

OECD Contribution to the United Nations Commission on Sustainable Development 16

TOWARDS SUSTAINABLE AGRICULTURE



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Preface

This brochure is a contribution to the 16th session of the United Nations Commission on Sustainable Development (UNCSD-16) from the Organisation for Economic Co-operation and Development (OECD) – including the Directorates for Trade and Agriculture, Development Co-operation, Environment, and Public Governance and Territorial Development, and the OECD Development Centre, Africa Partnership Forum Support Unit, and Sahel and West Africa Club. It has been produced under the auspices of the OECD Horizontal Programme on Sustainable Development and reviewed by the OECD Annual Meeting of Sustainable Development Experts (AMSDE).

Under the title “*Towards Sustainable Agriculture*”, this brochure presents analytical findings from OECD reports relating to the UNCSD-16 themes of agriculture, rural development, land, drought, desertification and Africa. It focuses on the need to integrate analyses and formulate more coherent policy approaches addressing the three pillars of sustainable agriculture – economic, environmental and social. The report was prepared with the assistance of Alison Burrell, Agricultural Policy Consultant.

Further information on OECD sustainable development activities can be found at www.oecd.org/sustainabledevelopment.

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Summary

Agriculture accounts for only 2% of output in OECD countries, but it is a major employer and source of national income and export earnings in most developing countries. Agricultural growth, through its leverage effects on the rest of the economy, can enable poor countries and households to advance economically. But the potential contributions of agriculture to poverty reduction may not be realised owing to unsustainable trends in production and resource use which are exacerbated by a lack of policy coherence for agriculture in both OECD and non-OECD countries.

Rising food prices, ecosystem damage, water scarcities and more undernourished people are the signs of a world agriculture system facing significant challenges. Increases in world food production are being achieved through unsustainable demands on natural resources with negative environmental and social consequences. Public and private investment in agriculture and rural infrastructure has stagnated. Climate change is increasing pressure on fragile agricultural systems which are the mainstay of rural livelihoods in many developing countries. Providing adequate food for growing populations is problematic.

Coherent, mutually reinforcing policies are needed across the three dimensions of agricultural sustainability – economic, environmental and social. The productivity of agricultural production can be enhanced through appropriate technology and management techniques for farms, resources and land which do not harm the environment. Adequate infrastructure, in terms of irrigation, transport, electrification and communications, is crucial. Taking into account broader social goals of rural development, poverty reduction, food security and gender equality will facilitate and help sustain the achievement of economic and environmental objectives.

At the global level, greater reliance on market signals is needed to bring food supply and demand into better balance. The international community must take action to cut harmful agricultural support, open up markets, and focus more development assistance on the agricultural sector. These policy reforms must be accompanied by environmental and social safeguards to assure their longer-term sustainability.

Introduction: Policy Coherence for Sustainable Agriculture

New challenges for global agriculture

The latest global projections of macroeconomic and demographic trends have challenging implications for the sustainability of world agriculture. Three interrelated dimensions of sustainability are involved: economic, environmental and social. The complexity of addressing agricultural challenges is compounded by the need to encourage sufficient food production, protect the environment, and ensure sustainable rural livelihoods.

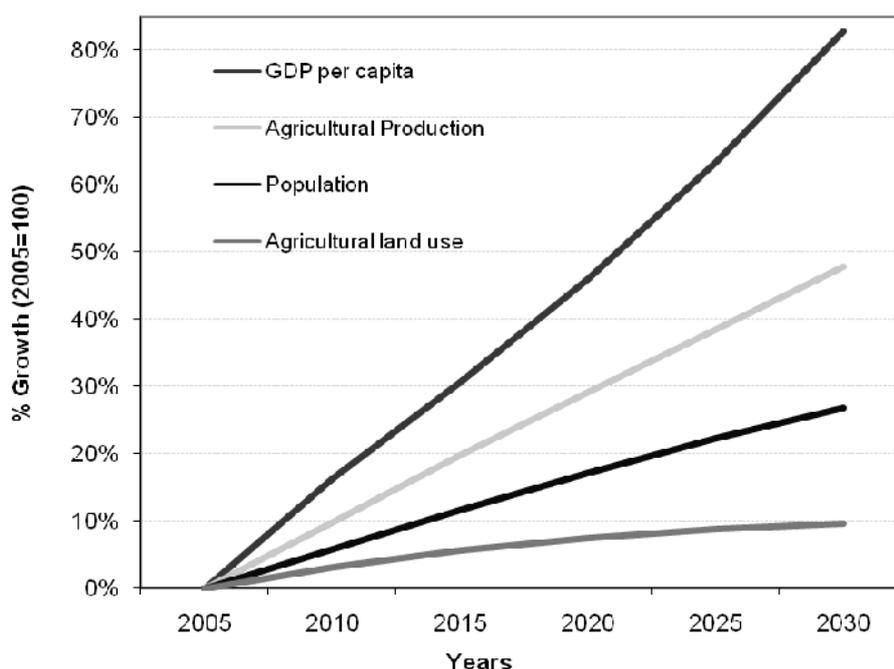
In the period 2005-2030, food demand is projected to increase by 50% fuelled by global population growth of 27% and income growth of 83% (**Figure 1**). This scenario has important consequences for the agricultural sector (OECD, 2008d):

- 1) agricultural land use (currently at 40% of total available land) will have to increase by 10% to meet expected demands for food, and even further if biomass for energy production is included;
- 2) agricultural area will grow by only 4% within the OECD area, but by as much as 18% in Africa;
- 3) agricultural production will become more land- intensive with growth in agricultural productivity per hectare of around 40%;
- 4) global emissions of greenhouse gases will increase by 2% due to land use changes, with large variations by region; and
- 5) the availability and quality of global water resources will be under increasing pressure owing to the projected growth in agricultural production.

Without any mitigating market, technological or policy responses, many regions will experience one or more of the following consequences: growing pollution levels and biodiversity loss; higher incidence of local food scarcity; and increased emigration as living conditions deteriorate in some

rural communities. Although particular effects will be regional or even local, all parts of the world will be affected. For these reasons, there is a worldwide need for national and international policy action in order to keep agriculture on a path towards economic, environmental and social sustainability.

Figure 1. Projected Growth of Agricultural Production and Land Use, 2005-2030



Source: OECD (2008), *OECD Environmental Outlook to 2030*.

Integrated policy responses

Each of the three dimensions of agricultural sustainability – economic, environmental and social – involves many technical and behavioural processes. They are complex and dynamic and often not well understood. The interactions between them are even less well researched. Appropriate policies for bringing agriculture closer to meeting the conditions for sustainability can be intricate: they need careful design, continuous monitoring and frequent adjustment. There may be unexpected synergies

between them, but these policies may inadvertently work against each other as well.

Policy priorities will vary greatly with location, so instruments need to be locally applicable. There are also trade-offs between the three pillars of sustainable agriculture which the political process has to resolve. *When does the economic viability of agriculture begin to threaten environmental sustainability? To what extent is the economic sustainability of food production compatible with affordability and social equity?*

Other policies relating to domains such as transport, taxes, health, communications, science and technology, energy, and education, may have significant interactions with policies addressing different aspects of agricultural sustainability. This complexity underlines the strong need for policy coherence (**Box 1**). Lack of coherence undermines the effectiveness of each policy by providing conflicting incentives, by imposing constraints on the attainment of each policy target or by reducing the value of each policy outcome.

Box 1. The Need for Greater Policy Coherence for Sustainable Agriculture

“Despite efforts to incorporate sustainable development into the policy agenda of several OECD countries, there is much scope for better integrating economic, social and environmental considerations into policy assessment and decision-making.”

OECD (2005), *Environmentally Harmful Subsidies: Challenges for Reform*.

“Policies and investments to unlock the productive potential of poor households are often ill-informed about the constraints and fail to address the range of interlinked environmental, physical, institutional, social and political factors that trap them in a stagnant growth setting.”

OECD (2006), *Promoting Pro-Poor Growth: Agriculture*.

“To raise productivity, irrigation schemes must be accompanied by measures such as provision of access roads, market information and extension services. For a pro-poor approach, partner governments should provide “service packages” – coordinating efforts among planning, agriculture, transport, energy and environment ministries as well as decentralised irrigation agencies.”

OECD (2006), *Guiding Principles on Using Infrastructure to Reduce Poverty: Water*.

“Subsidy reform demands integrated assessments and whole-of-government approaches. Sectoral Ministries as well as those dealing with finance, economics, environment and social issues must all be involved. The OECD intends to push the categorisation and comparison of subsidies, their integrated analysis and assessment, and co-ordinated and enlightened approaches to their reform.”

OECD (2006), *Subsidy Reform and Sustainable Development: Economic, Environmental and Social Aspects*.

Table 1 gives hypothetical examples, from developed and developing countries, of synergistic and conflicting policies across and within the different pillars of agricultural sustainability. In the cells on the main diagonal, both policies in the pair are targeted on the same dimension of sustainability. They are either synergistic or conflicting, depending on the sign. Policy pairs above the main diagonal work against each other, whereas those below the main diagonal are mutually enhancing. For example (second cell of first row), energy subsidies aimed at raising the adoption of irrigated agriculture and higher charges for water use intended to prevent aquifer depletion work against each other in terms of producer incentives so that neither policy objective is achieved.

There is a wide range of instruments available for policies aiming at different aspects of sustainability. These include regulations (prohibition of certain actions or outcomes, or constraining them by fixing quantitative upper or lower limits), direct provision of resources and services, allocation of property or user rights, tradable permits, contracts, auctions, payments for supply of non-marketable public goods, insurance schemes, safety nets, production and input subsidies, and market price support.

