop residues for **mulching**, to keep water, nutrients and living organisms in the soil
- Improved preparation of **compost** by different methods, and increased compost application
- Use of different methods of **agroforestry** (such as hedgerow intercropping and select tree cultivation in fallow periods) as certain species of tree can act as a source of nutrients, nutrient cyclers, and protection from soil degradation
- Cultivation of **legumes** for food, forage and green manure
- Use of **biofertilizer** (like *Rhizobium*) for increased nitrogen-fixation in soils
- **Minimum tillage** to prevent loss of soil structure, various soil nutrients and water
- **Crop rotation and intercropping** to improve nutrient balance in the soil, naturally reduce the impact of pests and diseases, and maximize the available sunshine with plants of different heights catching light at different canopy levels ensuring complete soil coverage by leaves and reducing evaporation of water from soils
- **Biochar** application to add nutrients and help to retain water
- **Soil acidity management** to increase availability of the nutrients in the soil to plants. This can be done in different ways, first by reducing the land degradation that leads to soil acidification, and secondly by mitigation and adaptation to acid soils; for example,
  - Addition of organic matter to soils;
  - Liming;
  - Cultivation of acid-tolerant crops and crop varieties (e.g. some types of banana, taro, potatoes and coffee).

Some of the component technologies that may be integrated in an ISFM system include: increase biomass production; quality seed for dual-purpose (grain/residue) crop varieties; location and crop specific fertilizer application; liming of acid soils; relay / double / intercropping.

ISFM has many benefits in terms of soil health and long-term farm productivity. In addition, ISFM has a great role to play in climate change adaptation and mitigation:

- ✓ Healthy soils sequester carbon



- ✓ Highly productive lands, with multi-storey intercropping maximize the available water and solar energy resources, thereby turning more carbon dioxide to plant tissue.

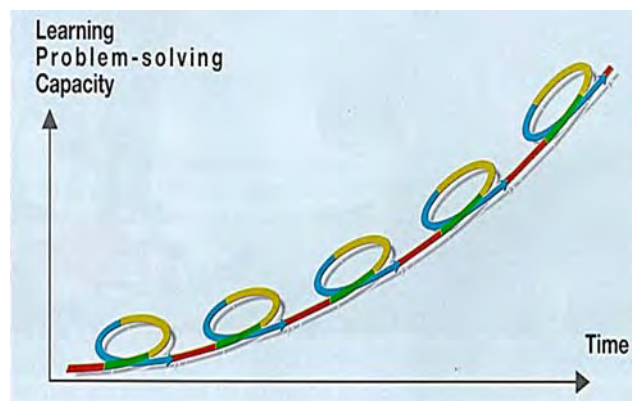
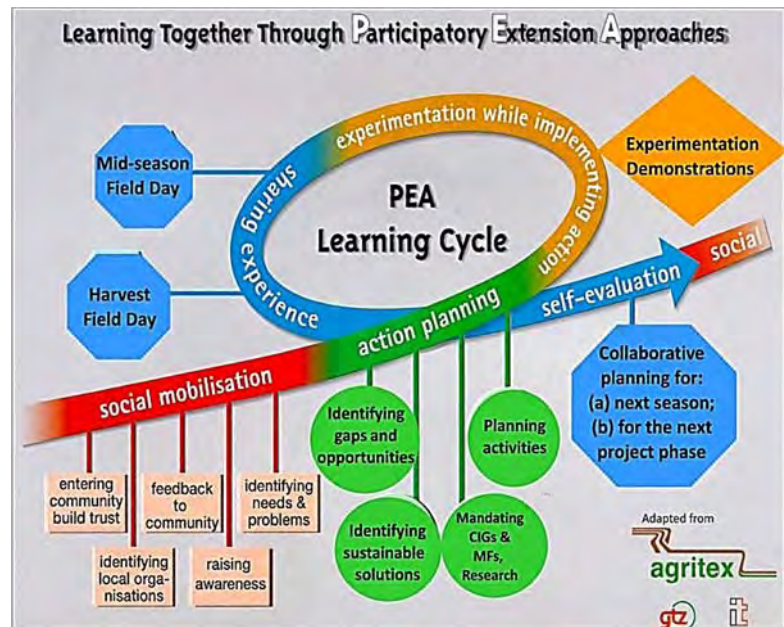
ISFM+ is currently aligned with a series of national development policies for optimal, coordinated implementation: Soil Fertility & Research Management Road Map (2010); Soil Sector Strategy (2013); GTP2 (2014): Sector Development Objective 4.6: Develop new soil fertility improvement technologies.

ISFM+ has a participatory extension approach to improving outcomes (and capacity to achieve desired outcomes) over time. To improve the adoption of ISFM techniques, farmer experimentation and knowledge sharing is key.

ISFM+ is a Ministry of Agriculture and Natural Resources Project, supported by GIZ and implemented by many partners.

### Discussion

Many participants said that they use and advocate different ISFM techniques. Techniques selected should be chosen in accordance with the needs of the soils at the specific site on hand, and with consideration of available resources.



A good resource for extension agents practicing and promoting ISFM is the *Technical Manual - Integrated Soil Fertility Management, Sustainable Land Management (SLMP) Training Series No. 14* by the Ministry of Agriculture and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Jan 2016, available at [www.slmethiopia.info.et](http://www.slmethiopia.info.et).

### Next steps for the ISFM+ project

The ISFM+ project goals are as follows:

- Apply Integrated Soil Fertility Management (ISFM+) on 15,000 ha
- Teff, wheat and maize yields increased by 20%
- ISFM input supply provided through private sector
- ISFM concept incorporated into national extension system

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## **ባዮቻር**

ባዮቻር የሚባለው ደግሞ ህይወታዊ ይዘቱን (Biomass) አየር አልባ በሆነ ወይም ትንሽ አየር በሚያገኝ ቦታ ከ 250 ዲግሪ ሴንቲግሬድ በላይ በሆነ ሙቀት የማቃጠል ሂደት ነው። ይህም “ቻሪንግ” ወይም “ፓይሮሊሲስ” በሚባል ሂደት ከሰል የሚመረትበት አሰራር ነው። ይሁን እንጂ ምርቱ ለአፈር ማከሚያነት ወይም በሰፊው ካየነው ለአካባቢ ጥበቃ ስራ የሚያገለግል በመሆኑ ለሀይል ፍጆታ ከምንጠቀመው ከሰል ይለያል። ባዮቻር ለማምረት የሚያስፈልጉት የሙቀት ምድጃና የግብርና ተረፈ ምርት ናቸው። በኢትዮጵያ ለባዮቻር ማምረቻ የምንጠቀምባቸው የግብርና ተረፈ ምርቶች የቡና ገለባ፣ አጥንትና ሌሎች የግብርና ተረፈ ምርቶች ናቸው። አጥንት በፎስፈረስ ይዘት የበለጸገ በመሆኑ ከአጥንት የሚሰራ ባዮቻር ጥሩ የፎስፈረስ ምንጭ ሊሆን ይችላል።

በካርቦን የበለጸጉ ነገሮችን ለመጠቀም ባለው ሽሚያ ሳቢያ በበርካታ የኢትዮጵያ አካባቢዎች በሚገኝ አፈር ውስጥ የካርቦን እጥረት ይታያል። በመሆኑም ባዮቻር መጠቀም በጣም ተፈላጊ የሆነውን ካርቦን ወደአፈር ለመመለስ ያስችላል።

የአጥንት ባዮቻር በመጠቀም ኢትዮጵያ ከ50 እስከ 150 ሚሊዮን የአሜሪካን ዶላር በማውጣት በየአመቱ ከውጭ የምታስገባውን ፎስፈረስ ማስቀረት ይቻላል።

## **ህይወታዊ ማዳበሪያዎች**

ህይወታዊ ማዳበሪያዎች የምግብ ንጥረ ነገሮችን ለዕጽዋቱ የሚያቀርቡት በህይወታዊ አካላት በኩል ነው። በኢትዮጵያ ህይወታዊ ማዳበሪያ ለጥራጥሬ ሰብሎች የንጥረነገር ፍሰትን ለመጨመር ጥቅም ላይ ይውላል። ይህ በሚሆንበት ጊዜም ማዳበሪያው የአፈሩን ንጥረነገር ይዘት በመጨመር የጥራጥሬ ምርቱ እንዲጨምር ያደርጋል።

## **ውጤታማ የደቂቅ ህዋሳት (ማይክሮኦርጋኒዝም)**

ውጤታማ የደቂቅ ህዋሳት (ማይክሮኦርጋኒዝም) ቴክኖሎጂ በተፈጥሮ የምናገኛቸውንና (ለምሳሌ እርሾ፣ ‘ፎቶቶሮፒክ ባክቴሪያ’፣ ‘የላክቲክ አሲድ ባክቴሪያ’) በየቀኑ ምግብና መጠጥ (ለምሳሌ ዳቦ፣ እርጎ፣ አይብ፣ ወይን) ለማዘጋጀት የምንጠቀምባቸውን ጠቃሚ ባክቴሪያዎች የመጠቀም ቴክኖሎጂ ነው። እነዚህ ጠቃሚ ባክቴሪያዎች በደን አፈር ውስጥ በስፋት የሚገኙ ናቸው። ውጤታማ የደቂቅ ህዋሳት (ማይክሮኦርጋኒዝም) ቴክኖሎጂ በግብርና ስራ ውስጥ የንጥረነገር እንቅስቃሴ ለመፍጠርና ኡደት ለማስቀጠል የሚያስችሉ በርካታ አሰራሮች አሉት።

## **የተቀናጀ የአፈር ለምነት አጠባበቅ**

የተቀናጀ የአፈር ለምነት አጠባበቅ በአጠቃላይ የአፈርን ስርአት ደህንነት ለማጠናከርና ብሎም የግብርና ምርትን ለመጨመር የሚያስችሉ የተለያዩ ዘዴዎችን አቀናጅቶ ተግባራዊ ለማድረግ የሚያስችል አሰራር ነው። የአፈሩ አጠቃላይ ስርዓት እንዲሻሻል በአፈሩ ውስጥ የሚገኙ አካላዊ፣ ኬሚካላዊና ህይወታዊ ማዕቀፎች እንዲገለብቱ ያደረጋል።

የተቀናጀ የአፈር ለምነት አጠባበቅ በማሳደሪጃ የንጥረነገርና ህይወታዊ ይዘት መጨመርን ያካትታል። የተቀናጀ የአፈር ለምነት አጠባበቅ ግብ የስነ ግብርናና ግብአቶች ውጤታማነትን መጨመር ነው። ይህም ሊሳካ የሚችለው ለቦታው/ሰብሉ ተስማሚ የሆኑ ግብአቶችንና የላቁ የተጓዳኝ ቴክኖሎጂዎችን በጥምረት በመጠቀም ነው።

