
Web-based References for: Managing Agricultural Resources for Biodiversity Conservation

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INTRODUCTION

Agrobiodiversity has recently been defined as a focal area for biodiversity conservation, under the United Nations Convention on Biological Diversity. The Concept of agrobiodiversity as a whole is rather new, and its policy implications even less explored. A number of web pages on the internet address the concept, and can help in outlining its dimensions. ELCI is undertaking a project, in collaboration with the UNEP GEF Biodiversity Planning Support Program, to develop guidelines for integrating biodiversity conservation into national agricultural policies. As a resource for use in this project, and for other interested in the concept, we are assembling a list of relevant web-based references to agrobiodiversity. The following list is under development, and we welcome any suggestions or additions.

The following list is organized according to the topics to be addressed with the development of the guide, which are:

- 1 The impact of agricultural production systems in the region (or country) on the conservation and use of biodiversity
- 2 Summary of status and trends of key aspects of agrobiodiversity
3. Approaches to the conservation and management of the following components of agrobiodiversity, in national agricultural plans and in national biodiversity strategies:
 - 3.1 Pollinators.
 - 3.2 Soil biodiversity.
 - 3.3 Biodiversity that provides mitigation of pests and diseases
 - 3.4 Crop and livestock genetic resources
 - 3.5 Diversity at the landscape level
 - 3.6 Wild biodiversity in agro-ecosystems
 - 3.7 Traditional knowledge of agrobiodiversity
- 4 Policies, regulatory mechanisms and the implications of agricultural development plans on agrobiodiversity management
- 5 Constraints to the use of sound policies and practices
- 6 Examples of best practice.



LIST OF WEBPAGES RELEVANT TO AGROBIODIVERSITY

1. Impacts of agricultural production systems on the conservation of biodiversity

a. Pilot Assessment of Global Ecosystems (PAGE): Agroecosystem: an IFPRI and WRI report which it states that "40% of agricultural land is seriously degraded, with the net result that crop productivity has been reduced by 13% overall, with the poor bearing a disproportionate burden, particularly in the poorest parts of sub-Saharan Africa and Central America. Agriculture is using up more land every year – 12.5m ha annually – a surface area size of Greece or Nicaragua."

Web address: www.cgiar.org/ifpri

b. Measuring the potential of farmland: FAO's GAEZ system produces an optimistic outlook for world food production and reveals limits to growth in several regions.

Web address: <http://www.fao.org/ag/magazine/0012sp1.htm>

c. The International Institute for Sustainable Development notes that "Definitions of sustainable agriculture are general concerned with the need for agricultural practices to be economically viable, to meet human needs for food, to be environmentally positive, and to be concerned with equality of life. Since these objectives can be achieved in a number of different ways, sustainable agriculture is not linked to any particular technological practice. Nor is sustainable agriculture the exclusive domain of organic farming. Rather, sustainable agriculture is thought of in terms of its adaptability and flexibility over time to respond to the demands for food and fiber (both high and low), its demands on natural resources for production, and its ability to protect the soil and the resources. This goal requires an efficient use of technology in a manner conducive to sustainability. Finally, because agriculture is affected by changes in market and resource decisions in other sectors and regions, it is important that these changes do not provide a rationale for depleting the agricultural resource base locally." They offer a bibliography of selected sources exploring these concepts, at the web address below.

Web address: <http://iisd.ca/ic/info/ss9507.htm>

d. FESLM: An international framework for evaluating sustainable land management, is a web-paged document available from FAO that notes that: "Perceived wisdom in the approach to evaluation use and management of land resources is changing rapidly and dramatically. Past emphasis on land 'development', focused on maximizing production and return from land use investment and planned against a background belief that suitable lands for expansion could always be found somewhere, is forced to give way to a more cautious approach-one that recognizes the finite extent of fertile land and the seemingly insatiable demands of a growing human population."

This report proposes a strategic framework approach for evaluating sustainable land management is an integral part of the process of harmonizing agriculture and food production with the, often conflicting, interests of economics and the environment in most developing countries but, for this to be realistic, agriculture in the future will have to be increasingly more productive, more economically efficient and more environmentally friendly-in a phrase, more sustainable. Although sustainability will continue to be elusive, learning to evaluate sustainability **answers**.

