CONVENTION ON BIOLOGICA L DIVERSITY

Distr.
GENERAL

UNEP/CBD/SBSTTA/9/INF/13
8 October 2003

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL
AND TECHNOLOGICAL ADVICE
Ninth meeting
Montreal, 10-14 November 2003
Item 4.2 of the provisional agenda*

TECHNOLOGY TRANSFER AND COOPERATION

Indicative list of technologies for conservation and sustainable use of biological diversity

Note by the Executive Secretary

I. INTRODUCTION

1. At its sixth meeting, the Conference of the Parties endorsed, in its decision VI/30, the proposals by the Executive Secretary regarding preparatory work for the seventh meeting of the Conference of the Parties as given in the preparations for the seventh meeting of the Conference of the Parties (UNEP/CBD/COP/6/2). Section IV of this document addressed technology transfer and technology cooperation. In paragraph 60 (a) (ii) of this section, it was suggested that the Executive Secretary will "initiate a compilation and assessment of existing technologies for conservation and sustainable use of biodiversity, including from local and indigenous communities, as they are required and applied in the Convention work programmes on thematic areas and cross-cutting issues."

2. The note by the Executive Secretary (UNEP/CBD/SBSTTA/8/7/Add.1) provided an indicative list of technologies relevant to the conservation and sustainable use of mountain biological diversity and other related thematic areas and cross-cutting themes, for consideration by the Subsidiary Body for Scientific, Technical and Technological Advice at its eighth meeting. In its recommendation VIII/1, on mountain biodiversity, the Subsidiary Body for Scientific, Technical and Technological Advice requested the Executive Secretary to revise and expand the indicative list by taking into account, *inter alia*, the thematic national reports; traditional knowledge, innovations and practices of indigenous and local communities; the needs to implement the ongoing work programmes of the Convention; other thematic and cross-cutting issues and initiatives (e.g., guidelines and guiding principles) of the Convention; legal and socio-economic aspects; and the need of developing countries and countries with economies in transition for capacity-building. The table should include, *inter alia*, information on:

* UNEP/CBD/SBSTTA/9/1.

/…

(a) Availability of relevant documentation;

(b) Opportunities, requirements and possible barriers/obstacles to access, transfer and cooperation and absorption/adaptation of the technologies, including legal and socio-economic aspects; and

(c) Assessment of the possible impact of the technologies on biological diversity;

Further to decision VI/30 of the Conference of the Parties and recommendation VIII/1 of the Subsidiary Body for Scientific, Technical and Technological Advice, this document presents an indicative list of technologies for the conservation and sustainable use of biological diversity, for consideration by the Subsidiary Body for Scientific, Technical and Technological Advice. While this list is not restricted to mountain biodiversity, many technologies covered by the list will also be useful for the conservation and sustainable use of mountain biodiversity. Pursuant to the request of the SBSTTA, the list also gives information, inter alia, on the availability and on relevant documentation, on the opportunities, requirements and possible barriers/obstacles to access, transfer and cooperation and absorption/adaptation of the technologies, and on the possible impact on biodiversity.

Indicative list of technologies for conservation and sustainable use of biological diversity