In general, no one instrument or type of instrument can be singled out as more appropriate or efficient. The optimal choice of instrument depends on the objective to be achieved and the political and agro-ecological context in which the instrument will operate. The OECD has analysed the design of agricultural policies that can improve the attainment of objectives (**Box 2**). In OECD countries, approaches such as targeting and decoupling can create incentives for producers to adapt their behaviour in line with the policy objective (OECD, 2007f). In developing countries, instruments aimed at the reduction or removal of constraints posed by lack of information, infrastructure, access to credit and other barriers to sustainability are needed.

Table 1. Agricultural Sustainability: Examples of Synergistic (+) and Conflicting (-) Policies

	Economic sustainability of agricultural production	Environmental sustainability of agricultural production	Social sustainability of rural communities	Other policy domains
Economic sustainability of agricultural production	Subsidy to pesticide use/ subsidy to adopt integrated land management (-)	Energy subsidies to irrigated agriculture/ higher water use prices to slow down aquifer depletion	Mechanisation subsidy increasing with size of tractor/ land reform favouring farm size fragmentation	Capital grants that lock in energy-intensive farm technology / development of low carbon technologies (research policy)
Environment sustainability of agricultural production	Investment grants for improved on-farm slurry management/ programme to denitrify local watercourses	Payment for grass cover on highly erodible land/ payment for increase in insect biodiversity (+)	Establishment of no-access zones for wildlife preservation/ policies to create jobs in local tourist industry	Payments to farmers for landscape enhancement / proliferation of wind turbines in rural areas (energy policy)
Social sustainability of rural communities	Policy to encourage uptake of high-yielding crop varieties/ extension of farm credit to women farmers	Environmental cross-compliance conditions linked to direct income support to farmers / training and education of farmers	Creation of village micro-credit schemes/ literacy and numeracy campaigns (+)	Provision of social infrastructure in rural areas/ tax breaks for capital and land investment (fiscal policy)
Other policy domains	R&D policies to promote farm productivity/ improved road access (transport policy)	Economy-wide environmental regulations/ tax incentives for environmentally beneficial farming investments (fiscal policy)	Policies to strengthen local food market networks/ telephone access for rural areas (communications policy)	Enhanced legal rights for women (legal policy)/ development assistance focused on gender issues in agriculture (aid policy) (+)

Box 2. Features of Agricultural Policy Instruments

Targeting – policy instruments should be targeted to maximise the impact on the policy objective per dollar of cost. A targeted policy is one that pursues specific and clear outcomes as defined by policy objectives, while minimising transfers to unintended recipients and negative spillover effects.

Tailoring – policy instruments should be tailored to an individual or clearly specified group to increase efficiency. Tailored payments are fixed at the minimum level necessary to achieve clearly identified outcomes, and recipients are not over-compensated for complying with the policy's requirement.

Decoupling – payments or subsidies from governments to agricultural producers should not influence the level of production. A fully decoupled payment is not linked to the volume of commodities produced, input use, price or whether production takes place. As a consequence, the size of the payment a producer receives is unaffected by his production decisions.

Cross-compliance – in order to receive support payments, farmers can be required to respect certain specified environmental or animal welfare standards. Such conditionality can promote conservation of land, natural resources and biodiversity; enhancement of landscape amenities; reduction of water and air pollution; preservation of habitats; or better living conditions for farm animals. This allows a greater coherence in achieving economic, environmental and social goals and increases best practice by producers.

Cost-effectiveness -- policy-related transaction costs (PRTCs) may increase with targeting and tailoring, but this should be balanced against the cost reductions from avoiding negative spillovers. Policy instruments involve direct budget costs, PRTCs and external costs (negative spillovers). PRTCs include costs incurred by governments in gathering information, planning and designing policies, collecting revenue, and implementing, monitoring and checking the outcome of policies. They also include the costs incurred by farmers when complying with the policy, such as obtaining information and advice, and claiming benefits.

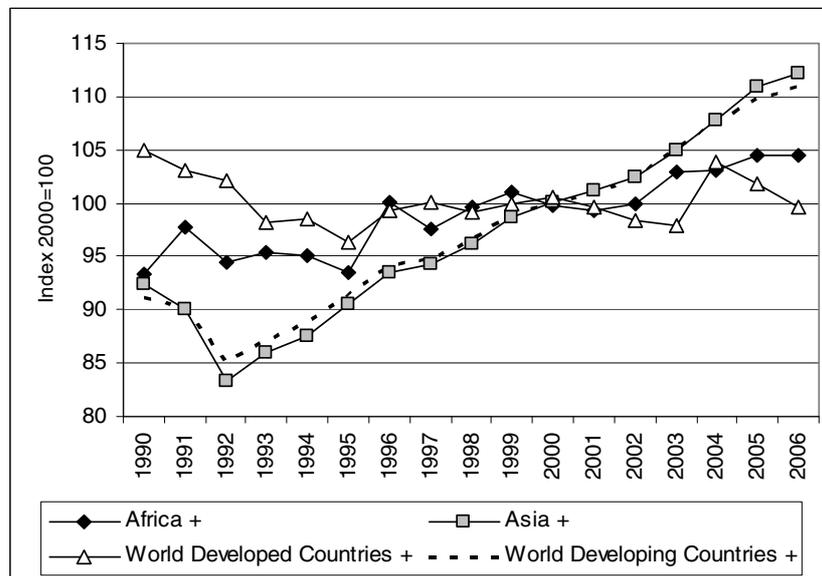
Based on: OECD (2006), *Decoupling: Policy Implications*; OECD (2007), *Effective Targeting of Agricultural Policies: Best Practices for Policy Design and Implementation*; and OECD (2008), *Agricultural Policy Design and Implementation: A Synthesis*.

ECONOMIC ASPECTS OF SUSTAINABLE AGRICULTURE

Increasing agricultural productivity

Between 1990 and 2006, growth in world food production averaged 2.3% per year. This corresponds to average annual per capita increases of 1.5% in developing countries as a whole, 0.6% in Africa, and a declining rate of 0.1% per year in developed countries (Figure 2). A continuation of this underlying rate of growth could be enough to meet the 50% increase in demand for agricultural production projected for the period up to 2030.

Figure 2. Growth in per Capita Food Production, 1990-2006

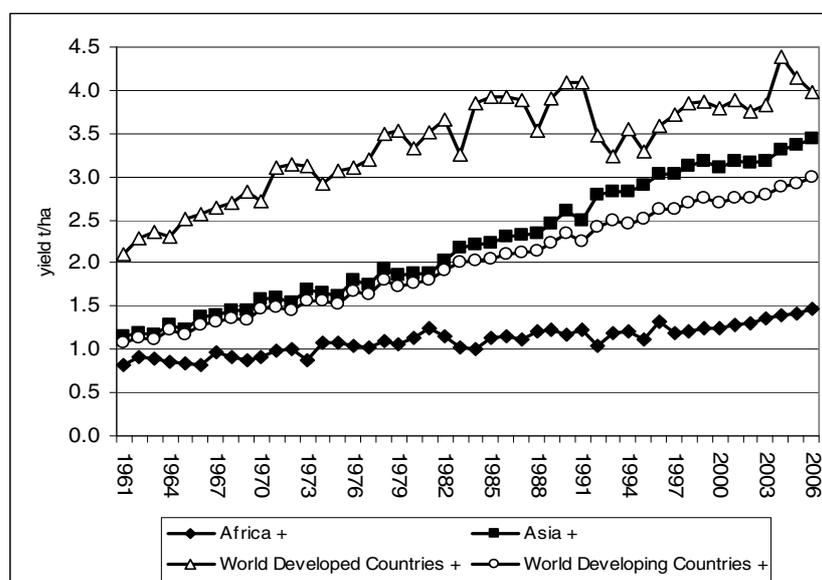


Source: FAOSTAT.

However, this growth in world food production was achieved through policy approaches which may not be sustainable in the longer-term when environmental and social impacts are taken into account. Output was boosted in OECD countries by more intensive inputs of fertilisers, pesticides, energy and water on a largely unchanged land area. In developing countries, the Green Revolution, aided by technology transfers and greater use of inputs and land, was the main driver.

The steady increase in agricultural productivity in developed countries for most of the second half of the twentieth century was associated with technological and structural change. This was often boosted by high levels of trade protection and domestic production-linked support to farmers. From the early 1990s, support became more decoupled in many OECD countries and the policy-determined price incentive to increase production was reduced (Figure 3). There was an associated reduction in the intensity of fertiliser and pesticide use in many OECD countries.

Figure 3. Growth in Cereals Yields, 1961-2006



Source: FAOSTAT.

While technology can continue to contribute significantly to productivity and yield increases in OECD agriculture, policies are needed to minimise agriculture's potentially harmful impacts on biodiversity, resource

use and ecosystems (**Box 3**). This involves further control of and substitution for damaging overuse of farm inputs (including pesticides and fertilizers) by basing a wide range of agronomic, husbandry and management decisions on computer-controlled systems, aided by modern communications technology and backed by on-farm generation of renewable energy. However, such “precision farming” will succeed only if it is profitable and if farmers have the right educational level, information, motivation, financial resources and incentives (OECD, 2008d).

Box 3. Increasing Agricultural Productivity and Sustainability

Steps to increase agricultural productivity in all countries in a sustainable way should be based on:

- improving resource productivity by reorganising production processes and managing resources more efficiently;
- increasing the use of intellectual capital as a production input;
- up-grading farmers’ levels of education and farming skills;
- creating an environment and incentives conducive to farmers’ adoption of appropriate technology;
- implementing safeguards against negative environmental effects; and
- managing the resulting social adjustment processes.

In developing countries also, there are trade-offs between increasing agricultural productivity and other dimensions of sustainability. The Green Revolution, begun in Mexico in the 1950s and extended to southern Asia in the 1960s, is still driving yield growth in those regions. Its basic instrument is technology transfer: the introduction of new seed varieties developed to produce high yields when cultivated with intensive applications of fertiliser, pesticides and irrigation.

