Less-Favoured Areas: Looking Beyond Agriculture Towards Ecosystem Services

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Abstract

Many dryland regions are considered less favoured areas as they face a variety of either biophysical or socio-economic constraints to agricultural production and sustaining livelihoods. Growing population numbers, limited infrastructure and market access, land tenure problems as well as increasing degradation problems due to poor management of soils prone to erosion, steep slopes or low rainfall quantities are some of the limitations for agricultural production that have led in many areas to growing numbers of poor people. The paper describes a framework, using land and labour opportunity costs, for classifying dryland production systems and devising a set of development strategies based on initial resource use endowments and resulting land use. In this way policy options for dryland development are tied to the wider economic context within a country. Policy strategies for dryland areas are discussed which take the varying starting points for development into account. Options discussed include land management strategies where the provision of ecosystem services enhances agricultural productivity for areas with high opportunity costs of land. Under high labour, but low land opportunity costs conditions, land unproductive for agricultural production could have good potential for land uses that produce non-agricultural ecosystem services. Mapping out these varying land management strategies can thus help to tailor policy measures to specific dryland area conditions.

Key Words: Less-favoured areas, Environmental services, Drylands, Opportunity costs for land and labor.

JEL: O13, Q01, Q56, Q57, Q58

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1. Introduction: What are less favoured areas and why do we need to care?

In the context of poverty alleviation, the discussion on less favoured areas has gained in momentum over recent years. About 40% of the rural population in developing countries are estimated to live in these areas (Kuyvenhoven *et al*., 2004), which face quite a number of diverse bio-physical and socio-economic constraints to sustaining livelihoods. Growing population numbers, limited infrastructure and market access, land tenure problems as well as increasing degradation problems due to poor management of soils prone to erosion, steep slopes or low rainfall quantities are some of the limitations for agricultural production that have led in many areas to growing numbers of poor people. In addition, policy-makers as well as the national and international research and extension systems have neglected these regions in recent decades (Kuyvenhoven *et al*., 2004), thus aggravating some of the problems. As Pender and Hazell (2000) describe, development strategies in many countries emphasized for a long time the importance of investing in highly productive areas as returns to investments would be greatest there. Improved food production and therefore increasing food security together with economic growth would stimulate the migration out of less-favoured areas, thus reducing pressures on fragile resources and population numbers.

Increasing evidence shows today that upward trends in population and poverty numbers have not changed (Pender and Hazell, 2000; Kuyvenhoven *et al*., 2004), while the resource situation worsened in a number of cases. In addition, investments in favourable areas have not always had the desired effect as diminishing returns to investments and increasing environmental problems in many intensively used agricultural areas around the world demonstrate. All these developments have put less-favoured areas back on the agenda of policy-makers and researchers alike (see for example the CGIAR TAC report on research priorities for marginal lands (CGIAR TAC, 1999)).

Varying definitions have been proposed to describe less-favoured or marginal areas. Part of the difficulty of clearly defining what a less-favoured or marginal area is stems from their heterogeneity and the diversity of encountered problems. Furthermore, less-favoured lands can be defined based on a variety of different characteristics, such as their potential or constraints for agricultural production or the encountered socio-economic conditions. Pender and Hazell (2000) give a short, but simply definition by describing these areas as “less favoured either by nature or by man”. The CGIAR TAC report on marginal lands (CGIAR TAC, 1999) provided a useful overview over various terms used in this context. The definition adopted in this paper is the one on marginal lands from the CGIAR report. Marginal lands are defined as lands that with ‘limitations which in aggregate are severe for sustained application of a given use. Increased inputs to maintain productivity or benefits will be only marginally justified. Options for diversification without the use of inputs are ‘limited’ (CGIAR TAC, 1999). Important here is the term ‘for a given use’: An area might be marginal or less-favoured for use as a crop production area under a specific production system, either for example due to water scarcity or lack of market access. The same area though could nevertheless become more favourable, if either new water-saving technologies or new marketing routes became available.

In order to devise new development options for less-favoured areas taking a wider approach that looks beyond agriculture is crucial. As most of these areas have important limitations for agricultural production *per sé*, targeting these bottlenecks is definitely one way forward. Nevertheless, in recent years the use of land to produce not just food or fibre but to also provide other ecosystem services, such as carbon sequestration or biodiversity conservation, has gained in importance. These options need to be explored in addition.

