INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS

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**Submission from IFOAM on its views of the issues related to agriculture that needs to be considered by SBSTA in order for the Conference of the Parties to adopt a decision on agriculture.**

**Summary of key points:**

- The principle of differentiated responsibilities is upheld and supported
- The findings of the IAASTD report, the UNCSD JPOI, UNCSD 17, the reports and recommendations of the UN Special Rapporteur on the right to food and the outcomes of Rio+20
- The worlds small scale farmers, forest peoples and pastoralists must be protected and strengthened
- Enhance the potential of smallholder farmers to simultaneously cool and nourish the planet and its people
- Enable smallholder farmers to help realize their potential in lifting themselves out of poverty and hunger, nourishing a growing local and global, urban and rural population with high quality food and nutrition and mitigating global warming through low emission and high sequestration farming practices and systems.
- Recognize and support OA as an effective form of climate smart agriculture (CSA) that can be quickly and affordably replicated and which is outlined with scientific evidence in this submission
- Ensure that agriculture technologies are subject to multi-stakeholder technology assessments.
- Guard against justifying actions, programs, finance etc. on carbon equivalents alone

## A: Introduction

IFOAM is an umbrella organization composed of over 870 member organizations in 120 countries. Our member organizations represent several million famers. Most of these farmers are smallholders in developing countries and are potentially some of the most vulnerable people to the extremes of climate change. To this end IFOAM believes that the issue of the multifunctional roles of Agriculture in terms of adaptation and mitigation are critical to ensure viability of farmers in predicted increase of climate extremes.

IFOAM is a key player in UN processes and works very effectively with a wide range of stakeholders and is guided by the four principles of Organic Agriculture; Ecology, Health, Fairness and Care.  At UNEP, IFOAM leads the Farmers Major Group; at UNFCCC, IFOAM is

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highly active partnering with agencies and countries such as WFP, FAO, Kenya, Malawi, and Ethiopia on issues related to food security and support to smallholders. Our Rome office organizes regular side events with the Rome Based Agencies together with countries such as Switzerland and also coordinates IFOAM's role on the Committee on Food Security. IFOAM is also a leading organization within the Rio+20 process and is working with key stakeholders such as the African Union, WFP and leading disaster relief charities etc. to bring affordable and resilient practices and systems to vulnerable rural communities.

## B: Organic Climate Smart Agriculture

Organic agriculture has a role in the many strategies that are needed to ensure food security and the viability of farming in the predicted climate extremes that will occur with climate change. Currently agriculture is a significant contributor to greenhouse gas (GHG) emissions and therefore to climate change. Organic agriculture has the potential to help agriculture to become a net sequester of GHGs and to assist in building resilience and adaption in farming systems.

The following submission outlines the multifunctional benefits of organic agriculture in terms of the ability to sequester, adapt and food security based of the published literature.

### Soils as a carbon sink

Soils are the greatest carbon sink after the oceans. According to Professor Rattan Lal of Ohio State University there are over 2,700 Gt of carbon is stored in soils worldwide. This is considerably more than the combined total of 780 Gt in the atmosphere and the 575 Gt in biomass. (Lal, 2008)

The amount of $CO_2$ in the oceans is already causing a range of problems, particularly for species with calcium exoskeletons such as coral. Scientists are concerned that the increase in acidity caused by higher levels of $CO_2$ is damaging these species and threatens the future of marine ecosystems such as the Great Barrier Reef. The world's oceans, like the atmosphere, cannot absorb any more $CO_2$ without causing potentially serious environmental damage to many aquatic ecosystems (Hoegh-Guldberg et al., 2007).

Despite the fact that soil is the largest repository of carbon after the oceans and has the potential to sequester more $CO_2$ than biomass, neither soil nor agriculture is incorporated in any formal agreement of the United Nations Framework Convention on Climate Change (UNFCCC) or the CDM.

