

**Livestock-Environment Interactions in Watersheds
(LEAD): A study in semi-arid India**



International Water Management Institute, South Asia

in partnership with

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Samuha, Karnataka
Sevamandir, Rajasthan
WASSAN, Andhra Pradesh
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LEAD, FAO**

Executive Summary

1. **Background:** Watershed Development Programmes (WDPs) were conceived as tools for correcting the regional imbalances in agricultural development created by Green Revolution, through investments in soil and water conservation (SWC) and natural resource management (NRM) in rainfed areas. The WDPs have evolved from being purely technically oriented SWC programmes to more integrated and participatory programmes aiming at NRM with organisation of beneficiaries (watershed plus) and more recently targeting livelihood improvement (watershed plus plus). The overall impact of WDPs has been positive and significant, with increase in access to water, but only for better off households located in downstream areas and with access to irrigation. Landless and marginal households hardly benefited with the inequities embedded in the distribution of agricultural land being reinforced.
2. Livestock production is a major livelihood activity in most rainfed areas. In addition to providing income through animal and dairy sales, it has an important function for crop production by providing manure and draught power. Livestock makes an important contribution to the survival of the economically weaker sections especially in the ecologically fragile areas of semi-arid watersheds, small ruminants in particular playing an important role in ensuring rural livelihoods against drought.
3. Water and fodder are the most critical constraints for livestock development in semi-arid areas. Although in some cases WDPs have tried to improve biomass production on commons, in most cases livestock production has insufficiently been accounted for, missing out on important opportunities to improve the livelihood of the watershed poor. Watershed development appears to have even negatively affected livestock production due to grazing restrictions on common lands. Households dependent on small ruminants have in some cases been forced to migrate with their livestock and/or to sell it off.
4. A desk study of livestock-environment interactions (LEI) in watersheds by Mangurkar et al (2001) found support for the hypothesis that WDPs tend to change the livestock composition (numbers, proportion of different breeds and species in their total population) depending on the restrictions on access to feed/fodder resources and, quantitative and qualitative change in the types and availability of fodder. The study concluded that WDPs with integrated livestock component strongly strengthen the crop-livestock integrated mixed farming system, with a positive impact on the environment. The study supported the premise that introduction of practices such as stall feeding, prohibited access to grazing resources and declining traditional arrangements in WDPs do influence the promotion of natural regeneration, but tend to adversely affect the livelihoods of the resource-poor livestock owners. Lack of appropriate policies and approaches, adequate poverty focus and convergence of related sectors in NRM programmes are limiting the promotion and effective utilisation of positive LEI.
5. As a follow up to the Mangurkar study, the International Water Management Institute undertook together with five NGO partners (Sampark, Samuha, Sevamandir, WASSAN

and WOTR) and with the support of CALPI/SDC and LEAD-FAO, a study (hereafter referred to as the LEAD study) to identify, research and document livestock-environment-livelihood interactions in five watersheds in semi-arid India. The LEAD study focused on the interlinkages between livestock production, resource endowment and market conditions, in addition to the management of resources and policy environment.

6. **Objectives:** The specific objectives of the study were to improve the knowledge base on the following relationships at the core of the livestock-environment-watershed triad:
 - Livelihood dependence on livestock in watersheds, specifically related to income strategies and intra-household and gendered allocation of resources
 - Biophysical interactions among water, land and vegetation in watersheds, particularly as these relate to livestock systems (type, duration and intensity are crucial)
 - Potential for increasing the poverty reduction impacts of livestock through intensification of watershed resource use, and the relationship with off-farm and off-watershed livelihood support strategies
 - Use, access, and management of common property in watersheds (actual vs. potential) and the relationship with private resources, particularly as related to water and rainfall input for productive purposes
 - Socio-economic and biophysical inter-linkages as determinants of watershed and farm productivity and environmental sustainability
 - Watershed context—specifically rural-urban dynamics, markets, credit, capacity building, and institutional arrangements—and its role in enhancing or limiting the poverty impacts of livestock-environment interactions
7. **Data and Methods:** The LEAD-India Research study was conducted in five meso-scale watershed sites (Kosgi, Vaiju Babulgaon, Kanakanala, Kalyanpur and Ladki nadi) which provide a representative sample of the broad diversity of semi arid areas of India, located in five states and each covering an area between 3,500- 13,000 ha. Criteria for site selection were relative resource scarcity and economic integration, resource scarcity being estimated by average rainfall and economic integration by location and market access. Besides, these watersheds also differ with respect to implementing partnership arrangements (GO, NGO, GO-NGO, NGO-CBO) and, focus of their watershed development projects (SWC/ NRM/ NRM &SRM/ Livelihoods). In all five sites, investments were made by non-governmental and governmental organisations in SWC, reforestation, horticulture development and rainwater harvesting. Apart from Kosgi watershed, where investments mainly focused on horticulture development, tank maintenance and groundwater recharge, in most sites some investments were made to increase biomass availability through reforestation, pasture development and plantation of road sides, nala beds and bunds.
8. Hydrological and land use analysis employing GIS/RS techniques has been used to explore the biophysical characteristics in relation to livestock management practices. For the socioeconomic and institutional assessments, primary information regarding livestock and livelihood patterns, resource management and institutions was collected at the village/hamlet level in all the watersheds through focused PRAs and key informant interviews. These qualitative data were ranked by the partner organisations, using the

methodological framework provided by Quantified Participatory Analysis (QPA). Household level data was collected from a sample of 200 households in each watershed through questionnaire surveys and statistically analysed.

