Economic and ecological roles of smallholder farmers and pastoralists

PROVISION OF PRODUCTS

Long overlooked, the provision of products and services by pastoralists and smallholders can be quite substantial. According to a study commissioned by the World Initiative for Sustainable Pastoralism (Rodriguez, 2008), pastoralism contributes about 8.5 percent of the gross domestic product in Uganda, 9 percent in Ethiopia, 10 percent in Mali, 20 percent in Kyrgyzstan and 30 percent in Mongolia; its contribution to the agricultural GDP of Sudan, Senegal and Niger is about 80 percent. In Ethiopia, milk produced by pastoralists makes up 65 percent of national production, not counting pastoralists' own consumption, which is estimated at 77 percent of total milk production (ibid.).

Smallholders and pastoralists not only provide food, but also hides, skins, wool, manure and transport services, and may attract tourism. Perhaps more important given the threat of climate change, they have means to use marginal areas sustainably for food production and they provide environmental services. Such contributions have been little captured in official statistics (ibid.).

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Donkeys ploughing in South Africa

SUSTAINABLE USE OF MARGINAL AREAS

Large, and possibly expanding, parts of the globe can be used for food production only by livestock that are adapted to local conditions. This includes the 41 percent of the earth's land surface that consist of tropical and subtropical drylands, mountainous and high-altitude zones, as well as some very cold areas. Grazing livestock are able to convert the local vegetation in these ecozones into food that can sustain people.

Locally adapted breeds used by small-scale livestock keepers allow people to live in some of the most inhospitable and marginal environments in the world. Across Africa, Asia, Latin America and the Near East more than 50 percent of local sheep and goat breeds, and almost all camelid and yak breeds, have been developed in, and are adapted to, drylands. The equivalent figures for local breeds of horse and cattle are around 30 percent; the figure for asses is more than 70 percent. In many species, breeds adapted to drylands also constitute a large proportion of transboundary breeds (those present in more than one country) – reflecting the particular importance of cross-border movement and exchange of breeding stocks in dryland breeds and dryland production systems (FAO, 2007c).

To be able to utilize such inhospitable areas, which are often seasonally infested with diseases, pastoralists and smallholder farmers have developed an array of strategies ranging from the use of hardy, well-adapted breeds to sophisticated herd movements and grazing strategies. Their livestock are thus a means of extracting value from uncultivable land and generating food without competing for cereals (Hoffmann *et al.*, 2008). This not only contributes considerably to food security in marginal areas but also provides products and services to the wider society. Seasonal movements optimize the use of scarce vegetation. Limiting the duration of grazing to short periods and certain times of the year allows vegetation to regrow and prevents overgrazing.

Pastoral societies often have special decision-making structures to organize their herd movements and to coordinate with neighbouring pastoral groups (see e.g. Homann, 2005). However, these traditional mechanisms are disturbed when social and agricultural development restricts herd movements (Hoffmann, 2004). Another strategy to optimize land use is daily movement of the animals to take advantage of diverse grazing sites such as hedgerows, field borders, fallow fields and crop residues (Bayer, 1990). Grazing several species with different feeding preferences together is a further way to optimize the use of scarce fodder.

Herd movements and grazing strategies not only optimize the use of scarce resources, they also reduce disease challenges. Seasonal migrations avoid areas known to be unsafe because of infestation with disease and parasites; if possible, herders use these areas only at times when challenges are perceived to be lower. Examples include the movements of West African pastoralists to avoid tsetse-infested areas (Schillhorn van Veen, 1997) and movements of Saami herders to keep their reindeer away from flies (Anderson, 1996).

Long-term contact with prevailing diseases means that many local breeds and the management practices used by their keepers are uniquely adapted to local disease challenges (McCorkle *et al.*, 2001; Gibson, 2002).

