Low emissions agriculture in Asia: Cross cutting themes and perspectives for systemic sustainability.

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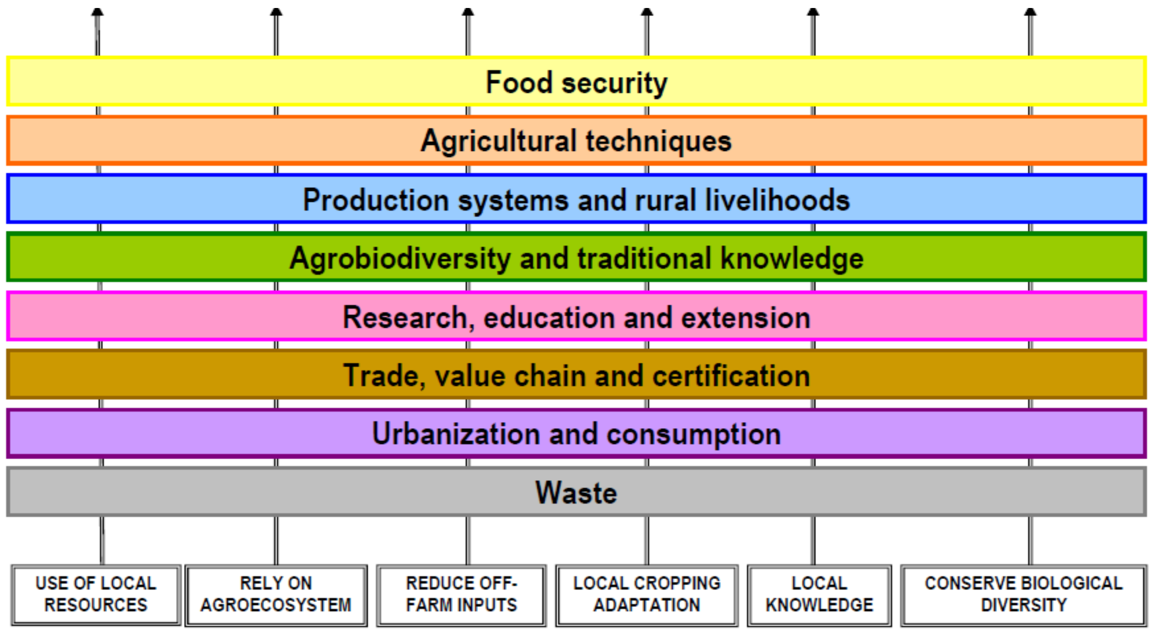
VISION

*Agriculture, in Asia and globally, is at a crossroads, largely affected by climate change while at the same time being an important driving force of it. Yet agriculture can also be an **integrative solution,** tackling both mitigation and adaptation while contributing to broader developmental goals. Realizing the potential of agriculture requires a paradigm shift that embraces **systemic thinking**, moving from applying quick fixes to partial problems, to effecting deep transformations that result in the enhancement of the multifunctionality of agroecosystems. Thus **addressing emissions in agriculture requires adopting a systemic approach, as opposed to focus primarily on climate, enhancing multifunctionality across mosaics of production** that deliver a bounty of agroecological goods and services (UNCTAD 2013).*



Towards low emissions agriculture in Asia: from agroecologial principles to a systemic vision through cross cutting themes.

Farming practices

Overall conventional agriculture is optimized for industrial scale of production and presents serious environmental (and social) challenges including intensive energy and water use and GHG emissions (IAASTD, 2009). Transitioning towards a systemic approach from planning to implementation requires different set of optimization characteristics – e.g. low emissions (or even carbon sequestration), climate change resilience, regional food security, job creation, poverty reduction, etc. – and may suggest a largely different set of farming practices than those of the conventional paradigm (IAASTD, 2009).