The Green Revolution succeeded in these regions because the arrival of the new technology was accompanied by the creation of rural credit institutions that enabled farmers to purchase the required inputs; large-scale irrigation projects; transport infrastructure; and provision of extension services and training for farmers. Attempts to repeat this success in Africa

have not borne fruit partly because of the failure of governments to provide the accompanying institutions and infrastructure necessary for the new technology to succeed.

Despite its success in achieving food self-sufficiency in Mexico and banishing famine from the Indian subcontinent, the Green Revolution has had some negative environmental consequences: replacement of traditional mixed cropping patterns with monocultures requiring unacceptable levels of pesticide use and negative impacts on biodiversity, as well as irrigation-induced problems of mineral contamination, increased salinity and the lowering of water tables. At the same time, the Green Revolution may have relieved pressure to expand agriculture into ecologically fragile areas and reduced the dependence of rural areas on unsustainable resource extraction activities.

Negative social consequences of the Green Revolution are due to the rapidity of the structural changes it triggered, high rates of ambient population growth and the relatively low absorptive capacity of other sectors in developing economies. These impacts include threatening levels of debt incurred by some smallholders and the loss of farm labour jobs to mechanisation, which have created new groups of rural poor and increased migration to urban areas. Social and regional inequalities have been exacerbated, since larger farms and certain regions are better placed to benefit from the new opportunities.

Although computer-controlled farming systems are not on the horizon yet in most developing countries, many of the same principles underlying the impetus towards precision farming in developed countries are relevant. These include the need for better resource management, production systems that are more knowledge-intensive, appropriate incentives, and policies that remove bottlenecks and constraints on farmers.

Removing harmful agricultural subsidies and trade barriers

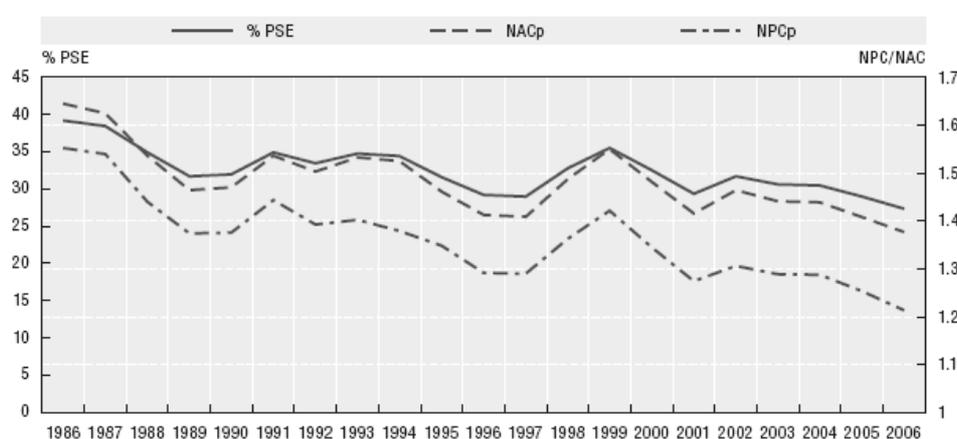
International attention has focused for the last 20 years on reducing the high levels of domestic support and trade protection delivered by most OECD countries to their farm sectors. The goals are a more efficient allocation of agricultural production across countries according to their comparative advantage and a more level playing field in world markets.

OECD agricultural policies have been dominated in the past by production-linked market price support, production payments and input subsidies. Experience has shown that coupled, untargeted support instruments are not appropriate in a policy package for sustainable agriculture. In economic terms, this approach is very costly and inefficient

due to a high rate of unintended transfers. The negative spillovers of these supports on the environment and social systems are substantial.

Overall in the OECD, there has been a long-term downward trend in support to farmers as a share of the value of agricultural revenues (**Figure 4**). Production-linked support to farmers (as measured by OECD producer support estimates, but excluding input constraining policies) accounted for 60% of the total in 2005-07 on average, compared to 90% in 1986-88 on average.

Figure 4. Trends in OECD Agricultural Support



Notes: Producer Support Estimate (% PSE), Producer Nominal Protection Coefficient (NPCp) and Producer Nominal Assistance Coefficient (NACp).

Source: OECD (2007), *Agricultural Policies in OECD Countries: Monitoring and Evaluation 2007*.

OECD agricultural support was made possible by high border protection, complemented by subsidised exports when surpluses emerged on the domestic market. For developing countries, this meant increased competition, lower world market share for certain commodities, reduced income from agricultural exports, and lower economic growth. Starting with the Uruguay Round Agreement on Agriculture (1986-94), trade-distorting agricultural subsidies have been subject to multilateral rules and agreements.

OECD policy reform has included a reduction in the degree of border protection since the late 1980s. However, bound tariffs on agricultural products are among the highest in the world in comparison with other sectors, averaging 60% across the OECD area. Applied tariffs are much

lower: around 17% on average for bulk agricultural commodities and 20% for processed foods.

Developing countries, too, often impose high tariffs on imports of agricultural commodities. Nevertheless, many developing countries have a comparative advantage in agriculture because of low labour costs, natural endowments and in some cases advantages in quality/price ratios. Both OECD and non-OECD countries, by imposing tariffs and non-tariff barriers on agricultural imports, have created significant market distortions with negative repercussions for revenues and rural economies.

Reforms to support and trade policies need to continue and at the same time address the emerging threats to agricultural sustainability. For example, price pressure from policy reform and international competition could lead to significant restructuring of farms, in particular encouraging larger farm sizes and greater specialisation and substitution of labour by purchased inputs and capital. Proponents of “multifunctional” agriculture fear that various environmental services like landscape and biodiversity preservation, which are provided by some types of agriculture, would dwindle as market incentives could lead to more “industrialized” production systems.

Alternatively, farming systems could become more extensive and more mixed if producers shifted towards low input-low output production models. This shift would be more likely to relieve environmental stress. But if the presence of the agricultural support has changed behaviour and underlying conditions, removing the support will not involve a simple reversal to the pre-support situation.

The potential environmental effects of removing a particular support measure depend on a number of factors, including (OECD, 2005b):

- 1) the extent to which the support acted to alter input, output or consumption flows, and the extent to which each of the altered flows is environmentally beneficial or harmful;
- 2) whether removal of the support removes impediments against, or increases incentives for, investing in newer, more environmentally benign technology; and
- 3) whether environmental regulations are in place that prevent potentially harmful production or technology choices that otherwise might be made after the support is removed.

Not every support measure is bad for the environment. The objective of some support payments is to correct for the under-provision of environmental services. An example is a payment to farmers for landscape enhancement. Alternatively, payments may aim simply to counteract

environmental damage resulting from another policy measure or activity in another sector. They may also finance investments to avoid environmental damage from farming activities, for example, through constructing animal waste storage facilities or fencing water courses from livestock.

Countries have adopted different approaches to dealing with (harmful and beneficial) environmental externalities, including regulations, payments, taxes and fines, and voluntary approaches. The most efficient approaches are those that target the farm practices that lead to environmental damage or improvements. Economic, environmental and social impacts, in both the short and long term and at national and global levels, must be considered in policy reform, as can be seen in the case of biofuels (**Box 4**).

Removal of support in OECD countries has brought some striking successes (OECD, 2006h). Two well-documented cases from the 1980s – Norwegian fisheries and New Zealand agriculture – have shown that removal of support can initiate a series of structural changes that ensure the long-term unsubsidised survival of the industry. Similarly, Australia’s water reform of the mid-1990s involved a doubling of the real price of water to farmers over 8 years and resulted in greater efficiency through improved allocation across uses, including allocation of water to ecosystems. Moreover, the savings on water subsidies permitted irrigation infrastructure to be upgraded.

In all cases of policy reform, careful planning and care to maintain coherence with other policies are needed. Instead of a “big bang” approach, more precautionary or incremental steps should be matched to the adaptive capacity of the individuals and/or ecosystems bearing most of the adjustment burden. This might involve phasing out the support measure over time, or introducing a pilot scheme that can then be scaled up. Governments should also consider the case for transitional support to those most affected.

A broadly based, whole-of-government process is required, since single ministries are unlikely to have access to all the information and tools permitting optimal policy reform. Experience also shows that stakeholder involvement and building alliances for change through multi-stakeholder processes can be important (OECD, 2007j).

Box 4. The Case of Subsidies to Biofuels

Without large subsidies to biofuel production, biofuels would not be cost-competitive with fossil fuels in most countries. In 2006, these subsidies cost OECD countries US\$ 14.3 billion (at constant 2001 prices) and are projected to reach US\$ 82.5 billion by 2030. Brazilian sugar ethanol is one of the few economically competitive biofuels. However, the future competitiveness of biofuels will depend on the relative prices of both crude oil and biofuel feedstocks, which are subject to considerable uncertainty.

Increased crop production for biofuels could have negative environmental effects, particularly if additional land is cleared, industrial monocultures are established, competition for water increases, and cultivation of food crops is intensified inappropriately. Second generation biofuels, however, are expected to be more competitive when they reach the market, and may well have environmental benefits. They use non-food feedstock, principally biomass from grasses and trees that can be grown on poorer quality land unsuitable for food crops.

However, time horizon by which they may be available and the commercial viability of second generation biofuels is still uncertain. There are also questions as to whether biofuels can have a net positive impact on climate change. Once the upstream inputs and transport costs involved in biofuel production are taken into account, it appears that with current technologies the GHG emission reductions compared to fossil fuels may not be significant.

The net effects on rural poverty are also not known. Higher food prices will impact particularly on the rural poor. At the same time, biofuel production has the potential to increase energy security for poor countries that are net oil importers, and to expand employment opportunities. They may also stimulate broader economic development in such countries, in particular if current trade restrictions on biofuels or the feedstock used to produce them are lifted. Substituting biofuels for the traditional biomass that forms a major energy source in poor countries could bring both environmental and health benefits. However, concerns are expressed that, as has occurred with the introduction of other cash crops into poor areas, small holders with weak tenure rights might be displaced by large private interests keen to exploit the potential of biofuels.

