Annex C: Details of Sustainable Agriculture Improvements in Thirteen Agroecosystems

I: Wetland rice

1. Total global production of rice was 597 million tonnes in 1999, of which 81% was produced in Asia. World average yields are 3.84 t/ha (both irrigated and rainfed). Average developing country yields vary from highs in Indonesia (4.3 t/ha), China (5.87 t/ha), and Egypt (7.9 t/ha), to lows in Thailand (2.2 t/ha) and Bangladesh (2.8 t/ha). Average yields in Japan, USA and Ukraine are 6.2-6.7 t/ha[15]. The highest yields are on irrigated land, of which there is 271 million ha worldwide (up from 139 million ha in 1961), of which 160 million ha are in Asia, 13 million ha in Africa, 38 million ha in North and South America.

2. There have been four major changes to rice agroecosystems achieved with sustainable agriculture:

   i) farmer field schools leading to the adoption of agro-ecological IPM, with sharp reductions in pesticide use and small increase in rice productivity (some evidence of 30% increases when whole system management addressed);

   ii) introduction of fish, crabs, prawns into rice fields, so increasing protein production, but also improving nutrient recycling and disease control;

   iii) social capital formation in farmers' water users groups, leading to more equitable water management and distribution, as connected individuals and groups with strong relations of trust are able better to share water, especially during scarcities;

   iv) the system of rice intensification, developed first in Madagascar, and based on wide spacing of plants, regular weeding, transplanting of immature seedlings, and water stress and aeration of soils rather than flooding during growing (requiring more labour but less water and fertilizer). The SRI has been tested during 1998-99 in 12 countries, and consistently shows rice productivity increases in multiples (more tillers per plant, and more grains per tiller), leading to typical yield growth from 2 to 8t/ha[16].

3. In wetland rice systems, therefore, total system productivity can increase, particularly of fish and vegetables; while rice per hectare productivity shows only small increases (with the exception of the system of rice intensification). The

[15] In this report, all agricultural production data (yields, production, hectares cultivated etc) are drawn from the FAOSTAT database at www.fao.org.

[16] Uphoff (2000) reports on SRI experiments in Madagascar, China, Indonesia, Philippines, Cambodia, Nepal, India, Cote d'Ivoire, Cuba, Bangladesh, Sri Lanka and Sierra Leone. Although there are many sceptics, rice yields of 6-10 t/ha have been achieved when there had been careful attention to all components of the system. In Madagascar, where the system was developed, SRI yields are 6-11 t/ha, compared with average national yields of 2t/ha. These increases are so great that many agronomists and agriculturalists simply did not believe the evidence.

changes are accompanied by substantial reductions in pesticide use, both in total kg a.i. used and in the number of sprays per season.

4. It is clear that demand for rice will continue to grow, but though these transitions towards sustainable agriculture are promising in terms of total system productivity and benefits to environment and health, rice productivity is not increasing sufficiently to suggest that sustainable agriculture alone can meet urban demand (unless SRI proves to be widely replicable – see Chapter 4 for discussion). Further productivity increases are, therefore, likely to have to come from i) application of biotechnology and genetic modification to aid rice breeding; ii) better soil and nutrient management; iii) whole system redesign (such as the system of rice intensification).

Table 11. Selection of impacts of sustainable agriculture in wetland rice systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity and input use
	Farmers	Hectares	
Sri Lanka			
CARE agro-ecological IPM	55,000	33,000	rice yields up 30-50%
Gal Oya / Mahaweli	500,000	750,000	rice yields no change, but better water distribution leads to extra seasons of crops
Vietnam - agro-ecological IPM	108,000	162,000	rice yields up 9%
Indonesia - agro-ecological IPM	1,000,000	500,000	rice yields up 5-10%
Madagascar – SRI (system of rice intensification)	20,000		rice yields up from 2 to 6-11 t / ha
Bangladesh – INTERFISH, GOLDA,	150,000	90,000	rice yields up 7-9% to 4-5000 kg / ha (dry season) and to 3000 kg / ha (wet)
China – Jiangsu aquaculture	103,000	70,000	rice up 10-15% to 6600 kg / ha, plus fish, crab and shrimp

