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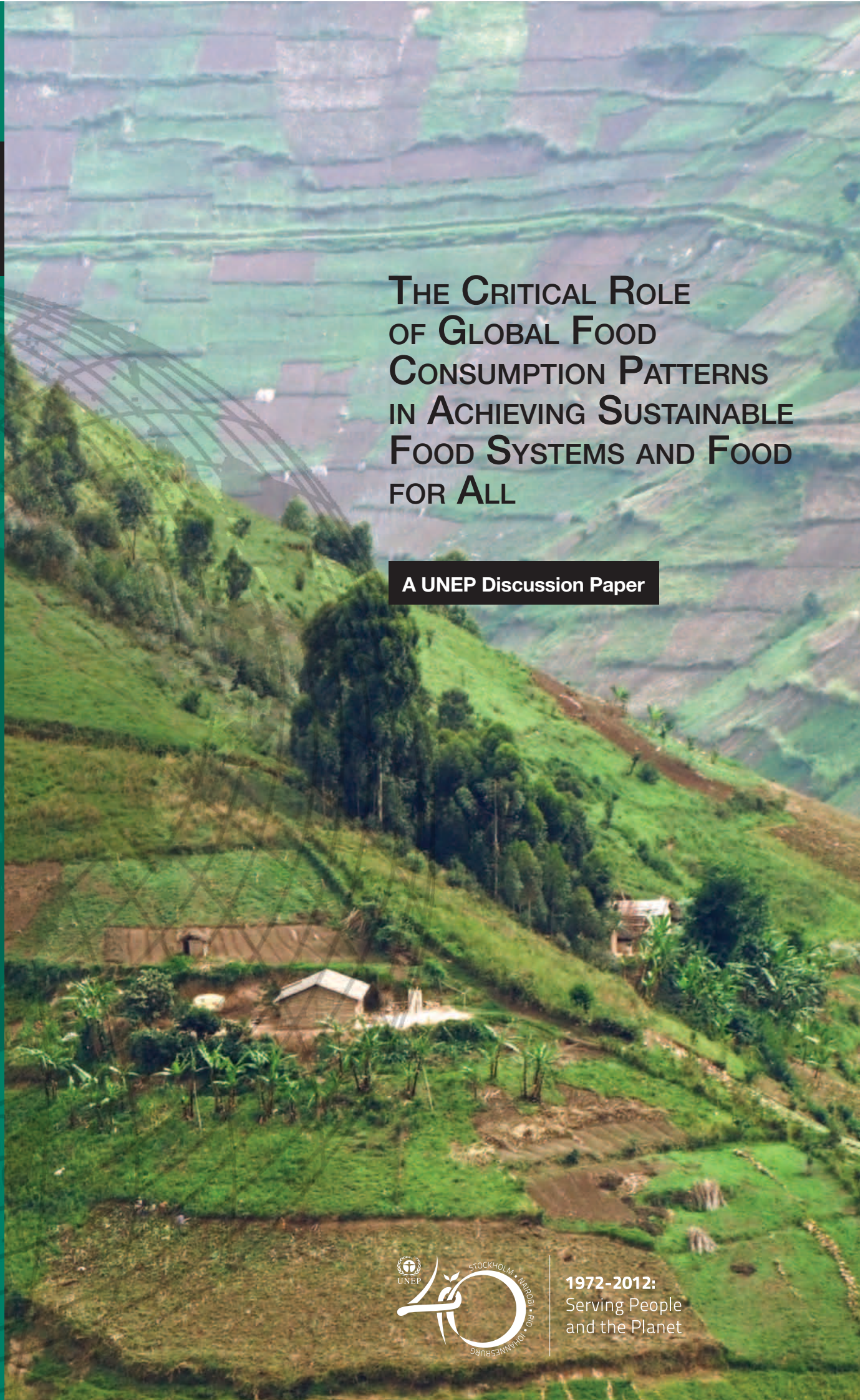
The Critical Role of Global Food Consumption Patterns in Achieving Sustainable Food Systems and Food for All

A UNEP Discussion Paper



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Contents

Boxes

Figures

Tables

Acronyms

BSR	Business for Social Responsibility
CDC	United States Centers for Disease Control and Prevention
EC	European Commission
EU	European Union
FAO	United Nations Food and Agriculture Organization
GAP	Good Agricultural Practices
GBP	Great British Pounds
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emissions
HLPE	United Nations High Level Panel of Experts on Food Security
EPA	United States Environmental Protection Agency
IDF	International Dairy Federation
IFPRI	International Food Policy Research Institute
IAASTD	International Assessment of Agricultural Science and Technology for Development
LCA	Life Cycle Assessment/Analysis
MPTF	Maize Productivity Task Force (Malawi)
MSC	Marine Stewardship Council
NGO	Non-Governmental Organisation
NOAA	United States National Oceanic and Atmospheric Administration
SAI	Sustainable Agriculture Initiative
SMRS	Sustainability Measurement and Reporting System
SRP	Sustainable Rice Platform
TSC	The Sustainability Consortium
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
US	United States
USD	United States Dollar
VAD	Vitamin A Deficiency
WEF	World Economic Forum
WFP	United Nations World Food Programme
WHO	United Nations World Health Organization
WRAP	Waste & Resources Action Programme (UK)
WTO	World Trade Organization
WWF	World Wildlife Fund

Executive summary

If current population and consumption trends continue, humanity will need the equivalent of two Earths to support it by 2030 (Global Footprint Network, 2012). These consumption trends are of particular concern when related to food. The most vital of all sectors and yet the most resource intensive, a global discussion has begun in recognition of the need to address the unsustainable trajectory of the global food system. What has not yet been included in these discussions, however, is the need to go to the roots of the challenge: the increasingly resource-intensive consumption patterns that largely dictate the shape of our global food production system.

This paper examines the largely unexplored impacts of food consumption patterns on the sustainable productivity of the agricultural resource base and in turn, food security. The decision to produce a discussion paper on the topic is the result of a consultative process held at UNEP offices in Paris in January 2012. The intention of the paper is to highlight the role that current and future food consumption patterns play in food security and sustainable development.

The paper provides an overview of global food consumption trends. It describes how significantly changing patterns in food consumption – worldwide – are having profound effects on health, the agro-ecological resource base and food security. It examines the drivers behind these trends and previews how the anticipated continuation of these trends will affect the ability of the world to feed itself sustainably. The paper provides illustrative case studies which demonstrate that unsustainable food consumption patterns are already leading to considerable detrimental effects.

Finally, the paper concludes with key messages and offers a suite of suggested opportunities and actions, for both the public and the private sectors, that will address the challenges presented by unsustainable food consumption.

Key messages:

1. We cannot successfully address unsustainable production patterns without acknowledging the consumptive drivers that shape and largely dictate the design of these production systems. **We must address the consumptive demand and productive supply elements systemically**.

2. The key drivers behind unsustainable food consumption patterns – a growing population, increasing urbanisation and rising incomes – are likely to continue. Thus **concrete action is needed at the public and private sector levels, with the support of non-governmental organisations (NGOs) and consumers, to redirect elements of the universally observed nutrition transition to diets based on less resource-intensive foods**. The increased consumption of animal products, including fish,

deserves particular attention. Working together, the public and private sectors – with the support of NGOs will have even greater influence.

3. **Consumptive trends are detrimentally affecting health**. The social and economic costs of now widespread diet-related illnesses are straining individuals, families and national healthcare budgets.

4. **Consumptive trends are negatively affecting the agro-ecological resource base and its ability to sustainably provide**. Land degradation, declining soil fertility, unsustainable water use, overfishing and marine environment degradation are all lessening the ability of the natural resource base to supply food. It is expected that this problem will be exacerbated by the effects of climate change.

5. **Consumptive trends are adversely affecting food security**. Firstly, overconsumption in developed and developing countries has a direct impact on food prices, disproportionately affecting food accessibility for the poor. Secondly, the intensive production methods that have come to define modern food production are a direct response to increased demand for more resource-intensive food products. Thirdly, intensive production of resource-intensive foods depletes the agro-ecological resource base, affecting its ability to produce plentiful food.

6. **Curbing the amount of food loss and waste generated annually, across the globe, is a tangible starting point for effective collaborative action in this arena**. Initiatives already underway provide valuable case studies for adaptation and replication globally.

Opportunities and actions for the public sector:

1. **Adopt "sustainable diets" as a policy lens**. Sustainable diets are " ... *those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimising natural and human resources* (FAO 2009)." The adoption of a comprehensive "sustainable diets" approach to agriculture and food policy making could help structure and develop a coherent and sustainable set of policy tools to support nutritional health, food security and agro-ecological systems.

2. **Reduce or eliminate subsidies that encourage unsustainable consumption and waste, and consider tax options to shift consumption patterns**.

3. **Design and conduct targeted public awareness campaigns on unsustainable food consumption and food waste**. Public awareness campaigns can play a significant role in addressing and curbing unsustainable food consumption. Designed to meet specific goals and to reach particular populations, they have played important roles in successfully changing consumers' dietary patterns, for health, socioeconomic or food security reasons, in both developed and developing countries.

4. **Consider implementing advertising and marketing regulatory measures to curb the influence of campaigns for unhealthy and unsustainably produced foods**. This is especially important for advertising that specifically targets children.

5. **Use public procurement as a catalyst for change**. Public procurement policy has a role to play in decreasing unsustainable food consumption given the significant amounts of food purchased for use in public institutions.

6. **Improve availability of agricultural technologies and infrastructure to reduce food losses in developing countries**. These losses lead to less food availability, higher prices for the producer and consumer, lost income for producers and governments, and wasted agro-ecological resources in the form of land, soil nutrients, water and other inputs.

7. **Increase inter-governmental coordination for sustainable food systems**. Governments, with the help of intergovernmental organisations and NGOs, must work collaboratively to develop initiatives that bring the public and private sectors

together on food consumption and production issues.

Opportunities and actions for the private sector:

While a concept of "consume less" may sound antithetical to profit-oriented enterprises, the strategy for halting or reversing unsustainable food consumption trends is rather based on "consume smarter." The private sector can work together, and with the support of NGOs and intergovernmental organisations, to realise business opportunities in curbing unsustainable food consumption.

1. **Decouple economic growth from resource intensity across the supply chain**. Decoupling does not imply a reduction in economic output but rather maintaining, or even improving, economic performance through better resource efficiency. The private sector can use less to produce more. This makes sound business sense as well as having positive effects on the agro-ecological resource base and food security.

2. **Reduce waste at the retail and consumer levels**. There is a role for government in curbing this waste through public information campaigns and the use of other policy measures. However, there are clear business opportunities for doing so as well, not the least of which is a more efficient supply chain.

3. **Use certification, standards and labelling to capture market share and to shape consumption**. Adoption of voluntary certification schemes, standards and eco-labelling approaches can increase awareness of consumers, build loyalty for sustainably-certified products and shape consumption patterns – all resulting in more sustainable food consumption. It can also be profitable for businesses.