Moving away from compartmentalized, single-function land-use to systemic, multifunctional land-use based on ecological rationale can tackle many of these challenges at once, while maintaining or increasing production and leaving room for further improvements (HRC, 2010). This new agricultural paradigm draws on multi-disciplinary scientific research ranging from ecology to soil science to anthropology, and incorporates conventional and alternative agricultural advances, while rediscovers and integrates some remarkably sophisticated management techniques of various traditional agricultural systems.

Mitigation potential for agriculture (89% according to IPCC) lies in carbon sequestration and fixation in soils achieved through the application of soil-building agroecological techniques (HRC, 2013). Emissions can also result from changing agronomic practices, the adoption of integrated pest management, livestock integration and agroforestry (Godfray et al., 2010).

Conventional monocultures have much to gain from this systemic reorientation. Promising techniques like Sustainable Rice Intensification (SRI) claim 20-50% greater yields, 30-50% less water, 20-100% less chemical fertilizer than conventional methods (Oxfam, 2010). However, even greater potential may lie in intentionally mimicking some of the complexity of natural systems by taking advantage of spatial, temporal, and ecological niches, it is possible to stack multiple forms of production into the same land area, decreasing the

Farming practices (cont.)

need for outside inputs to deal with weeds, pests, and fertility, while increasing energy efficiency, water efficiency, and total production output (HRC, 2010). “Intercropping” can make use of facilitative relationships between plants to protect soils from erosion, reduce risk to farmer of total crop loss, control weeds and pests, and provide “smart” nutrient supply automatically regulated by plants themselves to match other environmental conditions (Machado, 2009). The study of agroforestry contains numerous further examples such as use of nitrogen fixing trees to provide carbon-sequestering perennial fertility enhancement (HRC, 2010).

Growing coffee in the understory of complex multistrata perennial crop systems has been found to maximize coffee yield and quality while minimizing pests (Staver et al., 2001)

Similarly, integrating animal systems with crop and other systems produces high-value protein sources while simultaneously addressing problems such as weeds, pests, and feed provisioning in a more energy- and land-efficient manner. Successful combinations include fish and/or ducks in rice paddies, cows in oil palm and coconut plantations, pigs and chickens in food waste recycling, and more (HRC, 2013; Oxfam, 2013; Wong and Moog, 2001).

Coconut yields increased 20% in Sri Lanka with cattle grazing under them. Oil palm yield similarly increased by 17% with cattle. There are over 210 million ha of tree crop plantations in SE Asia, most of which do not have integrated animal systems (Wong and Moog, 2001)

Looking at agricultural areas from a systemic perspective opens up new planning and implementation opportunities. Degraded landscapes and damaged watersheds become future opportunities as opposed to past losses. Marginal landscapes stand out as misused and misunderstood, but with great potential. Robust biodiversity and ecosystem services become possible even amidst intensive production through considering the landscape as a diverse mosaic of interlinked, positive-sum parts (HRC, 2010; FAO 2010; Lu et al. 2012).

Better pasture management and grassland rehabilitation in particular, should stand out to those concerned about carbon emissions. Grasslands cover about 3.5 billion ha of land worldwide (i.e. 70% of agricultural land and 26% of all land in total), of which at least 270 million ha have been degraded to some degree, usually by human mismanagement such as overgrazing (FAO, 2010). Less carbon is stored in grasslands per unit area, but due to the sheer size and extent, they are estimated to store nearly 50% more carbon than forests globally (FAO, 2010). Conversion of grasslands to cultivated crops tends to reduce this carbon storage by an average of 60% (FAO 2010). Seeking emissions reductions, there is potential to not merely slow this conversion, but also restore degraded grasslands and sequester significant amounts of carbon through improved grazing management. Global sequestration potential is estimated as high as 0.2-0.8 giga tonnes per year by 2030 (IPCC, 2007).