This needs to be changed because according to the United Nations Food and Agriculture Organisation '*Agriculture not only suffers the impacts of climate change, it is also responsible for 14 percent of global greenhouse gas emissions. But agriculture has the potential to be an important part of the solution, through mitigation — reducing and/or removing — a significant amount of global emissions. Some 70 percent of this mitigation potential could be realized in developing countries.'* (FAO, 2012)

### Soil carbon sequestration through agricultural practices

The ability of soils to absorb enough $CO_2$ in order to stabilize current atmospheric $CO_2$ levels is a critical issue, and there is a major debate over whether this can be achieved through farming practices. (Lal, 2007; Sanderman et al, 2010)

Two independent global Meta reviews have looked at the average amount of $CO_2$ sequestered by organic farming systems.

A preliminary study by FiBL, published by FAO, collated 45 peer reviewed comparison trials between organic and conventional systems that used 280 data sets. (FAO, 2011) These studies included data from grasslands, arable crops and permanent crops in several continents. A simple analysis of the data shows that on average that the organic systems had higher levels of soil carbon sequestration (Gattinger et al, 2011).

Dr Andreas Gattinger and colleagues wrote (2011:16): *'In soils under organic management, the SOC stocks averaged 37.4 tonnes C ha-1, in comparison to 26.7 tonnes C ha-1 under non-organic management.'*

This means that the average difference in between the two management systems (organic and conventional) was 10.7 tonnes of C.

Using the accepted formula that soil organic carbon (SOC) x 3.67= $CO_2$ this means an average of more than 39.269 tonnes of $CO_2$ was sequestered in the organic system than in the conventional system.

The average duration of management of all included studies was 16.7 years. (Gattinger et al, 2011)

This means that an average of 2,351 kgs of $CO_2$ was sequestered per hectare every year in the organic system compared to the conventional system.

Another study by the United Kingdom Soil Association found that average organic farming practices removed about 2,200 kg of $CO_2$ per hectare per year (Azeez, 2009). This is critical information as it clearly shows that organic farmers are currently sequestering significant amounts of carbon. Most importantly, this is not based on untested concepts like "carbon capture and storage" and "clean coal"; it is based on current practices that can be adopted by other farmers.

**Potential of organic practices**

Based on these figures, the widespread adoption of current organic practices globally has the potential to sequester 10 Gt of $CO_2$, which is around 20 per cent of the world's current GHG emissions.

| | | |
|---|---|---|
| Grassland | 3,356,940,000 | ha |
| Arable crops | 1,380,515,000 | ha |
| Permanent crops | 146,242,000 | ha |
| Total | 4,883,697,000 | ha |

*Source:* (FAO, 2010)

Organic @ 2.2 tons per hectare: 10.7 Gt of $CO_2$ (Azeez, 2009)

Annual GHG emissions: 49 Gt of $CO_2e$ (IPCC Fourth Assessment Report (AR4), 2007)

**Potential exists for higher levels of $CO_2$ sequestration**

All data sets that use averaging have outlying data. These are examples that are significantly higher or significantly lower than the average. They are always worth examining to find out why. Research into them will allow an understanding on what practices significantly increase soil carbon and those that decrease or do not increase it.

There are several examples of significantly higher levels of carbon sequestration than the averages quoted in the studies above. The Rodale Institute in Pennsylvania, USA, has been conducting long-running comparisons of organic and conventional cropping systems for over 30 years that confirm that organic methods are effective at removing $CO_2$ from the atmosphere and fixing it as organic matter in the soil. La Salle and Hepperly (2008:5) wrote: '*In the FST [Rodale Institute farm systems trial] organic plots, carbon was sequestered into the soil at the rate of 875 lbs/ac/year in a crop rotation utilizing raw manure, and at a rate of about 500 lbs/ac/year in a rotation using legume cover crops.*

*During the 1990s, results from the Compost Utilization Trial (CUT) at Rodale Institute – a 10-year study comparing the use of composts, manures and synthetic chemical fertilizer – show that the use of composted manure with crop rotations in organic systems can result in carbon sequestration of up to 2,000 lbs/ac/year. By contrast, fields under standard tillage relying on chemical fertilizers lost almost 300 pounds of carbon per acre per year.'* (La Salle and Hepperly 2008:5).