4. **Increase private sector collaboration for sustainable food consumption and food systems**. As does the public sector, the private sector needs to increase cooperation to strengthen efforts in the food consumption arena. Sustainability-focused consortiums provide action-oriented platforms for industry-related sustainability dialogue and for sharing best practices and emerging tools. Existing consortiums can incorporate the food consumption issue – as some already have – and industry sustainability leaders can initiate new endeavours on the topic.

1

Introduction

There are many ways to look at food consumption, most of which prompt difficult and often complex conversations. Whether one resides in a developed or developing country, or in an economically affluent or impoverished household, food means family, culture and survival. Food is also heavily politicised and a global industry worth approximately USD 4.8 trillion yearly (World Bank, 2006). With such high cultural, political and economic connotations, it is not surprising that the role of sustainable food consumption remains largely unaddressed within the ongoing global dialogue on food security. This omission does not negate the fact, however, that food consumption patterns and trends have a direct and significant influence, in the short and longer terms, on food production patterns and overall food security.

Often characterised as the stark contrast between over-consumption by the affluent and under-consumption by the poor, consumption trends are much more complex than this – with significant health, economic and environmental implications. For example, a universally-observed Nutrition Transition – whereby a growing population, increasing urbanisation and rising incomes result in a sharply increased demand for resource intensive foods – is having considerable effects on our health as evidenced by climbing rates of obesity worldwide – even in food insecure countries. The UN High Level Panel of Experts (HLPE) on Food Security and others also observe that consumers' increasingly resource intensive consumption patterns, in both developed and developing countries, have a major impact on global food price increases – disproportionately affecting poor consumers who are increasingly more exposed to the price fluctuations of the international commodities markets (HLPE, 2011).

Finally, our ever-growing demand for resource-intensive foods is adversely affecting the agro-ecological resource base, to the point of diminishing its productive capabilities. Today, nearly one quarter of the world's land is in use for food production – almost the entire quarter that is suitable for cultivation. This land is increasingly degraded, and its soils depleted, due to intensive or unsustainable agricultural production methods. It is expected that the effects of climate change will diminish productivity further – reducing yields by as much as one third in some areas (UNFCCC, 2012).

The paper examines how current and anticipated future food consumption patterns and trends are related to sustainable global food security and sustainable development goals. While it is anticipated that the conversation may be challenging the food consumption discussion must be fully part of the international food security agenda, clearly identified it as having unique and distinct characteristics from the topics currently dominating this discussion. As most are aware, the United Nations Food and Agriculture Organization (FAO) estimates that 70% more food must be available by 2050, from a severely depleted natural resource base, to ensure food

security needs. UNEP recognises that a necessary rise in consumption must occur in some areas. What is needed is a strategic mix of both production and consumption interventions, in both the policy and private sector spheres and with the support of NGOs, to fight imbalances and sustainably meet food security needs.

Section 2 of the paper provides an overview of our current and anticipated future food consumption patterns and how these patterns drive the unsustainable dynamics of the global food system.

Section 3 provides concrete examples of how these unsustainable food consumption trends are already detrimentally affecting our health, agro-ecological resource base and food security.

Section 4 identifies opportunities for both government and business in responding to these unsustainable food consumption challenges.

Section 5 suggests areas needing further investigation and collaboration to advance the sustainable food consumption agenda. It is the goal of the paper to explore the relationship between food consumption, unsustainable food production methods and food security so that the topic of food consumption is considered as part of discussions on international food security.

2

Food consumption patterns: shaping food systems and food security

The world currently produces enough food for its citizens (FAO, 2011). However, food demand is only met in the aggregate, as there are profound disparities in access to food across geographic regions and across the spectrum of incomes at both the household and country levels. Despite considerable efforts to combat global hunger, 925 million people were undernourished in 2010 while the number of overweight and obese people, across the developed and developing worlds, rose to 1.5 billion in 2008 (FAO, 2012). The rise of this extreme discrepancy provides new and unique challenges to households and governments as they strive to provide sustainable dietary sustenance to citizens (WHO, 2011).

While the challenges of providing stable physical, social and economic access to adequately nutritious food define the food security agenda, today these challenges are exacerbated by unsustainable dietary patterns – both under- and overconsumption – that in differing ways affect markets, health and the natural resource base. Current food consumption trends, the global disparities in these consumption patterns, and how these consumption trends impact the ability of our agro-ecological systems to provide food for all are addressed in this section.

2.1 Unsustainable trends in food demand: underconsumption and overconsumption

Food consumption varies widely between countries and among different cultures. As shown by the FAO and others, average caloric intake in least developed, developing, and industrialised countries varies widely – 2,120, 2,640, and 3,430 kcal per person per day, respectively (FAO, 2011). However, in many communities in the developing world, the average intake is far lower than 2,120 kcal per person, resulting in systemic hunger and undernourishment. The health effects of chronic undernourishment are severe, especially for children, and include slowed growth, underweight, susceptibility to disease and shortened life expectancy.

Populations in South Asia and Sub-Saharan Africa remain especially vulnerable to undernourishment. One third of Indians are undernourished and 44% of people living in sub-Saharan Africa suffer from food insecurity. (Stuart *et al*, 2011, Shopouri *et al*, 2011) Ironically, many of the chronically undernourished are smallholder farmers themselves, participating in what is typically subsistence agriculture. In addition to inequities in global agricultural trading regimes, the lack of access to extension services, to market information, to physical markets via sufficient infrastructure, and to agricultural inputs keeps many smallholder farmers trapped in poverty.

Box A: Defining nutritional status and food security

This report focuses on the consumption of food by people. Commonly used nutritional status terms are defined here:

Hunger: The uneasy or painful sensation caused by a lack of food. When used in programme evaluations, lack of access to food must be involuntary.

Food insecurity: Inadequate access to sufficient and nutritious food results in food insecurity. The lack of access can result from economic, physical or social barriers or any combination of these.

Malnutrition: In recent years, malnutrition was typically interpreted to mean hunger, either acute or chronic. There are now several specific types of malnutrition: undernutrition, overnutrition, and micronutrient malnutrition.

Undernutrition: This term focuses on macronutrients, especially energy and protein, responsible for skeletal and muscular growth. Daily intake of less than 2100 kcal (for adults) would result in undernutrition.

Micronutrient Malnutrition (or Hidden Hunger): Even when sufficient energy and protein are consumed, diets may consistently lack specific nutrients. The most common examples of this are deficiencies of Vitamin A, iron and folic acid. Hidden hunger can also be combined with overnutrition.

Overnutrition: The definition of overnutrition is person-specific; it is the surplus of energy intake over energy expenditure.

Overweight and Obesity: According to the World Health Organization, Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in metres). A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight.

At the same time, there exists a clear trend toward overconsumption across the developed and developing worlds. Food security reports have hesitated to draw attention to obesity when hunger and undernutrition remain so globally prominent. However, for the first time the number of overweight individuals worldwide exceeds those who are underweight. Developing countries have joined these ranks. Obesity is now found in all developing regions, and is growing rapidly, even where hunger exists. In China, the number of overweight people jumped from less than 10% to 15% in just three years. In Brazil and Colombia, the figure hovers around 40%–a level comparable to a number of European countries. Even Sub-Saharan Africa, where most of the world's hungry live, is seeing a rise in obesity. In South Africa, an estimated 29% of men and 57% of women are overweight or obese (FAO, 2012, Pouane *et al*, 2002).

In all regions, obesity seems to grow as income increases. Of concern is the impact that obesity has on health and public health expenditures. Obesity is associated with many chronic diseases such as diabetes, heart disease, hypertension and some forms of cancer. While research on obesity-related costs to public health systems has been limited in the developing world, data tracked and collected in the United States is illustrative of the enormity of the budgetary concern. Total healthcare costs attributable to obesity and the overweight are set to double every decade to reach USD 860.7 to 956.9 billion by 2030. This would then account for 16-18% of all US healthcare costs (Wang *et al*, 2008). This figure does not include the economic value of lost productivity associated with obesity-related health concerns, which is estimated to be USD 96 billion (FAO, 2012).

2.2 Compounding the food consumption challenge: food losses and waste

It is important to note that there is a significant difference between the amount of food *produced* (at the farm level) and the amount of food *actually consumed*. The FAO estimates that global food loss and waste is approximately 1.3 billion tonnes annually – or roughly one third of all food produced for human consumption. Food loss and waste occurs at points throughout the food supply chain – from

the field through to household level – and occurs across the global socioeconomic spectrum. Although the food lost and wasted results from very different circumstances in say, the US and Sub-Saharan Africa (see Box B), it is interesting to note that aggregate levels of food lost or wasted is similar in these regions – around 40% – although patterns of waste and loss vary considerably (Charles *et al*, 2010).

Box B: Definitions of food loss and food waste

The FAO makes an important distinction between food loss and food waste:

Food loss: Food losses take place at production, post-harvest and processing stages in the food supply chain. Food losses are greatest in developing countries where agricultural technologies and infrastructure are less developed.

Food waste: Food waste occurs at the end of the food chain (retail and final consumption stages) and relate to retailers' and consumers' behaviour. Food waste is most prominent in developed countries.

Both food loss and waste is "measured only for products that are directed to human consumption, excluding feed and parts of products which are not edible."

Source: FAO, (2012)

The majority of food loss in the developing world occurs in the field, transport and storage stages (see Figure 1). There is a direct relationship between the state of development of supply chains and post-harvest losses in these countries. Post-harvest losses of maize in East Africa range from 5 to 35% (World Bank, 2011). The post-harvest loss of rice in Asian countries commonly ranges from 10 to 25%, and sometimes more (Hodges *et al*, 2010). In China, post-harvest losses of fruits and vegetables were recently estimated to be 37 and 46% (Foresight, 2011). Because smallholder farmers produce much of the output intended for consumption in developing countries, these losses have a direct impact on the food security of their households and communities, as well as on the wider domestic market.

In the developed world, waste occurs primarily at the retail and household levels. US losses total 26% of the food supply just at the retail and consumer levels, and losses in the UK total 22% of food brought into homes (Hodges *et al*, 2010). In the US, it is estimated that the caloric energy in wasted food increased from 900 to 1,400 kcal per person per day between 1974 and 2003 (Hall *et al*, 2009). This represents an increase from 30 to 40% of food energy in wasted food over this time period.