The objective of this paper is to contribute to the discussion on new policy options for less-favoured areas by presenting a set of conceptual ideas for directing policy strategy development for alleviating the constraints faced by land users in these regions. In section two using drylands as an example, the paper describes first a typology of dryland crop production systems around the world based on differences in resource endowments of land and labour. We then discuss the various pathways that drylands development has taken, based on opportunity costs for land and labor, as well as conditions external to the agricultural sector. In section three the paper develops concepts for the incorporation of environmental services into drylands development strategies, looking at the way in which supply environmental services can contribute to livelihoods by either impacting agricultural productivity or providing an alternative source of income. The potential returns to providing environmental services are also explored in this section with a discussion on current sources of demand. The paper concludes with a discussion of the way forward: the type of information, policies and institutions that will be required for successful incorporation of environmental services into drylands development strategies.

2. Agricultural development pathways for marginal lands: the case of the drylands

Drylands, defined as water scarce lands (MA, 2005), serve as a good example of less-favoured areas, their problems and possible solutions. Their main bio-physical constraint is lack of water, resulting from low precipitation and high evapotranspiration levels, which can restrict crop and livestock production severely. In addition the quality of soils found in drylands can vary tremendously. The degree of aridity varies as well across drylands, which has resulted in classifying them in four sub-categories along an increasing gradient of moisture deficit: dry sub-humid, semi-arid, arid and hyper-arid. These four dryland types cover about 41% of the Earth's surface (about 6 billion hectares) and are inhabited by about two billion people (MA, 2005).

Drylands can be found on all continents and, as Figure 18.1 shows, they are located in developing countries, such as the Sahel region in Africa or Rajasthan in India, as well as in industrialized ones, like central Australia or California in the USA. Nevertheless, the MA (2005) calculated that the lion's share of global drylands - about 72%, are in developing countries. The figure also depicts the trend that the drier it gets, the more likely it is to find this area in a developing country. For example, no industrialized country has hyper-arid areas.

INSERT HERE FIGURE 18.1

Figure 18.2 indicates that the vast majority of dryland inhabitants (roughly 90%) live in developing countries (MA, 2005). In many cases they are the poorest of the poor and display the lowest levels of human well-being. The MA compared indicators such as infant mortality and GDP across different ecosystem types and found that dryland populations had the highest infant mortality and the lowest GDP levels (MA, 2005). In addition to water stress, dryland areas in developing countries also face a number of socio-economic constraints, such as increasing population pressure, poor infrastructure and market access, lack of proper land tenure systems, and poor governance systems (MA, 2005). Thus drylands are a good example of less-favoured lands in which bio-physical constraints and a number of socio-economic conditions working together make them marginal areas.

INSERT HERE FIGURE 18.2

Not all dryland environments are low productivity subsistence systems though. Quite a few examples exist where human modification to the existing constraints has resulted in the conversion of these areas to profitable crop or livestock production systems. However, the profitability of such conversion depends on suitable technologies, economic incentives and supportive institutional set-ups. Moreover, what happens outside the agriculture sector is as important, if not more important, to what happens in the agriculture sector for determining the status and future of the drylands.

We identify four categories of drylands farming systems can be used to distinguish different drylands development pathways in an induced innovation type framework (Figure 18.3) (Hayami and Ruttan, 1985). Many traditional subsistence farming systems, often with low productivity, can be found in areas with low opportunity costs for land and labour. Examples are small scale subsistence farming systems in many Sub-Saharan African countries which are based on the production of traditional staple crops such as sorghum, maize or manioc. The incentives for increasing productivity in these systems are minimal since low population densities and poor market infrastructure conditions imply that the farmers face an inelastic demand for their output.

Economic growth and trade integration triggers a movement away from subsistence systems towards commercial farming in areas of low population density, provided investments in irrigation and market infrastructure are made. Increasing economic development outside of a less-favoured area is likely to change opportunity costs of labour by providing new job opportunities with the resulting out-migration of labour. Rising labour costs will increase the incentives for farmers to look for labour saving technologies. Such mechanized large scale production systems are observed in cereal production areas in the Argentinean, Australian or the US drylands. These areas are also conducive to the development of extensive pastoral systems for livestock rearing, such as beef cattle production systems in Argentina.

INSERT HERE FIGURE 18.3

Where labour is abundant but land is the more constraining factor, intensive cereal systems develop that rely more on the use of high-yielding varieties and fertilizers to increase productivity while saving land. Typical examples for this kind of development are the intensively managed rice-wheat production systems in the Indian Punjab or the intensive rice production systems in South East Asia. Intensive livestock production, generally associated with stall feeding, is also common in these systems. Sustainable development of crop and livestock production systems in these environments depends on good access to input and output markets as well as a functioning R&D system that can provide adapted varieties and develop solutions for better resource use and agronomic management. If such conditions do not exist, one would observe high levels of degradation with population growth and the associated increase in land use intensity.

