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Alliance Bioversity and CIAT



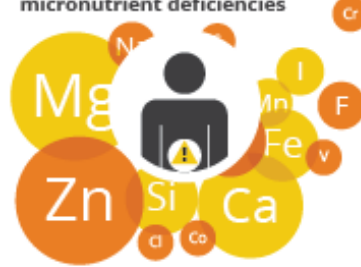
GLOBAL SYMPOSIUM ON SOIL BIODIVERSITY | 19-22 April 2021

The Challenges

- Our planet – both humans and the natural world – faces four global crises: climate change, biodiversity loss, environmental degradation, and the so-called triple burden of malnutrition – hunger, nutrient deficiencies, and overnutrition.
- These four crises are interlinked and tied in with food systems, with agriculture and related land uses accounting for 23 percent of human greenhouse gas emissions and a major driver of loss habitat and biodiversity.

Malnutrition crisis

2 billion people suffer micronutrient deficiencies



More than 2 billion people are affected by hidden hunger, meaning that they suffer from micronutrient deficiencies.

Obesity increase



Worldwide obesity has nearly tripled since 1975.

Biodiversity crisis

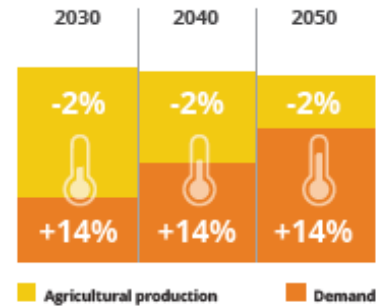
Out of +6000 plant species

>200 make major contribution to food production
9 account for 66% of total crop production



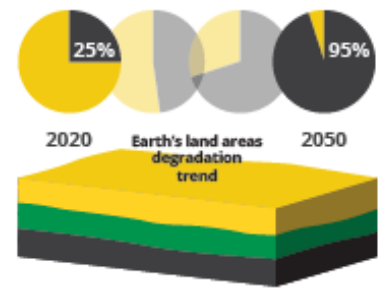
While over 6000 plant species have been cultivated for food, fewer than 200 make major contributions to food production and only nine account for 66% of total crop production.

Climate crisis



Climate change projections estimate that every decade until 2050, agricultural production will reduce by 2% while demand will increase by 14%.

Land degradation crisis



Nearly a quarter of the world's agricultural land area has been degraded. If this trend continues, 95 percent of the Earth's land areas could become degraded by 2050.

Call for change

- **FAO:** Biodiversity for food and agriculture is indispensable to food security, sustainable development and the supply of many vital ecosystem services, but many key components of biodiversity for food and agriculture at genetic, species and ecosystem levels are in decline.
- **CBD:** Transformations need to be achieved in the production of goods and services, especially food. This will include adopting agricultural methods that can meet growing global demand while imposing fewer negative impacts on the environment