Production systems and rural livelihoods

High population density, smallholder-led farming and a shift from subsistence to commercial production are present in many parts of Asia. Although combined productivity (and per unit of energy use) is generally higher in small-scale diverse

The Loess Plateau Watershed Restoration project restored watershed and ecological functionality to over 10,000 sq km of degraded land in central China through advanced terrace building, mini-dams, and “green hat, green belt, green boots” re-vegetation of marginal areas, in the process tripling incomes for local people and sequestering over 35 megatonnes of carbon (Lu et al., 2012)

significant potential for increased productivity, lower production costs and reduced use of external petroleum based inputs in Asia (IATP, 2011). However, such production systems need to be fostered through farmer empowerment and an enabling policy environment. Improved value chains, infrastructure, legal frameworks, viable business opportunities, and technical and financial support can play an important role for increasing smallholders’ yields and income through sustainable low-emissions agriculture (IFAD, 2013).

Farmers’ organizations throughout Asia provide support for smallholders, including engagement with sectoral and commodity chains, allowing them to better plan and manage their productive activities (AFA, 2011). For example, various organic movements have emerged providing training, certification and a link to consumers, supporting ecologically sustainable and economically profitable alternatives to conventional production (IATP, 2011).

Food security

Despite recent improvements, hunger and food insecurity remain unsolved globally, and especially in South Asia (FAO 2009). Thus addressing emissions from agriculture requires careful consideration of food security tradeoffs. Producing more food from the same area of land while reducing environmental impacts, including emissions – usually referred to as "sustainable intensification" – must be sought. Food security concerns should be incorporated into biofuel production, if possible avoiding food crops for fuels. Non-edible biofuel feedstock options are limited (e.g. jathropa). Asia has an important amount of jatropha cultivation and it is expected that by 2015 the total acreage will increase up to more than 9 million hectares. Pro-poor support schemes to rehabilitate wastelands and outgrower schemes have shown potential to deliver additional income to small farmers (WWF, 2008).

Biodiversity and traditional knowledge

Agricultural growth in Asia has stagnated in recent years. In addition to declining rates of increase in yields, the mechanization, irrigation, and increasing dependence on petroleum-based inputs has been accompanied by a loss of biodiversity as many indigenous crops have been replaced by monocultures of high-yielding varieties (Novotny et al. 2009).

Yet, agricultural biodiversity can be managed for the optimization of low-emissions agricultural production alternatives. Diversification of crop and genetic variety has the potential to improve farm system efficiency through the enhancement of natural soil fertility, maintenance of biological processes and complementarity between plant-animal species with better use of resources and biological regulation of pests etc. – reducing the need for off farm inputs (FAO, 2003; Altieri 2012).

Based on an ecological rationale, traditional and indigenous communities throughout Asia utilize agricultural biodiversity in agricultural systems developed on a landscape level by integrating soil, water, animal and plant management (PAR, 2010). Derived from generations of empirical experience, such traditional knowledge systems inform a variety of long-standing examples of successful, flexible, energy efficient and low carbon-emitting agricultural production systems (Galloway McLean, 2010; Altieri 2012).

Characterized by both biological and cultural diversity, Asia is home to 60-70% of the world's indigenous peoples (Trosper, 2012). Its agrobiodiversity and associated traditional knowledge hold significant potential to be utilized and upscaled to provide solutions for mitigation and adaptation measures to climate change in the region. As a response to current climatic variability, practices such as restoration of traditional rainwater harvesting systems, and increased cultivation of indigenous crop varieties (especially fast maturing and drought and flood resistant types) are being utilized across Asia (BI, 2010; Galloway McLean, 2010). Recognizing this potential, efforts are being made to expand cross-cultural dialogue to preserve and increase understanding of traditional knowledge systems and livelihoods in the context of climate change.

Research, education and extension

Realizing a paradigm shift in agriculture that departs from our current fragmented understanding of problems and solutions, towards a systemic, integrated approach requires communities of practice that are able to study, design and manage multifunctional agroecosystems successfully, across disciplines and in collaboration with a variety of stakeholders.