It is important to recognise there are multiple facets of food loss and waste, all of which exacerbate food consumption and food security challenges. These include:

Figure 1: Per capita food losses and waste at consumption and pre-consumption states in different regions

Source: FAO, Gustavsson *et al*,2011

a. Through loss and wastage, the overall availability of food for consumption is reduced.

b. Food that is lost or wasted carries direct economic and environmental costs. For example, disposal of food waste in landfills is a significant source of methane emissions.

c. Food loss and wastage depletes the resource base used to produce food. The use of land, soils, water and energy to produce food that is ultimately not consumed is substantial and also leads to the unnecessary emission of greenhouse gases (GHGs). For example, in the UK, tackling household food waste would reduce the volume of GHG emissions equivalent to taking over 20% of cars off UK roads. The water and energy embedded in lost and wasted food represented 25% of total water use and 4% of total energy use in the US in 2004 (Hall *et al*, 2009). Figures were similar in the UK (Parfitt *et al*, 2010).

d. The case of loss and waste in global fisheries – a provider of protein to 3 billion global inhabitants – deserves special mention. Post-harvest losses in small-scale fisheries are generally regarded as being the highest for all commodities in the entire food production system. Post-harvest losses can be the result of poor handling, spoilage and the discarding of bycatch. Spoilage is responsible for an estimated loss of 10 to 12 million tonnes per year, accounting for approximately 10% of total global production. The discard of unwanted bycatch produces an additional 20 million tonnes of waste yearly. This is especially significant in trawl and gillnet fisheries where the proportion of species caught incidentally can reach 95% of the total material taken on board (FAO, 2012). UNEP notes that the protein lost from fish by-catch and discard, if harnessed, could provide enough fish meal to increase current aquaculture by 50% (Nellemann *et al*, 2009).

2.3 Food consumption inequality

In 2008, people in developed countries consumed 39% of grain (for food, feed and biofuels), and 41% of animal protein, although they represent only 18% of the global population. This overconsumption in developed countries has direct and indirect impacts on the food security of people in developing countries:

- While there is currently not a shortage of cereals at the global level, the relatively inefficient conversion of cereals to either animal protein or biofuels is a **direct** diversion of resources and potential energy staples globally. For example, according to UNEP, it takes approximately 3kg of grain to produce 1kg of animal protein in cereal-fed animal production (Nellemann *et al*, 2009).[1] According to other research, the figure is closer to 6kg of grain for 1kg of meat (Pimmentel, 2003). Perhaps most illustrative is an estimate reported by the Worldwatch Institute that the total global grain harvest of 2004, if used directly for human consumption, would feed 6 billion people. If this same amount of grain were used for animal feed the meat produced would feed 2.6 billion (World Watch, 2004).

- The **indirect** impact may be even more powerful: the competition for cereals drives up prices which limit *economic* access in any location where people are buying these dietary staples. As the volume of food imports has increased in many developing countries, largely as a result of both agricultural underinvestment and low yields related to climate, price volatility further affects economic access. This is especially the case in countries where food expenditure comprises a larger percentage of total household budgets. In developed countries, the proportion of income spent on food has steadily declined, now constituting an average of only 10% of household budgets in both the US and UK. However, in developing countries food remains a significant expenditure for households – about 70% in Tanzania and 45% in Pakistan for example (FAO, 2012). Thus, as overconsumption in developed countries (and increasingly in more affluent constituencies in developing countries) drives up global (and national) food prices, consumption in developing countries is increasingly adversely affected (HLPE, 2011).

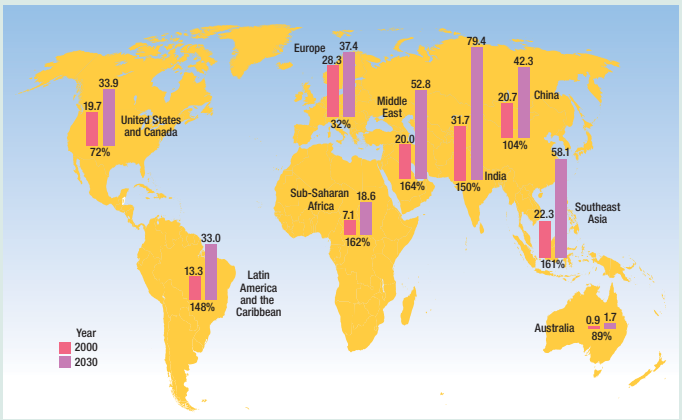
1. Livestock raised on forage convert to protein more efficiently than those raised on cereals.

Box C: The "paradox of undernutrition and obesity"

Reducing poverty has consistently resulted in dramatic reductions in the effects of undernutrition (Webb and Block, 2010). However, in today's world, the situation is more complex than this suggests. Undernutrition and obesity now coexist within countries and even within households. While this is a universal phenomenon, the patterns of this coexistence vary amongst geographies. Some facts:

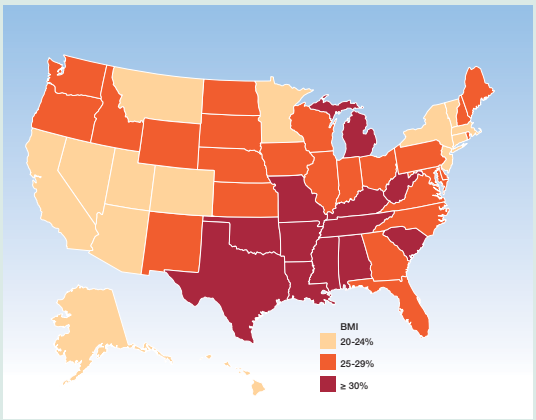
- During the next decade, deaths due to diseases related to overnutrition (diabetes and coronary heart disease, for example) will overtake undernutrition as the leading non-communicable cause of death in developing countries.
- At all socio-economic levels, there is an increase in "dual burden households," which are households that have both undernourished and overweight or obese members. Currently, the proportion of such households is about the same, for example, 7% in China and the US.
- The relationship between income and overnutrition is much less clear, giving rise to the "paradox of undernutrition and obesity." Specifically, the poor are more likely to experience both under- and over-nutrition. For example, the US has the largest number of obese people in the world but the rate is highest among the lowest income states (See Figure 2). The rate of overweight and obese is highest among the lowest income levels.
- Another demonstration of this paradox is the growth in the incidence of diabetes. Largely a diet-related disease, this growth is most evident in the Middle East, India and China and amongst the relatively more affluent in these countries. (See Figure 3)

Figure 2: Millions of cases of diabetes in 2000 and projections for 2030 with projected per cent changes



Source: Data are from Wild *et al*, 2004

Figure 3: Percent of obese: BMI ≥ 30 in US adults (1985-2010)



Source: CDC, 2010

2.4 What is driving these trends?

These trends are driven by three inter-related factors: growing population, migration of populations to urban areas and increasing incomes.

2.4.1 Growing population

The world population reached seven billion in 2011. The Population Division of the UN Department of Economic and Social Affairs reports that it took over 50,000 years for the world to reach its first billion, but the last two have been added in barely 25 years. Even with a projected slowdown in growth rate, by 2050 the world population will reach at least 9.1 billion, perhaps more (UNDESA, 2011). These additional 2 billion persons will reside almost exclusively in the developing world with 96.5% of all population growth occurring in low-income countries:

Table 1: Projected global population growth (in millions)

Region	2011	2050	Change	Percent
World	6987	9587	+2600	+37
High income	1242	1333	+91	+7
Low income	5745	8254	+2509	+44
Sub-Saharan Africa	809	1698	+889	+110
South Central Asia	1683	2605	+922	+55
Latin America and Caribbean	577	778	+201	+35
North Africa and West Asia	422	670	+248	+59

Source: Population Reference Bureau: 2011 World Population Data Sheet, based on UNFPA and US Census Bureau data and analyses (Population Reference Bureau, 2011)

2.4.2 Increasing urbanisation

The United Nations Population Fund reports that in 2008, more than half of the world's population was living in towns and cities. As increasing numbers of people move to urban centres, largely seeking increased economic opportunity, they rely on external forces for sustenance, and also have access to a more diverse diet, including more nutrient-dense foods available through the global supply chain. This results in an increase in the widespread consumption of these foods, even for relatively low-income consumers, known as the "nutrition transition".

Studies across the developing world show that, as urbanisation occurs and incomes rise, a convergence towards diets high in resource-intensive saturated fats, sugar and refined foods – often termed the "western diet" – occurs (Caballero *et al*, 2002). Tracking the rise of both urban populations and the increased consumption of resource-intensive diets is suggestive of a correlation between the two. In 1950, the global proportion of urban population was 29%. Today it is greater than 50% – more in developing countries (UNDESA, 2006). Between 1963 and 2003, consumption of meat, sugar and vegetable oils increased by 119, 127, and 199% respectively, in developing countries (Kearney, 2010). By 2030, the proportion is expected to be 60%, with urban growth concentrated in Africa and Asia (UNDESA, 2006).

2.4.3 Rising incomes and purchasing power

While poverty remains unacceptably high – particularly in Sub-Saharan Africa and South Asia – the UN reports that progress in its reduction has been made in both absolute and proportional terms (UNDESA, 2010). Data shows that the percentage of the population living in households with consumption or income per person below the poverty line has decreased in each region of the world since 1990 (see Table 2).

Table 2: Percentage of the population living in households with consumption or income per person below the poverty line

Region	1990	2002	2004
East Asia and Pacific	15.40%	12.33%	9.07%
Europe and Central Asia	3.60%	1.28%	0.95%
Latin America and the Caribbean	9.62%	9.08%	8.64%
Middle East and North Africa	2.08%	1.69%	1.47%
South Asia	35.04%	33.44%	30.84%
Sub-Saharan Africa	46.07%	42.63%	41.09%

Source: World Bank, 2012

Additional progress has been made in transitioning low-income households to the ranks of the middle class (see Table 3 overleaf).[2]

2. "Middle Class" is defined by the OECD as households having at least USD 10-100 of discretionary income per day.

Table 3: Numbers (millions) and share (percent) of the global middle class

Region	2009		2020		2030	
North America	338	18%	333	10%	322	7%
Europe	664	36%	703	22%	680	14%
Central and South America	181	10%	251	8%	313	6%
Asia Pacific	525	28%	1740	54%	3228	66%
Sub Saharan Africa	32	2%	57	2%	107	2%
Middle East/ North Africa	105	6%	165	5%	234	5%
World	1845	100%	3249	100%	4884	100%

Source: OECD, The Emerging Middle Class in Developing Countries (Kharas, 2010)

This increase in expendable income has considerable effects on the global consumption of food. Within diets, this is most evident in the nutrition transition and, perhaps having greatest impact, is the increased consumption of animal protein (with the exception of vegetarian cultures) associated with it. World meat and dairy consumption doubled between 1950-2009. If this trend continues, global animal protein consumption will increase by a factor of four by 2050 (Bouwman, 1997). The increased consumption of these resource-intensive products will have profound impacts on our agro-ecological resource base and its ability to provide food in the future.

2.5 The impact of food consumption on the agro-ecological resource base

The increase in aggregate agri-product demand, and particularly in the consumption of resource-intensive foodstuffs, is directly responsible for the rising ecosystem-level pressures on land, water and other natural resources used in the production of food. The global agriculture sector is extremely resource intensive. The global production of food occupies nearly one quarter of all the habitable land on earth. It is responsible for more than 70% of fresh water consumption, for 80% of deforestation, is the largest single cause of species and biodiversity loss and produces more than 30% of global greenhouse gas emissions. It continues to represent the single greatest cause of land-use change (Nellemann *et al*, 2009).