The net implications of biofuel development for agriculture's sustainability are uncertain. Current biofuel developments and their reliance on government subsidies are questionable. Moving too fast or committing too much in this rapidly changing area might be unwarranted and a reassessment of how to allocate subsidies optimally over alternative renewable energy technologies is needed.

Source: OECD (2007), *Biofuels for Transport: Policies and Possibilities*; R. Steenblik and R. Doornbosch (2007), "Biofuels: Is the Cure Worse than the Disease?" *Round Table on Sustainable Development*.

Increasing the effectiveness of aid to agriculture

Despite the fact that 75% of the world's poor live in rural areas and are dependent on the agricultural sector, bilateral and multilateral aid to agriculture accounts for less than 4% of total development assistance (**Figure 5**). This share has declined from 5.2% in 2000 to 3.4% in 2006. The largest decrease has been in agricultural aid from bilateral donors, from 3.7% of official development assistance (ODA) in 2000 to 2.5% in 2006.

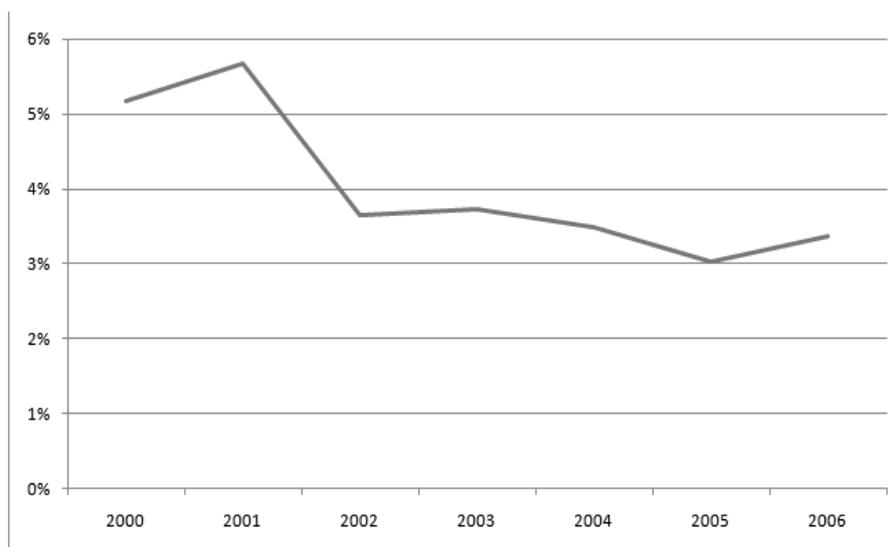
Assistance to agriculture from multilateral organisations such as the World Bank has also decreased in this period, but started rising in 2005 to reach 6.3% of multilateral aid in 2006. Global action is needed not only to cut distorting subsidies and open markets to agricultural products, but also to increase the level and effectiveness of development assistance to agriculture.

Greater emphasis should be placed on agriculture in the development agenda if the Millennium Development Goals (MDG) of halving extreme poverty and hunger by 2015 are to be realised. In agriculture-based countries, most of which are in Sub-Saharan Africa, the sector employs two-thirds of the labour force and generates over 30% of GDP growth (OECD, 2007a). For the poorest people, GDP growth originating in agriculture is four times more effective in raising incomes than that deriving from other sectors (World Bank, 2008). In other countries, enhanced agricultural performance would narrow the rural-urban income gap and reduce rural poverty.

The *Paris Declaration on Aid Effectiveness*, signed in March 2005, sets out a practical roadmap for removing inefficiencies in the way aid is delivered, improving the way it is deployed and thereby enhancing its impact on development (OECD, 2007c). Although the Paris Declaration focuses on the relationship between donors and partner countries and involves explicit commitments regarding their respective and mutual responsibilities, it has clear implications for the climate in which sectoral policies such as agriculture will be pursued.

In particular, specific commitments under the headings “ownership” and “alignment” indicate that future development assistance to agriculture will be channelled through coherent multi-objective national plans driven by national governments. Switching from project-based to programme-based assistance should reduce fragmentation of focus and effort while improving coordination and coverage of assistance.

Figure 5. Trends in Bilateral and Multilateral Aid to Agriculture
(as share of total)



Source: OECD Creditor Reporting System Aid Activities Database.

Policies that aim directly to promote agricultural development (policies “in agriculture”) will not deliver, or will underperform, unless accompanied by policies “for agriculture”, which include education, transport and communications infrastructure as well as private sector development (OECD, 2006e). Creating a supportive environment for agriculture policy interventions is a precondition for their success and sustainability. A main challenge is the translation of policy targets, budgeted expenditures and selection of instruments, planned at national level, into concrete context-responsive policies that can be communicated and implemented at village level.

Development assistance to agriculture should foster country-led partnerships, build institutions and empower stakeholders, and adapt approaches to diverse contexts. Unfortunately, national poverty reduction strategies (PRSs), which are the main point of reference at country level for operationalising the aid effectiveness agenda, have tended to neglect the agricultural sector. It is crucial that all agricultural stakeholders, including farmers, rural producers and their organisations, participate in PRS development and implementation.

Appropriate capacity needs to be built into public administrations, and private sector institutions serving agriculture (*e.g.*, credit institutions, input providers, output markets) should be strengthened. Local needs and feasible strategies will also be determined by the specific context. Diverse types of households depend on agriculture in the developing world, *i.e.*, large-scale commercial, traditional local, subsistence-based, landless rural, and chronically poor rural households, many of which are no longer economically active. One or several household types will predominate in a given rural area with its own structure of informal networks and outside links.

The Paris Declaration aims to remove donor-specified conditionality from development assistance while placing greater accountability on partner countries. However, the new partnership paradigm offers less opportunity for exerting leverage on partner countries regarding policies to change unsustainable parameters relating to ecosystem degradation, gender equality, property and user rights, and income distribution. The international community should continue both to encourage – and exert pressure – where necessary, in other forums and by other means, to promote a coherent sustainable development agenda for agriculture and other sectors.

Fostering investment in agricultural infrastructure

The economic performance of agriculture depends crucially on good infrastructure. Irrigation, rural electrification, storage facilities, telecommunications links and road access contribute greatly to production and marketing efficiency while reducing risk and transaction costs. Developing countries face a chronic lack of adequate infrastructural provision. One in six of the world's population has no access to roads or safe drinking water or both, more than one in three is without any reliable energy sources or sanitation facilities, and nearly two out of three are not linked to modern communications networks. The majority of these people live in rural areas. Africa's low population densities pose particular problems for adequate infrastructure provision (OECD, 2006f).

Investment in rural infrastructure has fallen significantly in recent years, due in particular to fiscal stringency imposed through structural adjustment programmes and lower donor support for infrastructure investments. It is estimated that the total annual investment needed for infrastructure (including rehabilitation and maintenance) amounts to 5.5% of GDP in developing countries and 9% in the least developed countries. Investment in irrigation has fallen more sharply than for infrastructure in general.

There are a number of challenges facing developing countries regarding the provision of infrastructure for agriculture and other sectors (OECD, 2006e). These include:

- pursuing infrastructure developments within an integrated national strategy framework rather than on a fragmented project-by-project basis;
- developing new financing arrangements for infrastructure, such as vouchers, user fees and co-financing mechanisms;
- securing adequate numbers of trained people, including policy advisors, agricultural researchers and extension workers, business managers and financial and computer experts to manage and maintain infrastructure;
- forging partnerships across the public, private and non-governmental sectors for the design and implementation of infrastructure; and
- involving local communities more actively in infrastructure delivery and maintenance.

The shortage of finance for new infrastructure investments makes it imperative that available funds be used in the most cost-effective way (**Box 5**). In addition, the exploitation of infrastructure already in place needs to be more sustainable. This involves recognising the crucial role of maintenance in preserving the value of infrastructure assets and assuring funding and technical assistance. Systems which recover costs and collect tariffs, while taking into account poor people's ability to pay, are needed as well as public-private partnerships to enhance operating efficiency (OECD, 2006c).

Increased private investment in infrastructure should be stimulated as well as higher public investment and increased donor funding. Investment levels in agriculture have declined despite the demonstrated high rates of return and reductions in poverty which ensue. Private investment in infrastructure could bring new technologies and techniques to alleviate environmental and economic pressures. Public investment on its own will not be sufficient to stimulate productivity and production at the farm level nor to fill the enormous gap in rural infrastructure. Improving the investment climate for agro-business is crucial.

Box 5. FEASIBLE Financing Strategies for Infrastructure Projects

FEASIBLE (www.oecd.org/env/finance) is a computerised decision support tool designed to help develop financing strategies for investment-heavy environmental infrastructure.

The model determines the costs and timetables of achieving given policy targets, and compares the schedule of expenditure needs with available sources of finance, in order to reveal “finance gaps” during planned implementation. It then develops scenarios for closing these gaps, whether by identifying policy reforms that could lower the cost of achieving targets or ways of mobilising additional finance, by adjusting the ambition level of the targets, or by extending the time period for achieving them. The model can assess the levels of finance (public, private, domestic, foreign) available under different macro-economic conditions. It can also help to assess the potential social implications of increasing user charges by determining the impacts on household income.

A basic assumption is that governments should not finance all or most expenditure for infrastructure. Government’s main role is to establish the policy, regulatory and institutional frameworks within which resources from users, financial and capital markets, donors, local budgets and enterprises can be mobilised in a complementary way and used as cost-effectively as possible.

Source: OECD (2007), “Feasible Financing Strategies for Water Supply and Sanitation”, *OECD Observer*.

Both developed and developing countries face similar issues when it comes to the optimal management of their agricultural infrastructure, as exemplified by the issues surrounding irrigation management. Irrigation systems are one of the most costly and complex items of agriculture-specific infrastructure. The challenge is to ensure the optimal allocation of water resources to competing uses while both preventing their degradation by pollution or over-depletion and respecting the ecosystems in which they are embedded (OECD, 2006k).