የተቀናጀ የአፈር ለምነት አጠባበቅ ከሚያካትታቸው በተለይ ለቦታው ተስማሚ የሚሆኑ ቴክኖሎጂዎች መረጣ መካከልም፤

- የጠቃሚ ማዕድንና ህይወታዊ ይዘት መጥፋትን መቀነስ፤

ለምሳሌ፤

- የግብርና ተረፈ ምርትና ፍግቃጠሎን በመቀነስ
  - የሽንትና ባዮጋዝ አተላን በማጠራቀምና በመሬቱ ላይ በማፍሰስ
  - ውሀ፣ ጠቃሚ ማዕድናትንና ህይወታዊ ቁሶችን በአፈሩ ውስጥ ለማቆየት የሰብል ተረፈ ምርቶች ብስባሽን ማሳው ላይ ማፍሰስ፤
  - የተለያዩ ዘዴዎችን በመጠቀም የተሻሻለ የኮምፖስት አሰራርና አጠቃቀምን መቀየስ፤
  - አንዳንድ የዛፍ ዝርያዎች የምግብ ንጥረነገር ምንጭ በመሆን፤ የንጥረነገሮችን ዑደት በማመቻቸትና የአፈር መሸርሸርን በመከላከል ለሰብል እድገት ጠቃሚ ስለሚሆኑ የተለያዩ የግብርናና ደን ጥምር ዘዴዎችን መጠቀም፤
  - ለምግብ፣ የእንስሳት መኖርና አረንጓዴ ፍግ የብርዕ ሰብሎችን መዝራት፤
  - በአፈር ውስጥ የናይትሮጂን ይዘትን ለመጨመር ህይወታዊ ማዳበሪያ መጠቀም (ለምሳሌ ሪሂዞቢየምን)፤
  - የአፈር ተፈጥሮአዊ አወቃቀር፣ የጠቃሚ ማዕድናትና ውሀ ይዘቱ እንዳይጠፉ ቁፋሮን መቀነስ
  - በአፈሩ ውስጥ ያለውን የጠቃሚ ማዕድናት ምጥጥኖሽ ለመጨመር፣ የበሽታና ተባይ ክስተትን በተፈጥሮአዊ መንገድ ለመቀነስና የተለያዩ ርዝመት ባላቸው ዕጽዋት ወደመሬት የሚደርሰውን የፀሀይ ብርሀን በተለያዩ ደረጃዎች ለማስቀረትና በዚህም አፈሩ በቅጠላቅጠሎች እንዲሸፈን ለማድረግና የዕርጥበት ትነትን ለመቀነስ አፈራርቆ የመዝራትና የቅይጥ ሰብል ግብርና ዘዴዎችን መጠቀም፤
  - ጠቃሚ ማዕድናት/ንጥረነገሮች ወደአፈሩ እንዲገቡና ውሀ የመያዝ አቅሙ እንዲጨምር የባዮጋዝ ተረፈ ምርትን/ዝቃጭን በማዳበሪያነት መጠቀም
  - ሰብል የሚያገኛቸው በአፈር ውስጥ የሚገኙ ማእድናት/ንጥረነገሮች መጠን እንዲጨምር የአፈሩን አሲዳማነት መጠን መቆጣጠር። ይህም በተለያዩ ዘዴዎች ሊሰራ ይችላል፤ ከነዚህም መካከል በመጀመሪያ የአፈሩን አሲዳማነት የሚጨምረውን የመሬት መከላከል/መቀነስና ሁለተኛ ደግሞ አሲዳማ አፈርን በማከምና የማጣጣም ስራ በመስራት፤ ለምሳሌ
    - የተፈጥሮ ማዳበሪያ አፈሩ ላይ በመጨመር
    - በኖራ በማከም
    - አሲድ ሊቋቋሙ የሚችሉ የሰብል ዝርያዎችን በመዝራት (ለምሳሌ አንዳንድ የሙዝ ዝርያዎች፣ ጎደሬ፣ ቡና)። በተቀናጀ የአፈር ለምነት አጠባበቅ ዘዴ ልንጠቀምባቸው ከምንችላቸው ቴክኖሎጂዎች መካከል ጥቂቶቹ፤ በማሳው አካባቢ የሚገኘው ህይወታዊ ይዘት እንዲጨምር ማድረግ፤ ድርብ ጥቅም (ፍሬና ተረፈ ምርት) ያላቸውን ምርጥ የሰብል ዘሮች መጠቀም፤ የምንጠቀመው ማዳበሪያ ለቦታውና ለሰብል ተስማሚ መሆኑን ማረጋገጥ፤ አሲዳማ አፈርን በኖራ ማከም፤ የቅይጥ ሰብልና አፈራርቆ የመዝራት ግብርና ዘዴን መጠቀም
- ✓ ጤናማ አፈር ካርቦንን መጠ የመያዝ አቅም አለው
- ✓ የተለያዩ ርዝመት ያላቸው የተለያዩ የሰብል ዝርያዎች የሚገኙበት ማሳ ብዙ የውሀ/እርጥበትና የፀሀይ ብርሀን የማግኘት እድሉ የሰፋ ነው። በዚህም ሳቢያ በርካታ ካርቦንዳይኦክሳይድ ወደእጽዋቱ ተመልሶ እንዲገባና ምርታማነት እንዲጨምር ያደርጋል።

## 7. Soil Education and Research

A lot of research on soil fertility and soil management practices is being carried out throughout Ethiopia. The Ethiopian Institute of Agricultural Research, based in Addis Abeba, has many satellite research institutes and stations in the regions. At the growing number of Agricultural Universities research is done by PhD students. All this research is supported by programs from various donors, e.g. CASCAPE.

Next to the international CGIAR institutes based in Addis Abeba, for example IFPRI (International Food Policy Research Institute), a Soil Health Consortium has been established for the South and East of Africa, based in Kenya. <http://www.soilhealthconsortia.org/where-we-work/kenya>. It is supported by a program called AGRA (African Green Revolution for Agriculture). AGRA exists to fulfill the vision that Africa can feed itself and the world. Investing in agriculture through stronger partnerships is the surest path to reducing poverty and hunger in Africa. AGRA is a dynamic partnership working across the African continent to help millions of small-scale farmers and their families lift themselves out of poverty and hunger. However, in this chapter we only discuss soil education and research visits that were part of the Ethiopian soil campaign.

### 7.1 Holeta Agricultural Research Center

On Wednesday November 18, 120 people from Addis and around Holeta visited Holeta Agricultural Research Center (HARC). During the visit, an overview of the HARC mission, vision, work and facilities was given. Papers on acid soils, watershed management, and biofertilizer research were presented. Participants visited the Holeta Dam, reservoir and soil conservation site. Participants also visited the experimental field and soil laboratory.



*Campaign visit to HARC's soil fertility testing site*

#### ***Issues that were addressed in the papers***

##### **1. Challenges of Soil acidity and its management in Ethiopia**

In this section, the causes and coverage of acid soils in Ethiopia was explained, major soil related constraints were discussed, and the outcomes of liming and research done on acid soils management were presented. A challenge cited in this regard was a mismatch between soil acidity problems and access to liming resources.

##### **2. Evolution of Integrated Watershed Management Research in Ethiopia, especially by EIAR**

In this section, points were raised regarding the importance, and the establishment of integrated watershed management (IWM) research in Ethiopia. IWM research achievements over the last two years include a gabion check dam and cut off drain constructed at Borodo (Ginchi), very successful gully rehabilitation, trainings involving farmers at Borodo and Girar Dakuna Watersheds.

##### **3. Concepts and Principles of Soil Microbiology and Biofertilizer Research**

In this section the following issues have been discussed: type of fertilizers and its importance; Soil components, effect and activities of living organisms in the soil; and the aim and status of biofertilizer research in Ethiopia.





*Gully rehabilitation*

#### Comments and issues raised

- We should incorporate environmental, soil and agriculture courses in the education system in all levels from elementary schools upwards, it is better if children know and have experience of soil at early age!
- *Rhizobium* strain for faba bean has been developed and is being distributed to farmers, that is a good one but now we need also for other cereal crops.
- Chemical fertilizer is expensive, biofertilizer and compost is very good so it is better if the farmers get more experience and training on these techniques to increase their expansion.
- Watershed management is a broad field which includes different disciplines and different sectors.
- Research and educational institutions do the research activities but the scale up and extension work is handled by Ministry of Agriculture. This creates a gap to scale up agricultural technologies and to distribute improved seeds.

*"We have to care for our soils like a mother cares for her children."*

Mahtsente Tebebe, email: mahtsenti@gmail.com, 0911484586,

## 7.2 Fertilizer and Pesticide Research, (HoA-REC&N)

HoA-REC&N is conducting research at Ziway Farmer Training Center. Agriculture is the most common livelihood practice in the Central Rift Valley (CRV) of Ethiopia. Pesticides and fertilizers are becoming more available and popular in the region; these are favored for their capacity to increase agricultural output. However, these have the potential to significantly harm the soil, pollute water sources in the area and deplete the soil of its organic matter and minerals.



The CRV of Ethiopia is an area with complex social and environmental problems emanating mainly from mismanagement of water and land resources and lack of proper integration of policies, multiple stakeholder interests, large-scale economic investments, and unique but fragile terrestrial and aquatic ecosystems. Therefore, the need to replenish the fertility of farmers' land and protect the waters of the CRV has become urgent. To this

end sustainable agricultural intensification to improve livelihoods in smallholder agriculture and mitigate the potential impact of global climate change is one of the major area for research.

HoA-REC&N, with the full engagement and consultation of all relevant stakeholders, has developed a small pilot project in Edo Gojola, Ziway. It is called "low carbon healthy production system", that seeks to integrate organic inputs with chemical inputs to achieve increased stakeholder capacities to promote practices that are environmental friendly, increase the agricultural productivity and resilience to climate change

**Overall objective of the pilot trial** is to evaluate the use of compost, neem cake and other organic pesticides as alternative soil and pest management options to reduce the current practice of intensive use of chemical pesticide and fertilizer, while increasing the soil carbon (SOM) and the agricultural productivities of smallholder farmers.

*Expected outcomes of low carbon trials*

1. Provides short-term solution to the current social and environmental problems of smallholder farmers
2. Gives opportunities to link different interested stakeholders (PPP) towards ecological farming opportunities and sustainable marketing strategies
3. Serves as a base for further scientific research related to climate smart agriculture and lead to specific LCF methodology development
4. Serves as a pilot for farmers training site on the use of agro-chemical and adaptation to climate change impacts

The experimental trials were established in September 2015, following receipt of 25 ha of land by ATJK district agriculture office. A total of 13 experimental plots with four replicates were prepared: each trial plot measures 4.5 x 4.0 m (inner net plot size of 3 x 3 m for data collection). The treatments include: compost + neem cake, compost + neem cake + organic pesticide, compost + organic pesticide, fertilizer + compost + organic pesticide + neem cake, fertilizer + compost + neem cake + inorganic pesticide, and control without any input. Each treatment was replicated four times in a randomized complete block design, respectively. The initial soil chemical properties across plots within a block can be considered uniform or with insignificant variability so that any significant changes in soil parameters within plots can be attributed to the effect of the different treatments.

The amount and type of nutrients and pesticides applied in each treatment were based on recommendations of the local agriculture office and scientific advisors. The variables were the amounts and type of N and P fertilizer applied to the soil (urea, DAP, TSP at three levels, neem cake or compost), the amount of water received (frequency of watering), and the plant protection management (chemical pesticides, neem cake and another organic pesticides). Onion was the test crop. Data analysis, and writing the results for publishing remain to be done, and will be started as soon as the chemical analysis of the remaining soil and plant samples are completed.

**Problems encountered included**

- Our data lacks information related to conventional input practice (chemical inputs only).
- Delay in the application of chemical fertilizers immediately after planting, particularly TSP and DAP.
- Scarcity of land to have a well-defined control plots.

**Comments from Soil Campaign visitors**



- Full research outcomes await laboratory reports. The research is a long-term study, so the data set will not be complete for several years.
- Organic fertilizer application to all plots is highly recommended by many experts, as soil organic matter is one of the major limiting factors in Ethiopian soils, though perhaps this blanket application minimizes the observable difference between conventional and organic fertilizer application.
- At first glance, the plots with chemical fungicide and fertilizer appear to be much healthier than the ones with the organic applications. The researchers hypothesize that this will be the case in the first few years of the study, but the more organic applications are expected to yield better in later years. Time will show.
- It is important to have more Ethiopian data on the best integration of agricultural inputs for maximum long-term output, so studies like these are very important.
- "Seeing is believing", so it is important to conduct such research on accessible places where farmers can easily come and learn, as at this Farmer Training Center. Participants discussed challenges in resources for FTCs, and how some FTCs are better maintained than others.