From 1980-2000, 83% of cropland expansion in the tropics originated from intact and disturbed forests (Gibbs *et al*, 2010). In many regions, the majority of this new agricultural land is used to supply the growing international market for animal protein, whether through the direct production of animals or through the production of animal feed. According to UNEP, ranches alone accounted for an estimated 70% of deforestation in Brazil in 2007. In 2007, these ranches covered an area of at least 8.4 million ha in total, illustrating that the Amazon is now "part of a national and international economy which, through globalisation, is responding to market (and consumer) demands…"(Nellemann *et al*, 2009).

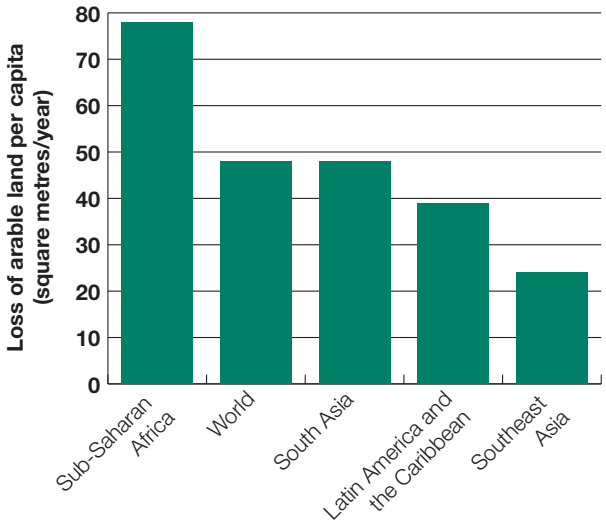
While forests are perhaps the highest profile victim of changing food consumption patterns, of equal concern is the deterioration of the immediate agro-ecological resource base through the intensive practices utilised to produce the foods that are increasingly consumed by a growing, urban, increasingly affluent consumer base. The production of food, after all, is entirely dependent upon well-functioning ecosystems in the form of healthy arable land, healthy soils, plentiful water and resilient fisheries. The data below provides a snapshot of where these stocks currently lie:

- **Land:** More than three quarters of the global land surface is unsuitable for cultivation so our food production remains confined to the potential

presented by a quarter of our planet's land. Cattle now occupy nearly 25% of this area and crops grown for feed take another 25%. In the US, nearly 70% of the grain crop is used for animal feed, and globally 35% of the grain harvest is used to produce animal protein. As previously stated, if consumption trends continue, by 2050 animal protein consumption will have increased by a factor of four. Additionally, the nutritional inputs required in livestock production are disproportionate. At least one study estimates the ratio of grain and fodder inputs to beef production are 40:1 (Pimentel *et al*, 2003).

- **Soils:** The farmland on which food production depends is rapidly degrading, primarily due to intensive agricultural practices. UNEP estimates that during the second half of the 20th century, 2 billion hectares of arable land were degraded largely due to intensive agriculture practice. Two to five million hectares are added to this figure annually (Nellemann *et al*, 2009). The International Food Policy Research Institute estimates that 24% of total global land area has been affected by land degradation – representing the loss of 20 million tons of grain each year, or 1 per cent of global annual grain production (IFPRI, 2011). Worldwide, 1.5 billion people and 42% of the very poor live on degraded lands (IFPRI, 2011).

Figure 4: Annual loss of per capita arable land in developing countries, 1961-2009



Source: Preliminary analysis based on linear regression model from data from Food and Agriculture Organization of the United Nations, FAOSTAT database.

- **Water:** Agriculture has a significant impact on water resources and water quality. Fresh water supplies are globally oversubscribed with at least 70% of fresh water being consumed, or wasted, by agriculture – primarily on resource-intensive crops. In the likely event that more land is converted to food production to cope with food demand increases, this figure will most certainly rise. Ongoing erosion and associated nutrient export from agricultural land also play important roles in the observed increase in the sedimentation and pollution of rivers and aquifers. Agricultural nutrient run-off from excessive application of intensive synthetic inputs also results in coastal hypoxic or "dead" zones which severely constrain the productivity and ecosystem integrity of marine ecosystems. The case of the Gulf of Mexico dead zone, and its environmental, social and economic implications will be discussed in the next section. (Diaz *et al*, 2003)

- **Fisheries:** The FAO *State of the World's Fisheries and Aquaculture* (2011) reports that fish consumption has reached an all time high, with the contribution of fish to global diets reaching a record of nearly 17 kg per capita, now supplying over three billion people with at least 15% of their average animal protein intake. Fisheries also support the livelihoods of an estimated 540 million people – or 8% of the world's population. (UNEP, 2012) However, 75% of the world's major marine fish stocks are either depleted, overexploited or being fished to their biological limit to supply this rising consumption. Aquaculture, which most often utilises wild-caught fish as feed for farmed species, does not relieve pressure on wild stocks. For example, 20 kg of wild-caught feed is generally required to produce just 1 kg of farmed tuna (FAO, 2011). Yet, FAO's *World Aquaculture* found that global production of fish from aquaculture grew by more than 60% between 2000-2008, from 32.4 million tonnes to 52.5 million tonnes. It also forecasts that by the end of 2012, more than 50% of the world's fish consumption will come from aquaculture. (FAO, 2010)

2.6 Food consumption and the future

At present, analysis suggests that current trends and patterns of food consumption will remain unchanged and are highly unsustainable whether measured for public health, environmental impacts or socioeconomic costs. Even if evidence of the global nutrition transition was unsubstantiated (and it is not) and current dietary patterns were constant (i.e. if diets remained constant for each country) population increase alone would lead to an increased food consumption of nearly 30%. Further, not addressed in this paper, nor incorporated into these estimates, are the anticipated effects of climate change which are expected to reduce yields by up to 25% in some areas. (Nellemann *et al*, 2009)

Due to existing planetary boundaries that will limit cropland, rangeland and fishery expansion, it is difficult to envisage that the current global food system could meet this consumptive demand. Simply, the specific demands we as consumers are placing on our global agro-ecological system are unrealistic, and perhaps negligent, in terms of our obligations to meet food security targets now and in the future.

3

Case studies: the effects of unsustainable food consumption

The previous section described how unsustainable consumption patterns – both underconsumption and overconsumption – present significant sustainability challenges to the health of human populations, the agro-ecological resource base and food security. This section provides case studies to illustrate these challenges. In all cases, linkages between changing food consumption patterns, the environment and human wellbeing are articulated. Although the immediate solution to these complex challenges is not always evident, what is clear is that unsustainable food consumption trends are now having a wide range of tangible detrimental effects.

The five case studies are:

3.1 Supermarkets and household waste: United Kingdom

***Food consumption challenge:* Urbanisation and rising incomes lead to excessive food waste at the retail and household levels**

As described in the previous section, approximately one third of all food produced for human consumption is lost or wasted globally – amounting to approximately 1.3 billion tonnes per year (Gustavsson *et al*, 2011). In the developed world, the majority of this waste occurs at retail and household level – meaning that it is discarded even if it is still suitable for human consumption. Supermarkets now represent 75-80% of all food retail outlets in the developed world (Reardon *et al*, 2008). Thus, supermarkets, their supply chains and their relationships with developed country consumers, can play a large role in shaping patterns of food consumption and waste.

Developed world food waste can be viewed as stemming from three sources: consumer behaviour, the consumer/retailer interface and the lack of coordination between supermarket supply chain actors:

- **At the consumer level**, insufficient purchase planning, confusion over government-mandated food date labels, a decrease in home economics skills and food knowledge and that discarding food has become an unconscious behaviour (made easier by the low percentage of disposable income

spent on food in developed countries) and the fact that many consumers spend a relatively small amount of their disposable income on food), all contribute to the high numbers reported above.

- **At the consumer/retailer interface**, cosmetic quality standards can lead to perfectly edible food being rejected because of imperfect shape or size; inefficient inventory control systems, combined with a lack of supply chain transparency, can lead to over-production and waste; and promotional events on perishable food items can encourage bulk-purchasing which can lead to waste if the food is not managed properly.

- **In the supply chain**, producers often produce larger quantities than required in order to ensure delivery of agreed quantities to supermarkets and to avoid contract penalties for partial delivery of order volumes. Surplus crops are sold to processors or as animal feed if prices are acceptable, but often it is cheaper for producers to discard their excess capacity.

While supermarkets have long been a developed country phenomenon, notable is that "supermarketisation" is on the rise in the developing world as well. Supermarkets now represent 30-50% of food retail in Latin America and Southeast Asia, as well as 5-20% in China, India, Vietnam, Russia and parts of Africa (Reardon *et al*, 2008). While this could be viewed as potentially worrying with regards to increased food waste, an example of how supermarkets and consumers might reverse these trends is illustrated by recent efforts in the United Kingdom.

In the UK, annual food waste is estimated to be about 15 million tonnes, with nearly half (7.2 tonnes) arising in the home and 400Kt from retailing (WRAP, 2012). Since 2005, there has been a concerted effort in the UK to reduce food losses in supply chains and food waste in retailing and individual residences, led by the Waste & Resources Action Programme (WRAP). WRAP is a not-for-profit company backed by government funding from the Department for the Environment, Food and Rural Affairs in England, the Scottish and Welsh Governments, the Northern Ireland Executive and the European Union. WRAP works with governments, business and consumers to realise its vision for a world without waste, where resources are used sustainably.

The WRAP-coordinated Courtauld Commitment is a voluntary agreement with members of the grocery industry to improve resource efficiency and reduce the wider environmental impact of the UK grocery retail sector (WRAP, 2011). Members represent 95% of the supermarket and convenience store food retail sector, as well as major food and drink manufacturers with a combined annual turnover of more than GBP 30 billion. The Commitment has set specific food waste reduction targets with signatory companies measuring and reporting their progress annually. First-year (2010) progress in reducing the carbon impacts of packaging was rapid, with a carbon reduction of over 5% achieved.

A parallel effort – WRAP's "Love Food Hate Waste" campaign – promotes sustainable food consumption to consumers – raising awareness of the need to reduce food waste and advising on practical, everyday steps that can be taken to do so. The campaign estimates that by following suggested steps, consumers help the environment and also save money. WRAP estimates that through this campaign, 1.1 million tonnes of food has been saved, representing a saving of 1 billion litres of water, 3.6 million tonnes of CO_2 emissions and 1 million tonnes of landfill waste yearly. Consumers are also saving GBP 2.5 billion a year in food and drink bills (WRAP, 2011).

3.2 Poverty, chronic food insecurity and the deterioration of agro-ecological resource base: Malawi

***Food consumption challenge:* Growing population and consumption levels + poverty = rapid depletion of the agro-ecological resource base that enables food production**

Low income countries already struggling with chronic food insecurity are the most vulnerable to the challenges presented by rising levels of food consumption. As is the case in many low income countries, the nexus of rapid population growth and its associated increase in consumption, high population densities, low production agriculture and depletion of natural resources has created negative synergies that exacerbate existing conditions of soil nutrient mining and under-development, thus creating a vicious circle of poverty and food insecurity (Cleaver *et al*, 1995).

External pressures on prices from global commodities markets exacerbate these challenges. Malawi presents an instructive case study in this regard, with details on the multifaceted nature of the problem but also on options for reversing destructive trends.