Agriculture uses about 70% of available water resources globally and exploits an irrigated area of about 260 million hectares. Market-based instruments, like structured water use charges and tradable water permits, can improve the efficiency of water use by farmers. A combination of instruments (market-based instruments, water use quotas and good management practices) is best suited to achieving multiple targets. Optimal policy solutions will differ because of local ecological characteristics, societal preferences and inherited characteristics of the system.

Assigning property rights and responsibilities attached to water use and provision is a necessary condition for building an appropriate institutional framework and for implementing market-based measures. User rights may be transferred to individuals or to water user associations. For example, a key element of water reforms in China has been the creation of over 7 000 water user associations, which operate by majority decision-making and self-management. The perceived benefits are more efficient management, improved incentives and less conflict over water use (OECD, 2006j).

Water charging achieves two objectives. It shifts the service costs to the users, allowing public water agencies to focus on reducing hydrological risk, maintaining water supply and quality, and promoting ecosystem sustainability. It also has the potential to maximise water use efficiency, ensuring that irrigators make best use of the resource. Full-cost recovery operated by charging a flat rate, such as a per hectare charge, meets the first objective but not the second, because the payment is not targeted to the rate of use. Thus, volumetric water metering is highly recommended (OECD, 2003).

Where this is not possible, it is suggested that water managers make an assessment of the amount of water used based on the combination of crops, technology and soil. The most efficient water allocation is achieved, however, through market interactions. When water trading was introduced in Australia during the 1990s, the observed market value of water rights was substantially higher than that implied by full-cost recovery. This indicates that full-cost recovery alone is not sufficient to ensure that water is allocated to its most valuable uses.

New irrigation projects should be considered sustainable only if future beneficiaries can cover all operating and maintenance costs. Given the complex mix of social costs and benefits provided by irrigation systems, the appropriate share of investment and operating costs to be borne by the taxpayer needs to be assessed on a case by case basis. Affordable public service prices in the poorest communities are essential. In any case, prices should be charged per unit of water used and subsidisation, if it occurs, should be decoupled from quantities used (OECD, 2006j).

ENVIRONMENTAL ASPECTS OF SUSTAINABLE AGRICULTURE

Promoting sustainable management of agricultural resources

In many parts of the world, agriculture is damaging its natural resource base. In low-input farming, characteristic of the poorer parts of the developing world, the main concerns are soil depletion, water scarcity and habitat loss due to over-cropping, over-grazing and deforestation. In many developed countries, high-input farming practices and farming on environmentally fragile lands are responsible for soil and water depletion; nutrient pollution of groundwater, internal waterways and estuaries; reduced agricultural and natural biodiversity; and landscape degradation.

Resource management and habitat conservation depend on very specific features of land use, such as the spatial distribution of unfarmed or unsprayed strips and pockets of land. Landscape performs different functions and its quality has various objective and subjective dimensions, including the type of land cover, land use intensity, diversity, openness, “smoothness” (non-disruption by man-made structures or infrastructure), “naturalness”, and heritage value (OECD, 2002a). Site-specificity, and the fact that resource-degrading spillovers from agriculture are often diffuse (non-point) in origin, complicate the measurement of environmental degradation and the design of policy instruments.

In OECD countries, more needs to be done to bring agricultural resource management up to best practice levels (OECD, 2008a) (**Table 2**). In a ten-year period (1990/2 to 2001/3), 13 OECD countries reduced both production and agricultural land use, 14 countries reduced land use while increasing production, and two countries increased both production and area. In addition, 5 countries have at least 30% of their agricultural area under moderate to severe water stress, whereas in 10 countries this share is virtually zero. Only two out of 13 countries reporting had more than 60% of arable area under soil conservation plans. The biodiversity indicators do not show any clear trends in what is a fairly sombre picture.

Table 2. Changes in Selected OECD Agri-Environmental Indicators (1990/2 to 2001/3)

Environmental indicator (direction of overall trend in OECD)	Number of countries with increase (+) decrease or no change (-/=)		Factors causing increase	Factors causing decrease
	+	-/=		
Nitrogen balance (-)	7	23	Overall expansion in production.	Adoption of nutrient management plans or environmental farm plans. Falling livestock numbers. Lower fertiliser use. Improved slurry management, payments for manure storage.
Pesticide use (-)	9	15	Expansion of crop production. Substitution of pesticides for labour.	Decline in crop production. Incentives or taxes. Use of new lower-dose and/or more targeted pesticides. Expansion of organic farming. Lower price support.
On-farm energy (+)	17	13	Expansion of production. Mechanisation, increased machinery power.	Higher energy prices. Lower energy subsidies. Increased energy efficiency.
Water use (+)	8	13	Increased irrigated area.	Increased water efficiency.
Irrigated area (+)	16	9	Government support.	Unknown.
Ammonia emissions (+)	8	16	Increasing livestock numbers.	Falling livestock numbers. Lower fertiliser use. Improved slurry management, payments for manure storage.
GHG emissions (-)	8	22	More livestock (CH ₄) or crop production (N ₂ O). Land clearing.	Fewer livestock and/or less crop production.
% of agr area	< 4	> 4		
Organic production (% of agricultural area) (+)	21	9	Support for conversion to organic system. Rising consumer demand.	Lack of markets.

Note: Not all OECD members provided information for every indicator; numbers in each row do not always add to 30.

Source: OECD (2008), *Environmental Performance of Agriculture in OECD Countries since 1990*.

The range of available policy instruments for promoting sustainable environmental management of agricultural resources has expanded considerably. Conventional instruments like taxes or damage thresholds are relatively ineffective for dealing with agriculture's negative environmental externalities, which are location-specific and diffuse in nature. The choice of suitable instruments has been shifting towards those involving voluntary or statutory requirements relating to good farming practices and environment-enhancing actions by farmers.

Advisory services serve as an independent source of information and guidance, and governments can maintain databases for monitoring agriculture's use of its natural resource base and the consequences. Farmers' responsiveness to market signals and their uptake of more resource-efficient technologies depend on good dissemination of information about technological and management options and their consequences for better resource management. For example, agricultural biotechnology can contribute to improvements in resource management, low-pesticide strategies and food quality. Farmers need a good basic education so they can evaluate the information received as well as flexible skills so they can adopt new strategies.

More direct instruments include various forms of cross compliance (where the compliance conditions specify certain on-farm activities or precautions such as minimum tillage, varying spray regimes or watercourse protection measures), payments to individual producers for clearly defined environmental enhancements (such as low stocking densities or heritage protection), and environmental contracts negotiated between government agencies and individual producers, or groups of producers, to deliver environmental services.

Voluntary payments and contracts can be precisely targeted to areas where the environmental benefits are expected to be large or where conventional farming practices would be particularly damaging to the environment. Alternatively, they can be targeted to types of farmers or farm production, to specific on-farm activities or to outcomes. An individual customised contract allows a finer trade-off between economic and environmental sustainability because it reflects more closely the farmer's compliance costs, which include foregone output as well as possible extra labour or materials costs.

The spatial aspect of resource management means that contracts with groups of farmers can sometimes be more effective than individual agreements. For example, integrated pest management is more efficient if adopted by all producers in a given region (Ravnborg, 2004). Similarly, incentives to leave patches of land unfarmed or farmed with low intensity,

or to establish wildlife corridors, often need to cover a considerable area of farmland before they have an impact on wildlife numbers and diversity. Group agreements also have the potential to be self-enforcing. For certain changes in farming practice, the ideal coverage would be at the level of the eco-system.

Other institutions driving improvements in resource management are market-based private standards and food quality schemes, the organic farming movement and farmers' organisations. Private standards schemes, developed during the 1990s mainly in the fruit, vegetable and meat sectors, were originally motivated by the desire of large processing and retailing companies to standardise products as they move into and along the food supply chain, in order to facilitate the sourcing of raw and semi-processed inputs from least-cost sources around the world. As food legislation strengthened the liability of processors and retailers for food safety standards, these schemes also became desirable as a way of passing some risk back up the chain to primary producers.

With growing consumer concerns about safe and environmentally sound food, retailing companies have also seen the marketing advantage of offering consumers products with more sustainable characteristics (OECD, 2008c). Environmental and social standards relating to resource use and farm practices have been added to the requirements that participants in certain labeling schemes have to meet. Farmers' organisations in some European countries have also, together with other stakeholders, been leading the way on farm practices like low-pesticide strategies. Preferential purchases of fair trade and local products by consumers and public institutions can support small-scale producers, local agricultural landscapes, and sustainable livelihoods.

Ensuring integrated management of land for agriculture

The concept of sustainable development combines the dual aims of improving the present conditions for much of the world's population and providing for the needs of future generations. However, current land-management efforts to address a multitude of interrelated problems, including deforestation, desertification, air and water pollution, and uncontrolled expansion of human settlements in urban and rural areas, are hindered by a piecemeal and uncoordinated approach, often with duplication of effort or conflicting sectoral goals. A more holistic and integrated approach would improve land management for agriculture and other uses.

Understanding the central role played by soil should be a foundation stone of an integrated resource management programme. Ecologists stress

the interdependence between soil, water, air and biodiversity, and the need for a coherent approach to the management of these resources. Soil itself provides a habitat and gene reserve for many micro-organisms and larger soil-dwelling animals, which can contribute to both soil productivity and biodiversity above ground. Soil stores nutrients and water, regulates and filters the flow of rainfall to plant roots and groundwater, and absorbs stores and releases atmospheric gases. Just like individual genetic species whose extinction is irreversible, soil is effectively a non-renewable resource once it is lost or severely degraded.

Since the early 1990s, an approach known as *integrated farm management* (IFM) has stressed the importance of a holistic strategy for managing the natural resources available to the farm. The main principles of IFM are: efficient soil management and appropriate cultivation techniques, good animal husbandry and animal welfare standards, use of crop rotations, minimum reliance on chemical crop protection and fertilisers, careful selection of seed varieties, landscape maintenance, enhancement of wildlife habitats, and a commitment to communication, training and involvement.