Web address: <http://www.fao.org/docrep/T1079E/T1079E00.htm>





2 Status and trends of key aspects of agrobiodiversity

a. OECD has published a report entitled: "Environment Indicators for Agriculture, volume 3: Methods and Results". This is the first international study to provide a comprehensive picture of the state and trends of environmental conditions in agriculture across OECD member countries from the mid 1980s to the present day. Its conclusions are largely based on a set of indicators that use a common methodology to allow cross-country comparison of agri-environmental performance. The main report Report, containing over 400 pages with nearly 60 tables and 100 figures (also available in French), is also available in summary form as an Executive Summary which can be downloaded free of charge from the OECD agri-environmental indicator website.

web address: www.oecd.org/agr/env/indicators.htm

b. Improvements in agriculture and land use are fundamental to achieving food security, poverty alleviation and overall sustainable development. The viability and quality of the environment, sources of food and fibre for cities, rural livelihoods and food security, all rely on best practice and joint efforts at management and conservation of our resources. The Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP) are responsible for assessing trends on these topics for the global community.

As Task Managers for Agenda 21: FAO reports on chapter 10 on the "Integrated approach to the planning and management of land resources" and chapter 14 on "Promoting sustainable agriculture and rural development" (SARD). FAO offers the following website of links on status of SARD, both in the policy arena and in implementation.

Web address: <http://www.fao.org/prods/sard/rio10/index-en.htm>



3.1 Conservation and Management of Pollinators

a. A special feature issue of the electronic journal, Conservation Ecology was published in April 2001 on conservation of pollinators in North America. The issue's general topic is given by the title of the introductory article, "Causes and Extent of Declines Among Native North American Invertebrate Pollinators: Detection, Evidence and Consequences."

Web address: <http://www.consecol.org/Journal/index.html>

b. Forgotten Pollinators Campaign, is a multi-media effort to call international attention to the critical role pollination plays in putting food on our plates, and in maintaining healthy wild communities around the globe. The campaign aims to inform scientists, conservationists, growers and the public about the animals that pollinate economically important crops and rare plants. It also works to call attention to the threats faced by many populations of wild and managed bees, butterflies, moths, bats and other pollinators.

Web address: <http://www.desetmuseum.org/fp/index.html>

c. The Bee Works promotes global discussions of pollinator importance by offering educational products, conducting pollinator surveys and pollinator restoration services to help restore our fragmented planet.

<http://www.thebeeworks.com/index.html>

d. One-third of the economic worth of the total agricultural production of the U.S. depends on insects visiting the crops' flowers so that the plant can produce seeds and fruits (McGregor 1972, Buchmann and Nabham 1996). A very good guide to pollination of different crops and fruits is available on this web site.

[<http://gears.tucson.ars.ag.gov/book/index.html>]

Ecoport

<http://wwwx.ecoport.org/>



3.2 Conservation and Management of Soil Biodiversity

a. This special feature from the Sustainable Development Department of the Food and Agriculture Organisation is an extract from "Human Nature: Agricultural Biodiversity and Farm-based Food Security" by Hope Shand, an independent study prepared by the Rural Advancement Foundation International (RAFI) for the Food and Agriculture Organization of the United Nations (December 1997). The full publication is available in Portable Document format (PDF)

Web address: http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/EP_direct/Epre0045.htm

b. Soil Biodiversity and Ecosystem Functioning homepage: a website that links to a number of scientific studies and workshops on below ground biodiversity.

Web address: <http://www.nrel.colostate.edu/soil/home.html>

c. The Soil Biodiversity Programme of the National Environment Research Council of the UK aims to achieve simultaneously an understanding of biological diversity of the soil biota and the functional roles played by soil organisms in key ecological processes. The programme will be closely directed and integrated, with the aim of producing data and insights of wider generality than the chosen ecosystem, an upland grassland system at Sourhope, near Kelso, Scotland.

Web address: <http://mwnta.nmw.ac.uk/soilbio>

d. One of the environmental themes of the European Environment Agency is soil. They note that "Soil is a complex system. Its ecological functions support life and ecosystems and it provides the physical medium on which human activities have developed. This section includes information about soil as a cross-cutting issue, its multiple functions and the importance of soil protection for the functioning of ecosystems and the development of human activities."