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and Dr. Eshetu Bekele, Adama University, email: eshetubekele@gmail.com, tel: 0911628564

### **የትምህርታዊ ጉዞ**

በሆለታ የግብርና ምርምር ውስጥ በተደረገ ስብሰባ ላይ በአሲዳማ አፈር፣ የተፋሰስ ልማትና ህይወታዊ ማዳበሪያ ላይ የተደረጉ የምርምር ወረቀቶች ቀርበዋል። “እናት ልጆቿን እንደምትንከባከብ አፈራችንን መንከባከብ አለብን።”

በማዕከላዊው የኢትዮጵያ ስምጥ ሸለቆ አካባቢዎች ግብርና ዋነኛው መተዳደሪያ ስራ ነው። በዚህ አካባቢ የኬሚካል ማዳበሪያና ጸረ ተባይ መርዞች አጠቃቀም በጣም እየተለመደ መጥቷል። እነዚህ ግብአቶች የግብርናውን ምርታማነት የመጨመር አቅም ያላቸው በመሆኑ ተፈላጊነታቸው እየጨመረ ሄዷል። ይሁንና እነዚህ ግብአቶች ጠቃሚ ጎን እንዳላቸው ሁሉ በአካባቢው የሚገኘውን የውሀ ሀብት በመበከልና የአፈሩን ተፈጥሮአዊ የማዕድንና ህይወታዊ ይዘት በመሸርሸር በማህበረሰቡ ላይ የጎላ ጉዳትም ሊያስከትሉ ይችላሉ። የአፍሪካ ቀንድ አካባቢ የአካባቢ ጥበቃ ቅንጅትና ትስስር (HoA-REC&N) የተባለ ድርጅት በዚህ ጉዳይ ዙሪያ በዝዋይ አካባቢ ጥናት እያካሄደ ነው።

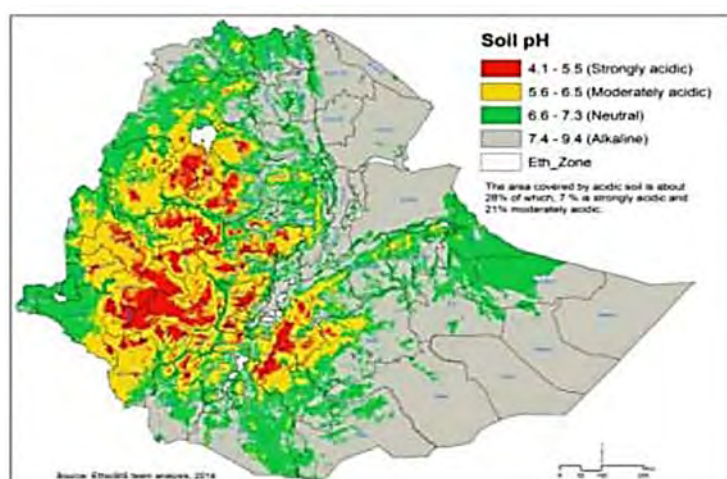
## 8. Soil Testing and Mapping

### 8.1 Soil Mapping and Fertilizer Blending (ATA)

Ethiopia is home to a great diversity of soils, and therefore, different fertility treatments are appropriate in different areas. There is a great need for soil information so as to allow informed application of site-appropriate soil fertility amendments. Ethiopian soil maps have often been extrapolated from world soil maps, so they don't provide information accurate enough for quality decision-making at the farm level. In response to this data gap, the Agricultural Transformation Agency (ATA) is undertaking a nation-wide soil-mapping project to allow for the application of site-appropriate blends of fertilizer, which are now being prepared within the nation.

Annual soil loss from cultivated lands is about 42 tons/ha. Soil erosion reduce crop production up to 30%.  
- Pimentel, 2003

16-50 % of the seasonal rain water is lost as runoff, which carries the soil away with it.



On November 17, Ato Behailu Kassahun of the ATA explained the most common challenges to soil fertility across the country, and the work of his agency to map and provide fertility recommendations for the various Ethiopian soils.

**Soil erosion and land degradation** are major causes for low productivity and vulnerability of smallholder farmers. Gully erosion decreases the land connectivity by fragmentation. In

addition to soil erosion and land degradation, nutrient depletion is reducing the productivity of our agricultural soils: rather than returning nutrients (e.g. P & N to the soil, in the form of cow manure) there are many competing uses for animal manure (such as construction and energy).

**Water logging reduces the productivity of vertisols**, 43% of our agricultural lands are affected by high acidity. (Nitrogen fixation becomes impossible in highly acidic soils, and other minerals form complexes making them unavailable to plants).

**Salinity**, about 1.5 m ha of fertile valley bottom soils are affected by salinity. The problem of salinity is increasing in connection with expansion of irrigation owing to poor on-farm water management

**Soil mapping.** Previous mapping initiatives have been carried out, but old maps are obsolete with regard to current-day fertilizer amendments. Prior to Ethio-SIS (soil information system), there has been no central repository for geospatial soil map data. State of the art technology is now being used to combine and disseminate soil data in Ethio-SIS. For the past decades, fertilizer consumption in the country has been limited to DAP and Urea that supply N and P only. Blanket fertilizer application recommendations regardless of differences in crop need, soil types and agro-ecology often fail to achieve optimal output.

### Now Ethiopia has developed the capacity to do its own fertilizer blending.

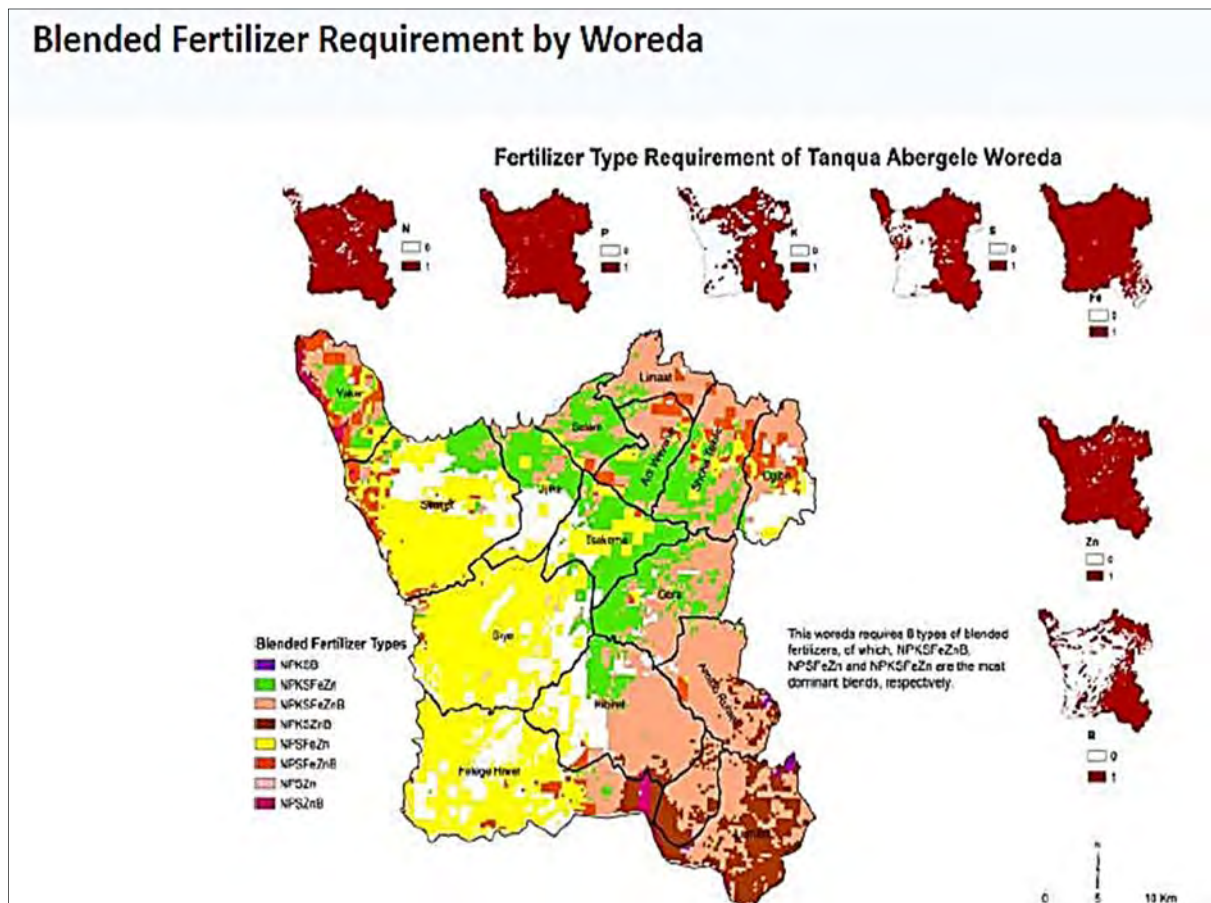
Fertilizer blending is a special type of fertilizer mixing, where blends are prepared by the mechanical mixing of two or more granular materials of fairly uniform size and density in defined proportions. It originated in the USA and now dominates the fertilizer market in many countries. Many African countries have already developed fertilizer blending plants; most use compound fertilizers that provide 4+ different elements to the soil in complex chemically bonded mixes.

#### Key take home message

1. Application of blended fertilizers gives satisfactory results when blends are fitted to the soil type, agroecology, and the needs of the crop.
2. This new soil database (Ethio-SIS) allows for optimal site-and soil-based blended fertilizer application.

#### Future

Mapping all the rest of Ethiopia shall continue by studying the specific type of soil and producing soil maps at the wereda-level. The final outcome of the soil mapping is a localized fertilizer blend recommendation map like the one below from central Tigray.

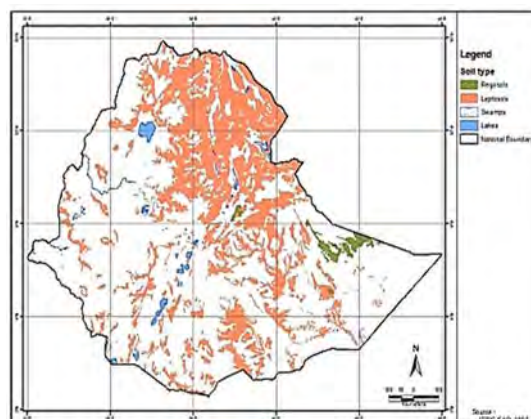


Behailu Kassahun, Agricultural Transformation Agency, email: behailukassahun@ata.gov.et,  
tel: 0911481032

## 8.2 CASCAPE Soil Mapping

CASCAPE improves existing soil maps by working with farmers and adding more detailed information. This way the soil maps can be used for recommendation of different fertilizer blends for various combinations of soils and climate, and soil fertility status.

Old soil maps do not capture the huge diversity of soils: They were based only on aerial photographs and are not properly validated with soil samples. The purpose of these original maps was crude land use planning, however these general maps have led to 'blanket application of fertilizer' based on these generalized maps. CASCAPE is working on 'best fits' – for every type of soil/climate combination. Now Ethiopia is moving to blended fertilizer recommendations. This needs good soil fertility mapping. The goal is to come to functional technologies with a high confidence level.



2015 CASCAPE Map of Regosols and Leptosols

The major finding of the CASCAPE mapping is that 99% of Ethiopia's agricultural soils consist of 5 soil types: Nitisols, Vertisols, Leptosols, Luvisols and Cambisols and physiographic regions hosting these soils have similar agroecologies and farming systems.

### Q&A with Dr. Eyasu

*Dr. Eyasu Elias is the national coordinator of CASCAPE. On Thursday October 21, participants of the Soil Campaign made a visit to the CASCAPE office.*



**Question:** Do the farmers know about the CASCAPE project and outcomes? How do you involve them in the studies or how do they get the results?

**Answer:** they are involved. Farmers are asked to make their own maps, they overlap. They know about soil/nutrient interaction. They are experts, but they are generally very much ignored. In CASCAPE there is a lot of teaching with farmers and they draw soil maps. We are working on journal papers based on farmers' knowledge.

**Question:** Are you already at the point of making recommendations?

**Answer:** The first drafts of the mapping are ready, and are now being validated.

**Question:** What about soil fertility status? Is it part of the research?

**Answer:** Yes, we are complementing Ethio-SIS.

**Question:** Do you collaborate with ATA?

**Answer:** Yes, there is a Memorandum of Understanding between ATA and WUR. We are planning to add more weredas. However, the challenge is the funding by the Dutch Embassy.