The concept of *integrated land management* (ILM) extends this idea to the level of the region or the ecosystem. ILM recognises the spatial and temporal variability of environmental conditions worldwide. For example, soil conservation practices on heavy soils in a temperate climate with average precipitation will not be suitable for soils in warm wet equatorial zones, where they tend to have lower levels of essential plant nutrients. Even within a particular ecosystem or region, there will be considerable variation between the agricultural potential and environmental vulnerability of different sub-areas (IDRC/UNCTAD, 1997).

One of the objectives of integrated land use planning is to identify areas where a particular technology can provide multiple benefits. Techniques that improve soil fertility, thereby both increasing agricultural productivity and enhancing biodiversity, are a good example. Such techniques, however, must also be matched to those areas where they can be adopted and will thrive. In order to identify these opportunities, planners need relevant information about interactions between farming practices and ecosystem properties, and appropriate spatial databases.

Among the main barriers to integrated land management are information and technology deficiencies, weak institutional infrastructure, and conflicts between the land use goals of different interest groups or types of farmer. Effective implementation of technically optimal land management strategies depends on the co-operation of the land users and local communities. In the ideal approach, stakeholders identify their needs, spatial planning units for the land area are selected, consensus is reached on optimum land use and

management systems for each unit, and the appropriate infrastructure is set up. But social and technical dilemmas can arise with this approach.

An example is the “intensive” vs. “extensive” agriculture question. The choice is to concentrate input-intensive production in a smaller area, where it creates high levels of local environmental pollution but leaves a wider area available for nature conservation, biodiversity maintenance and other environmental and social benefits, or to extend less intensive production over a wider area. In essence, the first option tries to maximise either economic or environmental sustainability in separate zones, whereas the second tries to optimise the trade-off between them within the same areas. While societal preferences are relevant, there is also the technical question as to which plan provides more of both economic and non-economic benefits in the longer term.

Combating desertification and drought

Desertification is the process of sustained deterioration of the biological productivity of land, as manifested in such phenomena as soil erosion, soil structure compaction, reduction in organic matter and nutrient content, and salinisation.

Estimates of the extent of desertification vary, but some estimates suggest 70% of the world’s drylands (excluding extremely arid deserts), or 3.6 billion hectares, are degraded to some degree. The problem affects more than 900 million people in 100 countries, some of them among the least developed nations. Erosion, salinisation, compaction, and other forms of degradation affect 30% of the world’s irrigated lands, 40% of rainfed agricultural lands, and 70% of rangelands (OECD, 2002b).

A major cause of desertification has been and remains inappropriate land use, especially cultivation of fragile and marginal soils, overgrazing of pasture, inadequate soil conservation practices and deforestation. Soil degradation reduces agricultural productivity and ultimately renders land unusable for agriculture. There are also negative spillovers: for example, flows of off-farm sediment increase the cost of providing clean drinking water, cause silting in rivers and reservoirs, damage roads and buildings and degrade aquatic ecosystems (OECD, 2006j).

Incentives are needed to tackle desertification and drought in both OECD and non-OECD countries. In developed countries, government programmes focus on offering producers targeted payments or by attaching cross-compliance conditions to payments given for other reasons. In developing countries, programmes should be targeted to removing impediments that constrain action and lower initiative, whether in the form

of insecure and inappropriate property rights, lack of technical know-how, insufficient access to finance, or weak institutions and governance.

Soil erosion problems have stabilised or slightly improved in OECD countries over the last 15 years, largely due to greater use of soil conservation practices like the adoption of reduced or no tillage cultivation techniques and the conversion of agricultural land to forestry. Various OECD countries have introduced incentive schemes to encourage producers to adopt practices that conserve land resources.

These initiatives include, in the United States, conservation compliance conditions that disqualify producers from receiving commodity support payments if they bring highly erodible land into production, and the Conservation Reserve Program (CRP) and Environmental Quality Incentives Program (EQIP), which reward resource-conserving practices. In the European Union, cross compliance conditions attached to the receipt of direct income support include the requirement to keep farmland, whether cropped or not, in good agricultural and environmental condition.

Despite the overall improvement, however, a sizeable proportion of agricultural land in some OECD countries is classified as having moderate to severe risk of water or wind erosion. As for drought in the OECD area, Southern Europe, South-Eastern Australia and parts of the United States already experience moderate or severe water stress. In developed countries, however, the presence of modern food distribution systems means that the survival of local populations is not vitally dependent on local food production.

This is not true in many parts of the developing world where food production is for subsistence or local markets. In Africa, 95% of agriculture is rainfed and large areas are subject to low and irregular rainfall. Moreover, two-thirds of Africa's agricultural area, which feeds 485 million people, is classified as having poor soils. Increasing prevalence and severity of drought and desertification are triggering regional migration flows that put pressure on sustainable development in other regions. Political instability also contributes to both migration and water stress. It has been estimated that, if temperatures increase by 3-6 degrees in the Sahel and parts of southern Africa as predicted under some climate change scenarios, rainfall would be 20% lower than in 1990 (OECD, 2007k).

In many parts of the world, there is renewed interest in the traditional practice of rainwater harvesting as a method of combatting increasing water scarcity. Water harvesting can be effective in arid, semi-arid and semi-humid areas where surface or ground water supplies are not available or are uneconomical to develop. Run-off water can be collected over large areas (macro-catchments), from micro-catchments or in the form of floodwater,

and is then stored in reservoirs, cisterns or in the soil. Adoption of this technology can allow crop production in areas where otherwise it would not be possible, reduce the risk of crop failure and generally increase yields in rainfed agriculture.

Secondary benefits of rainwater harvesting include groundwater recharge and improvements in soil fertility from nutrients and organic matter contained in run-off water. Moreover, water harvesting systems are thought to protect the soil from salinisation. Enhancing local water supply in this way can be a first step towards controlling desertification, as it can make possible the reestablishment of pasture and reforestation.

Agronomists report that water harvesting can increase yields two- or threefold in water stressed areas, and believe that this technology is still far from reaching its potential. More widespread adoption could be encouraged by targeted training of extension personnel, greater awareness of the technology on the part of decision makers, more applied research, better documentation of projects, more co-operation between projects, financial support for construction in the case of larger schemes, and appropriate institutional frameworks at community level to concentrate effort and forestall possible conflicts. Micro-credit availability can greatly facilitate the creation of micro-catchments and associated storage.

Incentive structures based on property rights to land are crucial. When land ownership is vested in individuals, yield and land improvements are captured by the individual owner. In this way, adoption incentives are maximised and water harvesting initiatives are most likely to succeed. Even when land is in private ownership -- but there are many owners -- incentives are weakened by free-riding and individual fears of losing the land. When land is in government or communal ownership, the likelihood of adoption and success are considerably weakened. At the same time, it is recommended that water harvesting be introduced at the level of the village (rather than at the level of the geographical catchment or by individuals acting alone), with a participatory approach at the planning, construction and operation stages.

Facilitating agricultural adaptation to climate change

Although the agricultural sector faces a major challenge in adapting to the effects of climate change, agriculture itself is responsible for about 10%-12% of global greenhouse gases (GHG). This includes about 50% of methane emissions (largely from rice paddies and ruminant livestock) and 60% of nitrous oxide (from soils). Agricultural soils can be a source or a sink for carbon dioxide (CO₂) depending on cultivation practices, whereas

increasing the area used for agriculture through deforestation releases carbon dioxide. Various steps can be taken to reduce agriculture's GHG emissions, from switching to low-energy technologies, changing tillage methods, adapting slurry management practices, and improving the digestibility of animal feed rations, to on-farm generation of renewable energy (OECD, 2008d).

At the same time, given its vulnerability to climate and weather, agriculture's main challenge is adapting to the effects of climate change. Higher temperatures and an intensification of the hydrological cycle will bring both more water evaporation and more precipitation, which will be very unevenly distributed. Rainfall and cropping patterns will be altered and areas exposed to vector-borne plant and animal diseases will expand. The vulnerability of agriculture to severe meteorological events will increase (OECD, 2005a).

Most climate change simulation models predict a drier climate for areas already suffering water stress, such as Southern Europe, Northern Africa and parts of the Americas, and increased precipitation in areas like Southern and Eastern Asia, and Northern Europe. With higher temperatures, more precipitation and greater crop fertilisation (from higher levels of CO₂), yields in temperate zones will increase. These gains are likely to be offset by reductions in the lower latitudes, particularly in Africa and the Indian subcontinent, caused by heat, water stress and changing growing seasons. In the longer term, the yield-increasing factors are likely to be dominated by the negative factors in temperate zones, ultimately leading to lower yields and higher production risks in most regions.

Government action plans for coherent, multi-sectoral climate adaptation strategies in agriculture are needed. Farmers in developed countries can employ various strategies, such as shifting sowing and harvesting dates, adopting different varieties or species, modifying field operations such as tillage methods and fertiliser applications, adapting animal housing, and changing grain drying and storing methods. Governments will need to implement other adaptation responses, including modifying water supply and irrigation systems, stimulating the efficiency of water use, strengthening forest fire management provisions, targeting specific local vulnerabilities, increasing training and education, refocusing agricultural research priorities and strengthening extension and communication systems (FAO, 2007).

Developing countries that rely strongly on rainfed agriculture are particularly vulnerable to the effects of climate change and have the fewest options for rapid and effective adaptation. Climate models predict for Africa that 600 000 square kilometres, classified today as moderately water constrained, will experience severe water shortage, and that by 2020

between 75 million and 250 million people will suffer an increase in water stress due to climate change. The impact will be most severe in North Africa, where water demand is already high, because of high population growth rates. As well as effects on food supply and malnutrition, potential consequences include increases in human and animal disease, population movements and civil conflict (OECD, 2007e).