Web address: <http://themes.eed.eu.int/state/soil>

e. The Organic Resource Database (ORD) is a project initiated in January 1997 by members of TSBF (Tropical Soil Biology and Fertility Programme), Nairobi and Wye College, University of London, UK with the aim to collate existing data on plant quality characteristics such as chemical and physical attributes, decomposition behaviour in soils and animal feed value; to allow users to compare their data with comparable literature data, to provide input data for soil decomposition and nutrient cycling models, to provide guidelines for a minimal dataset to characterize plant quality, to provide decision tools to identify best use options for these organic materials as soil amendments, to identify relationships between plant quality parameters and environmental conditions, and to allow the user to add new data. The database is aimed at researchers, extensionists, NGO's and ultimately farmers.

Web address: <http://www.wye.ac.uk/BioSciences/soil/ord2.htm#back>

f. Soil Biodiversity Portal: This web page provides general conceptions on the meaning and significance of soil biodiversity, stressing the need for integrated biological soil management. It also provides a framework, under which soil biodiversity can be assessed, managed and conserved, showing examples of successful and unsuccessful practices which have been used in various regions of the world to manage soil biodiversity. Finally, an assessment of needs for further work, research, capacity building and policy and programme development is presented.

<http://www.fao.org/landandwater/agll/soilbiob/default.htm>



3.3 Conservation and Management of Biodiversity that Provides Mitigation of Pests and Diseases.

a. The Systemwide Program on Integrated Pest Management (IPM) of the international agricultural research system is to ensure, by encouraging better communication, coordination and the adoption of more effective approaches, that IPM research at the International Agricultural Research Centers is more responsive to the needs of IPM practitioners and thereby contributes fully to sustainable agricultural development.

Web address:<http://www.cgiar.org/spipm/>

b. The international Centre of Insect Physiology and Ecology, based in Nairobi, Kenya, has pioneered research in utilizing indigenous aspects of biodiversity that mitigate against pest and disease outbreaks.

Web address:<http://www.icipe.org>

c. A DANIDA –funded project is in the making relative to the concept that modern information technology has a large potential for teaching farmers and traders with the latest news on pest management (early warnings, integrated solutions) and market prices. Even where the Internet stops due to lack of infrastructure or economic means, information can be conveyed further through traditional channels (e.g radio broadcasting) and institutions (district offices of NGOs and extension services). Internet-based information networks have the advantage that, once established they are not expensive to maintain; maintenance is more a question of organization, a steady hand, than of money.

Web address:<http://www.agrsci.dk/plb/nho/inppmm/>

d. "Leaf me alone" a 29 March 2001 Nature article by John Whitfield notes that "Plants can't run from trouble, but neither do they lie down and take it. They enlist bodyguards from higher up the food chain to kill the things that eat them. Now researchers hope to tap into these lines of communication to protect insect-threatened crops. Such an approach holds out the possibility of pest control that would be less harmful to people and the environment than chemical pesticides. And tinkering with the links between plants and predators cuts insect herbivores out of the evolutionary loop, loop, so they are unlikely to evolve countermeasures to such strategies.

Web address: <http://www.nature.com/nsu/010329/010329-11.html>



3.4 Conservation and Management of Crop and Livestock Genetic Resources

a. International Plant Genetic Resources Institute is an international research institute with a mandate to advance the conservation and use of genetic diversity for the well-being of present and future generations. It is a Centre of the Consultative Group on International Agricultural Research. It works with national agricultural research centers in on-farm and ex-situ crop genetic resource conservation.

Web address: <http://www.ipgri.org>

b. A large number of on-line publications and newsletters in relation to crop genetic resources can be found at the IPGRI publication page.

Web address: <http://www.ipgri.org/publications/publist.asp>

c. As part of the In Situ Agricultural Biodiversity Conservation Project of the Intermediate Technology Development Group (ITDG) and the Overseas Development Institute, UK (ODI), an annotated bibliography of on-farm management of crop genetic diversity is available at the web site below.

Web address: http://www.ukabc.org/abc_bibliog.pdf

d. DAD-IS (Domestic Animal Diversity Information System) is a communication and information tool developed by the Food and Agriculture Organisation to be used by countries; a clearing house for information and data, a secure system giving countries control over collating, releasing and maintaining their data, and an element of the strategic framework for the management of farm animal genetic resources.

Web address: <http://dad.fao.org>

e. Loss of animal genetic resources has been the greatest in developed countries, which have often concentrated on a few high-input breeds to the detriment of their locally adapted breeds. In developing countries, rapid transformation of traditional agricultural system, often through the indiscriminate use of exotic animal genetic resources, is the primary force that is contributing to the loss of livestock breeds. The full text of the Intergovernmental Working Group on animal Genetic Resources for Food and Agriculture is available at the site below.