Of course situations also exist in which both opportunity costs for land and labour are relatively high. This can be the case in areas with high population density, and dynamic, well-functioning manufacturing and/or services sectors that provide off-farm labour opportunities. Systems found in drylands in which these situations exist include the intensively managed fruit and vegetable areas around the Mediterranean (e.g. Israel, Egypt, Spain). As most of these production systems are highly intensified commercial systems, they require access to input and output markets, supporting R&D systems and the appropriate physical infrastructure. Many of these areas are also associated with various environmental problems resulting from inappropriate fertilizer, pesticide or water use.

Though this typology is highly stylised it nevertheless provides a historical sketch of the pathways followed in the transition out of subsistence agriculture in dryland environments.

The pathway chosen depends on two conditions: the land and labour endowments of particular societies and the dynamics outside of the agricultural sector that influence their opportunity costs. The above discussion indicates that drylands are not automatically destined to destitution, which is also the case for other less-favoured areas. Demographic, economic and institutional factors are the ultimate determinants of the pathways out of poverty for the marginal environments.

3. New opportunities for dryland systems: the provision of eco-system services

In this section we broaden the range of sustainable land use strategies we consider for drylands to include the potential for generating ecosystem services both as a complement to and substitute for agricultural production. Ecosystem services are defined as all benefits that humans receive from ecosystems (Daily, 1997; Costanza *et al*.,1997; Millennium Ecosystem Assessment (MA, 2003)). The Millennium Ecosystem Assessment distinguishes four different categories of services (MA, 2003): a) provisioning services, which include food production, b) regulating services (e.g. climate regulation, nutrient cycling), c) supporting services (e.g. biodiversity) and d) cultural services (e.g. amenity values). An eco-system perspective, as opposed to a conventional agricultural development perspective, recognizes that land management can produce more than just food or fibre and distinguishes between services that sustain agricultural production and those that are public goods in their own right.
Provisioning services in the form of agricultural production are one of the most important ecosystem services generated in drylands, which have clearly defined economic value, as compared with other environmental services. Supporting and regulating services, such as soil fertility and water flow management, while important complementary services to agriculture production, tend to be undervalued. In cases where the provision of environmental services

involves a tradeoff with agricultural production; e.g. conserving biodiversity by maintaining forest areas, poor societies have generally chosen in favor of production.

The following two questions are pursued here: i) Can the provision of environmental services be integrated into the development pathways for dryland environments; and ii) Can payments for environmental services provide an additional source of livelihood for poor households?

3.1 Supply of eco-system services

The ability of dryland systems to supply eco-system services is determined by the quantity and quality of the land resource base. Population density, agro-ecological conditions, level of market integration and primary technology employed in agriculture are all important determinants of the current returns to land and labor in drylands, and the potential role the provision of public environmental services may play in improving these returns.

In land abundant areas, including areas where rising off-farm employment opportunities have drawn populations out of rural areas, the potential for setting aside land for non-agricultural uses is high. Conversion of agricultural lands to forests contributes to carbon sequestration, watershed protection and biodiversity conservation. An example of this kind of conversion is China's Sloping Lands Program, in which the Chinese government has to goal of converting 14.6 million hectares of cropland on slopes into forest to stop soil erosion and improve water retention[i]. Given the low opportunity cost of land, the trade-off with food and fiber production is small in these areas, particularly where transport infrastructure is a limiting factor for competitive agricultural production.

On the other hand, in land scarce environments the trade-off between agricultural and non-agricultural services is high. In such environments, eco-system services would have to be complementary to, rather than a substitute for, food and fiber production. This requires the adoption of agricultural production systems that generate environmental services.

Conservation tillage, agro-forestry systems, and silvo-pastoral systems, are some of the many examples of agricultural production systems that can generate external environmental benefits in the form of carbon sequestration, biodiversity conservation and watershed protection. (See Dutilly-Diane *et al.*, 2004 for a discussion of rangelands management programs that can generate environmental services in drylands areas). The service is generated by the land user but the benefit is realized off site. The beneficiaries may include local residents, consumers in global markets or even future generations. These types of environmental services are generally in the form of public goods, with low rivalry in consumption and high exclusion costs.

