The University of Reading

School of Agriculture, Policy and Development
Department of International and Rural Development

Developing supportive policy environments for improved land management strategies - Nepal

Working Paper 3:

'Field-level Land Management Technologies in Nepal Hill Regions'

B. Regmi and A. Subedi (LI-BIRD)

B.P. Tripathi (LUMLE ARS)

October 2002

Funded by the Department for International Development
Natural Resources Systems Programme [R7958]

CONTENTS

GLOSSARY

Bari	Rainfed unbunded land
Bhir	Uncultivated steep slopes with big rocks
DADO	District Agricultural development Officer
DAP	Di-ammonium phosphate
FGD	Focus groups discussion
FYM	Farmyard manure
GO	Government organisation
ICIMOD	Integrated
Khet	Lowland with bunded terraces
LARS	Lumle Agricultural Research Station
NARC	Nepal Agricultural Research Council
NGO	Non-government organisation
Pakho	Uncultivated barren land
PDDP	Particpatory District Development Programme
PRA	Participatory Rural Appraisal
SALT	Sloping Agricultural Land Technology
SAPPROS	Support Activities for Poor Producers of Nepal
SSMP	Sustainable Soil Management Programme
VDC	Village Development Committee

1. FIELD VALIDATION OF IDENTIFIED SOIL FERTILITY MANAGEMENT TECHNOLOGIES

Background

Many hillside areas have characteristics that make them particularly vulnerable to poverty. These include their inaccessibility, fragility and marginality. At the same time high population densities, land fragmentation, encroachment onto increasingly marginal areas, unfavourable land tenure, poverty and often lack of exposure to appropriate natural resource management techniques threaten sustainability and existing livelihoods[1] (Ellis-Jones and Mason, 1999).

Agriculture is often an important source of livelihood for most people living in hillsides areas, especially in Nepal, where cropping systems are primarily based on the use of organic manure, with livestock, forest and corps being the three major interlined components of the system.

There have been many efforts in finding ways of sustaining soil productivity in the past. In the past, most of the research conducted by government and private sector has focused on trials especially on research stations and on farmers field. Despite some success, adoption rates of these technologies have been problematic. At the same time there are many soil management and fertility enhancing management options available to farmers, some of which are regularly used, others may be less appropriate under certain circumstances.

Land management strategies (LMS) hold the key to improving the sustainability of local farming systems in the hills of Nepal and in turn contribute to poverty alleviation among households in food deficit and with little access to non-farm livelihoods. Many improved LMS have been developed and validated at field, community and landscape levels through pervious on-farm participatory research. However, LMS innovations have often not spread beyond the locality in which they were developed.

This database of soil management practices, drawn from existing literature and field validation provides a framework from which biophysical and socio-economic factors affecting soil management can be examined. It has been prepared using data sources, which includes variety of soil fertility management options available for different circumstances as well as the biophysical and socio-economic constraints to their adoption.

Furthermore, the database contributes towards and improved understanding of biophysical and socio-economic factors (and their interrelationships) affecting the adaptability of sustainable soil fertility management strategies in hillside systems.

Methodology

The technologies adopted/adapted by farmers and which are successful locally, and potentially applicable to a wider scale were identified. These technologies include: Farmyard manure, chemical fertiliser application, legume in crop rotation and modified sloping agriculture land technology (SALT). On the basis of research findings and success stores, the sites where the mentioned technologies have been successful under different socio economic and geophysical circumstances were identified (Table 1).

[1] Ellis-Jones J., B.P. Tripathi, and R. Mattews (2001) 'Soil fertility enhancing technologies for hillside regions: A database of soil management options'. Joint publication of NARC and SRI, Cranfield University, UK.

PRA tools, especially focus group discussion (FGD), were used in validation process. FGD was done with farmers, based on gender and livelihood categories, to establish socio-economic factors influencing demand, decision-making processes and constraints to adoption of strategies identified. The research team through village tour further verified the findings. Village tour was seen very relevant in observing the biophysical and socio-economic environment about the site. The final findings from FGD were compiled by the research team.