In Malawi, agriculture accounts for 36% of GDP and 90% of foreign exchange. Poverty is widespread and severe with over 40% of Malawians living on less than USD 1 per day. The population is 90% rural and it is estimated that more than 89% of the population depends on income derived from natural resources with 87% of Malawians occupied formally or informally by the agriculture sector. Maize is grown by over 90% of farm households and accounts for 60% of calorie consumption, yet 80% of smallholder farmers are net buyers of maize and one in three households fails to meet its daily per capita caloric requirement (Makombe *et al*, 2010). Half of children under five years exhibit stunting (FAO, 2010).

As the population has grown, attempts to keep pace in meeting rising consumption levels have principally relied on expansion of the land base. However, as a small country with an average of only 1.2 ha available per household, combined with a severely depleted soils and resource base, the limits of this approach have been reached. There is overwhelming evidence from on-station research trials, district and adaptive on-farm trials and from discussions with farmers, that low and/or declining soil fertility is the main cause of low crop yields under smallholder farm conditions. In the field, low soil fertility is associated with stunted growth, yellowing and poor crop performance. Soil fertility decline is manifested through falling levels of soil organic matter, depletion of essential nutrient elements, increasing soil acidity and salinity. The main causes of these conditions are continuous monocrop cultivation with little or no added inputs, soil erosion, poor soil management, poor agronomic practices and the general degradation of the natural resource base (DFID, 2012).

In tandem with a government-subsidised inputs program, the Maize Productivity Task Force (MPTF) was introduced in the mid-1990s to bring sustainable agriculture approaches to maize producers for the purpose of rebuilding soil function and replenishing other elements of the agro-ecological resource base. The MPTF deployed extension services to encourage the uptake of crop diversification, crop rotation, intercropping, and other sustainable agriculture techniques to improve smallholder farm output and bolster ecosystem services that had deteriorated with monoculture maize production.

The effectiveness of these alternative practices was evaluated using participatory research methods involving nearly 150 smallholder farms. Modest inputs of nitrogen fertiliser resulted in a doubling of maize yield, even in monoculture systems. Rotating maize with legumes (crop rotation treatment) could substitute for the yield increase from fertiliser. While initially the total output of maize was reduced due to converting a portion of the land base to other crops, the total output of *protein* was increased in this system; the increased crop diversity reduced yield variability, which is a critical aspect in food insecure areas; and the increased profitability was less sensitive to changes in fertiliser costs (Snapp *et al*, 2010). After 2005 there was a rapid increase in maize yields and food security has subsequently improved (Ecker *et al*, 2012).

The World Food Programme (WFP) says that the MPTF contributed to a total cereal harvest in 2010 of an estimated 3.5 million tonnes, resulting in a surplus of more than 800,000 tonnes. These surpluses have allowed WFP to procure more than 100,000 tonnes of food during the past three years in Malawi for use in its operations in-country and elsewhere in southern Africa (WFP, 2012). Now that the subsidies portion of the MPTF has been phased out, work continues to focus on improving the agro-ecological resource base and progress on food insecurity is encouraging.

3.3 The nutrition transition, health and agro-ecological limits: Egypt

***Food consumption challenge:* Changes in consumption patterns associated with urbanisation and the nutrition transition produce large public health and agro-ecological depletion challenges**

During the past 20 years, as countries around the world having experienced urbanisation and economic growth (albeit in differing degrees), a nutrition transition has occurred, changing the face of food consumption. Accompanying this nutrition transition have been increased rates of obesity worldwide with obesity

tripling in some developing countries. The Middle East, Pacific Islands, Southeast Asia and China have faced the greatest challenges in this regard, with China, for example, exhibiting a tripling of obesity in its population since 1992 (USDA, 2008). The relationship between obesity and economic growth levels is complex: being poor in one of the world's poorest countries (GDP < USD 800 per year) is associated with underweight and malnutrition, whereas being poor in a middle-income country (GDP = USD 3,000 per year) is associated with an increased risk of obesity (USDA, 2008).

What this suggests is that changes in food consumption do occur, even amongst the less affluent, in countries undergoing urbanisation and economic growth. The increasing burdens this places on individual and family health, on public health systems and on national budgets are profound. Knock-on effects are also felt on the undernourished and on the agro-ecological resource base, as discussed in the previous section. These effects are of particular concern in fragile, degraded or otherwise agricultural-limited landscapes. The nutrition transition and its effects on health and agro-ecological productivity in Egypt are illustrative of this.

Since World War 2 when Egypt's population was 19 million, Egypt has undergone rapid population growth and urbanisation on a very limited resource base. Today, 43.4% of Egypt's 82,637,400 population lives in cities and on only 6% of Egypt's land area. Urbanisation is expected to continue at an average rate of 2.4% per year and in 2050 there will be an estimated 160,000,000 Egyptians living overwhelmingly in cities.

As Egypt grew in population and its people became increasingly urban, a nutrition transition occurred. Egyptians added more energy dense and highly processed foods to their diets, especially in the form of animal protein, pasta and added sugars. This transition has had two distinct, yet inter-related consequences. Firstly, its population has become increasingly overweight and obese, and secondly, its limited agro-ecological system has become all the more strained in meeting the demands of these new consumptive trends:

- The World Health Organization (WHO) reports that 69.4% of Egyptians over the age of 15 are now overweight and that 45% of urban women and 20% of urban men are obese. At the same time, malnutrition amongst pre-school aged children remains entrenched. In 1998, 16.7% of 2-6 year olds were underweight and 31% stunted (Galal, 2002).

- As Egypt became increasingly unable to meet its evolving food consumption needs, the percentage of imported foods from developed markets increased, as did major investments in the agricultural sector – particularly in the form of high-input, resource-intensive agriculture on the 4% of land that is cultivable in the country. This production is entirely dependent upon the Nile River. More than 80% of the Egyptian Nile's water is used in agriculture and has allowed the limited agricultural land area to be somewhat productive (Siam, 2003). However, the intensive production of food as well as cotton has led to considerable deterioration of the limited resource base (Al-Keraby, 2012). Land and hydrological constraints (due to both physical and political factors), soil degradation, wind erosion, desert encroachment, depleted fertility and the increased industrial and urban waste contaminating Egypt's agro-ecological foundation has resulted in production losses estimated at 53% (Gehad, 2003). Yet Egyptian agriculture continues to prioritise the production of resource-intensive and energy-dense products that its urban consumers now demand. The production of animal protein constitutes 30% of total agricultural production, with demand for animal protein growing by 4% yearly.

3.4 Commercial fishing and the depletion of artisanal fisheries: Senegal

***Food consumption challenge:* The rise in unsustainable fish consumption in more developed countries leads to marine resource depletion and increased food accessibility concerns in the developing world**

Globalised sourcing of food to meet consumption choices has been particularly detrimental to fisheries. As reported in the previous section, fish consumption per capita is at an all time high. This has created increased competition for limited fisheries resources and consequently 75% of the major marine fish stocks are either depleted, overexploited or being fished to

their biological limit. As developed country fishing waters have become increasingly depleted there has been a rise of the international "distant fishing fleet" – heavily subsidised industrial fishing operations, primarily from more developed, high fish consuming countries – that lease rights to fish in the exclusive economic zones of developing countries. While these lease agreements can be lucrative sources of revenue for host countries, often this is not the case in the medium to longer terms.

Over-capitalised fleets often deploy intensive technologies and practices that better locate, catch, and immediately freeze large captures for transport back to home countries, leaving stocks depleted and breeding grounds devoid of replenishment capability. This not only damages the productive capacity of the marine environment but also the domestic artisanal fishing fleets that rely on national fisheries for livelihoods.

Additionally, as most international fleets send their catch back to their home countries to satisfy rising levels of fish consumption, availability of fish for local consumption often declines, affecting food security. Many developing countries face capacity challenges in monitoring and enforcing the technical aspects of fishing leases so unsustainable practices may go unchecked. The European Union (EU), home to one of the largest international fleets, has issued new rules to encourage more sustainable fishing by its distant fleets, but major social, economic and nutritional consequences persist. The case of overfishing in Senegal, to satisfy rising international fish consumption, illustrates these problems.

Senegal boasts some of the most productive fishing grounds in the world and marine fish are one of Senegal's most important natural resources. Senegal's population of 12 million is heavily dependent on the fishing sector. Fishing and associated activities including processing, marketing, services and various part-time activities are estimated to provide around 600,000 jobs in Senegal, including those for 52,000 people directly employed in small scale fisheries. Employment in fisheries provides income for almost 20% of the labour force. The fisheries sector also accounts for approximately 75% of all animal protein consumed in the country. Estimated annual per capita fish consumption is around 26kg, substantially above the global average of 16kg (FAO, 2003).

Historically, Senegalese fisheries have been productive and have become increasingly so with the arrival of the distant fishing fleets. Senegal's total wild capture fish production was 50,000 tonnes in 1965, rising in 2005 to 405,000 tonnes. Foreign fishing vessels, particularly from EU countries, produce a significant percentage of this catch to satisfy growing consumption of fish in their home markets. An estimated 52,000 artisanal fishermen also produce food for domestic consumption and now for export as well – encouraged by high international demand and prices and aided by export subsidies. Fish products constitute some 37% of the country's exports by value and around 32% by volume (UNEP, 2012).

The productivity of fisheries in Senegal has contributed to some of the sector's problems during the past 20 years. Over fishing first by the international fleet, and then by domestic fleets feeling threatened by foreign competition, has resulted in annual catches exceeding a sustainable level of output. Many of the highest value fish stocks are severely depleted and facing rapid decline. What fish is caught is often sent abroad for the higher prices received – a consequence of this is a shortage of fishery products in local markets. Only small pelagic stocks are not entirely exploited and still serve for the national consumption and the African consumption, in general.

Recent developments have potential to change this landscape. In May 2012, the new government of Senegal announced a cancellation of all foreign fishing agreements. However, there remains the challenge of artisanal overcapacity and poor marine ecosystem monitoring and management.

3.5 The growth in demand for animal protein: Gulf of Mexico

***Food consumption challenge:* Increasingly high demand for animal protein provides incentive for agro-ecologically destructive production practices**

As mentioned in Section 1, world meat and dairy consumption doubled between 1950 and 2009 and is set to increase by an additional factor of four over the next 40 years (FAO, 1997). As these consumption patterns drive production decisions, and also the

increasingly intensive approaches that support them, it is important to understand how these consumption trends dictate the production systems that directly affect the future ecological basis for food security.

The global increase in consumption of animal protein can be viewed through different lenses. While increased access to this high quality protein is positive with regards to the fight against undernutrition, widespread increased consumption of animal protein is proving to have both deleterious health and agro-ecological consequences. A tangible example of this is the rise of marine dead zones which are a direct result of agricultural run-off, often from large animal or feed production facilities. The Gulf of Mexico Dead Zone demonstrates this linkage.