9. **Major findings:** The biophysical robustness or natural resource endowment of the watersheds as defined here provides good understanding of the potential for crop/livestock production. The way the resources are managed, the access to the markets and other such opportunities are of utmost importance in the assessment of the watershed robustness and production potential. The watershed with medium robustness had the most intensive livestock production system, as its good organization and management system enables to cope with the low rainfall pattern better. By protecting the forest, reducing access, implementing soil and water conservations structures, the watershed robustness is increased. The watershed development works have proved to have a positive impact on the environment. A combination of both the rainfall and external linkages as criteria to assess the livestock production potential gave good results.
10. 82% of the households in the study watersheds hold livestock with the livestock densities, especially that of small ruminants, being higher in more arid area. The data show that the distribution of large ruminant holding is more unequal and correlated to landholding size than the distribution of small ruminants.
11. In the watersheds with higher robustness and market access, livestock production is more intensive with dairy enterprise taking a prime place. But in watershed (Kosgi) where irrigation development is better, there is less reliance on livestock production for a livelihood. Where irrigation is not developed (Vaju) dairy production with crossbred animals and stall-feeding with strong external dependence for feeds, fodder and supplements is the major livelihood option. However, this watershed in times of drought faces severe feed/fodder shortages and the cattle camps organized by the government help them tide through these times, but there is very high mortality and sales of animals to cope with the situation making the production unsustainable and risky. In watersheds where both robustness and market access are not favourable, small ruminant production is the major livelihood activity. Dependence on bullocks for draught power is high in all watersheds except Kosgi (higher mechanization due to irrigated cash crop farming) as also the importance of manure.
12. The correlation between the biophysical robustness of the watershed and the intensity of the livestock reared is positive at 76% and stronger with the density of large ruminants than with the density of small ruminants. The results show that aridity is not a limiting factor towards livestock rearing and that it increases the dependence of the communities on the livestock production. However, a very strong positive correlation (98.8%) is found between the availability of biomass/vegetative cover and livestock intensity. The correlation is higher between availability of biomass and the density of large ruminants than between the availability of biomass and the density of small ruminant, corroborating the fact that small ruminants can survive in harsher conditions and are the preferred species in case of drought or arid conditions.

13. Land ownership is an important determinant of livestock holding in all the watersheds, although it differs whether it is irrigated land holding, fallow land or a combination of factors that is more important. The total income is a positive determinant of livestock ownership (more the income, more is the livestock), whereas the proportion of non-farm income (labour, migration) affects livestock holding in a negative way. The number of household members is a positive determinant of livestock holding. For the marginal farms, the mortality of the animals plays a significant role. Higher the incidence of deaths, more is the number of animals they would like to hold. In more arid watersheds, the extent of fallow lands or lands available for grazing plays an important role for the marginal and small farms. The hypothesis that small ruminant holders tend to be the poorer households is supported by the analysis: the more income the household has, the less small ruminants it is likely to own. Also, if the household has less than the average watershed income, the small ruminant holding is increased. Interestingly, the implementation of watershed development and involvement of an NGO are negative determinants for small ruminant holding.
14. While non-livestock owners earn 81% of their income from non-farm sources, for livestock owners only 43% of total income comes from off-farm labor and migration. But households dependent solely on small ruminants tend to be worse off: 80% of these households earn an income below the average of the watershed they are in.
15. With high value livestock production for the market, higher is the market dependence on inputs for livestock production. Subsistence farmers tend to spend much less on their livestock and all the feed needs to come from the watershed itself. In about 58% of the villages, no fodder is cultivated. In some villages of Vaiju Babulgaon, substantial seasonal fodder cultivation is reported due to high awareness regarding livestock and milk business and therefore extensive use of green fodder from farms. Crop residues are very critical in all watersheds and in case of non-availability of crop residues, farmers sell their livestock. Their importance has been increasing due to reduction in forests and grazing lands. In about 30% of the villages, some farmers report an improvement in crop residue availability due to increased crop production as a result of yield improvements, which are attributed to employment of improved agricultural techniques and access to irrigation. In the watersheds with irrigation development, a decline is reported due to the increasing cultivation of cash crops. Higher usage of pesticides is perceived to have resulted in deterioration in quality.
16. The differences between watersheds in local natural resource management are large. Common lands are managed in only 5 of the 26 study villages, with no management in more than half of the cases where common lands exist. Encroachment is a serious problem. Only in 9 villages do any grazing restrictions apply, but only in half of these villages are the rules and regulations actually enforced. In most of the villages, grazing lands are used as an open access resource, with no control on the intensity of use.
17. In some of the LEAD study villages some significant investments in community resource management were made, whereas in others either no watershed development was undertaken or investments in local resource management were superficial and non-participatory. In the study watersheds, in all NGO villages local institutions for NRM

