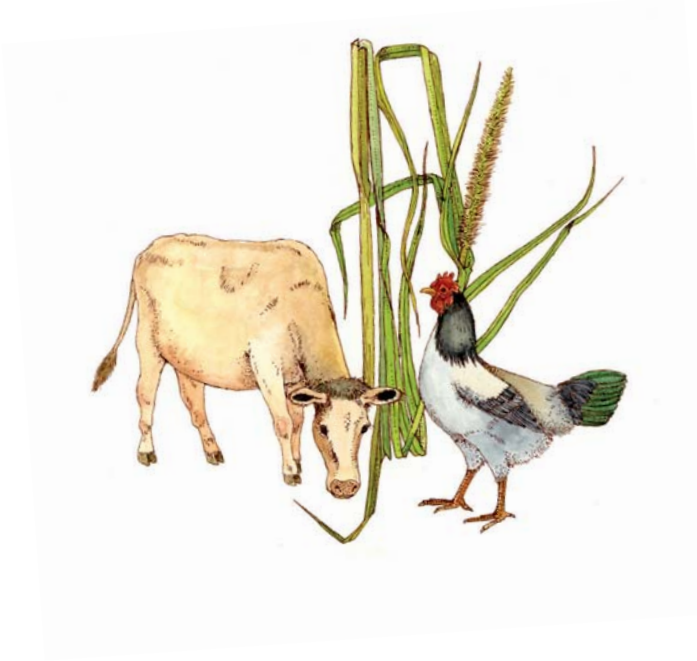
MORNING PLENARY



Agroecology and the Transformation of Global Food Systems

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Agroecology is the participatory action and change that brings sustainability, security, equity, and resilience to all parts of the food system - from ecological, to economic, to social components. To do this, agroecology must simultaneously function as a science, as productive practice, and as social change. With a foundation in ecosystem science, the agroecosystem becomes a purposeful system where humans design and manage food systems with sustainability as the ultimate goal. A process for guiding and evaluating the changes needed to transform food systems using agroecology is described.

Food security and ecosystem services in a changing world: it is time for agroecology

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Most of the agricultural land in the world is currently producing below its capacity (e.g., van Ittersum *et al.*, 2013). At global scale, however, the average yield of most major crops has increased steadily over the last 50 years (FAO, 2012). Such growth has been unequal across the world and today's productivity tends to be the lowest in the poorest regions of the world, where food is most needed, and even lower for the least resource-endowed farmers at any given location (Tittonell and Giller, 2013). Although, globally speaking, the world produces enough food calories to feed everyone (2700 Kcal person-1 day-1 produced vs. 1800 to 2100 Kcal person-1 day-1 required – WHO, 2013), food production per capita remains at the same level as in the 1960s in the least favored regions of the world (WFP, 2012). In such regions, inadequate models of agricultural development coupled with increasing (settled) population densities in rural areas led to severe degradation of the natural resource base. Most farmers in these regions do not have access, cannot afford or are unwilling to adopt 'modern' agricultural technologies. Such technologies were not developed to fit their reality of their systems and their environment and hence they are ineffective at increasing crop and livestock productivity. In the most affluent

regions of the world, by contrast, agricultural intensification through the use of inputs in excess of what their factor elasticity would dictate led to environmental pollution with often noxious consequences for human health and high costs for society as a whole (costs that are never internalised in the price paid for the agricultural produce). Climate change further threatens both food production and environmental risks in the South and in the North. The time has come to rethink our current agricultural model, one that has been conceived to address the world's problems in a completely different historical context. It is time for a new agricultural model that ensures that enough quality food is produced where it is most needed, that preserves nature and that delivers ecosystem services of local and global relevance. It is time for agroecology. I will explore this concept as put forward by different schools of thought around the world, and provide evidence from science, practice and policy on the potential of agroecology to propend to restorative, adaptable, inclusive and resource use efficient agriculture.

Enhancing the function and provisioning of ecosystem services in agriculture: agroecological principles

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Agroecology is essentially based on the use of biodiversity and ecosystem services in agriculture production, and thus represents a true rupture with the way agriculture has been seen and analyzed by mainstream science for over a century. AE does not have a consensual definition, but it represents a new conceptual space in which to think about agriculture sustainability through strong interactions between science and society with a wealth of new concepts, questions and tools. Among the diverse "incarnations" of AE, the lowest common denominator is found at plot level. The basic and common principle is to enhance the services provided by living organisms, taking the optimal advantage of natural resources, especially those which are abundant and free (sun radiation, air carbon and nitrogen, rainfall). AE aims to increase production in a sustainable and resilient way that will maintain and improve the ecosystem capital in the long term. It will pilot functional biodiversity above and underground, over space and in time, by both intensifying biological cycles for nutrients, water and energy, and controlling aggressors of crops. Because ecosystem services are involved, AE has long been working on larger scales (farms, landscapes, watershed basins, value chains, food systems). It has been extremely interested in inter-disciplinary research questions, in particular about some of the drivers of agriculture evolution such as food industries and distribution, consumer health, public policies, etc. Furthermore, since AE strongly depends on locally available natural resources including agro-biodiversity, it does not prescribe ready-to-use technical packages to farmers. The models and solutions are built mingling scientific and traditional knowledge and strongly relying on local learning and innovation processes. With the many challenges ahead, AE represents a true alternative for agriculture transformation but it questions the role and practices of agriculture research and calls for a significant renewal.