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- Livestock based livelihood and environment
- Vulnerability and adaptation to climate change
- Decentralisation and local governance

The platform provides field based knowledge through:

- Sharing documents
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## Livestock and climate change adaptation

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World over people are shifting away from sector-based to more complex approaches when dealing with development. They are now, not looking at livestock as production instruments but view them in the context of reducing vulnerabilities, increasing water use efficiency and as effective mechanism for climate change adaptation. Generally, environmentalists see livestock as contributors to global warming though its impacts are different in different contexts. In a country like India, where more than 60% of the geographical area is arid and semi-arid, livestock's contribution towards risk reduction and adaptation to climate variability is significantly higher than their negative impacts. This article analyses the contribution of livestock in climate change adaptation, especially in dry land ecosystems

### Climate change impacts

The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report (2007) indicated that many of the developing countries tend to be especially vulnerable to extreme climatic events and adverse impacts of a gradual climate change as they largely depend on climate sensitive sectors like agriculture and forestry. India has a geographic disadvantage as it is already in the warmer part of the world. Nearly two thirds of the Indian population is rural mostly living in harsh climatic regions of mountains, deserts and river deltas, which are more

susceptible to climate change. Annual rainfall in arid regions is between 100 and 400 mm and in semi-arid regions between 400 and 800 mm with a very high coefficient of variation ranging from 40 to 70%. More than 60% of the rural population in India depend on agriculture (over 60% of the crop area is rainfed), which is highly vulnerable to climate variability. Scientists report that for every 1°C rise in atmospheric temperature above 32°C, there will be 5% reduction in rice yield. The direct impact of change in climate is reported to be far worse.

### Impact on livestock

In the case of livestock, global warming and climate change are likely to impact negatively on production and health. Increase in physiological reactions at high temperatures will elevate heat loads of animals resulting into a decline in productivity of meat, wool, milk and draught power (Upadhyay, Singh and Ashutosh, 2008). Temperature increase is likely to cause a rise in animal diseases that are spread by insects and vectors. Both protozoan and viral diseases will spread in susceptible livestock populations. Some of the viral diseases may also reappear and affect small and large ruminants. Incidences of mastitis and foot diseases will increase due to the rise in temperature and humidity. Global warming will create favourable climatic conditions for the growth of causative organisms during most part of the year that will lead to spread of diseases in other seasons too.

### Animal genetic biodiversity and climate change adaptation

The Indian sub-continent is one of the most important mega biodiversity centres in the world and is gifted with a rich reservoir of genetic diversity in livestock. India has 30 well defined breeds of cattle, 40 breeds of sheep and 22 breeds of goats. The indigenous breeds have evolved over centuries through natural selection for adaptation to the harsh environment in different agro-ecological niches. Thus the evolved breeds are well adapted to the harsh climate, resistant to common tropical diseases and can subsist on poor quality feeds and scanty drinking water. The Rathi breed of cattle, for instance is highly water efficient. It can produce reasonably good amount of milk with little water and by feeding native 'sevan' grass. Rajasthan, which is predominantly a dry region, possesses 7 indigenous breeds of cattle, 8 breeds of sheep and 4 breeds of goats. For farmers in the dry lands they are important for their ability to survive, reproduce and perform optimally under sub-optimal



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management /nutrition regimes rather than for high productivity in optimal conditions. The indigenous breeds provide a buffer output in times of drought, flood and disease attacks. In the context of climate change, conservation of this livestock biodiversity assumes great significance.

### Livestock and marginal lands in India

Out of the total geographical area of 329 million ha in India, more than 40% is arid and semi-arid (called dry lands), where rainfall is less than 1000 mm and length of growing period is less than 180 days. It is estimated that in India about 410 million people live in the dry lands. It is also found that livestock is the most important single survival option for many of the people in these marginal lands, where there are no other livelihood alternatives. Livestock that is adapted to this harsh environment, where temperature can go even up to 50°C is the main livelihood option for the farmers, especially the resource poor. In Jaisalmer (Rajasthan), for instance, there have been 39 drought affected years over a span of 49 years since 1956 (Sevamandir, 2007). Livestock in these sorts of conditions act as adaptation and coping instrument to reduce shocks and vulnerabilities. The IPCC reports that climate change is likely to create more dry land, reduce irrigable land and more flood prone land in some locations. Hence, in the context of increasing climatic variability, livestock, particularly indigenous breeds of livestock can be of great use in climate change adaptation strategies.

### Livestock's contribution to environment

Livestock is an essential component of the dry land ecosystem. Grazing animals in dry lands contribute to a healthy soil through manure and seeding. It improves the soil's physical properties (porosity, water holding capacity, drainage) and its fertility (dung has high carbon : nitrogen ratio and urine is rich in 'nitrogen' and 'potassium' . Small ruminants spread the manure and urine very evenly. It is reported that a flock of 1000 sheep and goats, when spent five nights in the field can very well manure 1.32 acres of land (Pasha, 2001). After this, the field can produce well for another 6 years. This contribution is highly significant in the dry land context where little inorganic fertilizers are used. Indian animals have supplied manure, which helped fertilise Indian soils for centuries. Reports indicate that in extreme deserts, grazing of sheep and goats has increased the number of bushes, trees and grass cover (Gol, 1987). Contribution of animals in bush control is also very well documented. Goats are reported to reclaim land in saline areas by feeding on salt bushes . The complementarities between agriculturists and grazing communities result in

high water use efficiency and nutrient recycling. For instance, some of the sheep /goat herders from Rajasthan desert take their animals to the green revolution areas of Punjab during off-season for grazing and even get paid by the farmers there for penning the animals in their fields. This is an excellent example of harnessing complementarities between two agro-ecological zones for the benefit of both zones.