like watershed committees and forest committees were established, whereas in non-NGO villages few NRM organizations seem to function in an effective way. Investing in institution building however does not necessarily result in sustainable resource management over time. The community's perceptions revealed that more than 50% feel that local NRM is poor. Only in 20-25% of the villages are land, water and biomass resources apparently managed in a sustainable way. In 90% of the villages the role of the Panchayat Raj Institutions (PRI) in NRM was said to be non-effective, most panchayats seeing their role in natural resource management as small. The forest department plays a more active role in natural resource management, where forest lands exist. Typically, the relationship between villagers and the forest department is strained with the forest departments hesitantly permitting villagers to co-manage and develop forest lands for use. Even where communities invest in plantations and biomass development, the user rights of these newly created assets are not secure. The insecurity of user rights is refraining villagers from investing in biomass enhancement.

18. In the LEAD study sites explicit attention to livestock production has only been paid in Ladki Nadi, through breed improvement, vaccination and fodder cultivation. However, in the other sites except for Kosgi watershed, the programs have indirectly benefited livestock production through investments for biomass enhancement and NRM. Livestock camps have been organized and fodder purchases facilitated in times of drought. However, the main focus of most NRM interventions and investments in biomass production has not been increased livestock productivity, but rehabilitation of the degraded resource base. Livestock producer organizations, which are few, have not explicitly been involved in watershed planning and implementation.
19. Across the watersheds, the proportion of households that feels able to influence village level decision making increases with landholding size bringing in questions of equity in the participatory processes and consequently their sustainability. Participation in village organizations seems less defined by landholding size, with small landowning households being most strongly represented across the watersheds.
20. **Suggested interventions:** The specific interventions and improvements that would be useful for optimising the positive benefits and minimizing the negative impact of watershed development on livestock and vice versa are listed below. These interventions or improvements can be at various levels – policy or operational and implementation procedures (administrative instruments) or in terms of awareness, training and capacity building:
 - One of the most important issues that seriously hampers livestock and watershed development is that coordination among various government departments that work in related fields and between government and NGOs is not strong enough for a holistic development policy for an area to be adopted. The list of government departments itself is long enough (water resources, agriculture, animal husbandry, forests, panchayati raj, rural development etc) and achieving effective coordination between all of them at the field level, middle level and the top levels is a challenge. Only through such coordination will it be possible to include the crucial dimensions of livelihood dependence of poor on the livestock sector and the value of livestock

- assets in poverty reduction (especially small ruminants) in the watershed development strategy of the Government.
- The importance of common property resources and pasturelands, for sustainable livestock activity in watersheds needs to be emphasised. From the watershed point of view the degradation of land due to overgrazing and other reasons needs to be seriously addressed and there is a need for greater policy directions and ground-level interventions for controlled grazing and community management of common and revenue lands with clear usufruct rights regarding investments in biomass. The problem of encroachment is more complex, but various options for addressing this problem need to be explored as in low input-low output livestock production systems, CPRs play an important role.
 - On a related note the problem of shortage of fodder and feed because of an inadequate fodder policy is another aspect that needs attention. Emphasis needs to be placed on developing CPRs. There is also a need for assessment and inclusion of livestock fodder needs in forestry projects.
 - Treatment in resource scarce watersheds may introduce tradeoff between livestock and crop development, between upstream and downstream users, or between free grazing and stall-fed livestock. Long term sustainability of natural resources and livelihood assets like livestock must be given a priority while planning watershed development programmes.
 - The importance of draught animals for marginal farming has been neglected in India. Despite increasing mechanisation of traction, electrification of pumps and post harvest operations, draught animals still provide most of the power for marginal and small farmers in many semi arid areas. A clear policy needs to be worked out for draught animals in areas where their use is still extensive.
 - The government it seems has also not made too much effort to organise the livestock owners into user, self-help or beneficiary groups. Some organisations at district level do exist but there is a need to take them down to the watershed/ panchayat level for the livestock owners in semi arid areas to have a strong voice in the local decision making process. Also being organised will allow the livestock owners to take advantage of institutional support, like credit etc.
 - Facilitate market linkages through watershed based/other institutions so that the livestock production enterprises become more viable and profitable.
 - Assess livestock drinking water needs and incorporate livestock watering ponds/ points into the design.
 - Delineate clear methodologies for action planning, good field examples of practice, resource material and appropriate administrative procedures – planning, monitoring etc.