**Question:** ATA is top down, CASCAPE is bottom up?

**Answer:** Yes, things fit into the priorities of farmers. This makes CASCAPE totally different. The goal is to mainstream the system into the national programs. The National Soil Resource Information Database is now being created. The government has created a directorate for this.

**Question:** What are the next steps and future concerns?

**Answer:** Consistency of funding is a challenge. We must keep working towards making the information available for policy makers and farmers.

Dr. Eyasu Elias, CASCAPE, email: [eyasu@gmail.com](mailto:eyasu@gmail.com), tel: 0911839039.



## 8.3 National Soil Testing Center (NSTC)

On Thursday, November 19, a delegation of Soil Campaign Participants visited the National Soil Testing Center (NSTC). Mr. Tewfik Hussien, on behalf of the director for NSTC showed the group around the lab and explained the processes conducted therein.

The following processes are carried out at NSTC:

- ✓ Soil sample preparation
- ✓ Spectral analysis
- ✓ INET chemistry analysis
- ✓ Biofertilizer production
- ✓ Soil texture testing



In discussion, participants raised questions on the topics of the use of biofertilizer and chemical fertilizers together with lime.

**Take home message:** Quality soil analysis requires attention to detail, from the soil sampling stage, preparation and analytical laboratory work.

### Steps for the future:

- The NSTC could move into diversified service provision for agricultural, construction and other works.
- Establishment of multipurpose laboratory.

Tewfik Hussien, Email: [hussen.tofik@gmail.com](mailto:hussen.tofik@gmail.com), Telephone: 0911393201

## 8.4 Addis Abeba Environmental Protection Authority

On Thursday, November 19, a group of Soil Campaign Participants visited the Addis Ababa Environment Protection Authority (AA EPA) Compost Laboratory, in Addis Abeba.

This lab was established to meet the following needs:

- ✓ Inspection purpose i.e. for monitoring of pollution, providing analytical laboratory services for various customers including industries, researchers, and other organizations.
- ✓ Providing technical assistance for various institutions.
- ✓ Providing data for EPA researchers.



The laboratories consist of 4 sections dedicated to different processes: compost analysis, soil analysis, water analysis, and physical, chemical and bacterial analysis methods. The major parameters measured for compost in this lab are; moisture content, elemental analysis, heavy metal analysis, nutrient analysis.

The equipment used for each of these analyses was demonstrated to workshop participants.

The presentations and the laboratory visit gave participants insights into organic waste as a resource, composting methods of organic waste, use of effective micro-organisms, soil fertility, urban agriculture

and food security. Furthermore, the importance of laboratory results to tackle environmental and health problems related to waste water, treated waste water and soil degradation was discussed.

The equipment used in compost analysis was demonstrated, and the application of such analysis discussed. Water and wastewater physico-chemical analysis parameters to be analyzed in this unit are: COD, TN, TP, TOC, alkalinity, chloride, hardness, fluoride, etc. Heavy metals including lead, chromium, arsenic, and others can also be tested. They used GC, AAS, HPLC. Microbiology can be tested for the following parameters: BOD, TC, FC.

#### Discussion

Participants wondered about the cost per analysis and for whom this organization provides service, and the requirements of the soil sampling.

**Question:** What standards are used?

**Answer:** national and international standards.

**Question:** What is the result of the analysis done previously?

**Answer:** water samples mostly contain high pollution, coming mostly from rivers but the laboratory is not in a position to see such issues. It can only provide information on the samples for inspectors, researchers and organizations.

#### Take home messages

It is possible for anyone to take their sample here for testing!

It was suggested that proper laboratory analysis and monitoring of drink water, wastewater and storm water should be enhanced as it is crucial to prevent environmental and health problems.

Any relevant government and non-government organizations should give recognition for EPA laboratory institute, especially for soil, plant, compost, water and wastewater laboratory examination.

Abebe Alemayehu (EPA laboratory head), Email: [abi055492@gmail.com](mailto:abi055492@gmail.com)/  
[abio554p2@gmail.com](mailto:abio554p2@gmail.com), Telephone: 0935344803

ከሚታረሱ መሬቶች በየአመቱ በሄክታር 42ቶን አፈር ይጠፋል። በአፈር መሸርሸር ምክንያት የሚቀንሰው የምርት መጠን ደግሞ እስከ 30-በመቶ ይደርሳል።

ከ16-50 በመቶ የሚሆነው በየወቅቱ ከዝናብ የሚገኝ ውሀ በጎርፍ መልክ ይሄዳል። ይህም አፈሩን እየጠረገ ይዞ የሚሄድ ነው። ያልተፈለገ የውሀ መታቆር፣ ጨዋማነትና አሲዳማነት በኢትዮጵያ ለአፈሩ ጤንነትና ለምነት ተጨማሪ ስጋት የሆኑ ነገሮች ናቸው። በአፈሩ አይነት ላይ በመመስረት አስፈላጊውን ማስተካከያ (ለምሳሌ ቅይዋ ማዳበሪያ መጠቀምን) ለማድረግና ምርታማነቱን ለመጨመር ይረዳ ዘንድ የግብርና ትራንስፎርሜሽን ኤጀንሲ በሀገሪቱ ውስጥ የሚገኙ የአፈር አይነቶችን በካርታ ላይ የማመላከት ስራ በመስራት ላይ ይገኛል።

የመሬቱን ሁኔታ ካወቅን የአፈሩን ባህሪም እንረዳለን። በኢትዮጵያ 99-በመቶ የሚሆነው የእርሻ አፈር አምስት የአፈር አይነቶችን የያዘ ነው፤ እነሱም በሳይንሳዊው አጠራር ኒቲሶል፣ ቨርቲሶል፣ ሌፕቶሶል፣ ሉቪሶይና ከምቢሶል በመባል ይታወቃሉ። ተመሳሳይ የአፈር አይነት በሚገኝባቸው አካባቢዎች የሚካሄደው የግብርና አይነትም ተመሳሳይ ነው።

ለአፈር ጥሩና ትክክለኛ ክብካቤ ለማድረግ ስለአፈሩ ትክክለኛ መረጃ ያስፈልጋል። አፈሩን ወደ ቤተ መከራ በማምጣትና በመመርመር ለአፈሩ የሚያስፈልገውን የህክምና አይነት ማወቅ ይቻላል። የግብርናና ተፈጥሮ ሀብት ሚኒስቴር የአፈር ናሙናዎች የሚመረመሩበት የተደራጀ ቤተ መከራ አለው።

የኮምፖስት ምርመራ ከአፈር ምርመራ በመጠኑ ይለያል። በአካባቢ ጥበቃ ባለስልጣን ስር የሚገኘው ቤተ መከራ ውስጥ የኮምፖስት፣ የአፈርና የውሀ ምርመራ ይደረጋል።

## **Part Three - Country-Wide Awareness Raising**

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### የክልላዊ የአፈር ቀን ዘገባ

በዚህ የአፈር ዘመቻ ዘጠኝ የተለያዩ ክልላዊ ኩነቶች ተዘጋጅተዋል። የነዚህ ኩነቶች አላማም የልምድና እውቀት ልውውጥን ማስፋት፣ በአሁኑ ጊዜ ባለው የአፈር ሁኔታና በተለያዩ የአፈር ጤንነት ጥበቃ እንቅስቃሴዎች ዙሪያ በየክልሉ የሚገኙ የተለያዩ ባለድርሻዎችን (አርሶ አደሮች፣ ተመራማሪዎች፣ በተለያዩ ደረጃዎች በሚገኙ የመንግስት መዋቅሮች ውስጥ የሚገኙ የግብርና ባለሙያዎችን እና መንግስታዊ ያልሆኑ ድርጅቶችን) ስራዎች እንዲጣጣሙ ማድረግ ነው። በነዚህ ኩነቶች ወቅት የልምድና ዕውቀት ልውውጡን ለማመቻቸት ከተከናወኑት ተግባራት መካከልም፣ የመስክ ጉብኝቶች፣ የጥናትና ምርምር ስራዎች ገለጻ፣ ውይይቶች፣ በሬዲዮ የሚተላለፉ ፕሮግራሞችና በታላቁ ሩጫ መሳተፍ የመሳሰሉት ይገኙበታል። በበርካታ አካባቢዎች ተሳታፊ የነበሩ ሰዎች በአፈር ጤንነትና ልምድ ዙሪያ የመረጃ ልውውጡን ለመቀጠል ተስማምተዋል።

“የተቀናጀ የተፋሰስና አፈር ጥበቃ በአጠቃላይ ለሀገሪቱም ባይሆን ለአካባቢያችን በጣም አስፈላጊ ነው።” አክሱም

ለልምድ ልውውጥ ከቀረቡት ነገሮች መካከል የንጥረ ነገሮች ዑደት (በእርሻ ስርዓት ውስጥ የንጥረ ነገሮች ዑደት ምን እንደሚመስል) ይገኝበታል። ለምሳሌ ሳር→የእንስሳት መኖ→ፍግ→ባዮጋዝ→የባዮጋዝ ዝቃጭ/ባዮስለሪ→ኮምፖስት→አፈር/ሳር→የእንስሳት መኖ (ራማ) እና ከከተማ የሚወጣ ቆሻሻን ወደኮምፖስት መቀየር (ውቅሮ)፡፡

ከዚህም በተጨማሪ በተለይ በአንድ አካባቢ በሚታዩ ተግዳሮቶች ላይ የተደረጉ ጥናቶች ውጤቶች ቀርበዋል። ለምሳሌ የግጦሽ መሬት አፈር አሲዳማነትን በመከላከል ላይ የተደረገ ጥናት፤

አርሶ አደሮችም በቀጥታ የእርስ በርስ ልምድ ልውውጥ የማድረግ ዕድል አግኝተው ነበር። በዘመቻው ከተደረጉት ኩነቶች ሁሉ ደግሞ በተመራማሪዎችና አርሶአደሮች መካከል የታየው መግባባትና ተሳትፎ ልዩ ነበር።

በርካታ ሰዎችን በመድረስ በኩል ደግሞ በዘመቻው ከተላለፉት መልዕክቶች ሁሉ በሬዲዮ የተሰራጨት በርካታ ሰዎችጋ በተለይም እርሶ እደሩ ዘንድ መድረሳቸው ታውቋል። የተገኘው ምላሽም አስደሳች ነበር፤ የተለያዩ አድማሮች ስልክ በመደወል አድናቆታቸውን ገልጸዋል። ሬዲዮ ጣቢያዎችም ፕሮግራሙ እንዲቀጥል ጠይቀዋል። ዝግጅቱ በአድማሮች ዘንድ ከፍተኛ ተቀባይነት በማግኘቱም ሌሎች አዘጋጆች እንደሞዴል እንዲወስዱት ተደርጓል።



## 9. Experiences Shared at Regional Events

A series of regional events were organized with the objective of raising awareness, promoting exchange of knowledge and experience, and aligning the activities of the different stakeholders (farmers, researchers, agriculture experts at the different levels of government organizations and NGOs) within the regions, around the current status of soil and different good soil health management and conservation practices.

Techniques for sharing, learning and network building at the regional events included presentations, visits to farms and demonstration sites, dialogue, radio coverage, and community events including participation in the Great Ethiopian Run.

### 9.1 Aksum

In Axum, a regional event was conducted on November 29, 2015. The opening was made by Dr. Mekonnen Aregai, Vice President for Academic, Research and Community Service Affairs of the Aksum University (AKU). He explained about the duties of AKU in training, research and community services. “Out of commitment to community service, AKU is always ready to support this cause. Integrated watershed management, and soil generally is very important for our region if not for the country.” He extended his appreciation to the organizers and committed to keep backing them.