Converting these figures into kilograms of $CO_2$ sequestered per hectare using the accepted conversion rate of 1 pound per acre = 1.12085116 kg/ha and soil organic carbon x 3.67= $CO_2$, gives the following results:

- The FST legume based organic plots showed that carbon was sequestered into the soil at the rate of about 500 lbs/ac/year. This is equivalent to a sequestration rate of 2,055.2kg of $CO_2$/ha/yr.

- The FST manured organic plots showed that carbon was sequestered into the soil at the rate of 875 lbs/ac/year. This is equivalent to a sequestration rate of 3,596.6 kg of $CO_2$/ha/yr.

- The Compost Utilization Trial; showed that carbon was sequestered into the soil at the rate of 2,000 lbs/ac/year. This is equivalent to a sequestration rate of 8,220.8 kg of $CO_2$/ha/yr.

Thus there are significant benefits of adding compost.

**The Potential in desert climates**

Sekem is the oldest biodynamic farm in Egypt. It was founded in 1977 by Dr Ibrahim Abouleish.

The Louis Bolk Institute and Soil&More, two organisations based in the Netherlands, have made a study to calculate soil carbon sequestration at Sekem. Their results show that on average Sekem's management practices have resulted in 900 kgs of Carbon being stored in the soil per hectare per year in the fields that were 30 years old. Using the accepted formula of Soil Organic

Carbon x 3.67 = $CO_2$, this means that Sekem has sequestered 3,303 kgs of $CO_2$ per hectare per year for 30 years. (Luske and van der Kamp, 2009; Koopmans et al, 2011)

Based on these figures, the widespread adoption of Sekem's practices globally has the potential to sequester 16 Gt of $CO_2$, which is around 30% of the world's current greenhouse gas emissions into soils. (4,883,697,000 ha x 3,303 kgs = 16.1 gt $CO_2$/ha/yr)

**The potential in tropical climates**

Researchers at the Royal Thai Organic Project near Chiang Mai in Thailand have managed to increase their soil organic matter levels from 1 per cent to 5 per cent over a period of eight years (personal communication). This means that 187.2 tons of $CO_2$/ha has been sequestered through this project, which equates to 23.4 tons of $CO_2$/ha/yr. If this was applied globally, it would sequester 114 Gt $CO_2$/ha/yr – more than double the world's current GHG emissions. (4,883,697,000 ha x 23.4 tons of $CO_2$/ha/yr = 114 gt $CO_2$/ha/yr)

**Deeper carbon systems**

There is an emerging body of science showing that the most stable fractions of soil carbon are stored deeper in the soil than most of the current soil carbon measurements used on farms. Most soil tests tend to work at a depth of around 15 to 20 cm as this is the usual root zone for many crops. Research is finding that a significant amount of carbon is stored at lowered depths and this tends to be very stable.

Research by Rethemeyer and colleagues using radiocarbon techniques to analyse to various soil carbon fractions indicated a progressive enrichment of stable organic compounds with increasing soil depth to 65 cm. (Rethemeyer et al, 2005).

Research by Professor Rattan Lal and colleagues from Ohio State University compared carbon levels between no-till and conventional tillage fields and found that, in some cases, carbon storage was greater in conventional tillage fields. The key is soil depth.

They compared the carbon storage between no-till and plowed fields with the plow depth - the first 8 inches (20cm) of the soil the carbon storage was generally much greater in no-till fields than in plowed fields. When they examined 12 inches (30cm) and deeper, they found more carbon stored in plowed fields than in no-till.