<http://www.fao.org/ag.cgrfa/angr1/angr2-e.pdf>

f. Domestic animal diversity at risk: A new FAO/UNEP report warns that 1,350 mammal and bird breeds face extinction. Of the domestic animal breeds for which precise population data exist, at least one-third a total of 1,350 are at risk of extinction, 119 are officially confirmed as extinct and another 620 are reported to be so. "If anything, these are conservative figures," says Keith Hammond, responsible for FAO's Global Databank for Farm Animal Genetic Resources. "Over the past five years, the number of mammalian breeds at risk of extinction has risen from 23% to 35%. The situation with avian breeds is even more serious, with the total percentage of those at risk of being lost increasing from 51% in 1995 to 63% in 1999."

<http://www.fao.org/biodiversity/default.asp?lang=en>



3.5 Conservation and Management of Diversity at the Landscape Level

a. PLEC: The United Nations University Project on People, Land Management and Environmental Change (PLEC) involves a collaborative effort between scientists and small farmers from across the developing world to develop sustainable and participatory approaches to conservation, especially of biodiversity, based on farmers' technologies and knowledge within small farmers' agricultural systems.

Web address: <http://www.unu.edu/env/plec/index.htm>

b. LUCC: Land Use and land Cover Change: A core project of the international Geosphere-Biosphere Programme and the International Human Dimension Programme.

An international research project which attempts to compile information on global environmental change, including the areas of food systems, water issues and global carbon cycles. Typically, LUCC through its newsletter and other publication publishes articles on land cover changes in different regions of the world, and estimates flows such as carbon resulting from land use changes.

<http://www.geo.ucl.ac.be/LUCC>



3.6 Conservation and Management of Wild Biodiversity in Agro-ecosystems

a. Given that clearing and using land for agriculture is the chief cause of biodiversity extinction and that widespread hunger is persistent in areas with the world's richest biodiversity, many plants and animals will go extinct unless ecosystems are managed to feed people and protect wild species simultaneously. A joint report by The World Conservation Union (IUCN) and the Washington, D.C.-based agriculture organization Future Harvest finds that almost half of the world's 17,000 major nature reserves, which are intended to protect wildlife from extinction, are being heavily used for agriculture. They also report that extreme malnutrition and hunger are pervasive among people living in at least 16 of the world's 25 key biodiversity "hotspots," where wildlife is most at risk. Six key strategies for increasing agricultural production while saving wild biodiversity are proposed.

<http://www.futureharvest.org/earth/biodiversityen/shtml>.



3.7 Conservation and management of Traditional Knowledge of Agrobiodiversity

a. In situ Agricultural Biodiversity Conservation Project: A research project of the Intermediate Technology Development Group (ITDG) and the Overseas Development Institute, UK (ODI). The aim of the ABC project is to find out the extent to which farmers in Kenya, Peru and Zimbabwe are interested in having a wide range of agricultural biodiversity on their farms, their strategies for maintaining and developing this and how they, and farmers in other parts of the world, can be supported in the on-farm conservation and development of their agricultural biodiversity.

Web address: <http://www.ukabc.org/abc.htm>



4. Policies, regulatory mechanisms and the implications of agricultural development plans on agrobiodiversity management

a. As part of its first medium-term programme of work, the Conference of Parties of the Convention on Biological Diversity decided to consider agricultural biological diversity at its third meeting [decision 1/9]. It has also addressed issues relevant to agricultural biological diversity in its consideration of other items on its medium-term programme of work, including the relationship with the FAO Global System for Plant Genetic Resources for food and Agriculture, and access to genetic resources. This website details the programme of work and relevant guidance to parties.

We address: <http://www.biodiv.org/areas/agro/default.asp>

b. The Institute for Agriculture and Trade Policy promotes resilient family farms, rural communities and ecosystems around the world through research and education, science and technology, and advocacy.

Web address: <http://www.iatp.org/>

c. This partially-annotated bibliography on the Concept of Sustainable Agriculture and Rural Development has been compiled by the International Institute for Sustainable Development. The references are useful for exploring definitions of sustainable agriculture and its policy implications. A number of "grey" references and briefing notes are included.

<http://iisd.ca/ic/info/ss9507.htm>

d. World Development Sources: the entry page for searching for documents available from the World Bank. Many sectoral policy and plan documents are available on a regional or national basis. Click on "detailed search" at the top of the page, and a country and the Agriculture sector, to gain access to a number of documents online on agricultural plans and projects.