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
Identification, classification, monitoring and assessment					
Mapping techniques 1. Habitat, vegetation and gene-variation mapping, regional mapping 2. Remote sensing (e.g. aerial surveys; satellite imagery, infrared photography) 3. Geographic information systems 4. Geo-referencing (GPS, palm pilots) 5. Traditional knowledge of territories and habitats 6. Bioinformatics 7. Direct and indirect animal counts 8. Resource mapping	E.g: Landscape biological approach for biodiversity characterization using Satellite" Indian Institute of Remote Sensing (NRSA), India; Biodiversity Monitoring Transect Analysis in Africa (BIOTA): establishment of biodiversity observatories for long term monitoring, with the focus on the effects on man-made changes in biodiversity (East Africa); CIP 8A project "Integrated Natural Management Mountain Agro-ecosystem" with activities in refining methods for Geospatial analysis 1. Knowing spatial variation in vegetation characteristics is important to understanding and modeling ecosystem functions and their response to climatic change. 2. Vegetation mapping, mapping of water courses 3. The standard way of displaying spatial information via GIS (Arc-View, Map-info, etc.) allows for the simultaneous viewing of several geographic themes (e.g. water catchments and vegetation) for inference of correlations. 4. Species distribution maps 5. Community mapping e.g. for the designation of multiple-use zones in conjunction with protected areas, or showing the preferred zones for use for certain groups 6. Graphics-oriented tools for molecular sequence analysis, techniques in phylogenetic tree estimation and testing, assigning functions to unidentified protein sequences 7. Total counts, records of presence or absence, number of sightings, dung counts, other sign counts 8. For the application of the sustainable yield concept	1. UNEP-WCMC 2. ESA, NASA 3. ESRI 4. Producer/Designer, e.g Garmin 5. Handbooks, publications, oral communication 6. Universities, Bioinformatics groups 7. IUCN/SSC 8. Textbooks, handbooks and manuals; traditional knowledge	2. Aerial and infrared photography cost intensive, requires highly skilled and trained personnel for survey and data analysis. Satellite data available for all regions on earth and easily accessible. Grain size of satellite data might pose limitations 3. GIS require powerful computers and trained and specialized software users. 4. Techniques easy to use 5. Information not always easily communicated to outsiders. 6. Highly specialized technology 7. Monitoring of population sizes costly but reliable techniques, repetition in fixed time intervals 8. All aspects of the resource must be understood 9. Highly specialized, costly technology	Minimal impact through plot techniques Transects for ground truthing of aerial and satellite images might damage pristine vegetation	National research institutions; Ministries of Environment; FAO, UNEP, CGIAR centers; Conservation International, CSIRO, UNEP-WCMC; Meteorological stations, WMO, Space agencies e.g. ESA, NASA IUCN, WWF, WRI
Ecosystem identification and classification technologies 1. Ecosystem identification and classification 2. Landscape and habitat classification 3. Traditional knowledge about local ecosystems 4. Gap analysis	1. and 2. Ecosystem/habitat management is implemented on heterogeneous landscapes, which must be characterized in order to adapt management strategies that are sensitive to the spatial patterns and interactions. 3. Traditional landscape classification systems and nomenclature can make important contributions to ecosystem assessments. Development of an alternate approach of data acquisition, interpretation and management based on indigenous nowledge and classification systems, remote sensing and satellite navigation, and geographic information systems (GIS). (http://www.nuffic.nl/ciran/ikdm/2-1/articles/tabor.html) Indigenous soil classifications (http://www.nuffic.nl/ciran/ikdm/3-1/articles/niemeijer.html) 4. GIS for canopy and landscape analysis, IDRISI, ICRISAT, ArcView, ArcInfo: Early warning in regard to fragmentation in landscapes and forests.	1. Software for classification and ordination 2. Software for color/pattern recognition and polygone classification 3. Often not readily available and communicated orally 4. ESRI, NASA, ESA	1.,2. Requires highly skilled and trained personnel for data analysis. 3. Information not always easily communicated to outsiders Heterogeneity of local soil knowledge Correlating indigenous soil types with scientific classifications "Emic" versus "Epic" perspective 4. Requires highly skilled and trained personnel for survey and data analysis.	N/A	WWF Landscape and Spatial Analysis Departments ESRI, NASA, ESA