It is essential to prevent climate change from derailing the development process. There are many barriers to incorporating climate change into development programmes as well as concrete steps to be taken (**Box 6**). Raising awareness at all levels, from government down to local communities, is a precondition for ensuring that climate risk management becomes better integrated into development programmes and practices. At government level, adaptation should be approached cross-sectorally and responsibility should not be left to Environment Ministries. Government budgets should include provisions for adaptation initiatives.

Climate change also has financial implications for development assistance to the agricultural sector. Agriculture is particularly vulnerable to climate change in terms of salt seepage into groundwater as sea levels rise and anticipated increases in flooding and droughts. Additional finance needed to “protect” all new investment in developing countries from climate change risks could be as high as US\$ 40 billion. In 2006, OECD Development Co-operation and Environment Ministers together adopted the *OECD Declaration on Integrating Climate Adaptation into Development Co-operation*. This emphasised that adaptation to climate change is not a “stand-alone” agenda but should be integrated into development planning, including Poverty Reduction Strategies (OECD, 2006b).

Carbon finance presents an opportunity for securing new funds for climate mitigation and adaptation activities in agriculture. The Clean Development Mechanism (CDM), one of the three market mechanisms established by the Kyoto Protocol, offers the possibility to promote sustainable development in developing countries while allowing other countries to meet their greenhouse gas emissions reduction commitments. CDM projects like small-scale wind power generators and reforestation projects could be especially valuable to climate change mitigation and adaptation efforts in the agricultural sector (OECD, 2007e). Potential investors are urged to **review the CDM mechanisms to make them more easily accessible. At the same time, developing countries should continue efforts to provide an environment that is conducive to private sector investment in carbon finance activities.**

Box 6. Mainstreaming Climate Change into Development Activities*Barriers to mainstreaming climate change in development activities:*

- 1) lack of adequate human and institutional capacity to deal with uncertainty;
- 2) lack of guidance and political will;
- 3) competing agendas (often driven by donors/external partners);
- 4) aversion to change;
- 5) difficulties in working with non-state bodies and local communities;
- 6) segmentation and other barriers within governments and donor agencies;
- 7) prioritisation of shorter-term objectives over climate risk reduction;
- 8) short length of many development projects;
- 9) weak relevance of available climate information for development-related decisions; and
- 10) direct trade-offs between climate and development objectives.

Opportunities for mainstreaming climate change in development activities:

- 1) making climate information more relevant and usable;
- 2) developing appropriate tools for prioritising responses;
- 3) applying climate risk screening tools at the project level;
- 4) identifying and using appropriate entry points for climate information in project planning;
- 5) shifting emphasis to implementation, as opposed to developing new plans; and
- 6) encouraging meaningful co-ordination and the sharing of good practices.

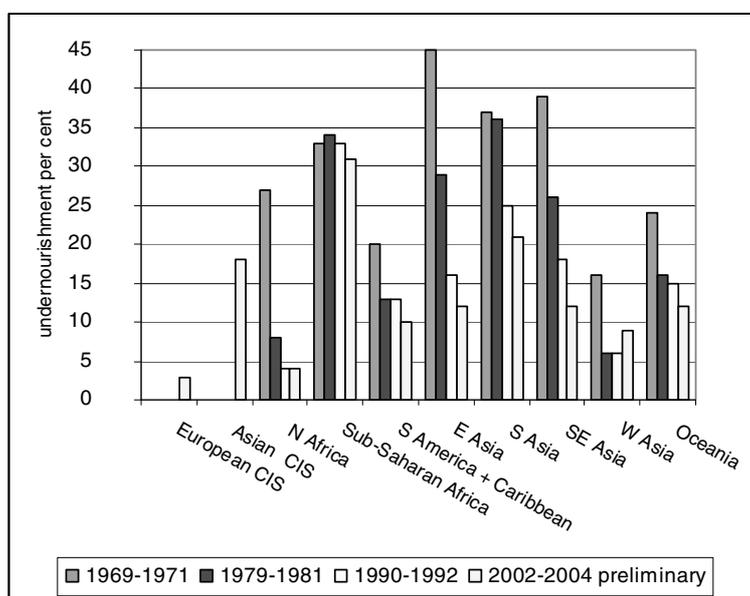
Source: OECD (2005), *Bridge over Troubled Waters: Linking Climate Change and Development*; OECD (2007), *Climate Change and Africa*.

SOCIAL ASPECTS OF SUSTAINABLE AGRICULTURE

Reducing the number of undernourished people

The ability of agriculture to produce enough food to enable people to lead productive lives is part of the core definition of agricultural sustainability. Adequate nourishment for populations has various dimensions: global food availability, food distribution across and within regions, economic access of households and individuals to the food they need, and the nutritional quality of this food. Assuring food security, in terms of people having both physical and economic access to the basic food they need at all times, involves ensuring that adequate food is available on a regular, stable basis.

One out of every seven persons in the world is classified as undernourished, which refers to the condition of people whose dietary energy consumption is continuously below a minimum requirement for maintaining a healthy life and carrying out light physical activity. This represents a total of about 864 million people, 96% of whom are in developing countries. The least developed countries account for 88% of the world's undernourished people. Although the share of undernourishment in the total population of South Asia is significantly lower than 30 years ago, this region still counts 314 million undernourished people, whereas in Sub-Saharan Africa, where the rate remains around 30% of the population, the total number is about 216 million (**Figure 6**).

Figure 6. Incidence of Undernourishment by Country Grouping

Source: FAOSTAT.

The consequences of widespread undernourishment for children are stark: in many of the poorest countries, the rates of moderate or severe underweight and stunted growth in children under 5 years old are above 35%. These high rates are linked to low average per capita income levels, but they also reflect the unequal distribution of income within countries. For example, rates of moderate or severe underweight and stunted growth among young children are well over 40% in both Nepal (a least developed country) and India (an emerging market economy with more than double the average per capita income of Nepal but a more unequal income distribution).

The issues of geographical distribution and economic access to food need to be addressed. Many factors are involved: infrastructure endowment (road access, communications), economic institutions (extent of market integration) and, above all, the distribution of resources, and hence income, across households and communities. These structural characteristics are slow to change, which helps to explain the deeply-rooted nature of food insecurity.

Effective policies for increasing food security have stimulated much debate. Visible food security failures, like the 2001-2 food crises in Sub-

Saharan Africa, have raised questions about whether food insecurity in that region is transitory or chronic (Maunder and Wiggins, 2007). If it is a transitory phenomenon, then the appropriate response would be rapid humanitarian aid, followed by assistance in mounting disaster risk reduction programmes and early warning networks.

Chronic food insecurity, on the other hand, calls for more permanent types of relief, like social protection measures in parallel with long-term development action to increase local food production, reduce poverty and diversify livelihoods. The evidence on rates of undernourishment, together with the occurrence of random but repeated crises due to crop failures, disease outbreaks and other external shocks, provide substantial evidence that food insecurity in certain parts of Africa is chronic. Multi-faceted policy responses are needed, including coping policies to deal with food crises when they occur, but also preventive and mitigating policies to treat the long-term causes and to prepare poor households for future crises.

Social protection programmes targeting the most vulnerable households should include safety net transfers (cash, kind or work opportunities) and measures to reduce vulnerability ahead of crisis situations. At the regional level, surveillance systems may be needed as set up over 20 years ago to monitor the food situation in West Africa and the Sahel. These systems coordinate information gathered from various sources, including rapid targeted assessments, regular farm surveys conducted at country level, and satellite records and market data to prevent the Sahel being caught unprepared by a full-fledged famine (OECD, 2008e).

The Sahel and West Africa (SWAC), an OECD body, in collaboration with the Permanent Inter-States Committee for Drought Control in the Sahel (CILSS) animate a Food Crisis Prevention Network gathering West African country representatives, experts on food security and major donors to assess the food and nutritional situation in the region. The annual meeting of this network provides an opportunity to suggest actions required to address circumstantial food crises, but also to exchange information on what could be done in the long term to achieve food security objectives. In order to make effective use of food aid, CILSS and several donor countries signed the Food Aid Charter in 1990. They also address issues of food sovereignty (**Box 7**).

Box 7. The Concept of Food Sovereignty

Food sovereignty is a concept that asserts the right of peoples to national autonomy over agricultural and food policies. It emphasises domestic consumer preferences about the food they eat and the importance of reducing dependence on international sources of food supply. In this, it promotes the formulation of trade policies and practices that support domestic food production and prevent dumping of agricultural products from other countries.

Food aid to provide direct help to hungry people can create distortions in local markets and enhance dependence on outside sources. Providing funds to purchase food on commercial terms is considered more effective. Similarly, dumping of food surpluses on developing countries at lower prices than the cost of production and distribution can squeeze out local producers with damaging effects.

There are questions as to whether greater food sovereignty is compatible or inconsistent with greater food security. If food sovereignty means raising trade barriers around domestic food markets, it could have negative consequences for food availability and access for the most vulnerable households. In contradicting the principle of comparative advantage in world trade, this could lead to higher domestic food prices, which would impact differently across households and types of farms. While food would be more expensive for consumers who buy food in markets, farmers who produce for the market would respond to the price incentive with higher output but only if they have access to the necessary additional farm inputs. Promoting food sovereignty has both positive and negative distributional and production effects which need to be considered.

Source: OECD (2007), *Food Sovereignty in West Africa: From Principles to Reality*, Sahel and West Africa Club.

Sustaining rural life and communities

The main challenge facing rural areas in developed and developing countries is broadly the same: how to stimulate the rural economy in order to increase economic growth, retain populations and create sustainable living conditions. A key issue is whether the promotion of agriculture is the driver of rural prosperity or rural prosperity is the driver of agricultural viability. The form which this challenge takes, the constraints it encounters and the appropriate policies for sustaining rural life and communities are very different in the two groups of countries.

