Livestock, Remote Mountain areas and Climate change

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Abstract

The cold areas of Asia which include the mountainous regions of Central Asia, Mongolia, China, Hindu-Kush, Karakoram and Himalayan ranges, will feel the impact of climate change and the impending fossil fuel crisis affecting their future development. A number of development options in the past have been energy and fossil fuel dependant and an energy crisis can have far reaching consequences for the poor and vulnerable in these regions. A characteristic of these cold regions are extensive pastoral livestock rearing systems. In the climate debate, livestock rearing is often viewed negatively. Traditionally though, energy obtained from livestock has played a key role but does not normally feature in modern development programmes. Successful integration of livestock into the cycle of energy and agriculture needs to be given more attention in the future. This means taking a fresh look at livestock development programmes in the regions; ways in which it supports agriculture, nutrition and feeds present and future energy demands. Critical areas are the effective use of draft animal power, effective capture of methane generated by animals for household energy requirements and the integration of animal waste into agriculture systems thereby reducing use of chemical fertilizer.

Context

The cold areas of Asia include the mountainous regions of Central Asia, Mongolia, China, Hindu-Kush, Karakoram and Himalayan ranges. The cold and harsh climate as well as the difficult terrain has made agricultural and industrial development difficult. Thus these areas are characterized by economies which are largely dependant on livestock rearing and products which emerge from livestock rearing. Extensive pastoral livestock rearing systems as well as some degree of settled livestock rearing are found in all these areas. Livestock and livestock based livelihoods contribute anywhere from upwards of 35.7 % of the total income and in certain areas even up to 80%.

Transhumant herding is common throughout this region; there are two main situations: full-time herders who follow a transhumance cycle between high pastures and lowlands throughout the year; and settled farmers, within reach of high pastures, who send their stock there in summer. The transhumance systems are similar throughout in that they are of the classical, vertical type, where stock over winter in warmer zones, the plains, foothills or the desert fringe, moving upwards as the weather warms until they reach mountain or alpine pastures in summer. Over wintering in the lowlands gives herders access both to markets and to opportunities for seasonal employment.

Species reared range from camels, yak, sheep, goat, cattle, buffalo, pig depending on the region, the community residing there and the religious preferences. Small ruminants are the basis of most systems, although the Gujjars in Pakistan and India migrate with buffalo and cattle; Camels are important in Baluchistan and Afghanistan; while the yak is more prevalent in Ladakh and parts of Nepal and Tibet. Buffalo is found in India and Nepal and essentially in lower regions where forest and rainfall are more. Cattle and yak dominate where the climate is more dry of greater altitude or arid.

Impact of Climate change on these regions

These mountainous regions are likely to feel the impact of climate change and the impending fossil fuel crisis extremely severely as many modern development options which have been energy and fossil fuel dependant will no more is possible. A number of development options in the past have been energy and fossil fuel dependant and an energy crisis can have far reaching consequences for the poor and vulnerable in these regions. For example the dairy farming model of the Indian plains which relies heavily on high inputs such as fodder, concentrates , medicines and other services being transported to the individual farms and high outputs; milk being collected and transported twice a day to a collection center is not feasible as many villages are remote and do not have access to roads. Similarly programmes which attempt to sedentarize pastoralists or introduce commercial poultry units may also fail as they are not sustainable and will not be able to with stand the effects of climate change or a fossil fuel crisis

Instead these regions will have to come up with systems which recognize the local ecology, its strengths and limitations, the natural resources within and build on these thereby decreasing the dependency on external systems. A system which relies on local livestock resources, local production systems which includes pastoral systems of livestock rearing , value addition of local resources is therefore desirable and to be advocated. This paper will touch on some of these aspects.

Climate change and livestock rearing

In the climate debate, livestock rearing is often viewed negatively. This is primarily because of the negative consequences of industrial livestock production systems. On the other hand; well designed local systems can in fact contribute positively thereby mitigating the effects of climate change in numerous ways. Some of the ways local systems become climate friendly are:

1. Local breeds of livestock and the use of draft animal power reduces demand on fossil fuels and also reduces green house gas emission.

2. Pastoral systems make use of seasonal availability of resources and thereby reduce the need for transporting inputs to area of production
3. Effective recycling of animal manure helps recycle carbon to the soil ,thereby closing the carbon cycle
4. Return of valuable bio mass to the soil ensures water retention thereby reducing risks posed by sudden periods of drought
5. By encouraging crops which require less water the need for fuel and energy driven irrigated systems. is reduced
6. Locally grown fodders crops can be are integrated into farming systems thereby reducing transportation costs.
7. Growing local crops aids local carbon sequestration
8. Local markets reduce transportation costs and thereby carbon foot prints.