One example of how the switch to an agro-forestry system can be facilitated by payments for carbon sequestration can be found in Mexico, where farmers receive payments from the International Federation of Automobiles as carbon offsets[ii]. Another example is the Integrated Silvopastroral Approaches to Ecosystem Management Project in Central America, in which small and medium sized farmers receive compensation for planting trees, fodder shrubs and living fences around pastures (FAO Livestock Policy Brief No. 3) Improving the supply of environmental services can thus be an important component of agricultural development strategies in drylands areas, depending on the existing natural resource endowment and the type of farming system in place (Zilberman *et al.*, 2006a; Dutilly-Diane *et al.*, 2004).

It is important to recognize that not every country or region has the potential to realize an economic benefit from supplying environmental services, and environmental conditions are an important determinant of the returns. Factors such as soil quality, topography and climate are critical determinants of the productivity of ecosystem service provision, and together can be considered as “land quality” which is an input to the production of ecosystem services. The way in which land quality affects the productivity of ecosystem service provision varies by the type of services; e.g. steep topography can result in highly productive watershed protection, but very unproductive agriculture. In other cases land quality has a similar productivity effect on more than ecosystem service: e.g. soil fertility is important in determining both agricultural productivity and the productivity of soil and above-ground carbon sequestration.

The differential impact of land quality on the productivity of agricultural versus public environmental goods has an important impact on the degree to which the production of the two goods is complementary. (Zilberman *et al.*, 2006a

) Converting lands from agricultural to public environmental service production on a site with land quality that is very poor for agricultural productivity but good for public environmental service provision has a lower trade-off than on land of excellent quality for agriculture. This variability has important implications for the role of supplying public environmental goods in developing strategies for improving drylands.

One key strategy for improving agricultural productivity in drylands has been to focus on improving land quality. This strategy has often been implemented using capital inputs to enhance land quality. The application of fertilizers and other soil amendments, terracing and irrigation are examples. These strategies are essentially trying to increase the returns to land for agricultural producers. The experience with relying primarily on capital inputs to increase the productivity of the land has shown that several types of problems can arise (Lipper, 2000) One is a low return to input use, e.g. low input efficiency due to degraded or poor natural resource base. Another problem is the lack of financial sustainability of applying capital inputs in systems with low input efficiency.

The provision of public environmental goods that are complementary to agricultural production and which contribute to dimensions of land quality important for agricultural productivity thus emerges as a potentially important component of strategies aimed at improving the productivity of land in agricultural production. (Zilberman *et al.*, 2006a and b)

The benefit of combining payments for the provision of public environmental goods such as soil carbon sequestration or watershed protection for the adoption of agricultural practices that can eventually lead to increased agricultural productivity is quite attractive. [iii] In some cases, however the adoption of the new agricultural practice could lead to a decrease in the returns to agriculture, in which case the payment for the public good component must be sufficient to compensate for such losses at a minimum.

In some cases, improving the quality of land to enhance agricultural productivity is not economically feasible, even with the potential of adding funds and improvement of natural resources through the provision of public environmental services. The land quality may be highly productive in the provision of public environmental goods however. An example here might include crop production on steep slopes where erosion has resulted in poor soil fertility. Cultivation in this area generates very low returns to the farmer, and at the same time generates negative impacts on the functioning of the watershed. Converting this land from agricultural production to watershed protection (via planting of trees) will generate a higher return to both land and labor. (Zilberman *et al*., 2006b) This strategy implemented in conjuction with growth in non-agricultural sources of employment could be the most viable option for areas with highly degraded resources.

Aside from environmental factors, the supply of environmental services and particularly their successful incorporation into the livelihoods of drylands inhabitants is dependent on other enabling conditions such as property rights, food security, and low transactions costs. These have been discussed in several publications on payments for environmental services and poverty (Zilberman *et al*., 2006a and b; Pagiola *et al*., 2005.; Wunder, 2005; Dutilly-Diane *et al*., 2004; Lipper and Cavatassi, 2003; Cacho *et al*., 2002; Smith and Scherr, 2002; Landell-Mills and Porras, 2002) One key issue is the widespread lack of formal property rights among most low-income land users and problems this entails with receiving payments for land use changes. Another is the importance of food security risk as a determinant of land use choice and the importance of including this concern into national and local planning. High transactions costs associated with environmental service payments to small producers seriously reduce the potential benefit of such payments.

3.2 Sources of Demand for Environmental Services

Even where all conditions are in place for the supply of environmental services to support drylands development , there is still the issue of economic incentives that motivate farmers to supply eco-system services, especially those that have larger off-site than on-site benefits. If producers don't receive payments which cover at least their costs of supplying the environmental good – they will have no incentive to participate in PES programs unless they generate some other form of benefit such as increased agricultural productivity. (Lipper and Cavatassi, 2003) Thus the demand for, and potential payment level to farmers for providing environmental services is critical in determining the feasibility of their incorporation into drylands development strategies.