The researchers found that farmers should not measure soil carbon based just on surface depth. They recommended going to as much as 3 feet (1 meter) below the soil surface to get a more accurate assessment of soil carbon. (Christopher, Lal and Mishra, 2009)

According to Gattinger and colleagues (2011:16): '*Researchers working of the long term comparison trials between organic and convention farming systems in Switzerland (the DOK trials), found that when rotation phases that contained two years of deep-rooting grass-clover leys, that 64 percent of the total SOC stocks are deposited between 20–80 cm soil depths. (Fliessbach et al, 1999)'*

*'In many parts of the world, organic farming systems are relying on the soil fertility build-up of deep-rooting grass-legume mixtures and on the incorporation of plant residues by deep-digging earthworms, making it quite likely that the currently available data sets underestimate the SOC stocks in organically managed soils. This is particularly significant considering that in deeper soil horizons, SOC seems to be more stabilized.'*

**Grazing systems**

The majority of the world's agricultural lands (68.7%) are used for grazing (FAO, 2010). There is an emerging body of published evidence showing that pastures and permanent ground cover swards in perennial horticulture build up soil organic carbon faster than any other farming system and with correct management this is stored deeper in the soil. (Fliessbach et al, 1999, Sanderman et al, 2010)

One of the significant reasons for this have been the higher proportion of plants that use the C4 pathway of photo synthesis as this makes them more efficient at collecting $CO_2$ from the atmosphere, especially in warmer and drier climates. According to Osborne and Beerling (2006:173): *'Plants with the C4 photosynthetic pathway dominate today's tropical savannahs and grasslands, and account for some 30% of global terrestrial carbon fixation. Their success stems from a physiological $CO_2$-concentrating pump, which leads to high photosynthetic efficiency in warm climates and low atmospheric $CO_2$ concentrations.'*

This knowledge is now being applied in innovative ways such as holistic stock management, evergreen farming, agro forestry in pastures and pasture cropping.

**Pasture Cropping**

Pasture cropping works on the principle that annuals grow naturally through perennial pastures in their normal cycles. It is not the purpose of this paper to explain the technical details on how it its being successfully implemented in a wide variety of climates and soil types around the world. However, a brief overview has been included in Breakout No 2 to help understand the system. The critical issue for this paper is to present the preliminary data on soil carbon sequestration so that the potential of this system can be further researched.

Research by Jones at Winona, the property of Colin and Nick Seis in NSW, Australia, that uses a combination of pasture cropping and holistic stock management shows that 168.5 t/ha of $CO_2$ was sequestered over 10 years. The sequestration rate for last two of the ten years (2009 and 2010) was 33 tons of $CO_2$/ha/yr (Jones, 2011). This system can be and is being successfully used in both arable and pastures systems including horticulture. If this was applied around the world, it could potentially sequester 82 Gt of $CO_2$/ha/yr. (4,883,697,000 ha X 16.85 tonnes = 82 Gt)

This significantly more than the world's GHG emissions of 49 Gt and would help reverse climate change. The increase is soil carbon will also significantly improve the production and adaption capacities of global grazing systems.

**The urgent need for more peer reviewed research**

It is not the intention of this paper to use the above types of generic exercises of globally extrapolating data as scientific proof of what can be achieved by scaling-up organic systems. These types of very simple analyses are useful for providing a conceptual idea of the considerable potential of organic farming to reduce GHG emissions on a landscape scale. The critical issue here is that urgent peer reviewed research is needed to understand how and why (and for the sceptics – if) these systems sequester significant levels of $CO_2$ and then look at how to apply the findings for scaling-up on a global level in order to achieve a significant level of GHG mitigation.

The potential of these farming methods is enormous, considering that these data are based on current practices.

**Permanence**

One of the major debates around soil carbon is based on how it can meet the CDM 100-year permanence requirements.