Table 1. Successful LMS Sites

LMS Number	Successful Technologies	Successfully adopted sites	Potential study sites (Non-intervention sites)
1	FYM and Compost Manuring	All ecological zones (Chambas, Lower Pakuwa, Upper Pakuwa and Bhakimle)	Bhanu VDC, Tanahu District Shankar Pokharai VDC, Parbat District Pang VDC, Parbat District Baraumja VDC, Myagdi District
2	Chemical Fertiliser	All ecological Zones (Chambas, Lower Pakuwa, Upper Pakuwa and Bhakimle)	Bhanu VDC, Tanahu District Shankar Pokharai VDC, Parbat District Pang VDC, Parbat District Baraumja VDC, Myagdi District
3	Legume in Crop Rotation	In Rainfed Upland Maize based System (Chambas, Lower Pakuwa, Upper Pakuwa and Bhakimle)	Bhanu VDC, Tanahu District Shankar Pokharai VDC, Parbat District Pang VDC, Parbat District Baraumja VDC, Myagdi District
4	Modified SALT Technology	ICIMOD-NARC Sites (Chitwan) and LI-BIRD site (Palpa)	Kusumkhola VDC, Palpa Abunkhaireni VDC, Tanahu

Limitations

Due to country's political situation, researchers were forced to limit their staying days in the village and some communities did find difficulties in disclosing some relevant information. Site Descriptions

1. Low and High Hill Site (1a Lower and 1b Upper Pakuwa)

Biophysical Situation

Lower Pakuwa **(1a)** and Upper Pakuwa **(1b)** are located in Pakuwa village Development Committee (V.D.C), ward number 1,2,5,6 and 7 of Parbat district at an altitude ranging from 800-1000m asl. The climate of the site is sub-tropical, monsoon starts from may and continues upto September with 83% annual rainfall. The dry season lasts from November to May. The highest temperature will be during April to June with January to February as the highest Minimum temperature.

The land types commonly known as khet (lowland, bunded terraces, Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land) and Bhir (Uncultivated steep slopes with big rocks). The total cultivated land is 972 ha, of which khet land covers 526 ha and bari land covers 446 ha. Average land holding of bari and khet land are 2 and 2.4 ha respectively. Out of total cultivated land only 22% is fully irrigated. Soil type of the site ranges from black to brown soil in khet land with low phosphorus, potassium and organic matter content. Whereas, brown to light red

colour soil is found in bari land with low phosphorus, organic and potassium content and strong acidic pH.

Socio-economic Condition

Lower Pakuwa can be reached within half an hour from the road head whereas one hour is needed for reaching Upper Pakuwa. Both sites have improved trail. Pakuwa has a mixed ethnic composition of 233 households, out of which, 88, 68, 59, and are occupational castes, Brahmin, Chhetri, and Thakuri, respectively. The dominant ethnic group is Brahmin. Out of total population 75 individuals can at least read and write. 50 individuals have secondary education. Overall the education status of the site seems to be satisfactory.

Rice, maize, millet, wheat and potato are the major crops grown in their area. Rice, maize and millet are the subsequent food ingredients. Cabbage, cauliflower, radish, potato, broad leaf mustard, pea, garlic and onion are common vegetables grown in winter season whereas, cucumber, sponse gourd, bottle gourd, brinjal, tomato and okra are grown in summer season. The major sources of income are on-farm (cereal, livestock) and off-farm sources (service, pension, prist work and others).

Khet and Bari lands are privately owned, whereas Pakho and Bhir lands are covered by forests and owned by the community. Most of the farmers are owner-cultivators and only very few families have migrated from the village and have leased out their land. The dominant cropping patterns on khet lands are rice-wheat-fallow, rice-potato-spring season maize, rice-vegetable-fallow, and rice-vegetable-spring season maize. In Bari land farmers grow maize/millet-fallow, maize/millet-mustard-fallow, maize/ginger-fallow and maize/potato-cow pea. Wheat, potato, onion, garlic and some vegetables were not cultivated in the past. The cropping pattern changed as these crops were introduced in the area.

Buffalo, goat, cattle are the most important animals raised by the farmers. Many farmers of both sites (lower and upper Pakuwa) sell milk and other livestock products in nearby market. Farmers fulfill their animal feed from their own domestic sources. Fodder and ground grasses are the most common animal feed used by farmers. Common fodder species are Raikhanim, badahar, kavro and tejpatta.