The 2011 Gulf of Mexico Dead Zone covered an area of 6,680 square miles (17,301 km) or roughly the size of Swaziland or Kuwait. The Gulf produces roughly 40% of all the seafood in the mainland United States and the 2009 value of these commercial fisheries was $629 million (NOAA, 2011). According to a report in the journal *Science*, 212,000 metric tonnes of food is lost to the annual Dead Zone (*Science*, 2005). The National Oceanic and Atmospheric Administration (NOAA) previously estimated that the dead zone costs the US seafood and tourism industries USD 82 million a year and impacts an industry supporting 600,000 jobs (NOAA, 2011).

The Dead Zone in the Gulf of Mexico is a result of massive fertiliser and sewage run-off into the Mississippi River that travels into the Gulf from an area known locally as the "Corn Belt" (maize) of the United States. This area of the US produces over 50% of the country's maize (US is by far the world's top producer – harvesting 78 million acres (31,565,480 ha) yearly with a value exceeding USD 15 billion).[3]

According the United States Environmental Protection Agency (EPA), about 89% of all maize grown in the US is consumed by domestic and overseas livestock, poultry and fish production (USEPA, 2011). The use of fertilisers in this production has increased from 11 million tonnes of nitrogen in 1960 to 91 million tonnes in 2004. The levels of nitrogen in the Gulf have tripled over the past 50 years. It is also estimated that over 60% of manure produced on animal farms in this area cannot be fully absorbed by the land or sea (*Science Daily*, 2011).

These nutrients feed massive algal blooms in the coastal regions of the Gulf where the majority of all seafood caught for human consumption resides. These blooms, in turn, create oxygen-free zones where marine life cannot exist. While some species are able to flee, each year there is a mass death of more immobile species. The EPA reports that the levels of nitrogen and phosphorus reaching the Gulf are so large that much of it ends up buried in sediment. Thus, even if new sources of nitrogen were removed from the system, those sediments would continue to release nitrogen over time – perpetuating the cycle (Biello, 2008).

There are now 405 identified dead zones worldwide, up from 49 in the 1960s. A transition to more resource-efficient and sustainable agricultural practices is likely to be required to bring life back to the Dead Zones. The International Assessment of Agricultural Science and Technology for Development (IAASTD) has posited that a key challenge in making agriculture sustainable will be "reducing pollution of land, air and waterways; maintaining soil health, in particular dealing with fertiliser run-off and animal waste from very large scale operations."(IASSTD, 2009) In addition to addressing the sustainability of production systems, it is critical that the consumption patterns driving the uptake of these intensive production methods are also addressed.

3.6 From case studies to "food consumption hotspots"

The case studies in this section illustrate the variety of ways in which unsustainable food consumption can adversely affect health, the agro-ecological resource base and food security. In due course, the development of a "food consumption hotspots" tool, based on robust criteria or methodology, would be valuable for tracking, curbing and sharing the effects of unsustainable food consumption patterns at local through to landscape and global levels. This would provide a systematic lens for disseminating information and data about the evolution of unsustainable food consumption and its effects.

3. The increased production of maize for biofuel in the Corn Belt also contributes to excessive nutrient runoff. While maize grown for biofuel covers a lesser area of the Corn Belt than does animal protein production, its contribution to total nutrient runoff is notable.

4

Opportunities for action: the public and private sectors

As has been demonstrated in previous sections, the consumption patterns shaping our current food systems are detrimentally affecting human health, food security and the agro-ecological resource base that supports both. The anticipated continuation of these consumption trends suggests that action must be taken now in the public and private spheres, and at the individual level, to curb overconsumption on one hand and to alleviate underconsumption on the other.

Governments must begin to adopt more comprehensive approaches to food systems – particularly by incorporating consumption elements into the production-centred mix.

Private sector companies working in the agriculture and food sectors must add consumption components to their growing sustainability agendas and business models.

Consumers, whether in developing, emerging or developed countries must see the value of the food they eat, nutritionally and economically, while also being aware of the environmental impacts of their choices. Waste and food loss can be addressed in all of these arenas through a number of activities that are applicable to governments, businesses and consumers.

The purpose of this section is to highlight some of the opportunities that exist for both the public and private sectors to address the challenges presented by the unsustainable consumption of food. Examples from existing efforts are provided to illustrate the value of the proposed areas for action. The options are suggestive of activities that both 'push' more sustainable behaviour (more sustainable production and food system governance) and create a 'pull' (influencing and harnessing demand). By adopting a varied suite of approaches on unsustainable food consumption, the public and private sectors can work together to shape a global food system that is healthier, supportive of the agro-ecological foundation on which it depends, and that provides a higher level of food security for all.

4.1 Public sector opportunities

4.1.1 Adopt "sustainable diets" as a policy lens

***Initiated by:* Government (combined ministries), NGOs**

***Target impact on:* Private sector (retailers, food manufacturers), consumers**

The concept of "sustainable diets" has been proposed by the FAO and its partners as an entry point for policy making affecting the comprehensive sustainability of food systems. Sustainable diets are:

> *" ... those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations.*

Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimising natural and human resources." (FAO 2009)

While food policy remains the preserve of the Ministry of Agriculture in many governments (IFPRI, 2011), the adoption of a comprehensive "sustainable diets" approach to agriculture and food policy making could result in a more coherent and sustainable set of policy tools to support nutritional health, food security and agro-ecological systems. Practically speaking, this is of course a challenge. However, if ministerial policy 'silos' can be overcome, country-specific food-based dietary guidelines can be developed to address both production concerns and the consumption patterns that drive them.

As an example, the 'Mediterranean' diet – a diet recognised as being low in meat consumption, rich in fresh fruit and vegetables, low in added sugar and saturated fatty acids (Duchin, 2004) – has been advocated by FAO and others as an example of what a sustainable diet might look like, and could be a starting point for discussing the creation of enabling policies to support the diet's uptake (Burlingame *et al*, 2011). Similarly, in the UK, the World Wildlife Fund (WWF) developed the Live Well project, funded by the European Commission, in part to propose a "2020 Live Well Diet." While the diet was developed with the specific goal of reducing GHG emissions through dietary change, it is illustrative of the comprehensive and strategic action required to bring about necessary consumptive and productive change at the national level. The WWF project also highlights the cultural challenges that will likely accompany such an endeavour.

During the project's design it was learned that strong cultural preferences for certain foods – namely meat and dairy – would make it nearly impossible to prescribe a reduction in their consumption, irrespective of educational and awareness efforts. However, the project realised that in the UK, this could be mitigated by the reduction of meat portion size in highly consumed ready-to-eat meals (MacDiarmid *et al*, 2011).

4.1.2 Reduce or eliminate subsidies that encourage unsustainable consumption and consider tax options to shift consumption patterns

***Initiated by:* Governments**

***Target impact on:* Consumers, farmers, supply chain actors**

Fiscal tools, including subsidies and taxes, can be reduced or administered to encourage more sustainable food consumption choices. The debate surrounding agriculture and food subsidies is complex and a thorough evaluation of the merits surrounding the various arguments is outside the scope of this paper. However, there is a general consensus that perverse agricultural subsidies that encourage unsustainable food production (agricultural or fisheries) or that adversely affect food security need to be lessened or eliminated. This thinking can be extended to include subsidies that encourage unsustainable consumption. For example, in the US, heavily subsidised farmers produce corn (maize) that is used for cheap animal feed, artificially lowering costs and thus encouraging the production and supply of inexpensive, resource-intensive animal protein. These subsidies could be reduced and perhaps redirected to support the production of healthier, more sustainable choices.

Taxes can also be administered to positively affect food consumption. A recent report from the University of Oxford (Mytton *et al*, 2012) shares findings from a US-based study where a 35% tax on sugary drinks in a canteen led to a 26% decline in sales. The Oxford report also reveals findings from modelling studies that predict a 20% tax on sugary drinks in the US would reduce obesity levels by 3.5%, and suggest that extending VAT (at 17.5%) to unhealthy foods in the UK could cut up to 2,700 heart disease deaths a year. Meanwhile, in the past 12 months, Denmark has introduced a "fat tax," France a tax on sugary drinks, Hungary a "junk food tax". Peru has also announced plans to tax junk food. It is too early to judge the effectiveness of these programmes. However, while such taxes target the consumer, they send market signals to food and drink manufacturers to provide healthier and less resource-intensive choices as well.

4.1.3 Design and conduct targeted public awareness campaigns

Initiated by: ***Governments***

Target impact on: ***Consumers, farmers***

Public awareness campaigns can play a significant role in addressing and curbing unsustainable food consumption. Designed to meet specific goals and to reach particular populations, specific consumption-related campaigns could target, for example, the reduction of household waste in Country X or the health benefits of a sustainable diet in Country Z. In designing public awareness campaigns, particular attention must be paid to gender and cultural norms surrounding the production and provision of food. The successful public awareness campaign targeting vitamin A deficiency (see Box D) is illustrative of this.

4.1.4 Consider implementing advertising and marketing regulatory measures

Initiated by: ***Government***

Target impact on: ***Manufacturers/processors, consumers***

Government regulation of marketing and advertising of unhealthy and unsustainably produced foods could be a powerful tool in curbing unsustainable consumption patterns. While current examples of

Box D: Influencing healthy food consumption – the case of vitamin A deficiency in Mozambique

Vitamin A deficiency (VAD) afflicts an estimated 250 million children under five years of age, according to the World Health Organization (WHO, 2012). It is a leading cause of blindness, affecting 250,000-500,000 children per year. Mozambique, like many countries in Sub-Saharan Africa, suffers from a high rate of food insecurity, malnutrition and undernutrition. It is estimated that 71% of children between six months and five years of age are affected by VAD, a deleterious yet highly preventable problem (Low *et al*, 2007).

The Government of Mozambique, together with development partners, saw that there was an opportunity to stimulate local food production while also providing a solution to VAD. The "Towards Sustainable Nutrition Improvement Project" which began in 2002, promoted the consumption of the orange-fleshed sweet potato – rich in vitamin A - as a new food staple in targeted communities. Unlike supplements or food fortification, sweet potatoes could be cultivated locally, are relatively inexpensive and are easy to grow in drought-prone areas. This is critical in many areas of Mozambique (World Bank, 2012) However, traditionally the orange-fleshed sweet potato suffered from an "image" problem. There was a perception, primarily amongst women who are chiefly responsible for household food provision in Mozambique, that the orange-fleshed sweet potato was a "low-class" food and "not good enough" for household tables.

Farmers were given access to the sweet potato vines through extension services and were provided with training in improved agricultural practices.[†] Equally important, the project deployed an accompanying educational effort – targeting women in a culturally appropriate manner - to encourage consumption of the crop. Through interactive group learning, radio and community theatre, the campaign sought to empower members of the community with knowledge about the nutritional value of the orange-fleshed sweet potato. (World Bank, 2012)

Ten years on, the orange-fleshed sweet potato campaign is considered a success. The crop has become a widespread dietary staple and there has been demonstrable progress on local food security and VAD (Aguayo, 2004). The two-pronged public intervention, with a traditional extension component and a targeted, culturally-appropriate public information campaign, has now been replicated in other Sub-Saharan African countries.