Source: SAFE-World database, University of Essex

II: Arid and semi-arid millet and sorghum

5. Most of the world's millet and sorghum is grown in arid and semi-arid environments as a staple for rural households. Global production of the two staples was some (87) million tonnes in 1999, of which some 33 million tonnes were in Africa, 16 million tonnes in India and 8 million tonnes in China. The largest commercial operations with the highest yields are in USA (17 million tonnes sorghum per year) and Mexico (4 million tonnes). As a staple, millet and sorghum are vital in dryland India and China, and countries such as Burkina Faso (2 m t), Nigeria (8 m t), Sudan (4 m t) and Niger (2 m t). In these countries, per hectare yields are very low - on average 600-750 kg / ha in Africa and 700-900 kg / ha in India. Most farmers growing millet and sorghum are poor, and input use is therefore very low.

6. There have been two key changes to millet/sorghum agroecosystems achieved with sustainable agriculture:

   i) use of a wide variety of water harvesting methods that either improve cereal yields on existing farmland, or lead to new crops in land formerly abandoned or thought no longer to be productive;

   ii) soil fertility improvements, through organic matter additions (animal manures and composts); together with soil conservation methods, leading to better nutrient availability and water retention and rock phosphate amendments.

7. In these arid and semi-arid systems, there have been substantial increases in per ha cereal productivity, combined with large increases in total system production, through the conversion of formerly unproductive land to farming. These have led to substantial improvements in household food availability. In central Burkina Faso, the average household engaging in water harvesting produces a 645 kg cereal surplus compared with an earlier deficit of 145 kg per year (Reij, 1996).

8. The greatest challenges in these system after securing water for crops remains the provision of adequate nutrients and organic matter. As productivity increases, so more nutrients are removed from farms and consumed elsewhere. Much of this does not return, and many soils are showing substantial negative nutrient balances (ADD REFS). Farmers in arid and semi-arid areas do not have many options. They need to improve organic matter in soils, yet water stresses and existing levels makes this very difficult. Importing nutrients, either through rock phosphate or inorganic fertilizers may be the only way in the long-term to ensure the sustainability of production. In the short-term, more livestock can help to recycle nutrients, and leguminous crops can fix nitrogen.

Table 12. Selection of impacts of sustainable agriculture in arid/semi-arid millet and sorghum systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity (sorghum and millet)
	Farmers	Hectares	
Burkina Faso			
SWC-AGF	15,000	30,000	600-1000 kg/ha on new lands; rising to 1500 kg/ha with organic matter
Patecore	10,000	17,000	Up from 870 to 1650-2000 kg/ha
Ethiopia			
Ansokia	6540	7000	Sorghum/teff up 50% to 1200 kg/ha
ICAR	338	380	Millet up 73% to 2600 kg/ha
Senegal			
Rodale and Previnoba	15,700	26,000	Up from 340 to 600-1000 kg/ha
Mali			
USC	1000	4000	Up from 300 to 1700 kg/ha
Niger			
Illela IFAD	3100	6300	Up from 280 to 480 kg/ha
India			
IGWDP, Maharashtra	20,000	92,000	Up from 200 to 700 kg/ha (wet season) & 1250 to 2200 kg/ha (dry)

Rajasthan watersheds	300,000	240,000	Up from 200-400 to 400-875 kg/ha
KRIBCHO	4200	4000	Up from 400 to 900 kg/ha; plus new crop in dry season at 500 kg/ha
Deccan Devt Soc	3000	1082	New sorghum crop – 780 kg/ha
PIDOW, Karnataka	20,000	30,000	Sorghum up 65% to 695 kg/ha

Source: SAFE-World database, University of Essex

III: Rainfed maize, wheat, rice and legumes (uplands, dryland)

9. World maize production was some 600 million tonnes in 1999, with an average yield of 4.3 t/ha (up from 3.7 t/ha in 1995). The averages are, however, distorted by the very high yields in the USA (about half of the world's production at 8.6 t/ha). Of the 139 million ha cultivated, some 70 million ha are under modernised and irrigated systems, with yields of 5-8 t/ha. The remaining 70 million ha are in Africa (21 million ha), Latin America (19 million ha), Asia (18 million ha), and here yields average 1.3 t/ha (Central America) and 1.7-1.8 t/ha (Africa, India and Brazil).