“Integrated watershed management, and soil generally is very important for our region if not for the country.”  
- Dr. Mekonnen Aregai

A series of awareness, networking, and active learning events were arranged in the Axum area:

- **Axum Great Run** – On Sunday, November 29, 2015, there was a Great Run in Axum. The representatives of the Regional Soil Event in Axum gave prizes to the winners, and in return, the sports announcers gave coverage about the Ethiopian Soil Campaign throughout the run.
- **Site visit – Fertile Soil Collection in Rama** – The visit was to a location that W/ro Haregu uses as a soil bank. This means she has been collecting fertile soil from distant location by camel. Now she built a site where silt (fertile soil) can be accumulated without being disturbed by the force of flooding. She has collected more than 100 tons of fertile soil within one rainy season. With this soil she is replacing a one and half meter depth of gravel soil in her fields.
- **Soil Fertility Practices in Rama** – The multipurpose orchard visited applies many interesting soil fertility improvement techniques, including saline soil rehabilitation; removal of *Parthenium* weed; bioslurry fertilizer application in liquid and solid form; and composting in 25 compost pits. The farmer who owns this orchard is a woman who has over 6600 fruit trees in 12 hectares of land, and her own dairy cows feed in the orchard.

The model used for on-site nutrient cycling (cycling nutrients within the farm system) is:  
grass → animal feed → dung → biogas → bioslurry → compost → soil/grass → animal feed

- **Establishment of a soil forum** and naming of its leaders. The selected committee to run the forum includes teachers, students, researchers, extension personnel. The meetings and the field visits organized by this forum are to include farmers, students, extension workers and other stakeholders i.e. researchers, academicians and other stakeholders. They will communicate and have sessions every three months in order to discuss about soil health.



*Dr. Mekonnen Aregai opening the event in Aksum*

#### **Reflection on outcome:**

The event was extremely successful. These events were carried out with the full support of the Universities and TVETs and the agricultural extension. Participants mentioned how the event was important to create awareness among the different stakeholders about the need for healthy soil, and it was a very good opportunity also to know each other and coordinate activities towards sustainable soil management if it goes beyond the one-year event. There were journalists from the regional television program. There were 80 participants from farmers, elementary schools, representatives of agricultural offices, university staff and students, and researchers.

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## **9.2 Bahir Dar**

A regional event was held on December 8 in Bahir Dar at Rahnile Hotel.

The purpose of this event was to exchange knowledge and experience among different stakeholders, and to demonstrate good soil health management practices and innovative tools. The event included a keynote speech by Dr. Tesfaye Shiferaw, a discussion of land degradation and rehabilitation by Dr. Yihenew, a presentation on gully erosion and rehabilitation techniques by Dr. Getachew. Belayneh Adugna shared experiences of GIZ on sustainable land management and soil fertility management, and field visits were made in the vicinity of Bahir Dar.

Participants included farmers and DAs from Mecha, Durbete, Robit, Zenzelema, and Debre-Mewi. Staff and students from four universities were involved (Bahir Dar University, Gonder University, Debre Tabor University and Debre Markos University). Extension and other organizations included BoA, SLM, GIZ, A-TVET, BoEPLA, Agricultural and Environmental offices (BD/Zuria & BD city).

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## 9.3 Debre Berhan

A day of events in Debre Berhan took place on December 3, 2015. The event was organized by Debre Berhan University, together with the Ethiopian Soil Campaign, and involved participation of students, farmers and officers from the Bureau of Agriculture.

In the morning, presentations of different aspects of soil health and management were shared. Jelleke De Nooy of the Soil Campaign discussed the importance of care of our soils, saying “We all need to help the farmers to take good care for more and good food production”. Ato Segay of the soil directorate ARARI discussed use of organic fertilizers. A representative of the Bureau of Agriculture – Angolela & Tera district presented on fertilizer use and about lime and biofertilizers. Of note was the observation that an increase in use of DAP and urea of 15% is having only 5% increase in crop yield. Liming and biofertilizers, on the other hand, have been extremely impactful. A representative of the Bureau of Agriculture – Batto & Worana district, told of similar problems with fertilizer, and of successes in watershed management, honey and apple production in the region. Farmers budgets before and after the growing season was discussed, and research applying micro- nutrients added to potato and faba beans was also presented.



*Soil protection area in Guassa*



*Use of mulching to protect soil*

In the afternoon, a field visit to a soil and water conservation site around Guassa was made (left hand picture). At the watershed management site, one could see the effect of some hand-dug trenches for holding run-off water, also keeping the soil in place. The result was a very green area, especially compared to its surroundings. The green area is now in use by jobless youths, who keep bees.



*Trench bunds along the contour that capture water*



*Collecting grass seed*



In the left hand picture, we can see how a hand-dug trench is useful in slowing and absorbing runoff into the soil, and it also collects the silt on its bottom, thereby preventing soil erosion. In the right hand photo, we see that growing grasses on the bunds keeps them in place and provides fodder for cattle, which is particularly useful now that it is forbidden for the farmers to graze their animals in the now green land. In this photo, a campaign participant is collecting seed to propagate elsewhere.

#### **Reflection on outcomes:**

As a result of this soil day:

- ✓ Debre Berhan and Hope University start a partnership
- ✓ Debre Berhan staff will take part in the Soil Health platform
- ✓ Awareness about the importance of manure as fertilizer was raised.
- ✓ Practical tools for soil and water conservation were tangibly perceived by participants.
- ✓ Many connections made: a network is more important than money!

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## **9.4 Debre Markos**

Another Regional Event was carried out at Debre Markos University on November 29, 2015.

The purpose of the event was firstly, to raise awareness, exchange knowledge and experience, and align activities of the different stakeholders: farmers, researchers, agriculture experts at the different levels of governmental organizations and NGOs within the region, about the current status of soil and different good soil health management and conservation practices to reverse the situation.

Secondly, the event sought for farmers, students, extension workers and other stakeholders to view field demonstrations of good soil health management, conservation agriculture, watershed management practices and innovative tools such as effective microorganisms (EM), bio-fertilizer, conservation farming, and sustainable land management (SLM).

Thirdly, this event aimed to create a space to discuss what participants could do to increase synergy around activities that would improve soil health management in the region. A total of 145 participants attended both the presentations and field visits. Of these, 45 were farmers, and the others were representatives of agricultural offices, NGOs, University staff and students, and researchers.

The event included a welcoming speech by the University's research and community service vice president. A keynote speech was given by a Soil Campaign Organizing Committee member, Dr. Eshetu Bekele. In these speeches, the role of soils in nutrition and other critical ecosystem services was explained. Papers on the ongoing research at Debre Markos University on



the status of soil in Cheko watershed and use of acid tolerant wheat varieties as the possible technology to treat acidic soil were presented and discussed. Soil acidity is severe in the Choke mountains watershed, which ranges from 4.0-5.2 in most sampling areas. The use of lime only to



neutralize the effect were not economically and technically feasible in the region, on the other hand use of acid tolerant varieties of wheat showed a positive result and a potential alternative even if the study was not yet completed.

During the field visit the participants learned how a participatory approach is effective in convincing the local community about whether and how to embark on sustainable watershed development and land rehabilitation. Moreover, a demonstration made by Migbare Senay (NGO) clearly showed how watershed-based food security projects, incorporating conservation agriculture and gully rehabilitation, can make a significant contribution to the soil health issues of the region. The ongoing research of the university which compares the response of different bread wheat genotypes to acidic soil demonstrated the importance of using appropriate varieties of crops as potential management option in acidic soil in particular, also having other different soil health issues in general.

Different questions and comments were made by participants (mainly from farmers and agricultural office representatives and university staff):

- Soil erosion is the main cause of soil health related problems (example soil acidity) in the region and future integrated efforts should be towards minimizing this problem by doing watershed management practices even not only in the degraded land it should be beyond that as prevention is better than cure.
- Donors should assist the research activities and institutional capacity building in this region as it is the major producer of cereals with more than 30% of the country's production coming from this area.
- The use of different crop varieties for maintaining and treatment of soil health issues should be given due attention besides conservation agriculture practices supported by donors
- Changing the attitude of farmers by involving them in different activities of technology development, through education and following participatory approach were considered as the key for technology adoption and implementation.
- Delay in delivering agricultural inputs to the farmers was considered the major problem for decreasing production. It also resulted in farmers losing confidence to use the technology as its impact was not clearly observed as they were not applied at the right time.
- The cost of using lime to treat a hectare of land (7000 ETB) and its sustainability were discouraging the farmers from using this technology to treat acidic soil. This points to the involvement of researchers in finding effective ways of using lime and looking for other technologies that are cost effective, technically feasible, and socially acceptable.
- There was a saying as one of the farmers mentioned "ask to get the husband before the child" to justify how it is important to tackle the root cause of soil acidity in the region which is soil erosion and natural resource degradation by implementing natural resource conservation practice and so on, rather than always choosing the costly option such as purchasing lime to treat it after it has occurred.
- Still the roles of biological organisms in soil health management were neglected in most conservation management activities, so future work should consider this important component of healthy soil.
- Logistic and institutional weakness to deliver agricultural inputs (seeds, fertilizers on time).
- Lack of interest to accept and implement technologies mainly because of lack of education, and some technologies did not meet their interest or address their agricultural concerns.

- Lack of laboratories to do intensive analysis of different soil parameters to know their soils and act accordingly were considered as the major bottle neck in the region. This is their first priority if they get any fund from government or NGOs to do the analyses.

### Conclusion

The event was very successful and carried out with the full support of the University management, zonal and wereda agricultural institutions, and cooperatives. During the event the university president mentioned the full commitment of all the respective stakeholders to work closely with organizing committee in the soil health platform to bring an observable change in the region in all soil related issues. Moreover, other participants also mentioned how the event was important to create awareness among the different stakeholders about the need of healthy soil. It was a very good opportunity also to know each other and coordinate activities towards sustainable soil management if it goes beyond the one-year event.

The event has got coverage in the regional radio and TV programs. Those interested may be able to access the documentary.



Participants in Debre Markos wearing their Soil Campaign T-shirts

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## 9.5 Dessie

A Regional Event was also held in Dessie town on 5 December 2015 and hosted by Wollo University College of Agriculture.

During the opening, all participants discussed the theme, and banners, leaflets and T-shirts were distributed to commemorate the event. Participants in the workshop included farmers from Werebabo and Tehuledere weredas and Dessie town, heads of the agriculture and natural resource management, coordinators of the respective districts and those at Zonal level, experts from ISD based in Dessie and from Addis, graduating students of Wollo University Soil and Water Resource Management Department.

After different presentations, the focus of the discussion turned to the question, “what does soil health mean?” Various farmers presented their experiences. It became clear that linkage between stakeholders in soil health management (research, extension and farmers), rate of adoption of

research results by farmers, sustainability of different structures and management options for soil health management in particular and natural resource in general is essential for achieving holistic sustainable and fertile soil health.

**The way forward:**

1. We have to expand this good experience to other areas of our zone.
2. We have to work through integration (farmers, experts in the office of agriculture and researchers in the university).
3. Particular emphasis has to be given for the highlands where we do not have options of generating species adaptable to this agroecology and where the soil is highly degraded attributed to a long history of cultivation and over population.
4. We have to develop sustainable thinking so that we can come with sustainable development options by intensively working on human behavioral change.

83 people attended the workshop: 15 from Zone & Wereda Agricultural Offices, 17 farmers, 18 University Admin & Staff and 33 Students of Soil and Water Resources Management.

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## 9.6 Jima

A regional event was carried out at Jima University on December 4, 2015. A total of 85 participants comprised of farmers, representatives of agricultural offices, development agents, and university staff, students and researchers attended both the presentations and field visits.

A welcoming speech was given by the University Research and Community Service Vice President, Dr. Birhanu Belay. This was followed by words from Ethiopian Soil Campaign Organizing Committee Member, Dr. Eshetu Bekele. These introductory speeches highlighted the critical importance of healthy soil for feeding the growing population and other ecosystem services provided by soils in the Ethiopian context. "Soil is our limited resource which we cannot regenerate in one generation, the use of soil to produce about 95% of our food and the need of increasing our agricultural production at least by 100% in SSA to feed the growing population in 2050; severe degradation of soil, low in SOM, extensive soil nutrient depression (N, P, K, S, B, Zn, Cu), low water holding capacity and severe soil acidity and salinity in Ethiopia lead to the urgent need for appropriate use of soil health inputs to reverse the situation."