Two recent developments have created conditions for incorporating a wide range of environmental service provision into land use strategies in drylands: there is increasing willingness to pay for environmental services on the part of external beneficiaries and there is increasing recognition of the importance of environmental services in sustainable agricultural management, and the high costs of their depletion. However the concept of paying for environmental services is still relatively new, as just recently governments, international agencies, and individuals have begun to recognize the important role that farmers, ranchers, foresters and any land users could play in improving environmental management. Payment mechanisms are still being developed and much still remains to be done to fully realize their potential.

The source of payments and funds for environmental services depends upon the beneficiary of the service. One important criterion for assessing potential sources of demand is the scale at which benefits are realized: e.g. global versus local benefits from environmental services. Climate change mitigation through carbon sequestration and biodiversity conservation (including agricultural biodiversity conservation) are the two main services which fall into the first category. In both cases the environmental service has potential benefits for the entire global population as well as future generations. In contrast the benefits from environmental services for watershed management such as improvements in water flow, soil erosion and water quality are usually realized at a local level.

Another important criterion for classifying demand is whether they are from the public or private sector (Zilberman *et a*l., 2006a). In some cases PES programs are more supply driven, where the public sector seeking to utilize funds more efficiently (Pagiola, 2005) In other cases they are more demand driven and these cases are where private sector participation is most likely.

In the following section we describe some of the emerging sources of payments for environmental service by sector and scale.

A. Public sector funds

At the international level, a major source of demand for global environmental services in the public sector is the Global Environment Facilty (GEF) which was established as a funding mechanism for several multilateral environmental agreements, including the Convention on Biological Diversity and the UN Framework Convention on Climate Change. GEF funds projects that generate global environmental goods such as climate change mitigation, biodiversity conservation and the management of international water bodies. (GEF website) GEF is funded by contributions from donor countries. In 2002, 32 donor countries pledged $3 billion to fund operations between 2002 and 2006. (GEF website) GEF funds the "incremental" or additional costs associated with transforming a project with national benefits into one with global environmental benefits, such as climate change mitigation and biodiversity conservation. Another source of international public sector funds is the Biocarbon Fund, recently established by the World Bank with a capitalization of $53.8 million for the first phase. The Fund is a purchaser of climate change mitigation services in the form of carbon sequestration and substitution. (World Bank, 2002).

Other public sector funds for environmental services are managed at the national level. The Conservation Reserve Program in the United States and various payment schemes for multi-functionality in Europe are models of government-financed agricultural ES programs. Some large developing countries such as Brazil and China have established public sector funds for purchasing environmental services as well, with Proambiente in the former and the Sloping Lands Conversion Program in the latter.

The public sector can be an important purchaser of environmental services at the local level as well. One of the most famous examples is in New York, where the city of New York increased water fees by 9% in order to make payments to farmers in the watersheds feeding the city water supply to adopt farming practices that would generate less water pollution. (Mayrand and Paquin, 2004) In Brazil, some states have implemented a program of biodiversity conservation using sales tax revenues for funding habitat conservation. (Grieg-Gran, 2000).

B. Demand from the Private Sector

Private firms are already purchasing ES that result in higher profits by reducing production or environmental regulation compliance costs or increasing the sales value of their products on the market. (Zilberman *et al.*, 2006a) In some cases the firm is interested in obtaining goodwill rather than the environmental service itself. In the case of payments for biodiversity offsets for example, mining companies are agreeing to fund biodiversity conservation projects to offset the potential negative impacts their activities have elsewhere. One of the main benefits from this is improved relationships with local communities, reduced opposition to permitting and reduced costs of operating (Den Kate, 2005).

Demand for environmental services from the private sector is being generated where payments are the least cost means of meeting environmental regulations. The demand for climate change mitigation services is a good example, with a combination of legally binding commitments to reduce carbon emissions, and the potentially lower cost of emission reduction credits from carbon sequestration relative to other possible means driving the demand for this service. (Graff-Zivin and Lipper, 2006) Several exchanges of carbon offsets are being set up, but the one of most relevance for developing countries is the Clean Development Mechanism of the Kyoto Protocol. This mechanism allows developed countries with binding emissions reductions to offset their carbon emissions with the purchase of carbon emission reduction credits (CERs) from developing countries. The activities which are allowed as sources of carbon emission reductions are restricted. Some which could be beneficial to agricultural producers in drylands areas, such as soil carbon sequestration and avoided deforestation are not allowed in the first commitment period ending in 2012. Discussions on whether these should be included in the future are currently underway. Watershed services are another example where the private sector has provided payments. In the Cauca Valle in Colombia for example, farmer's associations are paying for watershed management practices that improve the supply of irrigation water, using funds from water user fees. (Mayrand and Paquin, 2004).