10. Rainfed rice is also a very important crop in many upland areas of Asia. Like maize, yields tend to be low – of the order of 1-1.5 t/ha.

11. There have been four changes to rainfed maize, wheat and rice agroecosystems with sustainable agriculture:

i) multiple cropping of legumes (eg velvetbean, jack bean) into maize, or incorporation into rotations as cover crops and/or green manures, or as a weed suppressant;
ii) agroforestry with maize/rice for soil nitrogen-fixing and phosphate-releasing;
iii) biological control of pests, particularly using functional biodiversity, such as the semiochemicals released by some grasses that push-pull predators, parasites and pests;
iv) watershed and catchment management programmes leading to whole system change.

12. There is extensive evidence to indicate that sustainable agriculture can lead to: i) substantial increases in per hectare cereal production, typically up 50-100%, and in some projects rising to 200% increases; ii) increases in diversity of systems - as cereal productivity increases, so commonly farmers reduce the area under cereals and increase diversity of alternative crops and animals, such as vegetables, fruit and livestock. There are many challenges, including in particular, improving understanding of functional biodiversity and soil health, so as to make better use of available resources in systems, and developing agroecosystems that improve nutrient (particularly P and K) availability.

Table 13. Selection of impacts of sustainable agriculture in rainfed maize and rice (uplands and dryland) systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Colombia			
CIALs	4000	4000	Mz up 71% from 820 to 1400 kg / ha
Guatemala			
St Martin Jilotepeque	3500	1500	Mz up 271% from 400 to 1500 kg / ha
Honduras			
Guinope & Cantarranas	3000	4000	Mz up 200% from 820 to 2400 kg / ha
Proyeto Lempira Sur	2000	5000	Mz up 128% from 670 to 1530 kg / ha Beans up 1325 from 190 to 440 kg / ha
Nicaragua			
Campesino a campesino	8000	16,000	Mz up 214% from 700 to 2200 kg / ha
China			
UNDP, Yunnan	150	300	Mz up from 1500-3000 to 2000-10,500 kg / ha
India			
AKRSP	4000	5000	Rice up from 200 to 560 kg / ha (wet) Rice up from 990 to 1850 kg / ha (dry)
Nepal			
BTRT watersheds	3000	1300	Rice up 240% ~ 500 to 1700 kg / ha
Jajarkot permaculture	580	350	Rice p 50% to 2400 kg / ha Mz up 33% to 1600 kg / ha
Philippines			
Claveria	277	206	Mz up 15-25% to 2250 kg / ha
IIRR VFMP	450	520	Rice up 113% to 1490 kg / ha Mz up 645 to 2110 kg / ha
Benin			
Mucuna in maize	14,000	11,000	Mz up 30% to 1210 kg / ha
Kenya			
C-MAD	500	1000	Mz up 100% to 4000 kg / ha
EAT	130	79	Mz up 249% to 2335 kg / ha
CARE agroforestry	8190	7900	Mz up 46% to 380 kg / ha
Niger			
IFAD Illela	3100	6300	Mz up 71% to 480 kg / ha
Malawi			
MoA extension	20,000	6200	Mz up 114-185% to 1500-2000 kg / ha
Tanzania			
SW project	21,608	51,859	Mz up 100% to 1200 kg / ha

Source: SAFE-World database, University of Essex

IV: Wheat and maize intensive rotations

13. In 1999, 583 million tonnes of wheat were produced worldwide, some 40% of which was grown in Europe and North America, 20% in China and 11% in India. Of the 215 million hectares cultivated, only 8 m ha are in Africa and 7.4 m ha in Latin America. North America, Europe and Australia account for about 80 million ha. In Asia, the largest growers are China (31 m ha), India (24 m ha), Kazakhstan (13 m ha) and Pakistan (8 m ha). Average world yields are 2.7 t/ha. Low-input systems (such as in Algeria, South Africa, Afghanistan and Nepal) generally yield 1-1.5 t/ha. Large-scale modern cultivation in India and China yields 2.4-3.3 t/ha, and very high input systems, such as in Egypt, yield 5t/ha. Some modernised systems, such as in the Punjab, are under severe pressure from over-use of irrigation water.