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
Identification and classification technologies on species and genetic levels • Taxonomy • Molecular biology • Entomology • Technology to determine species and genetic resource status • Traditional taxonomic knowledge • Inventories and rapid assessments	Ecology and ecosystem functioning: 2000 IUCN Red List of Threatened Species; System-wide Genetic Resources Programme (SGRP) of the CGIAR; The CITES-listed species databases hosted by UNEP-WCMC; TRAFFIC, a joint programme of WWF and IUCN: the wildlife trade monitoring network, to ensure that trade in wild plants and animals is not a threat to the conservation of nature; in cooperation with the Secretariat of CITES; State of the World's Animal Genetic Resources (FAO); State of the World's Plant Genetic Resources (FAO); Global Observation Research Initiative in Alpine Environments (GLORIA) Field Database & Network of standardized monitoring settings in all major mountain systems of Earth; and comparing biodiversity patterns along fundamental climatic gradients, vertically as well as horizontally.	Standard textbooks and scientific publications; Museums and Herbaria; 2000 IUCN Red List of Threatened Species; System-wide Genetic Resources Programme (SGRP) of the CGIAR; CITES-listed species databases hosted by UNEP-WCMC; TRAFFIC; First Report on the State of the World's Animal Genetic Resources (FAO); Second Report of the State of the World's Plant Genetic Resources (FAO); Global Strategy for Plant Conservation (GSPC) for mountain areas: particularly targets 1, 2 and 3; GLORIA Field Database; IUCN/Species Survival Commission for animal counts	The taxonomic impediment and limited ecological knowledge, particularly with respect to lower taxa, prevents a full understanding of ecosystem functioning; Challenges identified by IUCN for the red list: language barriers, communicating scientific complexity, use and abuse for political reasons, resources for longer term implementation; development of training tools and a long-term strategy addressing scientific complexity and language as response.	Collection of voucher specimen has positive impact for knowledge and localized negative impact where rare species are concerned	Global Taxonomy Initiative; IPGRI; Universities and national research institutions;
Monitoring technologies 1. Targets of both a quantitative and qualitative character which are measured against pre-agreed indicators; and periodic measurement of the value of each indicator 2. Monitoring techniques for fish stocks 3. Geo-referencing (GPS, palm pilots) 4. Data logger 5. Telemetrics 6. Fixed-point photography 7. Permanent sampling plots 8. Optical remote sensing (ORS) 9. Indicator species	Monitoring the capacity of pollination contributing to agricultural production and agro-ecosystem diversity through the monitoring of the populations of pollinators such as bees, bats, insects and birds. Examples: 1. Monitoring of stream quality based on the population of breeding salmon. Monitoring of forest health based on a combination of canopy cover and the total cover of invasive alien species. Monitoring of the quality of soils in agricultural fields using the numbers and diversity of earthworms. 2. To determine sustainable yields, primary and secondary producers, recruitment and reproduction, fish health, growth and mortality, fisheries and ecosystem modelling, fishery management, influence of fisheries on the ecosystem, fish population genetics. 3. Species distribution and range maps, operational monitoring at the field level with specially trained staff. Palm pilots can be used by the illiterate. If operated properly, very accurate and reliable information 4. Data loggers are useful in less accessible environments and where high-resolution information is needed. 5. Telemetrics (e.g. radiocollars, sensors placed in body parts of animals) used for range mapping 6. Monitoring changes in the landscape over time. 7. Monitoring vegetation changes over time.	Monitoring methodologies are generally available and information on approaches is accessible. Computational requirements and other equipment are increasingly available. 2. http://europa.eu.int/comm/fisheries/ 3. On-line documentation available from the producer/designer 4. On-line documentation available from the producer/designer 5. Scientific journals, producer/designer 6. Network of independent photographers linked via the internet 7. Forestry research	1. Clear definition of targets, scale and timeframe, financial commitments. 3. GPS available at reasonables cost, simple operation but requires some training 4. Produce very dense data, the analysis of which can be time-consuming, sensitive equipment, high costs 5. Very costly technology, requiring the intervention of a number of experts. 6., 7. Low cost and resource extensive technology, static 8. High-cost , high-tech 9. Easy to adapt, but caution is necessary with regard to interpreting absence/presence of certain species.	1.Timely management interventions to restore biodiversity and limit spread of invasive alien species. 2. Targeted management interventions to allow rehabilitation of declining stocks. 3. No impact 4. No impact 5. Risky, since collared animals in their confusion might fall prey more	National research institutions; Bioinformatics groups Ministries of Environment and Fisheries, EU, USFWS, FAO, UNEP, CGIAR centers; Conservation International, CSIRO, UNEP-WCMC; Meteorological stations, WMO, space agencies (e.g. ESA, NASA) ESRI, NASA, ESA WRI