Energy and Livestock rearing

The main needs of energy in cold climates are heating, cooking, agriculture, transport and lighting. Traditionally, energy obtained from livestock has played a key role in societies living in cold Himalayan mountain ranges. Animal dung has been used for cooking, heating, lighting as well as for agriculture. Animal power has been used for transport as well as for important agricultural operations. However, energy efficiency may have to be increased to make the systems more efficient and sustainable.

Energy need	**Traditional use**	**Suggested improved use**
Space Heating	Burning of animal dung cakes	1. Insulation of houses. Waste animal hair / wool may be used in plaster 2. Use of bio gas
Cooking fuel /heating water etc.	Burning of animal dung cakes	Bio gas plant which is built underground and which is covered on top by a green house
Agriculture	Draft animal power of dzo's , bullocks etc	To continue
Fertilizer	Animal dung applied to fields	To use composted animal manure or slurry from bio gas plant
Transport	Ponies, mules, yak, camel, bullocks	To continue
Lighting	Burning lamps using animal milk fat	Biogas generated energy

Biogas for cold climates

Bio gas is an effective way of recycling wastes and generating energy. Biogas units for cold climates need to be designed differently from those for hot climates as they have to enable proper fermentation and subsequent gas production. In certain areas as water also may be scarce the model designed must be as efficient as possible. The advantage of biogas is its thermal efficiency is 60% as opposed to 11% for dung cakes and 17% for fuel wood. Not only is it more efficient but it's more hygienic as wastes which can potentially lead to animal and human disease are not allowed to build up in the environment and the slurry can be used as chemical fertilizer. The two basic designs which seem to have worked in cold climates at high altitudes both have a green house to capture solar energy and aid fermentation. The Bolivian model has a tubular digester and has been used in the altiplano at 4000 meters above sea level. These digesters are kept inside a green house. The Chinese ecological courtyard model combines greenhouse, pigsty, and toilet and biogas digester. The typical structure consists of a greenhouse built in the yard, below which buried underground is the digester. A toilet in the yard is directly connected to the underground pit and wastes from the pig sty are also directly channelised into the underground pit. Thus there is no accumulation of wastes above the ground. Biogas generated is used for domestic cooking and lighting and the slurry is used to fertilize the vegetable plot in the green house.

Target group

The bio gas units are suggested for all livestock rearing communities in these cold climates both pastoral as well as settled. They can be designed at an individual level as well as at a community level depending on the situation. The gas generated can also be stored for future use. It is much cheaper to store gas than to store electricity. The cost of the Bolivian model is estimated at $150.00 (Rupees 7,500) per unit however, with appropriate design and use of local materials it may be possible to bring down the costs.

Expected Impact

Locally raised livestock and livestock products have high intrinsic social and cultural importance,. They also help conserve biological diversity .Local livestock products takes care of the immediate nutrition especially of vulnerable groups like young children, the elderly and sick. Handicrafts and by products from local produce including carpets, woolen apparel, special cheeses, leather goods have high value, items which need to be nurtured and encouraged as they provide local livelihood opportunities for many.

The environmental value of local livestock productions systems become more apparent through the energy they produce in terms of traction and draft animal power, thereby reducing the need

for fossil fuels. Local systems also effectively utilize crop residue and plant by products thereby reducing the demands on land (Mishra and Dixit 2004). Pastoral grazing has lower greenhouse gas (GHG) emissions associated with production than intensive systems (van der Nagel et al., 2003; Casey and Holden, 2005.

If livestock rearing is effectively integrated into ecological agriculture programmes the benefits can be enhanced. The systematic recycling of animal waste which is advocated in ecological agricultural programmes has two benefits a). Application of Farm yard manure reduces the use of chemical fertilizers b) biogas generated further reduces the need for fossil fuels.

By burning biogas generated this way you not only have a more efficient system as compared to burning dung cakes, methane produced in a biogas unit which is 22 times more potent than CO2 is efficiently consumed into useful domestic energy. The slurry from efficiently designed bio gas plants can be recycled into household agriculture / vegetable gardens / horticulture. Further and very importantly bio gas units prevent the accumulation of waste and thus help maintain hygiene and sanitation. Biogas also avoids smoke in the living quarters thereby leading to improved health.

Replicability

Local livestock systems are region dependant and make use of locally available resources and build on them. They are not cut and paste solutions which can be easily transplanted from one region to another. On the other hand the bio gas units have been tried in other countries and need to be further developed for these regions. To bring down costs the use of locally available material needs to be explored.

The way forward

Successful integration of livestock into the cycle of energy and agriculture needs to be given more attention in the future. This means taking a fresh look at livestock development programmes in the regions, ways in which it supports agriculture, nutrition and feeds present and future energy demands. Critical areas are the effective use of draft animal power, effective capture of methane generated by animals through well designed bio gas units for household energy requirements and the integration of animal waste into agriculture systems thereby reducing use of chemical fertilizer as energy.

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