<http://www-wds.worldbank.org/>

e. NGO caucus papers for the eight Commission on Sustainable Development session April 2000, with a special focus Agriculture. Papers posted include: Paper #1: Choices in Agricultural Production Techniques, Consumption Patterns and Safety Regulations: Potentials and threats to sustainable Agriculture, Paper #2: Globalization, Trade Liberalization and Investment Patterns, Paper #3: Ecological and Socio-Economic Foundations for Defining Best Practices for Sustainable Agriculture and Rural Development (SARD), Paper #4: Knowledge for a Sustainable Food System: Identifying and providing for Education, Training, knowledge-sharing and Information Needs, Paper #5: The Contribution of Food Production Through Sustainable Land Management Systems to Achieve Food Security.

http://www.igc.org/csdngo/agriculture/agr_caucus_papers.htm

f. United Nations Economic and social Affairs division: page on Sustainable Agriculture and Agenda 21. Access to United Nations documents on sustainable agriculture, national reports, and related links.

<http://www.un.org/esa/sustdev/agri.htm>

g. The Home Page of the Global Forum on Agricultural Research. GFAR is a multi-stakeholder initiative that contributes to eradicating poverty, achieving food security, and conserving and managing natural resources. It enhances national capacities to



generate, adapt and transfer knowledge.

<http://www.egfar.org/>

h. Swiss Node is the information platform of Switzerland on agricultural research for development Swiss Node, hosted by InfoAgrar, is one of several national nodes that make up the information system of the "European Initiative for Agricultural Research for Development" (EIARD InforSys). The corresponding forum on the global level is the "Electronic Global Forum on Agricultural Research".

<http://www.sfiar.infoagrar.ch/>



5. Constraints to the use of sound policies and practices

a. This website refers to a policy document written by the Earth Council in preparation for Rio+5, which addresses Perverse Incentives: Subsidies and sustainable Development, specifically the chapter dealing with agriculture.

Web address: <http://www.ecouncil.ac.cr/rio/focu/report/english/subsidies/chap6.htm>

b. As part of the Global Forum on Agricultural Research, a set of papers on key strategic issues of genetic resources management have been prepared aimed at developing a common understanding of them among stakeholders of Agricultural Research and Development and at clearly identifying the policy options that are available in each case. The following papers have been prepared and can be downloaded from the web address below. Among them are papers such as, "Why Governments Can't Make Policy – the case of plant genetic resources in the international arena", which explore the difficulties of national policy formulation for issues which are being driven globally.

<http://www.egfar.org/ngos/default.htm>



6. Examples of Best Practices

a. Agroecology in action: Miguel Altieri of the University of California, Berkeley discusses the criteria for sustainable agriculture: technologies for the poor must be developed in a participatory way, must be risk averting, cheap and accessible, adopted to marginal areas and health and environment enhancing.

Web: www.nature.berkeley.edu/~agroeco3

b. A special issue of the Journal of Environment, Development and Sustainability, volume 13/4 1999, highlights several successful case studies where agroecological studies resulted in enhanced food security and environmental conservation/regeneration, among small farmers throughout the developing world.

Web: www.kluweronline.com

c. The Reed Programme works towards the development of a culturally sensitive' programme for rural economic and environmental development. On their website, they present integrated solutions based catalyst of activities and programmes for attacking both the systemic conditions of rural poverty, the needs for improved and increased food production, the requirement for empowering all people and programmes for environmental protection and restoration. The programme identifies, integrates and epitomizes the best tools, practices and forms of organization for successful and sustainable development. They strongly encourage the participation of villagers and support the formation of cooperatives and mutual associations. The reed mance, sustainable technology and management practices.