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
	8. Monitoring, e.g., air quality, hot spots for forest fires. 9. E.g. Quality of soils in agricultural fields using the numbers and diversity of earthworms. Quality of water based on presence/absence or on population size of indicator species. Quality of air due to the presence/absence of mosses and lichens on stem bark, birds for ecosystem health, microorganisms for ecosystem functioning, etc	8. Scientific textbooks 9. Scientific textbooks and journals		easily. Diseases and discomfort associated with collars. 6., 7. Minimal impact 8. Presumably minimal 9. N/A	
Analysis, assessment and evaluation tools 1. Ground-based assessments 2. Assessments based on remotely sensed information (e.g. aerial surveys; satellite imagery) 3. Estimation of carrying capacity of selected ecosystems 4. Modeling 5. Geographic information systems (GIS); 6. Statistical analysis of quantitative information and time series based on hypothesis-testing 7. Economic valuation techniques	1. Surveys of rare or economically important species; rapid biodiversity assessments; full inventories to obtain information on status and trends 2. Assessment of susceptibility of agricultural land to soil erosion, vegetation changes, changes in the form and extent of inland waters and glaciers 3. Range lands, protected areas 4. Effect of various abiotic and biotic parameters, development of scenarios to influence decision making 5. Presentation and evaluation of spatial information ;, e.g. the spread of an invasive alien species. Simulation of the consequences of global warming on the biodiversity of mountain and forest ecosystems as well as dry and sub-humid land and coastal zones and small islands. 6. Population parameters, individual health of species 7. Economic valuation techniques can be applied within cost-benefit analyses/ impact assessments on project, programme and policy levels, for setting priorities and demonstrating the importance of an issue, for establishing the basis for environment taxes or levies and for legal damage assessment. Examples: Assessment of public preferences for enhancing biodiversity in forestry, through contingent ranking of different biodiversity standards and related management strategies (Garrod and Willis 2000, chapter 9); measuring the total economic value of restoring ecosystem services (Zhongmin et al. (2003) in Ecological Economics 44, 2-3, 345-58.)	Methodologies for ecosystem assessment and analysis are generally available and information on approaches is accessible. Computational requirements and other equipment are increasingly available. 1. 2000 IUCN Red List of Threatened Species System-wide Genetic Resources Programme (SGRP) of the CGIAR; The *CITES-listed species databases* hosted by UNEP-WCMC; TRAFFIC; First Report on the State of the World's Animal Genetic Resources (FAO); Second Report of the State of the World's Plant Genetic Resources (FAO); Global Strategy for Plant Conservation (GSPC) for mountain areas: particularly targets 1, 2 and 3; GLORIA Field Database; 7. Handbooks for the use of economic valuation techniques are available. For instance: Handbook of Biodiversity Valuation. A guide for Policy Makers, OECD, Paris 2002. Rietbergen-McCracken and Abaza: Environment Valuation, Earthsacn 2000, provide a compendium of valuation cases. Garrod and	1. Some specialist knowledge required 2. Interpretation and assessment requires laboratory equipment, software and expertise and long-term financial commitments. With regard to assessment based on remore sensing, obstacles and constraints include: • availability of georeferenced data; • development of algorithms for interpretation of multi-polar, multi-wavelength remotely-sensed images; • availability of vectorial information; • compatibility of data sets and software; understanding of ground-truthing requirements. 3. Usually doubtful models. Value of scenarios and models depends on the availability of baseline information, which is often scanty. 4. Each scenario depends on the accuracy of base data. Modeling has its limits in that usually only a small number of interacting variables can be used. 5. Powerful analysis systems usually operated in an institutional environment. The technical ability to analyse and present the information needs to be combined with capability to interpret ("absorb") the information. 6. Easy to implement, no adaptation required Who provides the "traditional knowledge" and how representative is it 7. Specific preconditions must be met in order to successfully apply specific valuation methodologies. For instance, the application of indirect approaches that rely on prices observed in surrogate markets requires that markets exist and function effectively. As the	N/a	