Soil carbon is a complex mix of fractions of various carbon compounds. Two of these, humus and charcoal (char), are very stable: research shows that they can last for thousands of years in the soil. Other fractions are less stable (labile) and can be easily volatilized into $CO_2$. Soil carbon tends to volatilize into $CO_2$ in most conventional farming systems. However, correct management systems can continuously increase both the stable and labile fractions through a number of approaches, several of which are discussed later in this paper.

The research conducted by Jones at Winona showed that the majority of the newly increased soil carbon was in the stable fractions. She reported that 78 per cent of the newly sequestered carbon was in the non-labile (humic) fraction of the soil and this rendered it into highly stable long chain forms.

Her research found that the carbon levels in the 0-10cm increment are from the recent decomposition of organic matter and formed short-chain unstable carbon. The carbon below 30cm was composed of the humic soil fraction and was highly stable (Jones, 2011).

Jones's research is consistent with the findings of Christopher, Lal and Mishra, (2009) and Rethemeyer et al, (2005).

Long-term research conducted for more than 100 years at the Rothamsted Research Station in the United Kingdom and the University of Illinois Morrow Plots in the United States of America showed that the total soil carbon levels could steadily increase and then reach a new stable equilibrium in farming systems that use organic matter inputs. This means that good soil organic matter management systems can increase and maintain the labile fractions as well as the stable fractions over the time periods required by the CDM. (Lal, 2007)

**Adaptation**

Even if the world stopped polluting the planet with GHGs it would take many decades to reverse climate change. This means that farmers have to adapt to the increasing intensity and frequency of adverse and extreme weather events such as droughts and heavy, damaging rainfall. Indeed, many areas of the planet are already experiencing this. (Anderson, 2010; Steer, 2011)

**Greater resilience in adverse conditions**

Published studies show that organic farming systems are more resilient to the predicted weather extremes and can produce higher yields than conventional farming systems in such conditions (Drinkwater, Wagoner and Sarrantonio 1998; Welsh, 1999; Pimentel, 2005;, see also the comment of Nemes in this chapter). For instance, the Wisconsin Integrated Cropping Systems Trials found that organic yields were higher in drought years and the same as conventional in normal weather years (Posner et al., 2008).

Similarly, the Rodale FST showed that the organic systems produced more corn than the conventional system in drought years. The average corn yields during the drought years were from 28% to 34% higher in the two organic systems. The yields were 6,938 and 7,235 kg per ha in the organic animal and the organic legume systems, respectively, compared with 5,333 kg per ha in the conventional system (Pimentel, 2005). The researchers attributed the higher yields in the dry years to the ability of the soils on organic farms to better absorb rainfall. This is due to the higher levels of organic carbon in those soils, which makes them more friable and better able to store and capture rainwater which can then be used for crops (La Salle and Hepperly, 2008).

**Improved efficiency of water use**

Research also shows that organic systems use water more efficiently due to better soil structure and higher levels of humus and other organic matter compounds (Lotter, Seidel and Liebhart, 2003; Pimentel, 2005).

Lotter and colleagues collected data for over 10 years during the Rodale FST. Their research showed that the organic manure system and organic legume system (LEG) treatments improve the soils' water-holding capacity; infiltration rate and water capture efficiency. The LEG maize soils averaged a 13% higher water content than conventional system (CNV) soils at the same crop stage, and 7% higher than CNV soils in soybean plots (Lotter, Seidel and Liebhart, 2003).

The more porous structure of organically treated soil allows rainwater to quickly penetrate the soil, resulting in less water loss from run-off and higher levels of water capture. This was particularly evident during the two days of torrential downpours from hurricane Floyd in September 1999, when the organic systems captured around double the water than the conventional systems captured (Lotter, Seidel and Liebhart, 2003).

**Critical differences between organic and conventional farming**

Organic farming has a range of practices that are regarded as essential to allowing the system to be certified as organic. Most of these practices are easily transferrable to other farming systems and many of them are now being adopted under the emerging title of Climate Smart Agriculture (FAO, 2012).