[†] Many farmers and households in Mozambique (as well as in other parts of Africa where similar projects have been implemented) were already cultivating the white-fleshed sweet potato so the transition to the orange-fleshed sweet potato was easier than attempting to introduce an entirely new crop or practice.

such regulatory measures targeting unsustainable food consumption are not well reported (Hawkes, 2004), the potential impact of such measures is large. In the US alone, USD 2 billion is spent yearly by the fast-food and beverage industries on marketing directed at children (Kovacic, 2008). One study suggests that 98% of this advertising promotes products that are high in fat, sugar or sodium (Story, 2008). Governments could model regulatory measures targeting food after similar efforts targeting other industries. The success in reducing the prevalence of smoking in some countries is a good example. In Brazil, a nationwide ban on cigarette advertising resulted in a reduction of smoking, including by youths aged 11-18, in 8 of 10 cities surveyed two years after the nationwide ban took effect (Galduroz *et al*, 2007). Similar regulatory measures have been used with success in curbing the consumption of alcohol by minors.

4.1.5 Use public procurement as a catalyst for change

***Initiated by:* Governments**

***Target impact on:* Consumers, farmers**

Public procurement either directly or through private contractors has a role to play in decreasing unsustainable food consumption given the amount of food purchased for use in public institutions (hospitals, schools etc). Changes in public sector food procurement in Brazil, for example, have improved not just the quality of school meals; they have led to a reduced ecological footprint and a more engaged civil society (UNRISD, 2011). In 2009, a new law came into effect effectively obliging every municipality in Brazil to spend at least 30% of its allocated budget for school meals on local produce purchased directly from small-scale farmers (Otsuki, 2011). Since then, about half of all municipalities in Brazil have established School Feeding Committees which lead local school food procurement. Consequently, school meals now contain fresh produce and other locally produced products, with menus reflecting the wishes and dietary needs of children and their parents (UNRISD, 2011).

4.1.6 Improve availability of agricultural technologies and infrastructure to reduce food losses in developing countries

***Initiated by:* Governments, intergovernmental organisations**

***Target impact on:* Producers, supply chain actors**

Food losses occurring early in the supply chain – most problematic in developing countries – indirectly affect food consumption. Losses lead to less food availability, higher prices for the producer and consumer, lost income for producers and governments, and wasted agro-ecological resources in the form of land, soil nutrients, water and other inputs. Options for curbing these losses are many and are regularly addressed in the traditional literature on agricultural development. However, increased public and private investment in production, transport, storage and market infrastructure and technologies, as well as the appropriate use of packaging to ensure food safety, are central to addressing this challenge.

4.1.7 Increase inter-governmental coordination for sustainable food systems

Initiated by: Governments, intergovernmental organisations

Target impact on: Global food systems from farmer to consumer

As mentioned in 4.1.1 above, achieving inter-ministerial food policy coherence, at the national level, is challenging but critical. This becomes even more complex, yet urgent, in the international arena. The nutrition transition has been observed globally and its effects are felt worldwide. Governments, with the help of intergovernmental organisations, must work collaboratively to develop initiatives that bring the public and private sectors together on food consumption and production issues. An example of this type of collaboration, the FAO/UNEP Sustainable Food Systems Programme, works through its Agri-food Task Force on both production and consumption issues to improve the resource efficiency and reduce the pollution intensity of food systems while also taking into account food and nutrition security. The Agri-food Task Force, comprised of representatives

from 16 countries, 5 UN agencies, 6 NGOs and 5 private sector organisations representing more than 300 firms was established in 2010 (FAO, 2012).

4.2 Opportunities for the private sector

Efficient food production, both economically and environmentally, is an established strategy in food supply chains, increasing competitiveness as well as decreasing ecological footprint. However, as this discussion paper has demonstrated, addressing unsustainable production methods will not deliver a sustainable food system if the consumptive trends driving the uptake of these production systems are not addressed.

While a concept of "consume less" may sound antithetical to profit-oriented enterprises, the strategy for halting or reversing unsustainable food consumption trends is rather based on "consume smarter". This is something that dynamic and innovative food businesses can rally around and there is clear evidence that they are beginning to do so. The World Economic Forum (WEF) in its 2012 report, *More with Less: Scaling Sustainable Consumption and Resource Efficiency*, sums this up well:

> *"There is an imperative for countries and companies to act to reduce the environmental consequences of consumption. This report demonstrates that over US$ 2 trillion in global economic output in 2030 is at stake, so the need for rapid action to shift towards a resource-efficient economy is high. Despite some success to date, change is now urgently required at scale and greater pace than current initiatives, policies or strategies are likely to achieve"(WEF, 2012)*

The WEF report highlights the leading role that the private sector can play in scaling sustainable consumption, through "transforming interactions with citizens, rethinking business models and value chains, and in playing an active role in shaping the policies and investments that define the rules of the game." While this thinking is evolving and progress in the food sector admittedly lags behind progress on unsustainable consumption in other sectors such as energy, leading businesses are now engaging with the challenging topic of food consumption in a number of ways. The following are private sector opportunities for immediate, tangible engagement on sustainable food consumption. New opportunities are regularly emerging but the options below point a possible way for private sector partners to immediately join in the challenge:

4.2.1 Decouple economic growth from resource intensity across the supply chain

***Initiated by:* Private sector actors**

***Target impact on:* Private sector operations**

The global food crisis of 2009 received a great deal of attention, particularly for the degree to which commodity price volatility impacted food accessibility and security in developing countries. Short-term volatility of key commodity prices remains high today. For example, between 2000 and 2010, the price of resource-intensive palm oil – a common ingredient in many processed foods and a cooking oil used globally – grew by 246% (WEF, 2012). This volatility adversely affects companies, governments and citizens through financial uncertainty and rising costs. However, the impact of such price fluctuations can be limited through decoupling growth from raw material intensity across the supply chain. This does not imply a reduction in economic output but rather maintaining, or even improving, economic performance through better resource efficiency. "Impact decoupling," according to UNEP, means "maintaining economic output while reducing the negative environmental impact of any economic activities that are undertaken" (UNEP, 2011).

An illustrative example of a valuable decoupling opportunity is presented by dwindling fresh water supplies. By 2030, it is estimated that the world will face a 40% shortage between demand for and supply of fresh water. This shortfall will hit food production – the largest sectoral consumer of fresh water – particularly hard as populations grow and consumption of water-intensive food products significantly rise. However, locally appropriate measures can be taken now to reduce water usage throughout the supply chain, saving money in the short term and ensuring longer term viability of operations.

4.2.2 Reduce waste at the retail and consumer levels

***Initiated by:* Retailers with the support of governments and intergovernmental organisations**

***Target impact on:* Retailers, restaurants, consumers**

Sections 2 and 3 of this paper outlined the severity of the food waste challenge in developed countries – where the vast majority of total food waste occurs at the retail and household levels. There is a role for government in curbing this waste through public information campaigns and incentive provisions. However, there are clear business opportunities for doing so as well. Some studies suggest that retailers who employ tools to encourage better consumer purchasing habits to reduce household waste can engender customer loyalty more than through the use of lower prices and special offers. In the competitive supermarket sector, where engendering customer loyalty is a core business strategy, this is a valuable realisation. In surveyed retailers in the UK, the Foresight *Report on the Future of Food and Farming* found that supermarkets that helped their customers to make the best use of the food that they purchased (by lessening waste and in turn saving money) saw customers trading-up to higher quality/better margin foods. Thus, customers consumed less but spent an equal amount or even more. (Foresight, 2011)

One example of many company-led efforts to curb waste illustrates the emerging value of such programmes. Walmart – the world's largest retailer, with more than 50% of its sales generated by its food and grocery businesses – has set ambitious waste reduction targets for its businesses and customers. Walmart's adoption of a "zero waste" campaign has set goals to divert 100% of its waste from landfill by 2025, already achieving 80% diversion of waste from landfills in California, US by 2011. Its development of a Sustainable Product Index also attempts to more systemically curb waste associated with its operations. Working together with more than 70 private and public sector organisations to develop a product sustainability measurement and reporting system (SMRS), Walmart is developing product data and tools based on Life Cycle Analysis (See Box E) that can be accessed by actors worldwide to manage waste and product sustainability. Ultimately the SMRS will result in the creation of a simple tool for customers that provides easy to understand sustainability and waste information about products (Walmart, 2011).

Box E: Using life cycle assessment as a tool for sustainable food production and consumption

Life-cycle assessment or analysis (LCA) is a commonly used tool that enables businesses to assess product impact and efficiencies not only in their supply chain but in the life of the product from production through to consumption and disposal. By utilising the LCA approach, businesses can develop products that can be consumed in a way that have minimal impact on the environment (WEF, 2011). LCA provides a snapshot of resource use throughout the life of a product, indicating precisely where inefficiencies exist. For example, following FAO's publication of *Livestock's Long Shadow* (2007), in which 18% of all man-made GHG emissions were attributed to the global production of livestock, the dairy industry embarked on an unprecedented attempt to improve environmental performance. This resulted in the International Dairy Federation developing in 2010 *A Common Carbon Footprint Approach for Dairy – The IDF Guide to Standard Lifecycle Assessment Methodology for the Dairy Sector* (IDF, 2011). This was specifically developed to ensure consistency through a methodology that can be applied to varied dairy systems, in any country, and to create clear and transparent reporting to consumers. Using LCA as part of a strategic and systemic decision-making process can lead to more efficient production and consumption patterns (UNEP-SETAC, 2011).

4.2.3 Use certification, standards and labelling to capture market share and to shape consumption

***Initiated by:* Retailers, food manufacturers and processors/traders**

***Target impact on:* Consumers, farmers**

Adoption of voluntary certification schemes, standards and eco-labelling approaches can increase awareness of consumers, build loyalty for sustainably-

certified products and shape consumption patterns – all resulting in more sustainable food consumption. It can also be profitable for businesses. Examples of these standards include the Marine Stewardship Council (MSC) for sustainable fisheries, Rainforest Alliance and Certified Organic Standards which are applicable in markets where consumer attitudes and demand allow for them.

In developed countries, this sector has experienced unprecedented growth in the last seven years. Sales of sustainability-certified coffee grew by 433% from 2005 to 2010 – representing 17% of global production (IISD, 2010). The sugar sector has also experienced a large increase in demand for certified product – particularly from global food and confectionary manufacturers who see added value in using certified sugar in their products. From 2008 to 2009, demand increased by 57%. The fisheries sector has experienced perhaps the largest increase in demand for certified product: the number of MSC-certified, labelled fisheries products grew from just 200 in 2003 to nearly 15,000 by April 2012, with total sales of more than USD 3 billion per year. Demand for MSC-certified fisheries products continues to outstrip supply (MSC, 2012).