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
		Willis: Economic valuation of the environment, Edward Elgar, provide an overview of methods and case studies. Searchable databases on valuation studies can be found under http://www2.epa.nsw.gov.au/envalue/ or http://www.evri.ca/	value of biodiversity sites is contingent on the state and spatial distribution of other sites, methodological problems may arise when simultaneously evaluating large numbers of sites. Some valuation techniques, and especially direct approaches, require substantial amount of institutional capacity.		
Conservation and sustainable use					
a) Technologies for in-situ conservation					
Control technologies for situational pests • Fencing and policing technologies • Integrated pest management, including biological control • Biotechnological approaches	Examples of integrated pest management: Many examples of control of weeds in agro-ecosystems and invasive alien species (in all ecosystems) using host-specific weed feeders and pathogens as well as mechanical approaches, e.g. control of water hyacinth (*Eichhornia crassipes*) using species of the water hyacinth weevil or mechanical control. Many examples of biological control of insects and pathogens on crops using microorganisms (e.g. *Bacillus thuringiensis*, mycopesticides) entomopathogenic nematods, insects (e.g. ladybeetle larvae, parasitic wasps). Increasing interest in genetic engineering approaches introducing resistance genes, e.g. to virus infections.	Methodologies and approaches are generally available and most of them are in the public domain. Possible exception: bioengineering technologies. Most technologies are inexpensive but have a good potential to combine positive conservation effects with long-term savings from reduced spending on mitigation measures. Required equipment is usually commercially available from many suppliers.	Transfer of technologies requires careful verification and monitoring of their applicability. Biosafety concerns have been raised regarding biotechnological approaches.		
Traditional agriculture technologies as disease management practices	Example of indigenous techniques: crop diversity, multiple cropping, burning, flooding, mulching, organic amendments, multistory systems, planting in raised beds, rotations and fallows.	http://www.tropag-fieldtrip.cornell.edu/tradag/agmethods.html			
b) Technologies for *ex situ* conservation					
• Data collection, analysis and dissemination technologies • Preservation and storage technologies (cryrogeny, lyophilization) • Management technologies for zoological and botanical gardens • Breeding in captivity technologies (e.g., genetic monitoring, in vitro	Accessible information systems on seed/gene collections Gene banks/seed banks would use a number of hard and soft technologies for *ex situ* conservation. Hard technologies would include databases and geographical information systems to manage data on species to be collected and to track the collections; dry room and cooling technologies; aspirators to separate the mature seeds from surrounding dead material; x-ray machines to assess the proportion of empty or damaged seed in a collection; hygrometers for non-destructive measurement of seed water status; incubators for germination testing. Soft technology would mainly include know how and an understanding of the scientific processes at work, and a knowledge of the techniques and procedures which have been developed using this understanding. Seed banking, especially of wild seed, has considerable advantages	Many of the technologies are not available in developing countries. Some of the technologies listed can be replaced with locally available or traditional technologies. For example, aspirators can often be replaced by traditional winnowing technologies.	Given the importance of soft technology, a key requirement for transfer and, in particular for, adaptation and absorption of the technology is well targeted training at all levels, including basic theory of *ex situ* conservation and practical guidance on procedures. Collaborative research can further understanding of the behaviour of local species. A key potential obstacle/barrier: low national priority for *ex situ* conservation. Practical barriers relate in particular to the lack of appropriate infrastructure to support the technology (e.g., poor telephone/fax and		FAO Global Information System on Plant Genetic Resources; GBIF; BIOCase; Millennium Seed Bank Project at Royal Botanic Gardens, Kew, UK. IPGRI runs programmes on the *ex situ* conservation of neglected and under-utilized plant

Technology, tools, methods and approaches	**Possible applications and opportunities**	**Availability/relevant documentation**	**Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption**	**Possible impacts on biodiversity**	**Potential supporters/ collaborators**
insemination, gene pool sampling) • Conservation technologies at subcellular level (gene storage, DNA banks) • Ethno-botanical methods to capture, record and analyze indigenous knowledge on biodiversity	such as ease of storage, economy of space, relatively low labour demands, and consequently the capacity to maintain large samples, with wide genetic representation at an economically viable cost. Seed banks generate a range of valuable data and research findings, which support wider plant conservation aims (e.g., effective germination and propagation protocols developed for species in seed banks can be vital to the success of recovery and restoration programmes). According to the 1996 FAO Report on the State of the World's Plant Genetic Resources, seed banking technology for wild seed is relatively under-utilized meaning many opportunities exist for its application. Of the 9000 wild plant species whose storage characteristics are known, over 90% are though to have desiccation tolerant seeds, and are expected to remain viable in storage for at least 200 years.		internet connections, lack of IT facilities, unreliable power supplies, lack of suitable vehicles for seed collection).		species. Botanic Gardens Conservation International (BGCI), networks Botanic Gardens and may facilitate technology transfer in this area. National and regional initiatives such as the Nordic gene Bank.
c) Technologies for sustainable use					
Sustainable forest management (SFM) • low-impact logging; • sustainable yield; • sustainable management of non-timber forest products	Many examples from different forest types including mountain and dry forests, as exemplified by certified forest management operations following ITTO, Forest Stewardship Council (FSC) or ISO criteria and indicators. Efforts are currently underway to open forest certification to small holdings and farm forestry (thus also applicable to agrobiodiversity conservation) as well as for the harvesting of non-wood forest products.		Short-term commercial interests often prevail over sustainable approaches with lower initial returns and tend to suppress local and traditional techniques. Large potential for application of traditional methods and approaches in most areas and ecosystems. Many traditional methods and approaches are labour-intensive but cost-effective. Importance to fully integrate the knowledge of local farmers, forest users, pastoralists and fishermen in the design and validation of local resource-based, production and conservation options, for example through appropriate integrated, multi-stakeholder planning and research activities.	N/a	CGIAR centres, Ministries for Agriculture; Technical universities; Intermediate Technology; Tropical Soil Biology and Fertility (TSBF) Programme; FAO, ITTO, FSC; ICIMOD

