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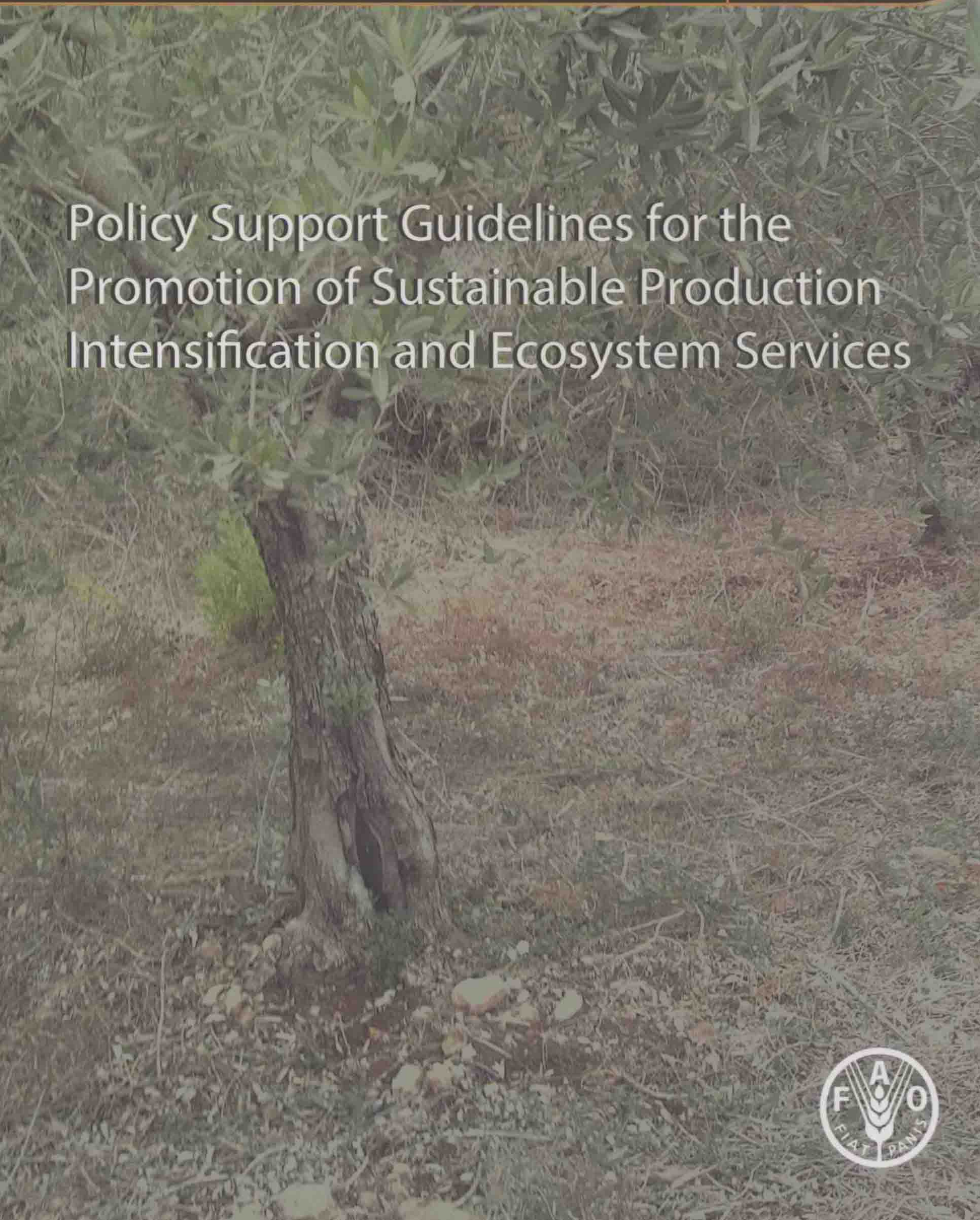

Policy Support Guidelines for the Promotion of Sustainable Production Intensification and Ecosystem Services

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Policy Support Guidelines for the Promotion of Sustainable Production Intensification and Ecosystem Services

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giz Programme Social and Environmental Standards

PLANT PRODUCTION AND PROTECTION DIVISION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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FOREWORD

The old paradigm of agriculture, originating from the Green Revolution, that asserts that intensive and productive agriculture must go along with ecological degradation as unavoidable side effects, is increasingly being replaced by a new paradigm of "sustainable intensification". This new paradigm results from the undisputed need to increase agricultural production in order to serve future generations with food, feed and industrial raw materials. But it recognizes at the same time that mankind, if it wants to survive, has to recover the natural resource base and stop environmental degradation, so that the agricultural land use does not only result in the provision of above biological goods, but also in the delivery of environmental services, enhancing the functions of ecosystems and agricultural landscapes in the provision of services essential for survival, such as clean water and air, but also biodiversity.