Both the sites do not have electricity and telephone services but there is drinking water facility in both the sites. Various social organizations are located in the sites. These include VDC office, Agriculture and livestock service center, Health Center, Schools, Community Forestry User group, environmental awareness groups, and farmers group. There are other support organizations like Lumle Agriculture Research Station and PDDP. The existing organizations have been contributing in the field of agriculture and rural development.

Existing Soil fertility management technologies (Lower Pakuwa)

a) Use of farmyard Manure- The production system in lower Pakuwa is traditionally sustained by combining animal manure and organic residues from the arable forest areas. The availability of fodder and grazing land has put less pressure on farmers to adopt other alternatives. In the past, the sufficient amount of available fodder and grazing land has stimulated the rearing of livestock. Another factor was population. The low population in the past has put less pressure on farmers so, farmyard manure was in sufficient supply and accepted to be the best means of soil fertility management. As time passes on, the increased population and decreasing forest and grazing land and recently the concept of community forestry has put a lot of pressure on farmers land use techniques. Thus farmers did not have choice rather they were forced to intensify their cropping patterns and seek for alternatives like chemical fertiliser and so on. Farmers used a large portion of farmyard manure in their crops and they still prefer this despite the use of chemical fertiliser. Hence, the old saying, *"Where there is farmyard manure, production is double"*.

b) Use of Compost Manure (Plastic cover technology)- Use of compost manuring was not the traditional use despite some of the farmers used the forest litter and organic residues since many years. The use of Plastic in compost manuring has recently been popular among many farmers. The initial impact shows the positive response of farmers towards this technology. The efficiency and quality of this system was an additional milestone to make this technology successful. This technology has been popular beyond the research farmers and community.

c) Use of Chemical Fertiliser- Use of chemical fertiliser was the recent development in cropping system. The introduction of wheat and new crops has been one of the major factors for its adoption. Farmers have not preferred chemical fertiliser before but population pressure, decreasing forest and grazing land, and need for higher production has forced farmers in adoption of this technology. Farmers compared this technology to be higher productive oriented in the short run but say that this can not sustain the production in the future. Farmers use Urea and DAP and sometimes Potash as fertiliser. The use of fertiliser is still not in balanced way. Farmers are even convinced that the use of chemical fertiliser increased soil acidity and also replaces local variety of crops.

d) Green Manuring – Some farmers practiced the use of green manuring. The use of Dhaincha was common. It was mixed with soil to make soil fertile. Farmers left practicing this technology due to lack of seedlings.

Initiation and adoption process

Lumle Agriculture Research Centre has introduced the use of plastic technology for composting, green manuring technology and very little about the use of chemical fertiliser. But in case of chemical fertiliser, farmers themselves initiated its use. Due to Lumle's intervention in some farmers' fields, other farmers realized the possibility in the technology of plastic cover and crop improvement was very effective and supportive. So, quite a large number of farmers adopted the technologies.

Reasons behind Adoption (What was wrong in the past technology?)

As the time passed, population in the area increased and due to its consequence grazing land and forestland decreased and remaining forest is now turned to community forestry. The overall impact was severe because the livestock population decreased which directly affected the production of farmyard manure. Furthermore, the introduction of new variety of crops like wheat and other vegetables put pressure on farmer to intensify their cropping pattern. As a result, adoption of chemical fertiliser and compost manuring (use of plastic cover) was evident.

Existing Soil fertility management technologies (Upper Pakuwa)

a) Use of FarmYard Manure- Similar instances was also seen in case of upper Pakuwa. The use of farmyard manure was traditionally adopted by most of the farmers of upper Pakuwa. The availability of fodder and grazing land has put less pressure on farmer to adopt other alternatives. The sufficient amount of available fodder and grazing land has stimulated in rearing larger number of livestock. The low population in the past has put less pressure on farmer so, farmyard manure was sufficient and the best used manure for soil fertility management. As time passes on, the increased population and decreasing forest and grazing land and recently the concept of community forestry has put a lot of pressure on farmers land use techniques. Thus, farmers did not have choice rather they were forced to intensify their cropping patterns and seek for alternatives like chemical fertiliser and so on. Farmers still prefer using farmyard manure despite the use of chemical fertiliser.