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
Integrated water management • watershed planning and stabilization; • wastewater management; • irrigation management	Design of structural water supply and flood control improvements including through desalination plants, water reclamation plants, groundwater protection, improved water harvesting techniques, micro watershed development small-scale surface water harvesting structures. Approaches particularly relevant to conservation of forest, dryland, mountain ecosystems and inland waters). Sewage treatment in specifically designed artificial wetlands. Introduction of appropriate and novel irrigation techniques, e.g. drip irrigation, relevant to agrobiodiversity conservation. Example for traditional technologies: Traditional Indian coconut pick-ups or weirs are small structures built across the seasonal or perennial streams to slow the flow of water at an appropriate location. This results in surface water storage, groundwater recharge, reduction of soil erosion and availability of water for other purposes.		Large potential for application of traditional methods and approaches in most areas and ecosystems. Many traditional methods and approaches are labour-intensive but cost-effective. Importance to fully integrate the knowledge of local farmers, forest users, pastoralists and fishermen in the design and validation of local resource-based, production and conservation options, for example through appropriate integrated, multi-stakeholder planning and research activities.Potential to use locally available products and technologies, e.g. for the creation of artificial wetlands for sewage treatment. Investments in construction of irrigation, desalinization and other plants can be large.		
Integrated soil management • erosion control; • soil improvement technologies • conservation farming	Erosion control through a range of measures including contour planting, leguminous ground cover and residue retention, terracing, no-till technologies, living fences. Particular relevance to agricultural, montane and dryland ecoystems. Soil improvement technologies include integrated soil nutrient management and effective microorganisms (EM) technology through nitrogen fixation, biofertilizers, use of vesicular arbuscular mycorrhizae or benign nematodes in agro-ecosystems. Mulching and planting in raised beds are traditional farming practices that reduce soil erosion and allow a better drainage and irrigation.	Methodologies and approaches are generally available and most of them are in the public domain.	Large potential for application of traditional methods and approaches in most areas and ecosystems. Many traditional methods and approaches are labour-intensive but cost-effective. Importance to fully integrate the knowledge of local farmers, forest users, pastoralists and fishermen in the design and validation of local resource-based, production and conservation options, for example through appropriate integrated, multi-stakeholder planning and research activities.	Change of soil systems including biodiversity is an inevitable consequence of soil modification techniques. Organic matter supplementation e.g. through dung and forest products can be a conflicting resource use. Where fire wood is scarce additional usage as soil fertility supplement may lead to deforestation.	Livestock, Environment and Development Centre (LEAD) (http://www.lead.virtualcentre.org/selector.htm) Tropical Soil Biology & Fertility (TSBF) Programme of CIAT (http://www.tsbf.org/) Global Network on Integrated Soil Management of FAO (http://www.fao.org/ag/agl/agll/spush/intro.htm) http://inrm.cip.cgiar.org/home.htm