While agriculture plays an important role in shaping the rural landscape in many OECD countries, its weight in rural economies is low and declining. For the last 15 years, absolute levels of agricultural output have been gradually falling as protection has been reduced and support has become more decoupled. Productivity increases have driven a dramatic decline in agricultural employment across OECD countries. Currently, less than 10% of the rural workforce is employed in agriculture. The gross value added of agriculture as a share of total GDP in OECD countries has been steadily declining and is now less than 2% (OECD, 2006g). However, agriculture (with forestry) is the main user of space and thus plays a key role in land-based environmental outcomes.

Although jobs have grown in the agrifood chain upstream and downstream from agriculture (*e.g.* input supply industries, abattoirs, off-farm storage, food processing companies), these activities are often undertaken by large companies located far away from rural areas and close to urban consumption centres or ports. Strategies for revitalising rural areas and stimulating local economies in OECD countries must look to non-agricultural sectors – such as light industry, leisure and tourism, and various knowledge-intensive activities – to provide new momentum. The policy challenge is to stimulate the installation of new, dynamic businesses in rural areas in a way that is economically, environmentally and socially sustainable.

A new rural paradigm is taking shape in OECD countries aiming to increase the overall competitiveness of rural areas, shift away from the focus on agriculture, reduce reliance on government subsidies, and broaden governance to include all stakeholders (**Table 3**). While agricultural support policies have brought large resources into rural regions, they have not been effective in triggering rural development as a significant share is spent on inputs sourced from outside the local economy. Agricultural support focuses on a small segment of the rural population – farmers and others involved in agricultural enterprises – rather than on rural places or areas. These supports do not address the most pressing socio-economic challenges facing rural communities and have had uneven impacts across the rural territory (OECD, 2006i).

In developing countries, in contrast, the majority of the rural population is engaged in farming. Rural communities are often caught in a vicious circle of deepening poverty and increasing resource degradation. Causes include rapid population growth, inequitable land distribution, limited credit and technology, and lack of infrastructure. Outmigration (usually of men) and expansion of cultivation onto marginal land, pasture or by deforestation are avenues for breaking this cycle but create further problems. The policy challenge is to stimulate agricultural productivity in a sustainable way while

expanding non-agricultural economic opportunities so that rural households can supplement their incomes and reduce their vulnerability to agriculture-related shocks.

Table 3. The New Rural Paradigm for OECD Countries

	Old approach	New approach
Objectives	Equalisation, farm income, farm competitiveness	Competitiveness of rural areas, valorisation of local assets, exploitation of unused resources
Key target sector	Agriculture	Various sectors of rural economies, <i>e.g.</i> rural tourism, manufacturing, information technologies
Main tools	Subsidies	Investments
Key actors	National governments, farmers	All levels of government (supranational, national, regional and local), various local stakeholders (public, private, NGOs)

Source: OECD (2006), *The New Rural Paradigm: Policies and Governance*.

The community and its constituent households are the target units for rural policy in the developing country context. There are three interrelated priorities: 1) enhancement of agricultural productivity and market opportunities, 2) promotion of diversified livelihoods on and off the farm, and 3) reduction of risk and vulnerability (OECD, 2006e). Under the first priority, governments need to create a supportive policy environment that will provide incentives and remove constraints for agricultural productivity and efficiency increases, while creating safeguards and incentives to prevent unsustainable resource use in the environmental and social sense.

The second priority recognises that a more diversified exploitation of household-owned assets (towards post-harvest activities and non-agricultural enterprises, including providing labour services in urban areas) is key to a sustainable rural economy. There is evidence from sub-Saharan Africa that household income increases with the degree of diversity of the income portfolio. There is mixed evidence on whether migration to cities reduces rural poverty (through remittances) rather than increasing urban deprivation (by increasing unemployment). Coherent policy planning at national level will couple rural development with industrialisation and urban job opportunities.

The third priority has a double rationale: first, it is based on a simple humanitarian logic, addressing the extreme vulnerability of the rural poor to external shocks like illness, weather events and rapid structural changes. Second, it relies on the idea that, when they become less vulnerable, many of the rural poor will be able to turn to new livelihoods that will increase their participation in markets and generate economic growth.

Focusing on gender roles in agriculture

About 40% of the female workforce worldwide is employed in agriculture. In South Asia and Sub-Saharan agriculture, around two-thirds of the agricultural workforce consists of women, and it is estimated that half of the world's food is produced by women agricultural workers. In the developing world, they are the main producers of staple food crops and the main providers of food for children. Women work in the fields, make the farm plans and are responsible for resource management (OECD, 2006e).

However, women perform these tasks in conditions that actively constrain their productivity and reduce the overall performance of the agricultural sector. Women suffer from inadequate access to land and property rights as well as credit. This restricts their use of productive inputs and their recourse to hired workers when needed. There are often barriers to their use of transport, communications and extension services. Rural women's educational levels and access to health services tend to be much lower than those of men. Women also suffer more from the effects of second-hand smoke and indoor air pollution due to burning traditional biomass fuels for cooking and heating.

Gender inequality has broader economic and social consequences than just reduced agricultural output (OECD, 2008b). If women had more economic autonomy and control, fertility rates would fall, a larger proportion of household resources would be spent on nutrition, health and education, and girls would be more likely to attend school for longer. In

addition, if women farmers had secure land rights and access to credit, they would be more willing to adopt medium-term soil conservation and improvement strategies and invest in micro-projects like small-scale rainwater harvesting. The triple dividend in economic, social and environmental terms of such actions is clear.

Gender inequality is both a direct and indirect constraint on agricultural production, especially in Africa. African women have not been able to benefit from investment and the expansion of trade in agricultural products due to limited access to productive resources, including land, credit, transport and extension services. Although women produce up to 80% of basic food stuffs, a survey of credit schemes in five African countries found that they received less than 10% of the credit given to male small-holders. Agricultural productivity in Africa could increase by up to 20% if women's access to such resources as land, seed and fertilizer were equal to men's (OECD, 2007i).

In many countries, the dwindling active presence of men in agriculture – due to emigration, AIDs and other factors -- has had little impact on the gender divide in rural areas because of power imbalances between men and women and cultural pressures to preserve the status quo. Cultural barriers to women's entry into the labour market reduce their ability to pull themselves and their families out of the rural poverty trap through diversifying their activities. Without concerted attempts to remove discrimination against women as agricultural producers and heads of rural households, poverty reduction programmes are likely to fail (OECD, 2006a).

The *Paris Declaration on Aid Effectiveness* is promoting a wider development effectiveness approach where gender issues are key. At present, less than 10% of the small amount of official development assistance to agriculture is focused on women. For more effective poverty reduction, differential gender impacts should be considered in the entire package of development activities, including agriculture and rural areas, to enhance women's opportunities through investments in livelihoods, infrastructure and legal rights (OECD, 2006d).

Greater legal rights for women are the starting point for addressing the negative impacts of gender inequality on agriculture. Land tenure systems in many developing countries discriminate against women who are generally prevented from owning or inheriting property. Women's access to land is obstructed through inheritance practices that prevent the transfer of property to daughters or through regulations that make land purchases impossible due to required documentation. Women are also disadvantaged by their low economic status and inability to obtain credit for land purchases. Women's

rights to property and land, once established, should be socially recognised and legally enforceable (OECD, 2007i).

Women's access to credit is another urgent area for action. Micro-credit or micro-finance is one of the most effective ways to empower women and increase their access to sustainable livelihoods and economic assets. Women receiving micro-credit should undergo literacy training if they are not already literate and taught other skills such as basic bookkeeping and business management. In some programmes, women receiving micro-credit agree to keep their daughters in school. With the expansion of micro-credit facilities, these schemes should be monitored to protect participants from unnecessarily high rates of interest.

Preventing exploitative child labour in agriculture

Child labour should be recognised as both a consequence of poverty and, by depriving the next generation of education, as a contributing factor to poverty. The majority of the world's child workers are in agriculture, from family smallholdings to large cash-crop plantations. Approximately 70% of working children, or over 130 million girls and boys under the age of 15, are found in the agricultural sector. Rural children, in particular girls, tend to begin work very young at 5 to 7 years of age. In some countries, children under 10 are estimated to account for 20% of child labour in rural areas. Most of these children are found in the Asia and Pacific region and Africa. Worldwide, the number of children working has fallen in recent years; only in Sub-Saharan Africa did numbers rise (ILO, 2006).

Much of this work is invisible and unacknowledged, as it is absorbed into "piece work" or "quota systems" based on family work units. Through various subcontracting arrangements, commercial agricultural enterprises can disclaim responsibility for child labour found on their farms and plantations. The "family farm" element in agriculture, which is universal and bound up with culture and tradition, also makes it difficult to acknowledge that children can be systematically exploited in such a setting. The fact that children work on family farms can be perceived as family solidarity.

Agriculture is still under-regulated in most parts of the world and is a sector where trade unions are traditionally weak. Child labour laws are less stringently applied in agriculture than in other industries. However, several factors – large numbers of children workers, the hazardous nature of work, lack of regulation, invisibility and the denial of education – indicate that agriculture should be a priority sector for the elimination of child labour.

This is generally not the case at the national level where an urban and industrial view of what constitutes child labour has prevailed (ILO, 2006).

The focus should be on promoting a sustainable agriculture sector that does not require the use of child labour, and on reducing rural poverty so that households are not only food-secure but can also keep their children out of work and in school. Child labour concerns should be incorporated into poverty reduction strategies and agricultural development plans. Programmes that are specifically targeted to those children trapped in work situations are also needed. These include projects to withdraw, rehabilitate and reintegrate child workers, to dialogue with employers, to involve NGOs and trade unions in campaigning or regulating, and to extend social protection measures to the most vulnerable groups.

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OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(00 2008 45 1 P) – No. 88743 2008



OECD Contribution to the United Nations Commission on Sustainable Development 16

TOWARDS SUSTAINABLE AGRICULTURE