



# Plenary speeches

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# Agroecological transformation of tropical livestock production through improved forages and silvopastoral systems

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Livestock production and consumption of animal foods around the globe are currently under scrutiny, as consumers usually associate these activities to the environmental damage largely caused by extensive cattle ranching and deforestation. However, a change in the narrative is gaining track among key stakeholders giving more visibility to the how livestock foods are produced, differentiating extensive and sustainable cattle raising. Using examples from the tropical belt it can be demonstrated that sustainably managed forages with different strata (e.g., silvopastoral systems) can contribute to all the agroecological principles, mainly recycling, input reduction, soil health, animal health, biodiversity, synergy, social values, and economic diversification. Silvopastoral systems, based in improved forages, have been largely acknowledged for the potential to contribute to climate change mitigation and adaptation. Improved feeds based on mixtures of grasses and legumes (usually local genetic resources) influence modulating the ruminants' digestive microbiota, and hence reduce enteric methane emissions per unit product (kg meat/L milk). Moreover, in a global N fertiliser shortage, agroecological livestock production through silvopastoral systems benefit from the legumes capacity to fix N, with estimates ranging from 80 to 600 kg N per hectare per year, which avoids about 4.5 kg CO<sub>2</sub>eq per kg N than if applied via fertiliser. Currently, diverse technologies have been proposed pointing for sustainable livestock production, however, silvopastoral systems stand out among them for the potential contribution to all agroecological principles, increasing livestock productivity while providing ecosystem services, including reduction of the carbon balance of the system.

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## Agroecology as a path in the face of chemical dependent agriculture

LARISSA MIES BOMBARDI

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With the worldwide economy, particularly after World War II, agriculture started to take on a global scale, not only in the sense that a significant part of the agricultural production started to be globally commercialised, becoming a commodity, but also because it began to become dependent on chemical industries of fertilisers and pesticides and, more recently, on patented seeds. The industrialisation of agriculture – which allowed agricultural production to be carried out on a very large scale and in a homogeneous way – became known as the “Green Revolution” and had, as a justification for its implementation, the promise of overcoming hunger, through the use of technology. However, more than half a century has passed and, even so, the only constant still is hunger. Currently, the number of hungry people in the world has increased. In 2020, from 9.2 % to 10.4 % of the worldwide population faced hunger.

Not only has hunger increased, but, in addition, the environment and human health have been intensely contaminated by chemical substances used in agriculture.

To look at the human and environmental tragedy resulting from this agricultural model, let us focus on Brazil, the country that is the largest worldwide exporter of soy, beef, sugar, coffee and orange juice, among other products. In Brazil, the emblematic expansion of soy – which currently covers an area equivalent to the entire territory of Germany and whose production has grown exponentially – shows us how devastating the monoculture expansion scenario for exportation is.

Between 2010 and 2020, the use of pesticides in Brazil substantially increased by 78.3 %. As a consequence of this increase, we are witnessing chemical violence, oftentimes indirect, silent and subtle, which arises as an unfolding of the aforementioned Green Revolution.

Facing the model imposed by the Green Revolution, which reveals itself to be external, homogenizing, dangerous and colonialist, agroecology appears as an alternative, proposing changes to the way economic processes unfold.

The need for a progressive transition to the path of agroecology is urgent. Otherwise, we will continue on a route that will result in a collision against ourselves.

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## **“It’s the economy, stupid”:** Why a 1980s American political slogan is a perfect illustration of the drivers for restoration in the Sahel

PATRICK WORMS

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The vast drylands of Africa’s Sahel region stretch from Mauritania and Senegal in the west to Eritrea and Djibouti in the East and are home to hundreds of millions of people, mostly farmers and pastoralists. Land use systems appear to have been adequate and sustainable for many centuries but were profoundly damaged by colonialism and the subsequent rise of the regulatory state, which emasculated evolved natural resource governance systems. Rapid population growth, serious droughts in the 1970s and 1980s, and maladapted regulatory systems and development priorities have led to a rapid degradation of land and ecosystem health indicators, the progressive worsening of rural livelihoods and a concomitant rise in outmigration and banditry. We propose a number of conceptual principles to apply in the effort to restore these landscapes to high ecosystemic productivity at scale, taking into account the range of modelled changes to local climates. Informed by decades of research and partnerships with development efforts across the region, these principles ask practitioners, regulators, donors and researchers to consider contexts, incentives and drivers, land, tree and livestock management strategies, scale, and nested regulatory and economic governance systems.

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# Crops and cropping systems

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# Crops and cropping systems I

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## Crop diversification under climate change: a comparative assessment in Ghana, Burkina Faso, Ethiopia and Niger

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Diversified farming systems as an agroecological measure maintain functional biodiversity at multiple spatial and temporal scales in order to be productive, resilient and efficient. However, the potential for transforming or maintaining diversified agricultural systems depends on the ability of the selected crops to be sustained under the climate of the specific areas they are grown. Climate change can affect the ability of one or more crops to grow within specific niches and thereby reducing their potential to be part of a crop diversification strategy. In this study, we assessed the agro-climatic suitability of four major food crops in Ghana (maize, sorghum, cassava and peanut), Ethiopia (maize, sorghum, teff and wheat), Burkina Faso (maize, sorghum, cowpea and peanut) and Niger (maize, sorghum, cowpea and peanut) under current and projected climatic conditions using the ECOCROP crop suitability model. We find that suitability for four crops will decrease in Burkina, Ghana and Niger, while it will increase only in Ethiopia with the magnitude dependent on the climatic scenario. Positive changes in suitability are also projected for three crops in Ghana (up to 26.3%) and for Ethiopia (up to 7.7%), while in Burkina Faso area suitable for three crops will decrease (up to -36.8%) and remain relatively unchanged in Niger ( $\approx 1\%$ ). Instead, areas that are suitable for only one crop will increase in Burkina Faso, Ghana and Niger, while it will decrease only in Ethiopia. We therefore conclude that the potential for higher crop diversification will be negatively impacted by climate change. The impacts will vary within and across countries and thus, will influence planning for scaling up diversification as an agroecological measure.

**Keywords:** Climate impacts, crop suitability, farming systems, food crops, multiple cropping

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