**The addition of organic matter**

The term organic farming is derived from the fact that organic farming systems improve soil health and fertility through the recycling of organic matter. There is a very strong body of evidence which shows that the addition of organic matter improves soil organic carbon (SOC) levels and this is more effective than synthetic, water soluble fertilizers. Lal (2007:822) provides an extensive list from the scientific literature that demonstrates this:

> *'Application of manures and other organic amendments is another important strategy of SOC sequestration. Several long-term experiments in Europe have shown that the rate of SOC sequestration is greater with application of organic manures than with chemical fertilizers (Jenkinson 1990; Witter et al. 1993; Christensen 1996; Korschens & Muller 1996; Smith et al. 1997). Increase in the SOC pool in the 0–30 cm depth by long-term use of manure compared to chemical fertilizers was 10% over 100 years in Denmark (Christensen 1996), 22% over 90 years in Germany (Korschens & Muller 1996), 100% over 144 years at Rothamsted, UK (Jenkinson 1990) and 44% over 31 years in Sweden (Witter et al. 1993). The data from Morrow plots in Illinois indicated that manured plots contained 44.6 Mg/ha more SOC than unmanured control (Anderson et al. 1990). In Hungary, Arends & Casth (1994) observed an increase in SOC concentration by 1.0–1.7% by manuring. Smith et al. (1997) estimated that application of manure at the rate of 10 Mg/ha to cropland in Europe would increase the SOC pool by 5.5% over 100 years. In Norway, Uhlen (1991) and Uhlen & Tveitnes (1995) reported that manure application would increase SOC sequestration at the rate of 70–227 Kg/ha per year over a 37–74-year period.'*

**Composts – multiple benefits**

Composting was pioneered by the organic farming movement through the work of Sir Albert Howard in the 1930s and 40s and then strongly promoted by Jerome Rodale in his numerous publications, especially in *'Organic Farming and Gardening'* that was the widely read around the world. (Rodale, 2011)

There is an increasing body of evidence that composts are superior to raw manures in increasing the level of soil organic matter. The Rodale Institute studies have demonstrated that good organic practices using raw manures and cover crops can sequester 3,596.6 kg of $CO_2$/ha/yr and that when compost is added this increases to 8,220.8 kg of $CO_2$/ha/yr (La Salle and Hepperly 2008).

**Avoided emissions**

Currently most of the food and other products from farms are exported off the farm and sent to cities. The disposal of these organic residues in land-fills is responsible for methane emissions. Methane is a significant greenhouse gas. The correct composting and bio-digester methods are now recognised as effective ways of avoiding methane emissions.

Research by FiBL is showing that more $CO_2$e can be avoided by these methods than most other farming practices. (Gattinger et al, 2011)

For example at Sekem in Egypt, since January 2007, they have offset methane emissions through their compost project. Through using the correct composting methods for organic materials they were able to reduce methane emissions by the equivalent of 303,757 tonnes of CO2e. (Helmy Abouleish Personal Communication)

Composting the organic wastes in cities and transporting them to the farm brings multiple benefits in closing the nutrient cycle by returning the nutrients that are exported from the farm, avoiding methane emissions and increasing the rate of soil carbon sequestration.

**Synthetic nitrogen fertilizers degrade soil carbon**

One of the main reasons for the differences in soil carbon between organic and conventional systems is that, as research shows, there is a direct link between the application of synthetic nitrogenous fertilizers and a decline in soil carbon.

Scientists at the University of Illinois analysed the results of a 50-year agricultural trial and found that the application of synthetic nitrogen fertilizer had resulted in all the carbon residues from the crop disappearing, as well as an average loss of around 10,000 kg of soil carbon per hectare. This is around 36,700 kg of $CO_2$ per hectare over and above the many thousands of kilograms of crop residue that is converted into $CO_2$ every year (Khan et al., 2007; Mulvaney, Khan and Ellsworth, 2009). The researchers found that the higher the application of synthetic nitrogen fertilizer, the greater the amount of soil carbon lost as $CO_2$. This is one of the major reasons why there is a decline in soil carbon in conventional agricultural systems and its increase in organic systems.