Paper presentations were made on the ongoing research works of Jima University at both researcher-managed and farmer-managed sites in the university site, and in the Gibe catchment. The first papers discussed biochar and compost technologies. The possibility of using biochar/compost based fertilizers as an alternative for chemical fertilizer as it is possible to produce equivalent crop yield was discussed – advantages of such organic fertilizer is that it is cheaper, environmentally sound and good option for sustainable management of soil. Later papers discussed the connection between soil health and public health, showing how unhealthy soils are breeding grounds for pathogens. Dr. Zeleke conclude his presentations by saying we need to organize an event with the slogan, "Healthy Soil and Deworming Day" to create awareness on the role of soil health as a primary solution to keep children healthy.

Field visits were made to different soil conservation and rehabilitation sites, and sites demonstrating use of organic fertilizer (biochar, compost) production. Onsite discussion was held. At a Kersa wereda site, participants learned how biochar is produced from locally available organic resources. They also observed the application of integrated soil and water conservation and gully rehabilitation technology to address severe soil degradation problem in the region. It was evident that application of compost and growing grass species were a good option for the rehabilitation such a highly degraded area.

**Questions and Comments made by participants (mainly from farmers and agricultural office representatives and university staff):**

The use of different organic inputs such as biochar and compost are the best options for rehabilitation of degraded land and even enhancing productivity of the soil with integrated application with chemical fertilizer. In addition, the use of bone char will result in a 40% saving in farmer's expenditure for chemical fertilizers. However, integrated efforts will be needed to disseminate the technology and even to train and produce the fertilizers at farmer training centers.

Soil erosion is the main causes of soil health related issues (example soil acidity, nutrient loss) in the region and participants agreed to make all efforts to rehabilitate and minimizing this problem in the future by doing integrated soil and water conservation measures such as the one demonstrated at the Kersa wereda – use of locally adapted biological and physical conservation measures.

Alternative uses of soils such as for making bricks were recommended especially for soil types such as planosols, one of the dominant soil types in area, which is poor in nutrients and highly water logged.

Lack of laboratories to do intensive analysis of different soil parameters to know their soils and act accordingly were considered as the major bottle neck in the region. This is their first priority to do if they get any fund from government or NGOs.

**Conclusion**

The event was very successful and carried out with the full support of the university management, zonal and wereda agricultural institutions, and cooperatives. During the event the university president mentioned the full commitment of all the respective stakeholders to work closely with organizing committee in the soil health platform to bring an observable change in the region in all soil related issues. Moreover, other participants also mentioned how the event was important to create awareness among the different stakeholders about the need of healthy soil. It was a very good opportunity also to know each other and coordinate activities towards sustainable soil management. A strong recommendation also came from the participants to organize a one-day event with the slogan “soil health and deworming day” in 2016.

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## 9.7 Mekele/Wukro

This Regional Event was held on November 27-28, in two locations: Mekele, hosted by Mekele University, and Wukro, hosted by St. Mary's Catholic Vocational School and the town municipality. After the introduction of participants, welcome and opening, paper presentations from university staff and other partners on their research related to soil were presented.

**Presentation topics included:**



- Ecosystem services provided by soils, accompanied with a short film from Global Soil Forum.
- The effect of compost, inoculants, biofertilizer and chemical fertilizer on faba bean. The effect of compost on the yield significantly out-weighed the effects of other inputs.
- Physico-chemical influence of parent rock on soil fertility.
- The soil and water conservation activities of the St. Mary church.
- Experiences of smallholder farming practices by farmers in Ethiopia.

The presentations were followed by many questions and answers. There were over 80 participants from the university, NGOs and different regional offices. Over 90 percent of the participants were farmers and students from elementary and high schools. Therefore, the program was brief about technical soil issues. It was supported by the film produced by Global Soil Forum about human induced land use change.

**The challenge of urban areas is urban waste.** Therefore, waste related field visits were conducted at three locations in Wukro Town.

**First visit – Urban waste dumping site.** This is a very big area and increasing. The purpose of the visit was to show participants how far our waste is polluting cultivated areas. If we recycle our waste, we can improve our soils and crop production.

**Second visit – Wukro Town slaughter house.** At this site, the town municipality and the St Mary Church allocated a green area for planting trees and producing compost. They have planted a lot of trees and all wastes from the slaughter house and the vegetable market are collected for composting. They have made a lot of compost using various techniques including vermicomposting. However, there is no market for the compost made by the unemployed youth group.

**Third visit – Recycling and waste management at St. Mary School compound.** This school is well known for its ecological farming through integrating animal and crop or vegetable production.



*Waste deposit at Wukro*



*Compost preparation at slaughterhouse*

The last session was a general discussion. Participants agreed to continue this forum; and five persons were assigned as a steering committee. The Catholic Church Vocational School agreed to host the steering committee. There were journalists in the two locations from the regional radio and Television program. There was a total of 120 participants at this last session – farmers, representatives of agricultural offices, NGOs, University staff and students, and researchers.

These regional events were deemed very successful by all accounts.

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## 9.8 Pastoralist Land Health Workshop

70% of the landmass of the country is land used by pastoralists. During the Soil Week it was pointed out that inadequate attention was given to pastoral area soil management.

On February 27, 2016, at Top 10 Hotel in Addis Ababa, a workshop was held addressing land health issues in pastoral areas. About 60 participants from organizations working with pastoralists all over the country attended.

Informative speeches from many top-level experts and officials were made, including an opening speech by H.E. State Minister for Federal Affairs and Pastoral Development, connection to the International Year of Soils by Dr. Hailu Araya of the Soil Campaign Organizing Committee, Dr. Kidane G/Meskel on Rangeland and Soil Health, Policy with regard to rangeland soil management from Ato Wendimeneh, Minister, Federal and Pastoral Affairs, water management in dryland areas from Ulrich Bormann (GIZ), and Soil Based GHG emission source, impact on agriculture and the mitigation strategies, by Dr. Tesfaye Ertebo (Ministry of Agriculture and Natural Resources).

Participants were very engaged and happy about the events that they stayed together 3 hours after the official closing of the event (from 3pm to 6pm!), to continue sharing on the issues raised. It was commented, “It is the first time for such an event to happen – so often attention is on Addis and the highlands, but it is very critical that we look at the health of the lands in pastoral areas.”

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Dr. Hailu Araya: email: hailuara@yahoo.com, Tel: 0911246046

## 9.9 Wolayita Sodo

This regional event occurred on January 30, 2016, in Wolayita Sodo town in collaboration with Wolayita Development Association and Wolayita Sodo University.

The Southern Nations and Nationalities People’s Region is home to over 65 percent of the traditional tribes/communities in the country. Some areas of the region, Konso (UNESCO World Heritage Site) in particular, are renowned for their traditional soil and water conservation.

This regional event provided people within the Wolayita Sodo area to network and share experiences and good practices. Before the opening ceremony a 20-minute film on agrobiodiversity, by Melca Ethiopia and ABN, was shown.

**Gebremedhin Birega** of Wolayita Development Association introduced the aim of this soil day: It is based on the UN resolution to celebrate the World Soil Day and 2015 as *International Year of Soils* to create awareness about our soil. “We need the soil to serve for generations.” Gebre presented a film on vermicompost from India.

Opening speech was by **Ato Altaye Ayele**, the General Director of Wolayita Development Association. He said “there is no life without good soil, which feeds our planet.” He also continued “Our Development should be integrated with soil. We have to work together for a productive soil and society. As of now we have to continue our development work together. We have to discuss together. We are responsible for our nature.”

**Dr. Hailu Araya** presented an overview of the soil day and other practices. He showed practical examples of agro-forestry, compost, Push Pull Technology, soil maker, biofertilizer, etc.

**Dr. Fassil Gebeyehu** from ABN presented “Our seeds –our life and our soils – seeds’, the challenges and prospects of smallholder agriculture. He explained the interwoven relationship of seed and soil - the traditional practices of maintaining soil fertility as a result of nutrient recycling due to human, animal, nature, agriculture, etc. The more the smallholder farmers maintain their traditional practice, the better they treat soils because of the traditional seeds they maintain.

He asked a question: what shall we do to maintain our life?

**Fanuel, Gifole and Getachew** from Wolayita Sodo University presented the participatory evaluation of locally available OM for wheat production at Kokate-Marachere Kebele Wolayita. Dr. Fanuel started by saying “we may need a doctor, an architect, lawyer, etc. once in our life; but we need a farmer at least three times a day for breakfast, lunch and dinner.” For successful meeting of our needs, soil is very important”. The result of the soil fertility mapping showed there is a need for N, P, K, S, B, and Cu. Generally organic matter is low due to crop removal. Therefore, farmers are getting low yields.

The research was conducted by FRG (10 farmers (3F) and researchers) using different leaves (banana, *korch* and farm yard manure).

Farmers’ contribution – selection of host farmer, selection and preparation of locally available materials, cost sharing (cheaper), decision of appropriate sowing time, idea of direct application, treatment modification/mixing and proportions, experience sharing and evaluation for generally improved research quality.

**The second presentation** was on the effect of liming and phosphorous level in haricot bean ... by Mesfin, Belay and Abera. Two thirds of the soils of the Wolayita area are dominated by Nitosol. It has low yield due to soil acidity, which reduces the availability of P and basic cations. It also affects activities of soil organisms. Heavy rainfall, removal of farm products from the farms, fertilizer application (for 60 years by WADU), leaching nitrogen, etc. Therefore, liming is very important. Yield and pH from fields treated with lime and phosphorous are improved.

Then the last session was a panel discussion by 11 farmers (4F). The main topic for the panel discussion was: what are the main challenges of your soils and what effective remedies are you trying or your people are doing?

Our challenge is soils without cover. Therefore, covering the soil is very important. Soil is our education (diploma / certificate) that we learn from birth to death. Mulching is very effective and low cost. We can control flooding; compost is also very important – I have got a good result and filled my store.

I used compost mixed with fertilizer. Soil removal is like dumping our yoghurt into a river. I have got enough to give my children grow and learned they have got jobs. It is not because I am rich but I have worked in improving soil fertility. There is no way to complain that less land is not enough. This is because if we work hard small land can supply enough food for our families.

Tadesse Tantu – land was infertile and weeds were tight to pick. Now after the introduction by Kalehiwet church for integrated land management I am fertilizing the soil, which became fertile and good for weeds to be picked very easily. I got everything food and feed from my land easily. I wish I would be young again.

From Humbo Carbon project - He appreciated and thanked the organizers for seeing the importance of soil day. His area was eroded and hot. But now after conservation it became cooler and good for human being.

Almaz Ayele—she was poor lady and a mother of five. She borrowed about 10,000 Birr to take her ill child to hospital. She can't pay and feed her children. She was visiting her mother for food. I asked God "Can't a person become rich without a support from someone?" But now she is a model after she focused in soil management supported by Send A Cow.

His name - De'adis Siraenlewt/Enadgalen – he used compost, called FeresKote, and changed into controlled grazing, but later do not give more yields without fertilizer. Now after training I modified my farm but others do not want to continue.

### **The way forward**

Participants suggested continuing this kind of platform to contribute to the maintenance of our soils.

- We have to work on awareness creation and sensitization
- We have to work in documenting and dissemination of good practices related to soil
- We need to work together for our people
- We need to conduct experience sharing programs

### **Finally, participants formed a steering committee with 11 organizations**

These are:

Wolayita Sodo University  
Wolayita Development Association  
Table Development Association  
Send A Cow  
Humbo Carbon Project  
Zonal Agriculture Office  
Wolayita Zone Soil Laboratory  
Areka Agricultural Research Center

Gebremedhin Birega, 0911945616  
Dr. Hailu Araya, Email: hailuara@yahoo.com; Tel: 0911246046



## 10. Radio Outreach

Approximately 80% of the Ethiopian population is employed within the agricultural sector. Smallholder farmers are the largest group of stakeholders living in direct relationship with the soil: their livelihoods are directly influenced by the quality of their soils, and their actions directly affect soil health. As the farmers of Ethiopia are dispersed widely across the country, and they speak a wide range of languages, the Ethiopian Soil Campaign decided that radio (rather than events which require physical presence) was the best way to reach as many farmers as possible. The Ethiopian Soil Campaign developed a series of critical topics for radio coverage, and contracted *Erkab Media and Communications* to prepare radio programs on each topic in the three most widely spoken languages in the country: Amharic, Oromiffa and Tigrinya.