14. The key changes under sustainable agriculture are zero-tillage in maize and wheat systems, usually combined with adoption of cover crops and green manures; and participatory plant breeding, with farmers engaged in testing and adapting wheat varieties (especially in India and Nepal). Future challenges centre on finding ways to increase the sustainability of intensive wheat- and maize-based systems by reducing externalities and seeking new approaches to improve productivity.

Table 14. Selection of impacts of sustainable agriculture in wheat and maize systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Argentina			
Zero-tillage	132,000	7,287,750	Mz yields up 37% to 6970 kg/ha
Brazil			
ZT Sta. Caterina	74,700	530,000	Mz yields up 31% to 3700 kg/ha Soyabean up 65% to 2640 kg/ha
China			
East Gansu	100,000	70,000	Mz up 38% to 8300 kg/ha
Hebei Plain	224,000	100,000	Wheat up 17% to 8045 kg/ha Mz up 9% to 7880 kg/ha
Pakistan			
Rice-wheat ZT	690	1000	Wheat up 10-25% to 2300 kg/ha
Paraguay			
ZT large farmers	15,800	785,000	Mz up 122% to 8000 kg/ha

Source: SAFE-World database, University of Essex

V: Home Gardens and Microenvironments (include. dairy)

15. It is impossible to say exactly what is the scale of food production in home gardens as most is for home consumption or local sales. Little is recorded in national statistics. Kitchen and home gardens, though, can be both highly productive and diverse. In Indonesia, pekarangan can contain up to 250 species of useful plants,

and productivity per m^2 is typically much higher than field crops. Homegardens can also be a vital source of food for urban populations.

16. Homegardens are productive because they are a focus for resources, particularly human labour and knowledge, nutrients and organic wastes, and water. They can also be an important source of livestock products, with small farmers or even landless households often owning 1-2 dairy cows, a few chickens, or a pig or goat. In addition, other micro-environments on the farm, such as gully fields and silt traps, can be highly productive, often supporting unusual crops (eg rice in drylands) in areas where they are not typically grown. Such microenvironments can substantially contribute to overall farm productivity and livelihood food security.

17. The key changes in sustainable agriculture projects focusing on homegardens:

i. Bio-intensive gardening and double-dug beds for year-round vegetable and fruit production;
ii. Dairy cow per family, with increase in domestic milk consumption and income;
iii. Other livestock, such as chickens, pig;
iv. Micro-environment development (more often an accidental rather than explicit part of agricultural development programmes);
v. Fish ponds in gardens.

Table 15. Selection of impacts of sustainable agriculture in home gardens and microenvironments

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Kenya			
ABLH	2500	1000	New vegetable crop;
SACRED	300	75	Veg production doubled
Manor House	70,000	7000	New veg crops through dry season
Cuba			
Urban gardens	26,000	8000	Increase in total production from 4200 t/yr to 727,000 t/yr
Cameroon			
HPI dairy	280	750	Milk up 300% to 8-12 litres/day
Bangladesh			
BRAC IPM vegetables	60,000	11,000	Veg yields up 39% to 12,400 kg/ha
Chile			
CET organic gardens	10	5	Veg up from 20 to 83 kg/month
India			
ICAP dairy cows	338	380	Milk yields up 60% to 8 l/cow
Pakistan			
Sindh rural women	5000	3500	Mango & citrus yields up 150-200%
Philippines			
IPM vegetables	1720	1720	Cabbage up 21%
Malawi			
ICLARM aquaculture	200	10	Veg up 48% to 4000 kg/ha; new fish yields of 1500 kg/ha
South Africa			
ADRI	400	40	New veg and poultry in gardens
Sudan			

Shendi SOS Sahel	400	300	New veg
Swaziland			
Vuko Mfati	60	6	New veg and poultry
Tanzania			
Iringa dairy	2300	3000	Milk yields up 157%
NAEP Dodoma	21,608	11,859	Milk yields up 300%
Uganda			
HPI	5000	10000	New dairy cattle
Environmental Alert	150	100	Milk yields up 30%; veg all year
Bushenyi	4636	6954	New dairy cattle
Zimbabwe			
Maonazvava	41	3	Veg yields doubled; 60 kg fish/pond/yr

Source: SAFE-World database, University of Essex

18. All these mechanisms lead to substantial increases in domestic food production for households, with particular benefits for the health of women and children, and increases in women's incomes where surpluses can be sold. In many cases, food supply is now guaranteed throughout the year, whereas previously families might have had to suffer several months of deficit (such as in winter in Swaziland, or the dry season in Kenya). The challenges centre on encouraging agricultural development programmes to focus on these very productive patches, and to consider home gardens as vital part of agricultural strategy, not something to be ignored. In addition, more research is needed to understand the potential beneficial synergies between farm components and homegardens.