During the past 50 years, ideas about how to achieve such "sustainable intensification" have matured from concepts to reality. Today we have at our disposal concepts and technologies, how intensive and highly productive and efficient agriculture can be combined in practice and on real farms with the enhancement of ecosystem services but without "trade-offs" or "unavoidable damages", opening up the chances for farmers to receive payments not only for their produce, but also for such services, as for example the sequestration of carbon in the soils or the provision of clean water, using healthy and biologically active soils as medium for such ecosystem functions and services.

This type of farming, commonly known as Conservation Agriculture, is actually applied on about 10 percent of the world's cropland and adoption is growing fast. However, it is not growing fast enough to face the challenges ahead, such as the need to eradicate hunger and food insecurity for a growing population and to address the threats of climate change, land and environmental degradation, resource scarcity and increasing cost of food, production inputs and energy.

For "sustainable intensification" strategy as being implemented through Conservation Agriculture to spread faster, it needs not only the accurate application of the concept and principles, but also supportive policies that can facilitate adoption of Conservation Agriculture and reward the adopters for example with payments for environmental services.

The present publication provides guidance on such supportive policies, as well as on protocols which would be needed to support schemes of payments for environmental services. It is based on actual field experiences of FAO and GIZ in the promotion of Conservation Agriculture in different world regions and is directed specifically to decision makers in governments for designing and implementing agricultural policies and regulations for sustainable development.

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The draft document was circulated internally in FAO-AGP for comments as well as to the participants of the GIZ-ACSAD Workshop on Conservation Agriculture held in Beirut on 19 June 2012. Comments and suggestions received are gratefully acknowledged.

The final draft of the report was formatted for publication by Ms. Magda Morales, and its publishing was facilitated by Wolfgang Prante who is responsible for overseeing the Integrated Crop Management series of AGP. Their help is gratefully acknowledged.

ACRONYMS AND ABBREVIATIONS

ACT	African Conservation Tillage network
ACSAD	Arab Center for the Study of Arid Zones and Dry Lands
AGRITEX	Agricultural, Technical and Extension Services Department
AMID	Ministry of Agriculture, Mechanization and Irrigation Development
ARC	Agriculture Research Council
AU	African Union
CA	Conservation Agriculture
CAADP	Comprehensive African Agriculture Development Programme
CADS	Cluster Agriculture Development Services
CAPNET	Conservation Agriculture Promotion Network
CATF	Conservation Agriculture Task Force
COMESA	Common Market for Eastern and Southern Africa
Contill	Conservation Tillage
CTDT	Community Technology Development Trust
CIMMYT	International Wheat and Maize Improvement Centre
EMA	Environmental Management Agency
FAO	Food and Agriculture Organization
FCTZ	Farm Community Trust of Zimbabwe
GTZ	Germany Agency for Technical Cooperation (now GIZ)
IAD	Institute for Sustainable Agriculture, France
IAE	Institute of Agricultural Engineering
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IOM	International Organization for Migration
IRCS	International Red Crescent Society
MLARR	Ministry of Lands, Agriculture and Rural Resources
NEPAD	New Partnership for African Development
NGO	Non-governmental organization
SAT	Sustainable Agriculture Trust
SSA	Sub-Saharan Africa
ZCFU	Zimbabwe Commercial Farmers' Union
ZFU	Zimbabwe Farmers Union
Zimpro	Zimbabwe Project Trust

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CHAPTER 1
Introduction

1.1 THE FUTURE OF AGRICULTURAL SOILS AND ECOSYSTEM SERVICES

Global food demand is steadily growing, due to increasing world population (currently ~1.1 percent per year and decreasing towards zero), and changes of food habits due to urbanization and per capita economic growth. With current dominant production systems it is proving difficult to increase agricultural production sustainably to meet demand, and this in a sustainable way. Additional challenges are posed in some regions with a limited agricultural potential, due to climatic conditions