b) Use of Compost Manure (Plastic cover technology)- Use of leaf litter and farmers have traditionally used crop residue but the use of Plastic in compost manuring has recently been popular among many farmers. The initial signal shows the positive response of farmers towards

this technology. The efficiency and quality of this system made this technology successful. This technology has been popular beyond the research farmers and community.

c) Use of Chemical Fertiliser- The use of chemical fertiliser was adopted by farmers since the introduction of wheat and potato. At first, farmers used chemical fertiliser in wheat and latter they used in other crops. The introduction of wheat is due to the fact that farmers in lower Pakuwa adopted it first so, farmers copied that technology and adopted latter. Yet, the use of chemical fertiliser was not promoted by any organizations. The use was even haphazard but later when Lumle worked in their site, they were properly instructed in its use. Farmers mainly use Potash for Potato and Urea and DAP for wheat and rice. They also use Dosbane/malathene for insecticide. Farmers say that they still prefer Farmyard manures but when crop is not good they use chemical fertiliser.

d) Use of legume in crop rotation- this practice is also traditional one but no organization has ever worked on this. The commonly used legume crops like bhatmas, bodi, maas etc. are planted along the terrace risers or Kanla. Farmers' version is that "We use for our own consumption but we do not have any idea about its importance in technical prospective as well as we have not conceptualised it practically".

e) Use of Banmara as green manuring – Some farmers have used banmara for green manuring but not continued latter because they said that they really did not find it significant in crop production.

Initiation and Adoption Process

LARS intervention in some farmers farm was the starting point for other farmers to see the relevance and adopt it latter. Most of the farmers were interested in the activities of the research farmers and adopted those innovations.

Reasons behind adoption (what was wrong in the past technologies)

1. Population boom- Population kept pressure on farmer to intensify their land use pattern so, new technologies were adopted by farmers.
2. Limited land for production- Land limitation is also another factor for farmer to seek for alternative technologies. Farmer has no choice but to adopt new innovations that are of high yielding value crops.
3. Acute shortage of animal feed- decrease in forage and fodder has ultimately created problems with rearing larger number of animal population.
4. Low amount of Farmyard manure- Farmyard manure was not sufficient in the place as livestock number decreased.

2. Bhakimle (High Mountain)

Biophysical Situation

Bhakimle is located in Bhakimle Village Development Committee (V.D.C) ward number 3, 4 and 5 of Myagdi district at an altitude of 1680m asl. The climate of the site is mild temperature, monsoon starts from June and continues upto October with 60% annual rainfall. The dry season lasts from November to May. The highest temperature is during June with January to February as the lowest minimum temperature.

The land types are commonly known as Flat and khet (lowland, bunded terraces, Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land), forest land and Bhir (Uncultivated steep slopes with big rocks). The total cultivated land is 250 ha, of which Flat khet land covers 127

ha, forest land covers 170 ha and bari land covers 80 ha. Out of total cultivated land, partial irrigated land is 53 ha and fully irrigated land is 170 ha. Overall soil color is black to brown. The available phosphorus is medium to high, organic matter content low to medium, potassium content medium-high, nitrogen content low and pH strong acidic.

Socio-economic Condition

Bhakimle can be reached within 4 hours trek from the headquarters of Myagdi district i.e. Beni bazar. Bhakimle has mixed ethnic composition of 145 households, out of which, 84, 9, 3, and 4 are Magar, Chhetri, Occupational caste and others. The dominant ethnic group is Magar. Out of total population 90% of population can at least read and write. But very few numbers of households have a college degree.

Rice, maize, millet, wheat and potato, soybean and barley are the major crops grown in the area. Rice, maize and millet are the subsequent food ingredients. Cabbage, cauliflower, radish, broad leaf mustard, pea, garlic and onion are common vegetables grown in winter season whereas, cucumber, sponse gourd, chayote, bottle gourd, brinjal, tomato and okra are grown in summer season.