Although in recent years the offer of degrees and short courses incorporating systemic agroecological approaches has notably increased worldwide, a conventional agronomic vision is still mainstream across well-established research and education institutions. Likewise, extension services that can provide systemic solutions to agricultural problems faced by farmers and rural communities are not widespread, often only accessible for a minority at a significant cost.

The importance of having appropriate research, education, and extension networks that enable a transition towards systemic agricultural sustainably is often overlooked at different levels – from governments to multilateral institutions, which contributes further to the current lack of professionals able to deliver appropriate solutions to current multifaceted challenges. Improvements would require more investment for scaling up existing alternative programs that have shown success (e.g. farmers' schools) together with deeper transformations in the curriculum of formal education and extension services.

Trade, value chain and certification

The geographical locations of agricultural production, transformation and consumption are progressively more disconnected. Food is a dramatic example of this dynamic; over half the world's population could depend on imported food by 2050 (Fader et al 2013).

The food chain, excluding agriculture, contributes around 5% of global emissions (CCAFS 2013). But international trade is growing rapidly as a result of lower trade barriers and lower transportation costs, and emissions related with international agricultural trade and agro transformation industries are also growing fast. Asia holds an important part of the worldwide agribusiness and transformation industry of agricultural products (as for example, cotton). Energy efficiency measures, technological innovation, carbon pricing and consumer education are the main tools to reduce emissions in the supply chain (ITC 2011).

Certification of emissions reduction has been mainly applied to sustainable and organic agriculture production. Global adoption of organic agriculture (based on local production and consumption, no use of mineral fertilizers and accurate soil management) has the potential to sequester up to the equivalent of 32% of overall GHG emissions (Jordan et al 2009).

Urbanization and consumption

Asia is the continent experiencing fastest urbanization rates and were urban population is expected to reach higher proportions in the decades to come (UNDESA 2013). Although cities occupy only 2% of the Earth's surface, they consume around 75% of the world's resources (UNEP and UNHABITAT 2005). Moreover, urbanization brings deeper changes to human consumption patterns, including changes in diets (e.g. increased meat and seafood consumption) and more generally overconsumption boosted by increasing disposable incomes. It is acknowledged that the consumption patterns of the world's richest cities cannot be sustained worldwide.

Achieving low emissions agriculture in Asia (and globally) thus necessarily requires taking into account transformations resulting from rapid, widespread urbanization, from the impacts in the sites of production of agricultural goods to feed city life to the transformation, transportation, and consumption of such products. Solutions for and from cities can emerge at different scales. In planning, recent approaches highlight the importance of designing more compact cities in which peri-urban spaces can be used for increased agricultural production to be part of local consumption-production networks, thus decreasing emissions related to packaging, preservation and transportation while also reducing the urban heat island effect and improving other ecosystem services produced by periurban agriculture.

Waste

Waste and wastage are widespread across the agricultural value chain. While there is little knowledge about the extent and impacts of waste and wastage for non-food products, recent data about the food supply chain estimate that each year, approximately one-third of all food produced for human consumption in the world is lost or wasted (FAO 2013). These losses have strong implications not only for improving food security worldwide, but also for reducing the environmental impacts and resource use across the food chain, including emissions. Without accounting for GHG emissions from land use change, the carbon footprint of food produced and not eaten is estimated to 3.3 Gtonnes of CO2 equivalent: as such, food wastage ranks as the third top emitter after USA and China. Moreover, produced but uneaten food occupies almost 1.4 billion hectares of land (close to 30 percent of the world's agricultural land area). Wastage of cereals in Asia is a significant environmental problem, with major impacts on carbon, blue water and arable land. Rice represents a significant share of these impacts given the high carbon-intensity of rice production methods (e.g. paddies are major emitters of methane), combined with high quantities of rice wastage. Fruit and vegetables wastage, especially in industrialized Asia, constitutes a high carbon footprint, mainly due to large wastage volumes.

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