On the other hand there is a good body of research showing that using legumes and carbon based sources such as compost for increases the levels of soil organic carbon (La Salle and Hepperly 2008).

Researchers from North America and Europe have also shown that organic systems are more efficient in using nitrogen than conventional farming systems. Significantly, because of this efficiency, very little nitrogen leaves the farms as GHGs or as nitrate that pollutes aquatic systems (Drinkwater, Wagoner and Sarrantonio, 1998; Mader et al, 2002).

**Diverse cropping systems**

Another critical aspect of organic production is the use of diverse cropping systems. Certified organic production systems prohibit continuous monocultures in cropping systems. Every certified organic farm needs to have a management plans that outlines their crop (and stock) rotation systems. Lal (2007:822) cites the scientific literature to indicate that this does make a difference:

> *'Soils under diverse cropping systems generally have a higher SOC pool than those under monoculture (Dick et al. 1986; Buyanoski et al. 1997; Drinkwater et al. 1998; Buyanoski & Wagner 1998). Elimination of summer fallow is another option for minimizing losses of the SOC pool (Delgado et al. 1998; Rasmussen et al. 1998). Growing a winter cover crop enhances soil quality through SOC sequestration. In the UK, Fullen & Auerswald (1998) reported that grass leys set aside increased SOC concentration by 0.02% per year for 12 years. In Australia, Grace & Oades (1994) observed that the SOC pool in the 0–10 cm layer increased linearly with increase in frequency of pasture in the crop rotation cycle. In comparison with continuous cropping, incorporation of cover crops in the rotation cycle enhanced SOC concentration in the surface layer by 15% in Sweden (Nilsson 1986), 23% in The Netherlands (Van Dijk 1982) and 28% in the UK (Johnston 1973) over [a] 12–28-year period. Similar results were reported by Lal et al. (1998) for the US cropland.'*

**Erosion and soil loss**

The highest percentage of soil carbon is contained in the first 10 cm of soil (Handrek, 1990; Handrek and Black, 2002; Stevenson, 1998). Soil loss and erosion from farming systems is a leading concern around the world (Millennium Ecosystem Assessment, 2005; IAASTD, 2009). It is a major cause of loss of soil carbon due to highest levels of the soil organic matter being in the top layer if the soil.

Comparison studies have shown that organic systems demonstrate less soil loss due to better soil health, and are therefore able to maintain greater soil productivity than conventional farming systems (Reganold, Elliott and Unger, 1987; Reganold et al, 2001; Mader et al., 2002; Pimentel, 2005). Reganold, Elliott and Unger compared the effects of organic and conventional farming on particular properties of the same soil over a long period and found, '…*the organically-farmed soil had significantly higher organic matter content, thicker topsoil depth, higher polysaccharide content, lower modulus of rupture and less soil erosion than the conventionally-farmed soil'* (Reganold et al, 1987:370 ).

Critics of organic systems point to conventional, no-till production systems as superior to organic systems because the latter use tillage. To our knowledge there is only one published study comparing conventional, no-till with organic tillage systems. The researchers found that the organic system had better soil quality. According to Teasdale, Coffman and Mangum (2007:1304*), '... the OR [organic] system improved soil productivity significantly as measured by corn yields in the uniformity trial ... [The] higher levels of soil C and N were achieved despite the use of tillage (chisel plow and disk) for incorporating manure and of cultivation (low-residue sweep cultivator) for weed control... Our results suggest that systems that incorporate high* *amounts of organic inputs from manure and cover crops can improve soils more than conventional no-tillage systems despite reliance on a minimum level of tillage.'*

The latest improvement in organic low/no-till systems developed by the Rodale Institute shows that these systems can deliver high yields as well as excellent environmental outcomes (Rodale, 2006; Moyer 2011).