HERDERS AND THE ENVIRONMENT: AGRO-ECOSYSTEM SERVICES

Many landscapes have been shaped by traditional livestock production systems and retain their special character only as long as livestock grazing is maintained. Among these are large parts of the Near East region where sheep and goats were first domesticated about 10 000 years ago, and heathlands, calcareous grasslands, Mediterranean *maquis* and *garigue*, as well as subalpine dwarf shrubland in Europe. Some plants may disappear under grazing pressure, while others need it to thrive (Rodriguez, 2008). Many tree seeds have to be eaten by animals before they will germinate (Bayer and Waters-Bayer, 1998).

Landscapes created through the co-evolution of livestock and vegetation often resemble wilderness to outsiders, although they have long been managed by indigenous and local people. In many long-inhabited and long-utilized landscapes, the distinction between "cultivated" and "wild" biodiversity can be blurred. In fact, many societies do not make a clear distinction between "wild" and "domesticated" (Phillips and Stolton, 2008). When traditional grazing systems, especially nomadic and transhumant ones disappear, there tend to be significant losses of biodiversity. One example is community-controlled grazing on "Allmende" (common land) in the Alps of southern Germany (Scholle *et al*., 2002).

In some areas, livestock have taken over the task of providing the ecological services once provided by wild herbivores: the Eurasian landscape was shaped by large herbivores such as aurochs, wild horses and wild boar, which created an open woodland habitat. Biologically diverse open woodlands can not be maintained by mowing, only by grazing. Low-intensity livestock keeping with traditional breeds replicates the effects of extinct herbivores and supports a rich wildlife.

Although understanding of livestock's impact on the environment is only beginning to be accumulated, it is clear that good grazing management has many positive effects – stimulating pasture growth and biodiversity, promoting ecosystem health and integrity, reducing invasive species, improving mulching, and promoting mineral and water cycling.

There is growing recognition of the ecological value of the services that smallholder farmers and pastoralists provide through their livestock management (Rodriguez, 2008). European Union policies now seek to use extensive livestock production systems for landscape and nature conservation purposes, and use two avenues to maintain and strengthen them: "contracts for sustainable development" between the state and individual farmers, and support for the marketing of typical animal products originating from defined breeds, locations and technologies (Kuit and van der Meulen 1999; Rook *et al*., 2004).

Creating mosaic landscapes and mini-habitats that sustain biodiversity

Grazing creates highly diverse mosaic landscapes. In Europe, widespread and low-intensity grazing is acknowledged as a key to maintaining many habitats that harbour rare animals and plants. In Ethiopia, traditional land management by Borana pastoralists has similar effects (Bassi and Tache, 2008). In the Sava floodplain in Croatia, grazing by pigs, horses, and cattle has a variety of positive effects on biodiversity: The animals disperse seeds through their dung; rooting by pigs creates mini-habitats that allow threatened plant spe-

cies to germinate; and the depressions left in the soil by the pigs and by animals' hooves create tiny pools where amphibians can reproduce (Poschlod *et al*., 2002). The positive effect that such systems have on biodiversity contrasts with that of many high external input farming systems which have, with their machines, agrochemicals and intensive sown pastures, led to drastic declines in biodiversity (Finck *et al*., 2002).

Conservation of wildlife

The animals kept by pastoralists and smallholder farmers are often important to wildlife conservation. Relationships between domestic and wild biodiversity have rarely been studied in detail. But evicting livestock from wildlife reserves may lead to an exodus of predators, or result in habitat changes that make it unattractive for wildlife. In the Kumbalgarh Wildlife Sanctuary in Rajasthan, India, for example, leopards and wolves (for which the sanctuary was established) prey almost exclusively on the sheep and goats pastured there (Robbins and Changani, 2005). In the Gir Forest National Park and Wildlife Sanctuary in neighbouring Gujarat, Asia's last remaining lions depend on livestock for part of their diet. Expelling pastoralists from the sanctuary has induced the lions to leave as well (Casimir, 2001). And in the Bharatpur Bird Sanctuary in eastern Rajasthan, a ban on grazing by buffaloes led to the disappearance of Siberian cranes, which need an open grazed environment for nesting (Lewis, 2003).