Web: www.reedprogramme.com

d. The "Rice-Wheat Consortium for the Indo-Genetic Plains" is a little known success story. Rice – wheat rotations take approximately 12 million hectares in South Asia, home to hundreds of millions of rural and urban poor. Slowing cereal yields, lack of new, farmland, intense year round cropping, and widespread systems. A consortium of international agricultural center, working in a area which constitutes the most intensively cropped land in the world, are promoting new tillage practices (direct drilling and surface seeding) which allows farmers to prepare soils and sow wheat in a single operation after the rice harvest. The benefits: 75% fuel saved, higher yields, reduced application of herbicides and 10% less water used. The fuel savings also translate into reduction of 1.3 million tons in emissions of CO₂. next steps are to work with farmers on cutting down the burning of crop residues – an activity with the potential to reduce CO₂ emissions by another 17 million tons. What is clear is that the work is anchored at 4 different levels: community, national, regional, and international. It is necessarily multidisciplinary (combining an understanding of trends, low-tillage methods, nutrient management, system ecology, integrated water management, socio-economic and policy (issues), information and knowledge-sharing, and building capacity in terms of human and institutional resources). Most importantly, the innovative research fulfils the criteria of global "global public goods," i.e. those technologies that depend on collective actions and provide shared benefits."

Web address: www.cgiar.org/rwc

e. SANE: Sane is an UNDP sponsored program and its principal goal is to enhance capacity building and human resource development in the area of sustainable agriculture through agroecological training, participatory research, policy advocacy and information networking among non-governmental organizations (NGOs) and other national/international organizations in Africa, Asia and Latin America. Sane's goal is to quickly train a critical mass of technicians and farmers, develop and disseminate



agroecological concepts and technologies, implement a series of sustainable agriculture demonstration modules and strengthen institutional capacities and collaboration, in order to advance more rapidly towards a form of agriculture that is both productive and resource conserving with a framework of social equity and economic viability. By assisting local communities to establish and manage integrated farming systems, it is expected that farmers will move ahead collectively in overcoming rural poverty, securing food self-sufficiency, and preserving their natural resource base.

Web address: http://nature.berkeley.edu/_agroeco3/index.html

f. The Institute for Agriculture and Trade Policy (IATP) is working to reduce the environmental impacts of agriculture and improve water quality through the voluntary adoption of on-farm assessment and decision tools. The institute for Agriculture and Trade Policy (IATP) is working to reduce the environmental impacts of agriculture and improve water quality through voluntary adoption of on-farm assessment and decision tools. The website below has information on the Nutrient Management Yardstick, and the Pesticide Decision Tool (PDT) facilitates the use of environmental information in the selection and management of pesticides in arable crop production. It is designed for use by agricultural professionals, primarily in the United States.

Web address: <http://www.iatp.org/pesticide/>

g. A report issued by the Institute for Food and Development Policy/Food First and the Transnational Institute finds that small farms are more productive than large farms, but are threatened by trade agreements. This report, entitled "The Multiple Functions and Benefits of Small Farms Agriculture in the Context of Global Trade Negotiations" is by Peter Rosset. The full text is available on the web. The report finds that communities surrounded by populous small farms have healthier economies than do communities surrounded by depopulated large, mechanized farms. They also state that small farmers take better care of natural resources, including reducing soil erosion and conserving biodiversity.

Web address: <http://www.foodfirst.org/pubs/policybs/pb4.html>

h. Web page of the UK ABC project, A research project of the Intermediate Technology Development Group (ITDG) and the Overseas Development Institute, UK (ODI). The aim of the ABC project is to find out the extent to which farmers in Kenya, Peru and Zimbabwe are interested in having a wide range of agricultural biodiversity on their farms, their strategies for maintaining and developing this and how they, and farmers in other parts of the world, can be supported in the on-farm conservation and development of their agricultural biodiversity. Links to reports on agricultural biodiversity, and an annotated bibliography.

<http://www.ukabc.org/abc.htm>

i. "Agriculture 21" the online magazine of the Agriculture Department of the United Nations Food and Agriculture Organisation.

<http://www.fao.org/ag/>

j. Sustainable Services Systems (3S): Transition towards sustainability? Products and services both provide functions to consumers that fulfil their needs. Products can also be regarded as a form of service delivery in meeting these human needs. There is a growing body of research and real-life case studies that look to reconfigure the relationship between products and services for meeting consumer needs with less environmental impact than using traditional products and traditional services to meet those same needs. New product-based services explore these possibilities. The environmental benefits of altering the product-service mix have been outlined in several pieces of international research.



This web page lists some key research papers that provide a start in understanding changing the product-service mix for environmental and "sustainable" benefit. Some are agricultural in nature.

http://www.cfsd.org.uk/events/tspd6_3s_cases.html

k. Irrigation management...Transfer of irrigation management services, a manual aimed at policy-makers and planners. It outlines approaches for a sustainable devolution of roles from irrigation agencies to water users' groups.

<http://www.fao.org/ag/>