*Erkab Manager Sosen Tesfaye*



*Erkab Radio Producer  
Abebe Teshager*

Soil is a “hard issue” for radio, as regular discussion of the topic is too technical and scientific to have much entertainment value. Therefore, *Erkab Media and Communication* chose the ‘Radio Magazine’ format to present material on soil in an engaging way, incorporating proverbs and sayings, interviews in action, and documentary presentation techniques into the shows. A soil poem set to *mazinko* music was composed and recorded specifically for this soil health program, and used as a spacer between sections of the radio show. Rather than simply translating original content from one language to the next (which would risk losing both the authenticity of the message and the attention-grabbing power of contextualized material), unique interviews on all topics were conducted with soil experts, agricultural extension workers and farmers from different regions in all three languages.

**The topics covered in the radio show were as follows:**

1. What is Soil?
2. Soil Types and Soil Classification
3. Soil Contamination, Soil Loss, and Land Degradation
4. What is Soil Management?
5. Soil Management Technologies and Practices
6. Soil and Climate Change

Weekly radio programs addressing one topic per week were aired in all regions in the three selected languages, from January 1 to February 16. Radio stations that featured the program included: National Radio, Oromia Radio, and Mekele FM.

Response to the show was very enthusiastic: Listeners called in response to the shows, and all of the radio stations requested a continuation of the program. Because of its successful and accessible treatment of a “hard topic,” the shows were shared with other producers as a model to replicate.

Over the six-month period of preparing the Soil Health Program, the radio producers visited fields and offices to obtain interviews with farmers and soil experts. They met with farmers in happy and hard times, and they attended every Soil Campaign event. “Developing this program involved so much learning that it felt like gaining a degree,” laughed Sosena and Abebe from Erkab. They were humbled by the wisdom and expertise they found amongst the farmers they interviewed, and they became sensitized to some of the dilemmas these farmers faced.

**Next steps:** As mentioned before, there has been much interest, from farmers, radio stations and the radio producers themselves, to continue the program on soil health. The 6 topics broadcast were selected from an original list of 26 radio topics brainstormed by soil professionals from the Soil Campaign, 15 of which were researched by the producers. It would be easy to create shows on the additional un-aired topics.

In addition to radio application, some of the materials collected for the preparation of this soils program could be used for publications on Ethiopian soil health issues.

**Erkab Media and Communication** is a private enterprise that specializes in audio and video communication on issues related to health and the environment.

*Sharing with farmers in feast and famine over the course of producing the show:*

*Around September, radio producers participated in harvest celebrations with injera and tela.*

*In December, they talked to farmers badly affected by climate variability, having lost crops due to untimely rains after reaping.*

*While visiting the fields to prepare this program, one radio producer saw a farmer spraying pesticide without any protection. He invited this farmer for an interview, and offered to give him the protective mask that he happened to have in his car.*

*The farmer was aware that protection was important, but he couldn't afford to buy any. He asked the producer to give the mask to his friend for safekeeping: He could neither stop to don the mask nor give an interview, as the pesticide sprayer he was using had no “stop” button.*

**“Get your sponsor, we don’t want this program to stop!”**

*Request from radio producers for Erkab Media and Communications to continue the Soil Health Program*

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Abebe Teshager, Radio Program Producer, email: abeteshager@gmail.com

## 11. Radio Highlights

- ዛሬ አፈር እየታከመች ነው፤ በኖራ ትታከማለች፤ በእርከን ትታከማለች፤ በኮምፖስት ትታከማለች....

አርሶ አደር

- የሰው ልጅ 95 በመቶ የሚሆነውን ምግቡን የሚያገኘው ከአፈር ነው።

ፕሮፌሰር ተካልኝ ማሞ

- ይህን አገላለፅ ገልብጠን ብንመለከተው ይህ 95 በመቶ የሚሆነው የምግብ አቅርቦት አፈር መስጠቷን ብትነፍግ የሰው ልጅ ህይወቱን ለአንድ ቀን እንኳን ማራዘም ይሳነዋል።

- አፈራችንን በአብዛኛው እያጠፋብን ያለው ውሃ ነው፤ ውሃ በመሰረቱ ሊያጠፋህም ሊጠፋብህም አይገባም።

የግብርና ልማት ሰራተኛ

- ማሰብ ያለብን ከጉሊት ቲማቲም፣ ድንች፣ ሽንኩርትና ሌሎች አትክልቶች ስንገዛ የምንከፍለው ለልጣጩም ጭምር ነው። ከዚያ ምግብ ሳዘጋጅ ልጣጩን ቅሪቱን አውጥቼ የምጥል ከሆነ የምጥለው ገንዘብ ነው። ይልቁን ይህን ተረፈ ምርት በኮምፖስት መልሶ ወደ ተፈጥሮ ማራበሪያ መለወጥ ይቻላል።

ኢንጅነር ዋልተ ንጉስ ወጋየሁ

- በመዳፋችን ሙሉ ዘግነን በምናነሳው እፍኝ አፈር ውስጥ የሚኖሩ ጥቃቅን ነፍሳት ብዛት በምድር ላይ ካለው ህዝብ ብዛት በላይ ናቸው።

- የጠቋሚ ጣታችንን አንዷን አንን ወደ መሬት ውስጥ አስገብተን የምናገኘውን አፈር ብዛት ለመፈጠር 200000 ዓመት አይበቃውም ይህ አፈር በውሃ ወይም በነፋስ ለመጥፋት ግን ቅፅበት ይበቃዋል። ከዚህ አንፃር አፈር የማይተካ ሃብት ነው።

ፕሮፌሰር ተካልኝ ማሞ (ATA)

- ኢትዮጵያ የመሬት አጠቃቀም ፖሊሲ ያወጣች ሃገር ናት የትኛው መሬት ለደንና የትኛው ደግሞ ለሰብል ልማት እንደሚውል ተደንግጓል ይህን ተግባራዊ ማድረግ አለብን።

ዶ/ር ይሄነው ገብረስላሴ ከባህርዳር ዩኒቨርሲቲ

- የሰው ልጅ ጣልቃ ካልገባበት በስተቀር አፈር በተፈጥሮው የራሱን ችግር ራሱ መቋቋም ይችላል።

ዶ/ር ይሄነው ገብረስላሴ

- አንድ የደረጃ አፈር ለመጥፋት ቅፅበታት ሊበቃው ይችላል ያን ለመተካት ግን ዘመናትን ይወስዳል።

ዶ/ር ሰላም ይሁን ኪዳኔ (ATA)

- አፈር ለእኛ ሞተራችን መንቀሳቀሻችን ነው አሁን አፈራችን ለምነቱን እያጣ ነው ልናገግመው አልቻልንም

አርሶ አደር

- የእኛ ሃገር አፈር በራሱ ጊዜ በውሃ በጥብጠህ ልትጠጣው ትችላለህ፤ ቫይታሚን አለው፤ የማይቀመስ አፈር አለ ይህ ግን ለም ነው።

አርሶ አደር



## 12. Running for Soil Health

To continue to raise awareness about soil health in the International Year of Soils, a special **Ethiopian Soil Health T-shirt** was printed and worn by 40 Ethiopian Soil Campaign participants during the Great Ethiopian Run in Addis Ababa, Sunday, November 20, 2015.



We are confident that these shirts will be re-worn into the future, and thereby they shall continue to remind the public about the importance of soil health. Many thanks to Tegbaru Bellete for organizing the shirts and participation.

In addition to soil campaign participation in the Great Ethiopian Run in Addis, on Sunday 29 November 2015 there was a Great Run in Axum in which the Ethiopian Soil Campaign was very active: For the occasion, the representatives of the Regional Soil Event in Axum negotiated to cover the cost of the winners while the organizers gave coverage about the Ethiopian soil week during the whole program.



## **Part 4 – Wrap-up and Next Steps**

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## የወደፊት ቀጣይ ስራዎች

ከጥር ወር 2007 ዓ.ም ጀምሮ እስከ ታህሳስ ወር 2008 ዓ.ም ድረስ ማለትም በ አውሮፓውያኑ 2015 ዓ.ም ተደርጎ በነበረው የአፈር ዘመቻ ከነበረው የልምድ ልውውጥና ግንኙነት የመማማሩ ነገር እንዲሁም ስለአፈር ደህንነት ጥበቃ የተፈጥሩትን ተነሳሽነቶች ማስቀጠል የሚቻልባቸው መንገዶች ቢቀየሱ የሚሉ በርካታ አስተያየቶች ተሰጥተዋል። ይሁንና በአዘጋጅ ኮሚቴው የተቀመጡ ወይም ስምምነት የተደረሰባቸው የድርጊት ዕቅዶች የሉም። በአፈር ዙሪያ የሚደረገውን እንቅስቃሴ ለማጠናከር በተሰነዘረው አስተያየት ላይ ጠለቅ ያለ የመጨረሻ ውይይት የተደረገው ጥር 17 ቀን 2008 ዓ.ም የዘመቻውን አካሄድና የተገኙ ውጤቶችን ለመገምገም በተደረገው ስብሰባ ላይ ነበር።

በዚህ ስብሰባ ላይ ከተሰጡ አስተያየቶች መካከል ጥቂቶቹ

- በአፈር ዙሪያ የሚሰሩ የባለድርሻ አካላት ዐውደ ጥናት እና በአፈር ሳምንት ማጠቃለያ ፕሮግራም ላይ የተሰጡ ዋና ዋና ምክረ ሀሳቦችን በግልም ሆነ በቡድን ተግባራዊ ለማድረግ መንቀሳቀስ፤
- የተሰጡት ምክረ ሀሳቦች በባህሪያቸው ውስብስብ ናቸው። ስለሆነም በነዚህ ምክረ ሀሳቦች ላይ የሚመክር አንድ ዓውደጥናት ቢዘጋጅ የተሻለ ይሆናል (ተጨማሪ የመማማሪያና ትብብር መድረክ ለመፍጠር)፤
- በኢትዮጵያ ለግብርና ስራ ከሚውለው መሬት 70 በመቶ የሚሆነው በአርብቶ አደሩ የተያዘ በመሆኑ በአርብቶ አደር መሬት አያያዝና አጠቃቀም ዙሪያ ግንዛቤ ማዳበር፤
- እኤአ የ2015 ዓ.ም የአፈር አመት መሪ ቃል “ጤናማ አፈር ለጤናማ ህይወት” የሚል ነበር። በ 2016 ዓ.ም “ለኢትዮጵያዊ አፈራችን መልካም አያያዝ እንወትውት” የሚል መሆን ይኖርበታል፤
- ለጤናማ አፈር ከገጠሩ አርሶአደር ጋር የልምድ ልውውጡ፤ መማማሩና ትብብሩ እንዲጠነክር የፌዲራ ስርጭቱንና ክልላዊ ኩነቶችን ማስቀጠል፤
- የአፈር ጤንነት ትብብር መድረኩን ማጠናከርና ማስቀጠል።

## 13. Wrap up of the *International Year of Soils*

December 5 was declared the worldwide annual *Day of the Soil*, by the 68<sup>th</sup> UN General Assembly. Over the course of two days (December 4 and 5), the Ethiopian Soil Campaign celebrated the International Day of the Soil at EIAR in the following ways:

### On December 4: Annual Conference of Ethiopian Society of Soil Scientists, ESSS

### On December 5: Celebrating SOIL DAY with FAO and 70 different stakeholders

On December 4, about 125 professionals were present. ESSS has a great role in transforming the soil health and fertility management of this country. They shared the latest papers on topics dealing with improvement of soil health management in Ethiopia. Important issues: lime application, effects of nitrogen-fixing crops on soils, salinization after irrigation, sustainable land management (SLM) and integrated soil and water management (ISFM).