VI. Tropical Roots and Tubers

19. Roots and tubers are very important crops because of their high per hectare productivity – a global average of 12 t/ha. The global tropical production comprises some 124 million tonnes of sweet potato on 9.4 million ha, 152 million tonnes of cassava on 15.8 million ha, 30 million tonnes of yam on 3 m ha, 6 million tonnes of taro on 1 million ha, and 265 million tonnes of Irish potatoes, of which 165 million tonnes in developing countries on 13 million ha (of which 0.75 million in Africa, 0.94 in Latin America, and 5 million ha in Asia), and 100 million tonnes are in Europe and North America.

20. The key changes with sustainable agriculture include varietal selection and testing by farmers; and IPM with farmer field schools for pest management. Although there was relatively little data on these systems, it appears that substantial improvements in tropical root production are possible through adoption of sustainable agriculture with cassava and sweet potato yields up 2-3 fold. We do not draw conclusions from these systems owing to the small sample size.

Table 16. Selection of impacts of sustainable agriculture in tropical roots and tubers systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture	Changes in system productivity

	Farmers	Hectares	
Indonesia			
CIP IPM	161	36	Sweet potato up 278% to 68 t/ha (wet) and up 50% to 62 t/ha (dry)
Ethiopia			
Freedom from Hunger	2300	2150	Sweet potato up from 6 to 35 t/ha
Ghana			
Peri-urban	200	20	Cassava up 75% to 26 t/ha

Source: SAFE-World database, University of Essex

VII. Banana and Plantains as Staples in Mixed Systems

21. Some 52 million tonnes of bananas and 29 million tonnes of plantains are produced each year. Although most banana production is for sale as a fruit, some communities and economies depend on both bananas and plantains as a staple. Uganda, for example, produces 30% of the world's plantain harvest. Bananas, though, are ubiquitous in tropical systems, and are an important source of carbohydrate for many rural people, particularly children. Bananas and plantains, however, suffer from a variety of pests and diseases, and soil nematodes have rendered some environments entirely unsuitable for their cultivation. Where they are grown in large plantations, pesticide use is high.

22. This study did not assess large-scale banana cultivation. In the smallholder sector, though, productivity has increased through better soil and nutrient management. Further productivity increases could come through novel breeding and the development of new planting material. A particular target for GM, for example, is nematode-resistant stock which could permit cultivation on the soils currently hostile to bananas and plantains.

Table 17. Selection of impacts of sustainable agriculture in banana and plantain as staples in mixed systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Uganda			
MOAAIF – SW	72,000	490,000	Banana/plantain yields up 80-100%
Accord Mbarara	350	350	Banana/plantain yields up
Kasese smallholders	200	250	Banana/plantain yields up 300%
Bushenyi CARE	4636	6954	Bananas – shortage to households turned to surplus (65 kg/hh/month)

Source: SAFE-World database, University of Essex

VIII. High mountains

23. The high mountains are extremely challenging environments characterised by cold, short, growing seasons and desert conditions. These systems are situated the in

Andes and Himalayas (there are none in Africa). Agriculture is typically complex and diverse, and centres on potatoes and cereals as key staples.

24. The key changes with sustainable agriculture include varietal selection and testing by farmers; legumes into systems to increase soil fertility; and waru-waru raised fields for frost tolerance. These have all led to increases in per hectare productivity of tubers.