### 'Livestock's long shadow' - some views in variance \*\*

The livelihood contribution of livestock has been well acknowledged. But there are increasing concerns on the likely negative impacts of livestock on the environment. This is mainly on three accounts, namely: methane emission, over grazing and pollution associated with industrial production. These issues are to be viewed differently in different contexts because livestock keeping in India is not the same as in New Zealand or Australia. For instance, in India livestock contributes more to environmental sustainability in the dry land context. Whereas, livestock production under an industrial system is reported to be less efficient in terms of energy and water use and is to produce more negative environmental externalities. Almost eighty percent of milk in India is produced in integrated mixed crop-livestock farming systems. A well managed integrated crop livestock system has the potential to create a win-win situation for both farmers and the environment. However, there are two areas where livestock in India has likely negative contributions on the environment. They are: (a) methane emission and (b) degradation of common lands. These are issues that need to be addressed through technical and policy interventions (see section on 'technical and policy instruments for a win-win approach'). But valuing livestock only from one perspective (environmental) in a context where it plays many roles might lead to making expensive mistakes. This is because a preponderant number of farmers in the marginal lands in countries like India are surviving only because of livestock. In these countries livestock is kept by people not just for production but because of its multiple (livelihood, social, environmental) contributions. When there was agrarian distress in India, farmers committed suicide. But no suicides were reported in areas where livestock was prominent as there was something to fall back. Livestock is found to be positively egalitarian. Therefore a more detailed and holistic assessment is required before drawing hazardous conclusions.



### Technical and policy instruments for a win-win approach

The poor livestock keepers depend heavily on common property resources for their survival. At the same time there are few organised efforts for the development of common lands and its sustainable management. This is likely to have a negative impact on the land. This scenario is not inevitable, provided the poor are offered alternative options that will reduce their dependency on the common resources and that will regulate the use, enhance the regeneration and raises the productivity of common property resources. Therefore, any change in the status and productivity of common property resources directly influences the economy of the rural poor. Jodha (1992) rightly suggested certain key elements of such an approach. Some of them are: (1) introduction of technological investments and creation of economic incentives to conserve such resources while raising their productivity and (2) regulation of common resource use with the involvement of user groups and mobilization of a community strategy that complements state interventions with the essential participation of local people. Available experiences of successful participatory natural resource management initiatives can offer useful lessons for replication. Public funding can be used for technological investments as it results in indirect ecosystem benefits such as carbon sequestration, soil conservation and water infiltration. Different technologies are available for reducing the methane emission by ruminants like increasing dietary energy level by incorporating cereal grains or molasses, straw fortification etc. But most of the technologies are not found accepted by farmers because of various practical reasons. However, considering the role of methane in global warming, one needs to continue to do research in developing farmer friendly technologies to reduce methane emission by livestock.

### Low external input livestock production as an adaptation mechanism in marginal lands

It has been very well acknowledged that the conventional model of livestock development is not appropriate in marginal lands, where the ecosystem cannot support the input intensive and market driven production model. In such areas, instead of forcing a system depending on relatively higher amount of external inputs, one should positively discriminate and promote (e.g. through incentives) low external input based production systems that are sustainable in ecological terms. Knowledge based innovations responding to local conditions with local resources shall be promoted in such areas. Here the ecological benefits should also be accounted and rewarded while evaluating their performance.

## Promoting incentive based mechanisms for addressing climate change and biodiversity issues

Incentive for Environmental Services (IES) is an emerging concept in India. According to this, farmers are paid incentives for appropriate land use changes in order to improve the provision of environmental services such as improved water quality and availability, carbon sequestration and biodiversity conservation. The incentive has the potential to be a successful tool for ecosystem improvement and reduction of the land degradation process. Compensations for these services are meant to act as incentives to tip the balance for adopting sustainable practices. Other goods and services generated as a result of the changes in the land use system such as increased availability of fodder and fuel wood, improved land and animal productivity etc. provide direct benefits to the local community who contributes in return to the sustainability of the practices developed in private and public lands. In this context the livestock keepers in marginal lands, including the land less and migratory communities, have great scope to get actively involved in making land use changes and receive respective benefits. Incentive schemes for environmental services have already been successfully implemented in different countries. A scheme of similar nature has been implemented in two states (Himachal Pradesh and Madhya Pradesh) in India by Winrock International in association with the International Institute for Environment and Development (WII, 2006). Other examples are also available in the Indian context such as Sukhomajri model in Haryana (WII, 2006) and Barawa case in Rajasthan (Sevamandir, 2006). Lessons from these experiences can be effectively used in mainstreaming this concept.

### Key message

Indigenous livestock adapted to harsh environment and responsive to low external inputs needs to be acknowledged as essential part of sustainable development in marginal lands. This is increasingly so in the context of climate change and adaptation. Necessary (forest, watershed, livestock) policy support, governance mechanisms and technological investments are highly essential to support livestock keeping in the above context, which will contribute to sustainable development and adaptation mechanism to climatic variability.

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The Knowledge Management Platform aims at improving the access to knowledge of stakeholders in the domains of Livestock Livelihood and Environment; Local Governance and Civil Society; and Climate Change and Adaptation. Through this platform we seek to capture, analyse and consolidate evidence based lessons that can help address some of development challenges before us today.

The knowledge management platform (to be accessed through the Intercooperation India website : [www.intercooperation.org.in](http://www.intercooperation.org.in)) also houses, among other things, important links such as National Rural Employment Guarantee Act, Right to Information Act, Forest Rights Bill, National Environment Policy, India's first National Communication to UNFCCC, Poverty-well being-net, CoP on Water for Food etc.

We welcome your suggestions to improve the content of the website and the platform, which may please be sent to:

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