Continuous agricultural soil degradation and increasing water scarcity are threatening agricultural productivity (efficiency) and production (output). Major reasons for this development are intensification of production based on mechanical tillage and agrochemicals in the industrialised nations while using extractive production methods and overgrazing in the developing countries. Symptoms of soil degradation are soil erosion by water and wind, and loss of soil organic matter, structure, and soil compaction. In addition soil degradation increases the vulnerability to droughts, thus increasing their frequency. Precious rain water is lost by run-off instead of being infiltrated and stored in the soil and as ground water. Yield levels can be maintained only with ever increasing inputs, fertilizers and irrigation water causing in addition pollution problems. Higher production costs, caused inter alia by increasing prices for fuel and other inputs, cut farm incomes to an extent which threatens the survival of many farms. Further, with tillage agriculture

FIGURE 1
Soil tillage consumes high quantities of diesel oil, dries out the soil and provokes erosion by wind and water

and soil degradation, it is not possible to adequately harness the necessary ecosystem services for the society such as clean water, erosion control, carbon sequestration, nutrient cycling, etc.

The need, therefore, is for farmers to take up more sustainable, productive and profitable ways of production that do not damage the soil, landscape and environment, and can deliver both higher productivity and enhanced ecosystem services. However, the land management systems now applied are damaging soils and limiting their capacity to generate rising yields and other ecosystem services on a sustainable basis. At present, the almost world-wide standard practice is to plough before planting a crop in order to loosen the soil and create a weed free seed bed. Mineral fertilizers are applied to replace the soil nutrients taken up by crops. Most agencies that advise farmers on technology choices – and the firms supplying inputs – recommend that increased production should come from more frequent tillage, higher levels of fertilizer and pesticide applications and the use of seed of genetically engineered seeds. This type of farming since the end of WWII has enabled global food production to expand in line with fast rising demand but there is a growing recognition that it is degrading the soil and thus is not sustainable economically and environmentally.

Moreover, it has not succeeded in ensuring that all people have enough food of adequate quality to eat or that levels of poverty are falling significantly amongst rural populations and the yield increases obtained with more inputs are declining, eventually reaching zero or negative values as, for example, already observed in the home country of the green revolution, India.

The problem is that, in many situations the combination of increasingly frequent inversion and non-inversion tillage, a failure to supply nutrients at sufficiently high levels to prevent "mining", and low levels of biomass restitution to the soil results in a progressive degradation of soil health and structure and its fertility and with this of its productive capacity and ability to respond to production inputs. This in turn normally leads to decreased factor productivity, increased production costs and reduced profitability of farming. Such degradation is the consequence of both mechanical damage to the soil (compaction and pulverisation) and an associated decline in its organic matter content and soil biodiversity, especially when crop residues are not retained and soil biota is dysfunctional. The result is a breakdown of soil aggregates and a reduction in the pore spaces within soils that are vital for their drainage and aeration, and their functioning as effective media for plant growth and ecosystem services. Tillage also reduces numbers of soil fauna, most noticeably a reduction in earthworm numbers with their inherent capacity to aerate the soil, incorporate organic matter to lower soil depth and create a porous soil.

These tillage-induced processes lead to physical changes in soil structure with subsequent reduction in a soil's capacity to absorb and hold water, nutrient and air needed for season-long plant growth, particularly in dry and drought-prone situations. Reduced in situ infiltration of rainfall, in turn, causes greater run-off over the land surface, raising the risks of erosion, catchment degradation and more variable stream-flows resulting in downstream flooding and pollution. Loss of organic matter also reduces the soil chemical and biological processes, so important in providing the humic gums which contribute to the stability of soil aggregates and release nutrients for uptake by plants. In short, farming as now widely practised, is not sustainable in the long run, from either environmental or economic viewpoints. It is unfortunate that most governments and the international community continue to promote these tillage-based farming methods with bare and exposed soils throughout much of the intensively farmed areas of the world, contributing to massive, though largely un-noticed, damage to the fragile layer of top-soil on which the future supply of humanity's growing food needs depends.

1.2 NEED FOR A CHANGE OF PRODUCTION SYSTEMS AND AGRICULTURAL POLICIES

The above described situation calls for a drastic change in agricultural production systems at the paradigm level. What is required are production systems which are no longer extractive and disruptive of ecosystem functions, i.e. which protect field from water run-off and soils from erosion, and which maintain soil fertility by restitution of organic matter and plant nutrients exported from the field.

The "key" to a sustainable future is to move towards environmentally friendly farming systems that are effective in harnessing nature to sustain higher levels of productivity. Critical to this is an increase in the quantities of organic matter on and in the soil, to provide the surface-protection, energy and nutrients required by soil-inhabiting flora and fauna that constitute the "life" of a soil, playing a vital role in maintaining its porosity, enhancing its moisture holding capacity and extending the availability of nutrients to crops.