Call for change

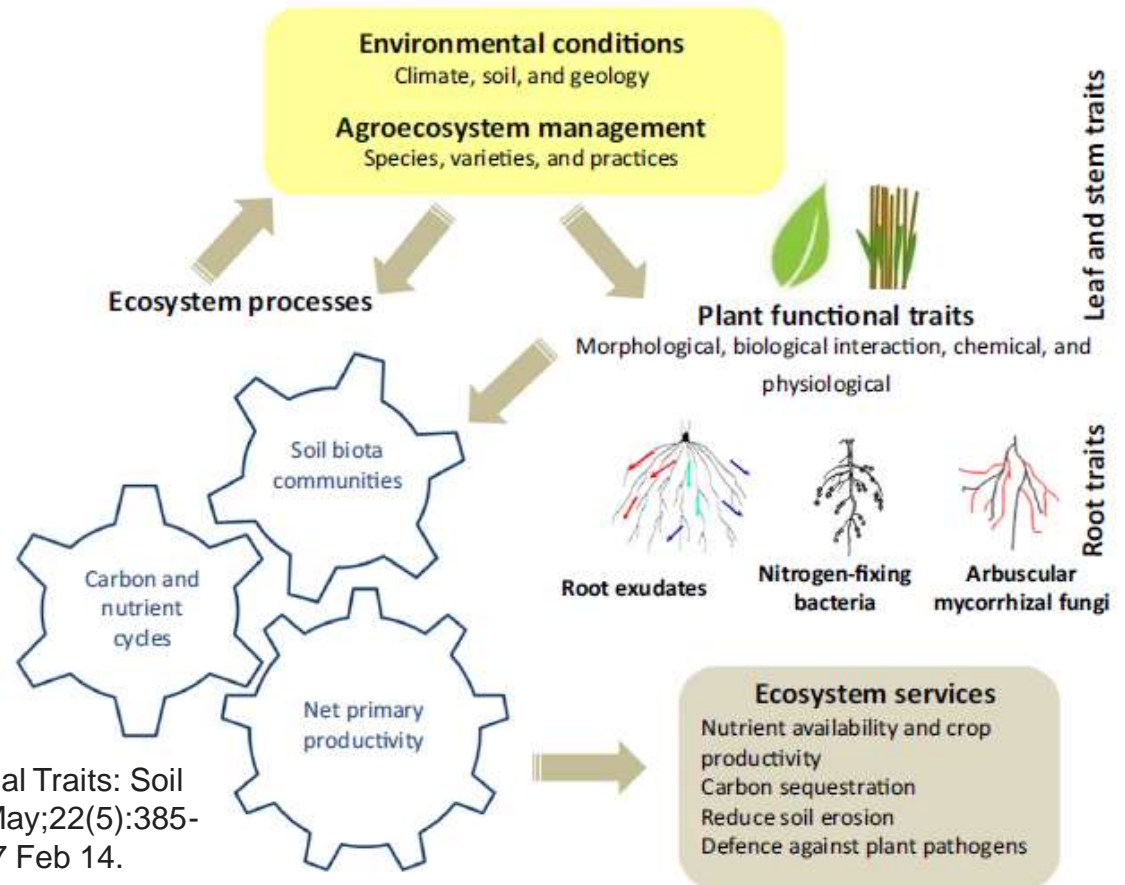
- **WEF:** There is no future for business as usual – we are reaching irreversible tipping points for nature and climate, and over half of the global GDP, \$44 trillion, is potentially threatened by nature loss
- **IPES-Food:** We need ‘a fundamentally different model of agriculture based on diversifying farms ... replacing chemical inputs, optimizing biodiversity and stimulating interactions between different species, as part of holistic strategies to build long-term fertility, healthy agro-ecosystems and secure livelihoods



Ecosystem Services

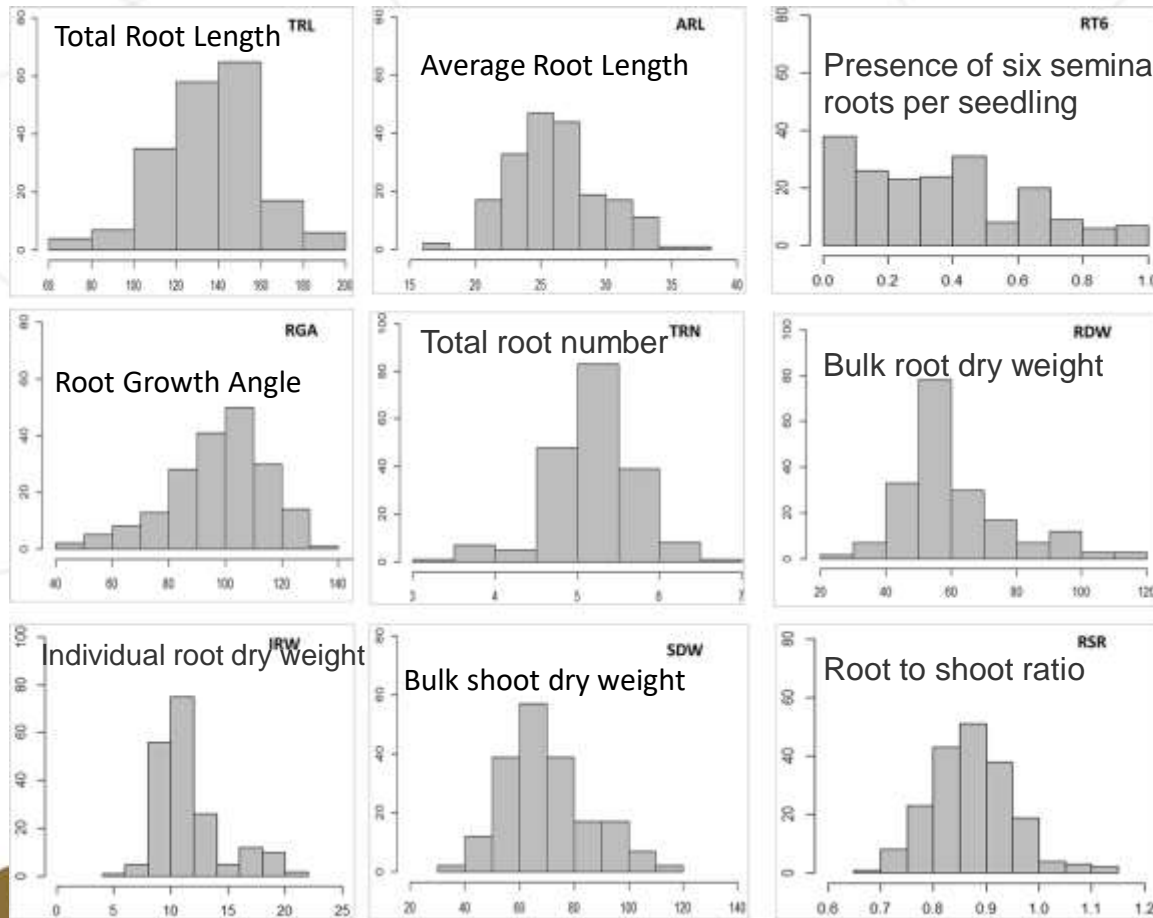
Relevant ES:

- Soil fertility
- Food production
- Crop protection
- Mitigation of climate change
- Soil and water conservation



Faucon MP, Houben D, Lambers H. Plant Functional Traits: Soil and Ecosystem Services. Trends Plant Sci. 2017 May;22(5):385-394. doi: 10.1016/j.tplants.2017.01.005. Epub 2017 Feb 14. PMID: 28209328.

The above ground perspective.



From Alemu, A., Feyissa, T., Maccaferri, M. *et al.* Genome-wide association analysis unveils novel QTLs for seminal root system architecture traits in Ethiopian durum wheat. *BMC Genomics* **22**, 20 (2021). <https://doi.org/10.1186/s12864-020-07320-4>

Soil and the nutrition crisis

Soil the foundation of nutrition

2015 International Year of Soils
fao.org/ia-2015

Role of 18 nutrients necessary for plant growth and human health

Soil macronutrients: N, P, K, Ca, Mg, S, C, H, O

Soil micronutrients: B, Cu, Fe, Mn, Mo, Na, Si, Zn

Plant Growth Benefits:

- Promote plant growth
- Increase winter hardiness
- Involved in photosynthesis
- Increase disease resistance
- Reduce plant respiration
- Promote root formation and growth
- Increase water-use efficiency
- Stimulate microbial activity
- Promote nodule formation on legumes
- Involvement in carbohydrate metabolism and translocation of starches
- Promote reproduction
- Aid in maturation of photosynthesis from leaves to fruiting organs
- Activate an O₂ carrier
- Fruit formation
- Quicken maturity
- Fruit quality
- Fruit flavour
- Seed formation
- Seed quality
- Enhance maturity of small grains
- Act in enzyme functionality and plant use of Fe and P
- Responsible for enzyme activity
- Helps enzyme activity and increases the availability of P and Ca

Human Health Benefits:

- Plays a key role in brain and muscle function
- Contributes to perception of taste
- Needed for immune system health
- Key component of protein
- Essential for muscle and nerve activity
- Important in immune system health, blood clotting and pressure regulation
- Component of proteins, DNA, RNA and blood
- Promotes digestive process
- Maintains acid-base balance
- Needed for proper fluid balance
- Essential for fetal development and functioning of reproductive system
- Key component of enzymes
- Helps deliver oxygen to the tissues
- Important for healthy bones
- Component of enzymes, DNA, RNA, proteins and promotes immune system health
- Component of enzymes and involved in fermentation

Soil Degradation Consequences:

- Soil degradation leads to the loss of soil micro and macronutrients
- Nutrient-poor soils are unable to produce healthy food with all the necessary nutrients for a healthy person
- Over 2 billion people suffer from micronutrient deficiencies

Soil Management Practices:

- Reduce erosion
- Ensure crop rotation
- Keep soil surface covered
- Minimize tillage
- Increase soil organic matter content

Sustainable soil management for healthy soils, healthy food and healthy people

Healthy soils for a healthy life

Food and Agriculture Organization of the United Nations
With the financial support of the Russian Federation



Conclusions

- Better understanding of the relationships between plant functional traits and agroecosystem processes and services
- Better understanding of how functional diversity influence agroecosystem processes and services, including from genetic diversity and crop rotation and intercropping
- Better understanding of soil biodiversity management to improve human nutrition





**Thank you for
your attention**