C. NGOs as Purchasers

Some of the most effective ES funds are managed by NGOs that represent groups with specific environmental interests. The Nature Conservancy has invested millions of dollars in various programs that buy or lease land and purchase development rights and other assets in order to provide ES. (Zilberman *et al.*, 2006a) The World Wildlife Fund has an active program developing PES in both developed and developing countries as a means of attaining sustainable agricultural development and poverty reduction objectives. (Zilberman et al., 2006a) Conservation International has recently started a new program of conservation incentive agreements which are based on an equitable exchange of natural resource conservation for economic and social benefits. The program involves compensation to local landowners for maintaining conservation activities (Zurita, 2005).

4. The way forward

In the previous section we ask two questions: i) Can the provision of environmental services be integrated into the development pathways for drylands environments, and ii) can payments for environmental services provide an additional source of livelihoods for poor households? Our analysis indicates the answer to both questions is yes - conditional upon several factors, including environmental conditions, as well as institutional and policy factors. In this section we discuss the policy and institutional changes necessary to meet the two objectives, and the role of various public sector actors in promoting these changes.

Perhaps the most important requirement for incorporating environmental services into drylands development strategies is the incorporation of their potential value into mainstream agricultural and economic development strategies. Consideration of the comparative advantages a country has in supplying such services and their potential to contribute to overall development objectives needs a broad perspective, and cannot be formulated solely by the environmental sector. To achieve this type of broad perspective across government sectors is no small or easy task. An important first step is thus information dissemination about the potential of environmental services and a dialogue between various ministries and agencies on if and how they could be integrated into development plans. At an international level, inclusion of the potential role of environmental services into major development strategies such as the TerrAfrica Program supported by the Global Environmental Facility to promote sustainable land management in Africa, as well as into country level poverty reduction strategy papers (PRSPS) as part of World Bank lending programs are important examples. Information on the potential demand and supply of environmental services from a given country or region is needed to alert policy makers and planners to the possibilities environmental services may provide, as well as to give a realistic appraisal of how well they can be integrated into overall development strategies. Ultimately the information is also necessary to design an effective strategy for their incorporation into drylands development. For example, a rough analysis of a country's potential to supply environmental services could be obtained from spatially referenced information on various dimensions of land quality as related to agricultural production and environmental services. In many cases this information already exists, but needs to be analyzed for the purpose of assessing supply potential. In other cases, data at the appropriate scale may need to be collected. The Millenium Ecosystem Assessment gives a good overview of available data and major gaps. (MA, 2005, Chapter 2) Assessing the potential demand for the environmental services a country can provide is equally important. For local level environmental services, such as watershed management, some analysis of the potential benefits (in terms of improved water quality, hydroelectric or irrigation operations) is needed. For global services such as biodiversity conservation and climate change mitigation some assessment of the requirements for participation among major funders and current level of payments for services should be done. Much of this information is also already available or partially available, but as in the case of the supply side information, it needs to be analyzed to derive an assessment of demand for a specific location. The Ecosystem Marketplace (www.ecosystemmarketplace.com) is one important source, as well as studies from international research and technical agencies including CGIAR centers FAO, the World Bank, the International Institute for Environment and Development and others are already involved in conducting some of this work, but more needs to be done and better coordination of information is necessary.

In addition to information gathering, analysis and dissemination, a proactive policy strategy is needed to incorporate environmental services into drylands development strategies and support to livelihoods. Governments, from the local to international level, have an important role to play in terms of creating demand for environmental services and establishing an enabling policy and institutional environment to support livelihoods.