**C: IFOAM supports the establishment of a UNFCCC SBSTA work program on both agriculture adaptation and mitigation provided it ensures the following are upheld:**

1. The principle of differentiated responsibilities is upheld and supported

Under the principle of differentiated responsibilities non Annex 1 countries should be supported by Annex 1 countries in their efforts to adapt to climate change. Adaptation, food security and poverty eradication are their primary objectives. To this end support for adaptation must be addressed in the context of poverty eradication and inclusive sustainable development that strengthens the agricultural sectors of non Annex 1 countries in particular the 1 billion plus small-holder farmers and pastoralists. The priority of Annex 1 countries and emerging economies and their companies (whether private or state-owned) must be on reducing the GHG intensity of their production systems, supply chains and inputs both at home and abroad as well as upholding the rights of farmers and local communities throughout the world.

2. The work program incorporates the findings of the IAASTD report, the UNCSD JPOI, UNCSD 17, the reports and recommendations of the UN Special Rapporteur on the right to food and the outcomes of Rio+20

3. The worlds small scale farmers, forest peoples and pastoralists are protected and strengthened

The UNFCCC should ensure that any programs, finance and mechanisms etc that are implemented must above all protect and strengthen such farmers and rural communities and certainly not weaken them through actions or incentives that contribute to exploitation including land grabbing in its various forms and any debt or speculation that might be associated with both the generation and selling of adaptation and or mitigation credits.

All adaptation actions should be appropriate and participatory ensuring the rights of farmers, indigenous peoples and rural communities etc are upheld in enabling them to decide on such actions. Focus must be on affordable, accessible and locally appropriate programs and actions that include the facilitation of local technology development and adaptation, south - south knowledge and technology exchanges and the right to refuse programs and technologies deemed inappropriate by farmers and rural communities on a local and individual basis. All initiatives must minimize the risk of indebtedness.

The right of farmers in non Annex 1 countries in the context of local food security, poverty eradication and sustainable rural development to enhance both the resilience and performance of their farms must be upheld even if this means increasing GHG emissions through increased mechanization for example. However appropriate low cost adaptation actions that increase resilience and farm performance that also mitigate global warming through GHG captures must be encouraged.

4. Enhance the potential of smallholder farmers to simultaneously cool and nourish the planet and its people

Smallholder farmers must be enabled to help realize their potential in lifting themselves out of poverty and hunger, nourishing a growing local and global, urban and rural population with high quality food and nutrition and mitigating global warming through low emission and high sequestration farming practices and systems.

5. Recognize and support OA as an effective form of climate smart agriculture (CSA) that can be quickly and affordably replicated

Must recognize the high sequestration, low emission, affordable and accessible benefits of organic climate smart agriculture (OCSA) by supporting research in and adoption of OCSA systems and its extensive range of climate smart practices as part of the wider CSA and climate agenda.

6. Ensure that agriculture technologies are subject to multi-stakeholder technology assessments.

7. Guard against justifying actions, programs, finance etc on carbon alone
The support and or development of systems and technologies must not be guided by carbon or mitigation or even adaptation goals alone. Environmentally and socially destructive practices that drive land use changes of ecosystems such as forests and grasslands etc as well as land grabbing and destruction of local livelihoods must be avoided and certainly not facilitated through any UNFCCC actions. Instead farmers must be supported in enhancing the resilience and performance of their farms in the context of sustainable development including their access to water, energy and nutrition and certainly GHG accounting should never be used to justify such destructive practices and programs. Furthermore any life cycle based assessment of systems or technologies must have global project boundaries that include assessment of all inputs etc. as well as carbon sequestration to sub soil depth.

Yours Sincerely,

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