Outside developed country markets, "business-to-business" voluntary sustainability schemes are an example of how sustainability standards can be applied in the absence of national consumer demand. One such standard, GLOBALGAP, is a business-to-business voluntary standard for the certification of agricultural products around the globe – the largest of this type of voluntary standard in the world (Will, 2010). Developed by the food industry and implemented by small and large-scale producers alike, producers agree to follow designated sustainability standards – set by distributors and retailers – in order to access major import markets. GLOBALGAP certification is required by a considerable number of retailers, especially supermarkets in industrialised countries. It has 112,600 certified producers in 113 countries (GLOBALGAP, 2011). Another way that business-to-business standards are being used is as a tool for procurement of more sustainable raw material by food processors and manufacturers. Unilever for example, through its Sustainable Living Strategy, has committed to increase its reliance upon small-scale producers and to help them improve their agricultural practices. Unilever aims to link 500,000 smallholder farmers into its supply network while achieving competitive prices (Unilever, 2010). Such programs can have tangible positive effects on customer loyalty and pricing but also on local food security and agro-ecological resiliency.

4.2.4 Increase private sector collaboration for sustainable food consumption and food systems

***Initiated by:* Private sector**

***Target impact on:* Private sector entities throughout the supply chain, governments, intergovernmental organisations**

As does the public sector, the private sector needs to increase cooperation to strengthen efforts in the food consumption arena. While the consumption topic is still relatively new, there is coverage within global agriculture and food business consortiums that are already working together on agricultural production challenges. These consortiums provide action-oriented platforms for industry-related sustainability dialogue and for sharing best practices and emerging tools. Existing consortiums can incorporate the food consumption issue – as some already have – or industry sustainability leaders can initiate new endeavours on the topic.

The Sustainable Agriculture Initiative (SAI), the World Economic Forum's New Vision for Agriculture Programme, and the Keystone Alliance for Sustainable Agriculture are all examples of global consortiums that increasingly work not only together but, crucially, with governments and inter-governmental initiatives as well. The World Economic Forum is embarking on a large programme specifically targeting food waste, in addition to the work they have already done on unsustainable consumption. And at the commodity level, the early successes of global commodity roundtables has been encouraging. Consortiums such as the Roundtable for Sustainable Palm Oil, Bonsucro – the Better Sugar Initiative and the Sustainable Rice Platform tackle commodity-specific concerns and set specific production goals. Attention to the consumption challenge is emerging.

The work of the Sustainable Rice Platform (SRP) is illustrative of this. Rice is a staple of diets throughout

Asia and increasingly in other parts of the world as well. About four-fifths of rice is grown by smaller scale farmers and consumed locally. Only 5% of rice is exported and thus 95% of production is consumed in the country where it is grown. Most international trade in rice occurs between developing countries where sustainability is not yet high on the societal agenda (IRRI, 2012).

Rice plays a central role in Asian food security yet prices have been rising due to falling yields and increased consumptive demand resulting from population growth. Resource-inefficient practices have stressed agro-ecological systems, rendering them less productive. The "thirsty" nature of the rice crop is also of concern. As rice will continue to play a central role in Asian and other diets, the need to adopt more sustainable methods of production is critical in securing the sustainability and affordability of future supply. If this can be done, it is estimated that 62 million undernourished people could reach caloric sufficiency in Asia, reducing hunger in the region by 12% (IRRI, 2012).

In response to this, UNEP and the International Rice Research Institute co-convened the Sustainable Rice Platform. A collaboration between producers, international traders, processors and multinational companies, the SRP was established to develop not only standards to address resource inefficiencies in production but also to develop mechanisms in the supply chain to provide financial incentives for sustainable production to growers. While similar in approach to other commodity roundtables, the SRP is distinctive in that it works with a staple crop that is both produced and consumed primarily in developing countries, requiring unique approaches to secure sustainable supplies to meet food security needs.

5

Conclusion

The purpose of this discussion paper is to provide an overview of the overlooked food consumption topic. While a global discussion has begun on the unsustainable trajectory of food production, what has not yet been included in these discussions is the need to go to the roots of the challenge: the increasingly resource-intensive consumption patterns that largely dictate the shape of the global food production system.

The discussion paper describes how significantly changing patterns in food consumption – worldwide – are having profound effects on health, the agro-ecological resource base and food security. By providing an overview of the drivers behind these trends the paper draws attention to the unsustainable food consumption patterns that are likely to affect the ability of the world to feed itself sustainably.

It is the goal of the discussion paper to bring the topic of sustainable food consumption to the forefront of international discussions on food security and sustainable development. As the paper suggests, this will not be easy. Food consumption is an intensely personal topic and at the same time, highly political. Individuals and countries will not lightly enter into difficult discussions on the need to alter what they eat. However, due to the potentially serious implications surrounding a failure to do so, it is necessary to bring these to light.

5.1 Key messages

The discussion paper provides a broad overview of global food consumption. This overview results in six key messages:

1. Unsustainable production patterns cannot successfully be addressed without acknowledging the consumptive drivers that shape and largely dictate the design of these production systems. **Consumptive demand and productive supply elements must be addressed systemically**.

2. The key drivers behind unsustainable food consumption patterns – a growing population, increasing urbanisation and rising incomes – are likely to continue. Thus **concrete action is needed by the public and private sectors and with the support of NGOs, intergovernmental organisations and consumers to redirect elements of the universally observed nutrition transition to diets based on less resource-intensive foods**. The increased consumption of animal products, including fish, deserves particular attention.

3. **Consumptive trends are detrimentally affecting health**. The social and economic costs of now widespread diet-related illnesses are straining individuals, families and national healthcare budgets.

4. **Consumptive trends are negatively affecting the agro-ecological resource base and its ability to produce sustainably**. Land degradation, declining soil fertility, unsustainable water use, overfishing, and marine environment degradation are all lessening the ability of the natural resource base to supply food. It is expected that this problem will be exacerbated by the effects of climate change.

5. **Consumptive trends are adversely affecting food security**. Firstly, overconsumption in developed and developing countries has a direct impact on food prices, disproportionately affecting food accessibility for the poor. Secondly, the intensive production methods that have come to define modern food production are a direct response to increased demand for more resource-intensive food products. Thirdly, intensive production of resource-intensive foods depletes the agro-ecological resource base, affecting its ability to produce plentiful food.

6. **Curbing the amount of food loss and waste generated annually, across the globe, is a tangible starting point for effective collaborative action in this arena**. Initiatives already underway provide valuable case studies for adaptation and replication globally.

5.2 Areas for further enquiry

In addition to the above messages, there are areas that require further enquiry and analysis in the food consumption arena that were not fully addressed in this paper. Investigation into the following five areas is encouraged:

1. The **cultural and gender aspects of food consumption** are central to any discussion on the topic and must be comprehensively understood if progress towards sustainable food consumption is to be made.

2. The further development of the **"sustainable diet"** concept as an entry point for decision-making requires careful consideration. The notion of a **"sufficiency-based diet"** could contribute to shaping the development of this topic. While it can be viewed as having philosophical elements, the concept of a sufficiency-based diet is actually a pragmatic tool rooted in the fact that food production is entirely dependent on natural systems. A sufficiency-based diet pre-supposes that a food system is designed to respond to the long-term needs of people and the resource base that supports them.

3. The development of criteria or **methodologies for identification of "food consumption hotspots"** would be valuable for tracking, curbing and sharing the effects of unsustainable food consumption patterns at local through to landscape and global levels. The FAO has done some work on developing the hotspots concept for application, more generally, to the agricultural/ecological interface. This work can inform the development of a "food consumption hotspot identification tool" to advance the understanding of the relationship between unsustainable food consumption, the agro-ecological resource base and food security.

4. While the private sector has begun to investigate its role in curbing unsustainable food consumption patterns, much more work needs to be done in **"making the business case"** for private sector innovation in this area. Central tenets of sustainable supply chains – including resource efficiency and lifecycle analysis – have a unique role to play in curbing unsustainable food consumption patterns from the supply side. NGOs have an important role to play in assisting the private sector in this task.

5. In practice, inter-ministerial collaboration at the national level is very difficult to implement as evidenced by a lack of such successful coordination worldwide. Enquiries into how this might be more effectively accomplished – in this case to facilitate a **systemic approach to sustainable food systems through national policy making** – needs considerable attention and reporting where lessons have been learned.

6. Similar to point number four, both **inter-governmental and public-private collaboration** is more challenging in reality than it appears on paper. However, as the global food system is increasingly shaped by universal trends in food consumption, more efforts need to be made to protect the agro-ecological resource

base that ensures appropriate nourishment and food security for all. Designing collaborative instruments for sustainable food consumption will be particularly challenging, given the cultural and political implications discussed in this paper. However, examples of such collaboration are emerging. Section 4 highlights the FAO/UNEP Sustainable Food Systems Programme and its Agri-food Task Force. A working group under the Task Force is charged specifically with looking at information campaigns to curb unsustainable consumption trends. More initiatives of this type need to be developed and supported to foster the necessary dialogue on the topic of food consumption. NGOs have a valuable role to play in catalysing these partnerships.

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About the UNEP Division of Technology, Industry and Economics

Set up in 1975, three years after UNEP was created, the Division of Technology, Industry and Economics (DTIE) provides solutions to policy-makers and helps change the business environment by offering platforms for dialogue and co-operation, innovative policy options, pilot projects and creative market mechanisms.

DTIE plays a leading role in three of the six UNEP strategic priorities: **climate change, harmful substances and hazardous waste, resource efficiency.**

DTIE is also actively contributing to the **Green Economy Initiative** launched by UNEP in 2008. This aims to shift national and world economies on to a new path, in which jobs and output growth are driven by increased investment in green sectors, and by a switch of consumers' preferences towards environmentally friendly goods and services.

Moreover, DTIE is responsible for **fulfilling UNEP's mandate as an implementing agency for the Montreal Protocol Multilateral Fund** and plays an executing role for a number of UNEP projects financed by the Global Environment Facility.

The Office of the Director, located in Paris, coordinates activities through:

- **The International Environmental Technology Centre** – IETC (Osaka), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
- **Sustainable Consumption and Production** (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- **Chemicals** (Geneva), which catalyses global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- **Energy** (Paris and Nairobi), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- **OzonAction** (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- **Economics and Trade** (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies. This branch is also charged with producing green economy reports.

DTIE works with many partners (other UN agencies and programmes, international organizations, governments, non-governmental organizations, business, industry, the media and the public) to raise awareness, improve the transfer of knowledge and information, foster technological cooperation and implement international conventions and agreements.

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If current population and consumption trends continue, humanity will need the equivalent of two Earths to support it by 2030. These consumption trends are of particular concern when related to food. The most vital of all sectors and yet the most resource intensive, a global discussion has begun in recognition of the need to address the unsustainable trajectory of the global food system. What has not yet been included in these discussions, however, is the need to go to the roots of the challenge: the increasingly resource-intensive consumption patterns that largely dictate the shape of our global food production system.

In this discussion paper a comprehensive overview of global food consumption trends is given and how significantly changing patterns in food consumption – worldwide – are having profound effects on health, the agro-ecological resource base and food security. It examines the drivers behind these trends and previews how the anticipated continuation of these trends will affect the ability of the world to feed itself sustainably. The paper concludes with key messages and offers a suite of suggested opportunities and actions for both the public and the private sectors. If implemented in a coordinated and effective manner and with the essential support of NGOs, these actions could address many of the sustainable consumption challenges facing our global food systems.

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