The most straightforward means by which governments create demand for environmental services is by enabling public funds to be spent on environmental services. For example, the SLCP in China was initiated by the central government in 1999 with the stated environmental goals of reducing water and soil erosion and the Ministry of Finance manages its funding. (Bennet and Xu, 2005) In Brazil, several state level governments decided to allocate some of their sales tax revenues to support biodiversity conservation through the establishment of the ICMS Ecológico. (Grieg-Gran, 2000) Of course, public sector funding for environmental objectives is likely to be quite limited in many developing countries. However, environmental service provision may be a least cost means of achieving a development goal that is, or will be, funded by the public sector. For example, reducing siltation in major waterways in China under the SLCP provides significant economic benefits to the country in terms of hydro-electric power and improved navigability and obtaining these benefits through an alternative means, such as dredging, is likely to be more expensive and less effective. Environmental services could be a cost effective means of improving drinking water quality, or in natural disaster preparedness – two important public policy objectives in many developing countries. Thus the demand for environmental services from the public sector could arise from either environmental or broader development objectives, and exploring the potential of environmental services to be a cost effective means of meeting broader development goals is an important task governments need to undertake in partnership with national and international research and technical institutions to successfully incorporate environmental services into drylands development strategies.

The enactment and implementation of environmental regulations that allow for market-based implementation mechanisms is another important role governments and national and international agencies can play to create demand for environmental services. Private sector entities looking for low cost means of meeting regulatory requirements is an important basis for several environmental service programs, such as the Clean Development Mechanism of the Kyoto Protocol. The demand for biodiversity conservation is highly conditioned by regulations governing the conservation and use of biodiversity at the national and international levels. National level policy-makers are important players in the development of international level environmental agreements and their support for environmental regulation and the use of market based approaches affects the level of demand for services. The multi-lateral environmental agreements such as the UN Convention to Combat Drought and Desertification and the Convention on Biological Diversity , together with other international agencies such as FAO, UNEP, IUCN and the World Bank have an important role to play in designing the incentive mechanisms to obtain the desired environmental objectives in a way that facilitates the participation and potential to benefit of low income countries and people.

On the supply side, policies to support potential suppliers are needed to realize the potential of environmental services for drylands development. One of the most important of these is a supportive land tenure policy environment. Lack of formal tenure is one of the biggest barriers to participation in environmental service provision, particularly among the poor. Public sector recognition and clarification of informal property rights to land and water is likely to be a very important requirement for having payments for environmental services become a significant contribution to livelihoods in many dryland areas. Dutilly-Diane *et al*., 2004 and Pagiola *et al*., 2005 discuss options that could or have been used in cases where tenure is informal. Potential conflicts with currently existing policies and regulations governing land use are another important area to consider. For example in some countries, productive use of the land has been required to maintain tenure, and this has generally been interpreted to mean agricultural production. Changes in these types of regulations to recognize environmental services other than agricultural production as a productive use would be necessary to support the integration of environmental services into a development strategy. A final step in the integration of environmental services into drylands development and into livelihoods is the establishment of institutions to facilitate the exchange of environmental services for payments. Payments for environmental services are a new type of exchange, and institutions are needed to support the process, including the development of projects, certification of product delivery and transfer of payments. An important issue is the need to establish institutions and rules that reduce transactions costs of participating for both buyers and sellers. In many of the existing cases, NGOs are involved in facilitating exchanges usually interacting with national or international public sector agencies. Transactions costs are high and if they remain so, they are likely to make environmental services unimportant – however these costs could decrease as markets and rules of exchange become more established. Countries committed to incorporating environmental services into their drylands development strategies will need to assess their current institutional capacity together with the new demands payments for environmental services will place on the system, and develop a strategy to meet these demands most cost-effectively.

Drylands areas are not condemned to destitution, but rather have several potential pathways towards achieving sustainable development, depending on their specific environments and socio-economic conditions. Incorporating environmental services into drylands development strategies is an important means of broadening the set of potential options for a sustainable development pathway, as is the recognition that going beyond agriculture to develop solutions is necessary.

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Figures

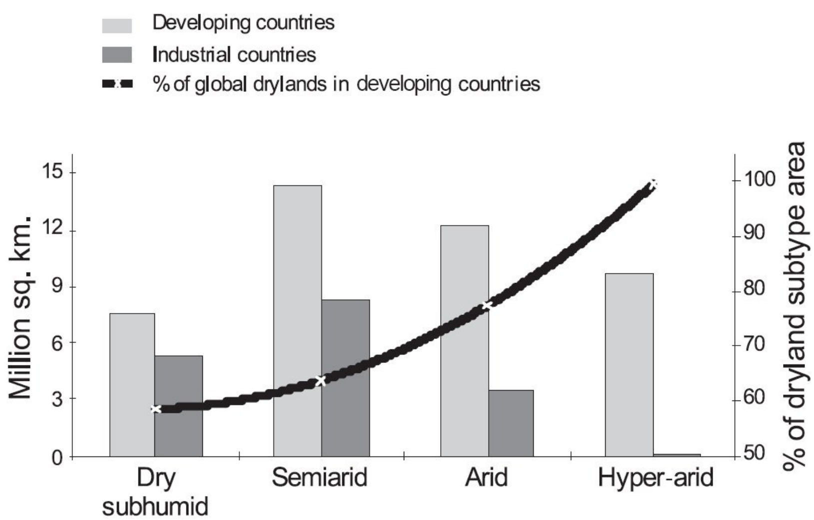

Figure 18.1 Dryland subtypes in developing and industrialized countries.