Table 18. Selection of impacts of sustainable agriculture in mountain systems

Country and names of projects/initiatives		Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
		Farmers	Hectares	
Peru				
	PIT Ecologicas Agro	10,000	11,565	Potato up 208% to 20 t/ha
	PIWA raised fields	500	200	Potato up from 1-4 to 8-14 t/ha
	CIED Cajamarca	1247	1124	Potato up 60% to 8 t/ha
Bolivia				
	Agroecol AGRUCO	500	300	Potato up 40-60% to 8-10 t/ha
	PRODINPO, Potosi	2000	1000	Potato up 250% to 10-15 t/ha

Source: SAFE-World database, University of Essex

IX. Livestock - extensive grasslands

25. Pastoralists have long made their livelihoods in extensive grasslands of Africa and central Asia. These systems tend to have a low per hectare productivity, but pastoralists have developed many complex management systems for making the best use of such patchy environments (Scoones, 199?). These extensive livestock systems have not formed a part of this study.

X. Livestock - intensive pasture and feed-based systems

26. In industrialised countries, most livestock are raised in intensive production systems. Some are highly centralised, such as feedlots in the USA, in which animals see no grass. Others make intensive use of grasslands through active management, such as rotational grazing (Pretty, 1998). In developing countries, livestock production is becoming increasingly intensive. Much of the growth in demand for livestock products predicted over the next 20 years is expected to come from intensive pig, poultry and beef-raising systems (Delgado et al, 1999).

27. Although these livestock systems have not been a focus of this study, it is clear that they will play a vital role in the world food system. Most rely on processed feed derived from cereals, and so the increased demand for livestock products will lead to much increased demand for cereals. Such growing demand could be slowed through programmes to increase feed conversion in animals (eg by genetic modification of gut bacteria, of crops or even the animals themselves), or through adoption of knowledge- and management intensive rotational grazing systems,

which make much more productive use of pastures.

XI. Intensive Horticulture and Orchards

28. This system comprises commercial horticulture and fruit production, often for international markets. During the 1990s, global trading of vegetables and fruit increased rapidly to meet out-of-season demand in industrialised countries. In some countries, the horticulture sector has become the main source of foreign exchange (such as Kenya). The key traded crops include green beans, baby corn, mange tout, and a wide variety of fruits – though more than 100 different products are now imported into Europe (Nolan, 2000). Although these systems are of vital importance as sources of income for some farmers and some countries, as well as being large consumers of pesticides and fertilizers, they have not formed a part of this study.

XII. Fibre Crops

29. Cotton provides about 50% of all global fibre requirements, with wool, silk and flax accounting for about 10% (Myers and Stolton, 1999). World cotton world fibre production is 18.9 million tonnes, with average yields of 0.57 tonnes/ha. These vary from the lows of 0.2-0.4 t/ha in Sub-Saharan Africa and India, to 0.7-0.9 in USA, Egypt, China and Uzbeckistan, to highs of 1.5-1.8 t/ha in Australia and Israel. The only types of systems that form a part of this study are organic cotton. In 1997, about 0.04% of cotton was organic - about 8000 tonnes. Yields are considerably lower in industrialised countries, but in Sub-Saharan Africa and India, they are equal or better than conventional systems.

Table 19. Selected of impacts of sustainable agriculture in fibre crop systems

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Senegal			
ENDA organic	523	233	No change in cotton yield (300 kg/ha)
Tanzania			
GTZ organic	134	778	No change in cotton yield (660 kg/ha)
India			
Maikaal organic	800	2200	Cotton up 36% to 400 kg/ha
Egypt			
Biodynamic	150	2000	Cotton up 24% to 2600 kg/ha

Source: SAFE-World database, University of Essex

XIII. Plantation and Estate Crops

30. These are of vital importance to many households in certain countries, both as growers and as workers on estates and plantations. Most of these crops do not form a part of this study, with the exception of organic and sustainable smallholder coffee production in Mexico and Kenya.

	Million hectares	Total production (million tonnes)
Coffee	10.5	5.4
Cocoa	5.9	2.6
Tea	2.3	2.6
Rubber	-	5.6
Oil palm	-	14.6
Coconuts	-	44
Sugar cane	17.6	1076
Sugar beet	7.9	259

Table 20. Summary of impacts of sustainable agriculture in plantation and estate crops (smallholder coffee)

Country and names of projects/initiatives	Numbers of farmers and hectares under sustainable agriculture		Changes in system productivity
	Farmers	Hectares	
Mexico			
UCIRI	4800	4800	Coffee yields up 100% to 600-1200 kg/ha
Kenya			
IIBC-FFS IPM	65	195	Coffee yields up 144% to 1.05 kg/tree

Source: SAFE-World database, University of Essex