Mr. Mohammed Salih, FAO  
Deputy Representative

On December 5 there were about 100 participants. An opening speech recognizing the accomplishments in the *International Year of Soils* was given by Mr. Mohammed Salih, FAO Deputy Representative. A poem in Amharic about soil was offered by a representative of Holeta Agricultural Research Center. Dr. Yohannis Gebremikael discussed pastoralism and pastoral land management in Ethiopia, Dr. Negash Demissie of the hosting organization, EIAR/ ESSS discussed the needs of Ethiopian soils generally, and the progress made in regional events and farmer field days in the latter part of the Ethiopian Soil Campaign was shared by Dr. Hailu Araya (Mekele/Wukro and Axum), Dr. Eshetu Bekele (Debre Markos and Debre Berhan) and Mahtsente Tibebe (Holeta).

The first issue of *Wegel*, an Amharic edition of Farming Matters magazine was launched as part of the day's celebrations. The first issue of the publication was all about Ethiopian soils, in solidarity with the Ethiopian Soil Campaign. All present were given a copy of the first issue. Many comments were offered regarding future topics, and the editors, represented by Dr. Hailu Araya, encouraged campaign participants to contribute.



Participants reading the first issue  
of the *Wegel* publication





*International Day of Soils celebrated together with the  
Wrap-up of the Ethiopian Soil Campaign on December 5, 2015*



## 14. Surveying Success of the Soil Campaign

During the World Soil Day events, a survey was taken of participants' views on the success of the Ethiopian Soil Campaign. Of the 55 participants interviewed, some had been present at each category of Addis-based events:

### At which activities of the Ethiopian Soil Campaign were you present and participate?



Interviewees discussed having received a range of benefits from participating in the Ethiopian Soil Campaign:

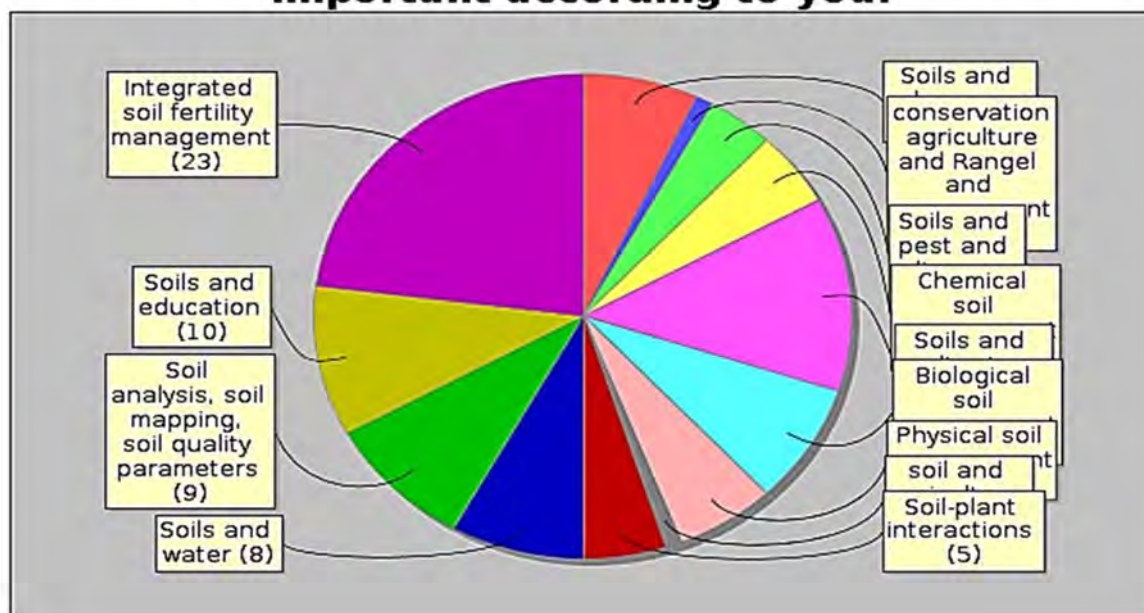
96% of interviewees said that they gained new knowledge by participating in the Soil Campaign.

### In general, what lessons or benefits did you acquire by participating in the Ethiopian Soil Campaign?



In selecting the most important topic addressed during the campaign, most (23%) top-rated “Integrated Soil Fertility Management (ISFM).” The second most top-rated topic was “Soils and Climate Change” (by 13% of participants). Third most top-rated topic was “Soils and Education.” “Soil analysis,” “soils and water,” and “soils and nutrition” were the fourth, fifth and sixth most selected topics.

### Which topic during the Soil Campaign was the most important according to you?



The topics least well covered, requiring more attention in the future were suggested to be:

Biological soil management	14%
Soils and climate change	13%
Soils and water	13%
Soils and human nutrition	12%
Chemical soil management	12%
Physical soil management	7%
Soils and education	7%
Soils and pest and disease control	6%
Integrated soil fertility management	6%
Soil-plant interactions	4%
Soil analysis, soil mapping, soil quality parameters	4%
disadvantages of organic matter (compost)	1%

A wide selection of suggested improvements to the campaign were offered:

Information beforehand	17%
------------------------	-----

Time utilization	16%
None of the above	11%
Selection of paper presenters	11%
Selection of discussion topics	10%
Facilitation of events	9%
Selection of visiting sites	7%
Registration process	6%
Transportation arrangement	5%
Per diem	1%
Must consider the pastoral areas	1%
Confirmation of speakers for events, meals for students	1%
Collaboration of other education institutes	1%
Payment complaint	1%
More involvement of farmers	1%
More participatory presentations	1%

**100% of participants interviewed said that they would like to be involved with soil events in 2016**



*Environmental Science Students from Hope College of Business, Science and Technology conducting Akvo knowledge-flow interviews to collect participant feedback on the success of the Soil Campaign.*

## 15. The Way Forward

Many suggestions were given regarding ways to continue to benefit from the knowledge exchanges, the networks and concern for soils developed over the course of the 2015 Soil Campaign. The secretary of the Soil Campaign organizing committee has noted them in a Concept Note for SOIL CAMPAIGN follow-up to the Minister of Agriculture. However, no course of action has been agreed or planned as yet. The last suggestion, to strengthen the soil platform, was discussed in most detail at the evaluation meeting of January 26, 2016, held in Asham Africa Hotel, Debre Zeit / Bishoftu.

### **Suggestions include:**

- ✓ Individually and collectively work to implement the top recommendations of the declaration from the Stakeholder Workshop and from the Soil Week Wrap-up.
- ✓ Each of the recommendations are of a rather complex nature, so it would be beneficial to host a separate workshop (to do more joint learning, collaboration and planning) on issues relating to each recommendation.
- ✓ Work to create more awareness around pastoral land management, as pastoralist land is 70% of Ethiopia's agricultural land.
- ✓ In 2015 the motto was “Healthy soils for healthy lives,” in 2016 it could be “Support for (good treatment of our) Ethiopian Soils.”
- ✓ Continue the radio show and regional events to have ongoing learning and sharing and network building for soil health with rural farmers.
- ✓ Continuing and Strengthen the Soil Campaign Committee. Ideally such a platform would have a formal linkage to the Ministry of Agriculture and Natural Resources. A formal group of stakeholder representatives such as from ministries and institutions could be the steering committee.
- ✓ Perhaps different stakeholders (decision makers and policy advisors, versus more grassroots actors) need different platforms to share and work on soil health.
- ✓ Continue the 2014 Soil Health Platform as a working and exchange platform of professionals and practitioners, also called Innovation Community, for professionals to meet and exchange knowledge, create synergy in their work, approach, manuals etc., with an agenda to mainstream good Soil Health management practices in Ethiopia AgriProFocus proposes to continue to facilitate this platform in partnership with other stakeholders. Next to physical meetings, AgriProFocus boosts an *online* platform where professionals from all over Ethiopia can be a member and so exchange discussions online.
- ✓ The State Minister wants to establish a platform for soil, similar to the small scale irrigation platform.
- ✓ The regions would like to have regional platforms to share and connect on issues of soil health.
- ✓ Perhaps such platforms could be nested within the National Soil Institute that the Ministry of Agriculture is starting up.



**Expectations from a platform for soil health management:**

- A platform is a meeting place between government and civil society, community based organizations and research. A platform is good for making a difference, leveraging manpower, skills and funds where they may be scarce for addressing issues like soil health.
- A platform is preferable to a consortium or network organization, which needs to be legalized. We need a platform that is established by the government, with the MoANR (the State Minister) as chair. We do not need to be registered but we need to be recognized as a useful platform.
- The platform discusses various issues and can bring issues to the government, as policy advice
- The (secretary of the) platform can organize meetings on the required topics, and depending on what happens at those meetings, projects can be formulated and started.
- “The platform should be like water: a membrane on the surface, and under that surface, various molecules cluster for the purpose of a project, but not forever, only for the time of the project. The platform should offer us a space where we can connect with others to be the change and be part of the change, like a learning center; not static, but like a contained river flow.”

## 16. Thanks to Organizers and Contributors

The *Ethiopian Soil Campaign* was organized by a consortium of organizations and institutions involved in soil health management. With top leadership from the Ministry of Agriculture and Natural Resources, a series of other Government Ministries and various organizations came together to collaborate around the planning and delivery of the campaign.

- The campaign was only possible from the in-kind and financial contributions from a diverse array of parties, including but not limited to the following list. We heartily thank all involved for their precious contributions.
- Ministry of Agriculture and Natural Resources
- Ministry of Environment, Forest and Climate Change
- Agricultural Transformation Agency
- AgriProFocus Ethiopia and AgriProFocus Netherlands
- Institute for Sustainable Development (ISD)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Institute for Advanced Sustainability Studies (IASS)
- Tufts University, Agriculture Knowledge Learning Documentation and Policy (AKLDP) Research Fund
- EIAR and its regional institutes
- Ethiopian Society of Soil Scientists
- Melca Ethiopia
- National Soil Testing Centre
- Food and Agriculture Organization of the United Nations (FAO)
- Horn of Africa Regional Environmental Center and Network (HoA-REC&N)
- Several Universities (Adama University, Addis Ababa University, Aksum University, Hawassa University, Hope College of Business Science and Technology, Jima University, Mekelle University, Wolaita Sodo University, Wollo University)
- Individual Soil Health Professionals

### **Ethiopian Soil Campaign Steering Committee Members:**

- Ato Mesfin Birhanu (Chair) - Ministry of Agriculture and Natural Resources
- Ms. Jelleke De Nooy (Secretary) – AgriProFocus
- Dr. Tesfaye Ertebo – Ministry of Agriculture and Natural Resources
- Sue Edwards – Institute for Sustainable Development
- Dr. Hailu Araya – Institute for Sustainable Development
- Dr. Georg Deichert – Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Mr. Tegbaru Bellele – Agricultural Transformation Agency
- Dr. Eshetu Bekele – Adama University
- Mr. Waltenegus Wegayehu – Civil Engineer, working on sustainable Solid Waste Management and Urban Agriculture
- Ms. Sarah Assefa – Hope College of Business Science and Technology
- Ms. Heran Tadesse – AgriProFocus

*“God made you from the soil  
and he will return you there”  
- Genesis 3:14*

“እግዚአብሔር ከአፈር ፈጥሮህል  
ወደዛውም ይመልስህል”  
(ዘፍጥረት 3:14)

*“Allah made you grow from  
the soil, and to the soil he  
shall return you”  
- Surah 71 17-18*

“አላህ ከአፈር አሳድኝህል ወደ አፈሩም  
ይመልስህል”  
(ሱራህ 71 17-18)



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and Natural Resources



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Addis Ababa Science & Technology  
UNIVERSITY



Ministry of Environment,  
Forest and Climate Change



Ethiopian **ATA**  
Agricultural Transformation Agency



— Partners of the Ethiopian Soil Campaign —