Source: Millennium Ecosystem Assessment (MA, 2005)

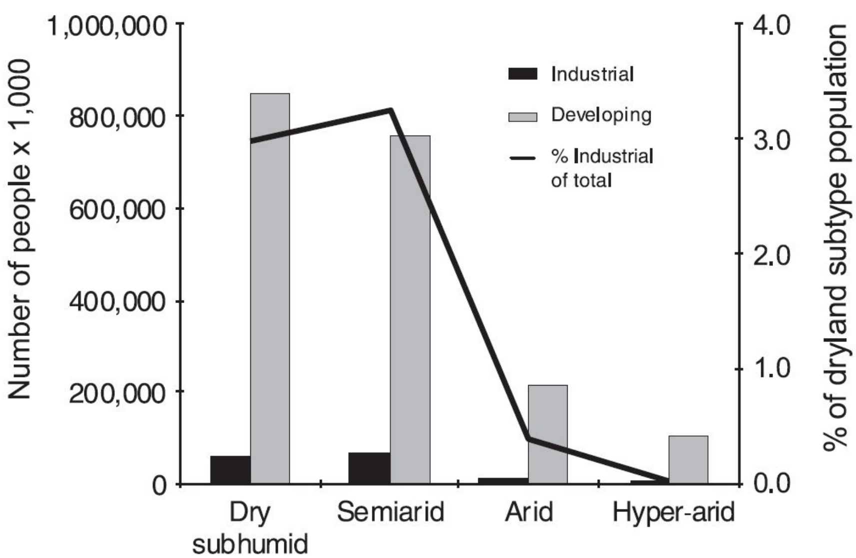

Figure 18.2 Developing and industrial country populations in different dryland subtypes.

Source: Millennium Ecosystem Assessment (MA, 2005).

Opportunity costs of LABOUR Economic Growth Trade Integration ↑			
	High	Mechanized large scale cereal production systems Or Extensive livestock systems	High value commercial agriculture
	Low	Traditional low productivity subsistence systems	Intensive cereal crop systems (green-revolution type) Or Intensive livestock systems
		Low	High
		Opportunity cost of LAND Marginal ----------------→ Favourable	

Figure 18.3 Dryland farming system types.

Endnotes

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[i] The central government started China's Sloping Land Conversion Program (SLCP) in 1999 with the goal of converting 14.67 million hectares of cropland to forests by 2010 (the largest conversion program in the developing world). 4.4 million of those hectares are also on slopes greater than 25 degrees. The project is taking place across 25 provinces in China and involves the participation of tens of millions of rural households. The total budget for the program is over US$40 billion dollars. The cash subsidy is US$36/ha per year. Subsidies are given in grain and cash and last for 8 years if forests are planted and for 5 or 2 years if harvestable forests and grasses are planted. If farmers plant trees in wasteland (baseline classified as "barren") sites, US$91/ha is given. These funds are also exempt from income taxes normally paid by farmers. The farmers will be the main beneficiaries of the potential environmental services from these activities which are watershed protection, increased productivity, and soil carbon sequestration (Bennet and Xu, 2005).

[ii] The Scolel- Te carbon project in Mexico involved 400 small scale farmers across 20 different communities. The farmers' switched from swidden agriculture to agroforestry systems that combined crops with fruit and timber trees and enriched fallow lands. The expected environmental service of these activities was forest carbon sequestration. The International Federation of Automobiles buys the carbon "offsets" (approximately 17,000tC from $10/tC to $12/tC). They purchase these carbon offsets through the Econergy International Corporation (US) and Future Forests (UK) (De Jong *et al*., 2000).

[iii] Payments for external environmental benefits for the adoption of agricultural systems which have higher private returns than existing systems is controversial in the extent to which the environmental services generated are "additional", e.g. would they have been provided even without payments for the externality? Presumably agricultural producers will choose production systems with the highest private returns, however barriers to adoption such as capital constraints, property rights or lack of information can prevent adoption. The recognition of socio-economic barriers as a part of the baseline scenario for calculating incremental environmental benefits has been recognized in some PES mechanisms however, including the CDM and GEF.

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