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
Pasture management • Grazing system • Choice of herbivores • Animal health • Controlled fires • Pasture rehabilitation • Organic farming	Control of grazing through management of grazing pressure (e.g. adaptive management of stocking numbers, strategic placement and management of boreholes and wells), the choice of grazing system (distribution of animals, e.g. continuous or rotational grazing), monitoring of range condition and adaptive management. Choice of herbivores: Mixed species herds to improved use of available pasture resources, including browsers and game species), conservation of local breeds, which are better adapted to local conditions (agrobiodiversity). Improved animal health and veterinarian practices and technologies, including preventive and therapeutic measures, sanitary measures, chemical and non-chemical methods; supplement feeding, improved animal housing (e.g. for agouti, pigs, chicken) Fire management including bare soil firebreaks, planted firebreaks, firebreaks with native vegetation, cropped firebreaks. Prevention of bush and forest fires essential. Pasture maintenance can be achieved through controlled burning, slashing, oversowing, pasture rehabilitation, fertilization, including manure management.Pasture regeneration techniques include soil modification and protection, oversowing, fencing (e.g. stone walling, live tree fences, earth dikes, ploughing) Organic farming practices are based on minimizing the use of external inputs, avoiding the use of synthetic fertilizers and pesticides. Mutiple cropping, agroforestry, crop-livestock systems are supported were appropriate.	Methodologies and approaches are generally available and most of them are in the public domain. Possible exception: bioengineering technologies. Most technologies are inexpensive but have a good potential to combine positive conservation effects with long-term savings from reduced spending on mitigation measures. Required equipment is usually commercially available from many suppliers. The implied costs are a hindrance. A key constraint it the inaccessibility of services provided by agricultural commercial as well as government extension as well as information is often inaccessible	Transfer of technologies requires careful verification and monitoring of their applicability. Adaptation of technologies to local institutional, infrastructure and capacity realities is needed. The techniques for genetic conservation and for genetic improvement of breeds include artificial insemination and embryo transfer. Also molecular techniques are used (ADN markers, ADN analysis) may be used to characterize the breeds. These are hardly affordable techniques to the common farmer.	Change of pasture or rangeland ecosystems including biodiversity is an inevitable consequence of grazing. Grazing management is the manipulation of these changes through the control and timing of grazing and the application of techniques and technologies. Poor application of techniques and technologies might lead to desertification, (alien) and local species invasion (weeds). Biodiversity conservation/management objectives to be clearly stated. Methane emissions of livestock potentially contribute to green house gases and climate change. Contribution to livelihood security, thus potentially enabling biodiversity conservation.	Livestock, Environment and Development Centre (LEAD) (http://www.lead.virtualcentre.org/selector.htm) The Crop and Grassland Service of the Plant Production and Plant Protection Division (AGP) of FAO (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPC/doc/Default.htm) International Livestock Research Institute (of CGIAR) (http://www.cgiar.org/ilri/) Livestock and rangeland knowledge base of IFAD (http://www.ifad.org/lrkm/index.htm) Society for Range management (http://www.rangelands.org/ScriptContent/Index.cfm) Organic Agriculture at FAO (http://www.fao.org/organicag/)

Technology, tools, methods and approaches	Possible applications and opportunities	Availability/relevant documentation	Requirements and possible obstacles/barriers to access, transfer and adaptation/absorption	Possible impacts on biodiversity	Potential supporters/ collaborators
Fishery/aquaculture management • Monitoring/tracking technologies for fish stocks, vessel movements • responsible fishing techniques • artificial fish attractors/fish aggregating devices • responsible aquaculture techniques	• enforcement of fishery regulations through tracking of vessel movements • By-catch reduction technologies. Examples include trawl gear modification or longline adaptation to avoid seabird by-catch. The National Audubon Society has recently concluded research on alternative seabird deterrence methods in longline fisheries and identified a side setting method that promises to be effective at minimizing seabird capture and operationally beneficial for industry. • Fish aggregating devices improve catch in small scale fisheries. • Best practices in siting of aquaculture facilities, pond management, management of seedstock, prevention of pollution/escapes/parasites etc. • Application of quantitative genetics in breeding programmes • Genetic techniques to prevent proliferation of escapes.	www.onefish.org http://www.worldfishcenter.org/ Report of the CBD Ad hoc technical expert group on mariculture (UNEP/CBD/SBSTTA/8/INF/6) http://www.fao.org/fi/default_all.asp			EC Satellite Vessel Monitoring (VMS) system) FAO, ICLARM, Regional fisheries organizations, World Fish Center, US National Audubon Society (for seabird deterrence devices)