Water use-efficiency, may it be rain water or irrigation water, has to be increased in many parts of the world. This is pertinent in face of increased probability of drought and dry spells during the cropping season due to climate change and increasing competition for water between the agricultural sector and other consumers. Shrinking net returns of farms due to increased input prices and reduced production because of progressing soil degradation threaten the survival of many farm households, if no measures for reducing production costs and degradation are taken. It is also questionable if governments can continue subsidising agricultural production to the same extent. Recent cuts of subsidies of fuel and fertilizers are signs of the continuous liberalisation of agricultural markets.

All of the above calls for on-farm changes but also for changes in agricultural and environmental policies.

Conclusion: There is an urgent need for a change to sustainable intensified crop production systems. Technical solutions are available, but supportive policies and institutional support are required for their adoption, especially by smallholder farmers.

CHAPTER 2 Sustainable Intensification of Agricultural Production and Ecosystem Services

Rising global food demand against the background of rising cost of energy and production inputs, land degradation and climate change calls for an increase in agricultural production. This is best achieved by intensification of production systems, but in a sustainable way, referred to by FAO as "Sustainable Intensification of Crop Production" (SCPI). SCPI has been defined as producing more from the same area of land while reducing negative environmental impacts and increasing contributions to natural capital and the flow of environmental services, also referred to as ecosystem services. For this farmers have to adopt what is generally called "Good agricultural practices". Good agricultural practices are environmentally friendly. They

Good Agricultural Practices

1. No Mechanical Soil Disturbance and Maintenance of Soil Cover with Residues:
   Soil is not tilled and all the necessary actions are carried out to achieve and maintain a proper soil surface residue cover for the production system. This minimizes soil erosion and degradation, and it promotes soil health and an efficient use of water and nutrients.
2. Crop Rotations/Associations/Sequences:
   It promotes the most diverse and intensified cropping system (involving rotations, sequences and associations) possible according to the economic and agro-ecological conditions (soil and climate).
3. Integrated Pest Management (IPM):
   Damaging and beneficial species are monitored to determine a management measure, if necessary, based on the economic damage threshold. Approved and registered phytosanitary products are used, and selective active principles, with minimum impact on environment and human health, are prioritized.
4. Efficient and Responsible Phytosanitary Products Use:
   It considers the conditions under which the products used are applied, stored, transported, etc., and the residues they may produce are properly disposed. The personnel are properly trained and have all the necessary safety equipment.
5. Balanced Nutrition:
   It promotes the proper use and the balanced replacement of soil nutrients, based on soil testing and plant analysis, and also nutrient cycling, whenever the system allows it, avoiding transfer, concentration and/or contamination due to excesses. It avoids soil degradation and aims to increase productivity.
6. Stockbreeding Information Management:
   It complies with the required sanitary documentation and other traceability evidences according to national regulations.

Adapted from: AAPRESID. http://www.ac.org.ar/

rely less on external inputs and more on biological processes and synergistic interactions between system components. Nutrient recycling and build up of soil organic matter are key processes. This is very much in line with ecosystems approaches to production, as **agricultural landscape is an altered and managed ecosystem, an agro-ecosystem**. Nutrient recycling and build up of soil organic matter are key processes. This is very much in line with ecosystems approaches, as **agricultural landscape is a managed ecosystem, an agro-ecosystem**.

2.1 ECOSYSTEM SERVICES

Societies everywhere benefit from the many resources and processes supplied by nature. Collectively these are known as ecosystem services, and include clean drinking water; edible and non-edible biological products; processes that decompose and transform organic matter; and regulatory processes that maintain air quality. Many of the key ecosystem services are considered to be important environmental services of a public goods nature. These ecosystem services operate at various levels from field scale to agro-ecological or watershed scale and beyond.

Ecosystems services can be classified in different categories (Table 1), such as:

- **Provisioning services** – food; water; pharmaceuticals, biochemicals, and industrial products; energy; genetic resources etc.;
- **Regulating services** – carbon sequestration and climate regulation; waste decomposition and detoxification; purification of water and air; crop pollination; pest and disease control; mitigation of floods and droughts, etc.;
- **Cultural services** – cultural, intellectual and spiritual inspiration, recreational experiences, scientific discovery, etc.
- **Supporting services** – soil formation; nutrient dispersal and cycling; seed dispersal; primary production, etc.;

Healthy ecosystems contribute directly or indirectly to human well-being. However most of them are currently in decline, and making their value clear to those who benefit from them, but are not direct land users, can encourage investment in their protection and enhancement.

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