PHOTO CREDIT: ILSE KÖHLER-ROLLEFSON

The Chilika buffalo is important for people's livelihoods and as part of the Chilika lake ecosystem in Orissa, India

Connecting ecosystems by transporting seeds

Migratory sheep flocks provide a means by which plants can move from one ecosystem to another – each animal transports thousands of seeds. Experiments in Spain (Manzano and Malo, 2006) showed that seeds attached to the fleece of transhumant sheep were transported over long distances and that substantial numbers were dispersed up to several hundred kilometres from their points of origin. With changing climates, this promises to be an important way to enable plants to move into new habitats, and thereby to prevent their extinction. A drawback is the distribution of unwanted species (ibid.). Livestock keepers sometimes make conscious efforts to disperse the seeds of preferred plants. Pastoralists in the Islamic Republic of Iran pack seeds in little bags and hang these around the necks of their sheep. During grazing the seeds drop out through little holes in the bags and are worked into to the ground by the sheep's hooves (Koocheki, 1992).

Improvement of water-holding capacity of grasslands

Well-managed grazing can also improve the water-holding capacity of grasslands by enhancing infiltration and reducing runoff (Niamir-Fuller, 1999; Sanderson *et al*., 2004). However, research on this is only beginning.

Managing landscapes and Reversing the effects of discontinued grazing

For various economic and political reasons and because of the increasing loss of agricultural land, livestock numbers on marginal lands have declined in several countries. Consequences for biodiversity are sometimes serious. In The former Yugoslav Republic of Macedonia, sheep numbers declined by 45 percent when subsidies for upland herding were eliminated; this led to an invasion by bush species and the disappearance of the natural flora. In other Mediterranean countries too, the abandonment of grazing has resulted in large areas of hills and mountains becoming covered by shrub vegetation with low biodiversity. This accumulation of woody biomass increases the risk of fires and erosion – with the accompanying environmental and economic costs (Osoro *et al*., 1999; Perrings and Walker 2003). In Germany and other European countries, the introduction of stall-feeding has changed the look of forests that used to be grazed by village livestock. In the absence of such use, blackberries and other shrubs have proliferated and prevent the rejuvenation of large forest trees.

Reintroducing grazing has become a well-established way of managing landscapes. In Germany, for example, it is supported by the Federal Nature Conservation Agency. Examples include the use of goats to control blackberry growth; sheep to keep vegetation open and maintain nesting habitats for migratory birds; and sheep, cattle and donkeys to re-establish sand-dune vegetation (Redecker *at al*., 2002). It is at present also being tested in a commercial forest to make the area accessible for tree cutters and other equipment.

While grazing for landscape and conservation purposes does not always require the use of traditional breeds from the local area, it frequently offers significant opportunities for promoting sustainable use of livestock diversity (Cole and Phillips, 2008).

PHOTO CREDIT: KARL-HEINZ RAACH

Sheep flocks have become important for landscape and biodiversity conservation in Germany

Preventing forest fires

Grazing animals control the growth of grass and undergrowth and thereby prevent forest fires – a fact recognized by livestock keepers who operate in forested areas (Raika Biocultural Protocol, 2009). Some developed countries such as the United States of America (Campbell, 1954) have experienced increased fire risk following the discontinuation of grazing. There is likely to be an increase in the deliberate use of livestock to control vegetation.

Restoring and maintaining soil fertility through manure and nutrient recycling

In many countries, there are long traditions of farmer–herder arrangements in which farmers allow pastoralists to drive their herds over harvested fields and pastures so that the animals can feed on crop residues and, in exchange, fertilize the fields with their manure (Hoffmann and Mohammed, 2004). These arrangements are becoming monetarized: in the Zamfara Reserve in northwest Nigeria, Fulani now have to pay for access to stubble grazing and crop residues, and farmers pay for manure (Hoffmann, 2004). Things are also changing in Europe: shrinking access to agricultural and common-property land and expanding infrastructure make it difficult for European pastoralists to continue their herd movements. Conversely, in some places commercial dairying has started to undergo a shift back towards grazing – taking advantage of the potential to improve nutrient cycling and reduce expenditure on chemical fertilizers (van't Hooft *et al*., 2008).