The major sources of income are on-farm (cereal, livestock) and off-farm sources (service, pension, others). Higher percentage of male members is working in foreign countries like Middle East and south Asian countries. Most of the farmers are owner cultivator and only very few families have migrated from the village so they have given their land in lessee. Khet and Bari lands are privately owned, whereas Pakho and Bhir lands are covered by forests and owned by the community.

The dominant patterns of khet lands are rice-wheat-Fallow (66%), rice-potato-vegetables (13%), rice-tori-vegetable (4%), and rice-fallow (17%). In Bari land farmers grow maize/millet-fallow (55%), maize-potato-wheat (7%), Maize-Soyabean-Tori (16%), Potato-Backwheat/Mustard (11%) and Maize + Legume-Fallow (11%). Wheat, potato, onion, garlic and some vegetables were not cultivated in the past. The process of cultivation changed as these crops were introduced in the area. In the past farmers have not used improved types of varieties but nowadays farmers have been using improved variety of crops in rice, wheat, maize, potato, fingermillet and rayo. Mostly the intervention was from organization like Lumle Agriculture Research station and Seed Support Service Programme.

Cattle, Buffalo, chicken, sheep, goat, duck and rabbit are the most important animals raised by the farmers. Many farmers of site sell livestock products in nearby market. Farmers fulfill their animal feed from their own domestic sources. Major livestock feeds include rice, straw, maize husk, maize stover, millet straw, wheat straw, fodder trees (bamboo, dudhilo, khanim, chuletro, bains etc.) and seasonal forage grasses.

Both the sites do not have electricity and telephone services. There is drinking water facility in both the sites. Due to high economic status of many farmers solar panel is commonly used as electric substitute. Various social organizations are located in the sites. These includes VDC office, Health post, post office, high school, Rani Pandhera Seed Production Women Group, Bhakbhake farmers group etc. There are other organizations like Lumle Agriculture Research Station and SSMP working in agriculture related research and development.

Existing Soil fertility management technologies

a) Use of farmyard Manure- The use of farmyard manure was traditionally adopted by most of the farmers of Bhakimle. Similar circumstances were observed in this site too. In the past, the availability of fodder and grazing land has put less pressure on farmers to adopt other alternatives. The sufficient amount of available fodder and grazing land has stimulated in rearing

larger number of livestock. Another factor was population. The low population in the past has put less pressure on farmer so, farmyard manure was sufficient and the best used manure for soil fertility management.

As time passed on, the increased population and decreasing forest and grazing land and recently the concept of community forestry has put a lot of pressure on farmers land use techniques. Thus farmers did not have choice rather they were forced to intensify their cropping patterns and seek for alternatives like chemical fertiliser and so on. Farmer used a large portion of farmyard manure in their crops and they still prefer this despite the use of chemical fertiliser. Farmers have the tradition of taking the FYM and dumping in the bari before ploughing the field. They are aware that the longer time they expose FYM in the ground, more will be the nutrient loss.

b) Use of Compost Manure (Plastic cover technology)- Use of compost manuring was not the traditional use despite some of the farmers used since many years. The use of Plastic in compost manuring has recently been popular among many farmers. Farmers are very excited and enthusiastic about the preliminary success of the technology. This technology has been popular beyond the research farmers and community too.

c) Use of Chemical Fertiliser- Farmers have been recently using chemical fertiliser in their field. The process of adoption of chemical fertiliser has been triggered by the fact that production was not sufficient before. Now farmers say that introducing soil fertility related technologies, their production has doubled and now they have problem to export maize and millet. The use of chemical fertiliser has been beneficial in the production point of view but according to the farmer, use of these fertilisers destroy soil composition and make the environment more harsh and they expressed that they want to prioritise in the use of farmyard manure and compost more than chemical fertiliser. The most commonly used chemical fertiliser was Urea and DAP. Farmers use these fertilisers in corn and millet. Farmers have even complained that the use of chemical fertiliser destroyed the legume crops like gahat, sayaltung, junelo and bhango (which are in critical stage of replacement).

d) Use of Legumes in Crop rotation- Although farmers have been unknowingly using various legumes in cropping system, they have not conceptualise its importance and neither they have formally used as a basis of fertility management. Lumle has now technically supported them in terms of legume crop management for the improvement of soil fertility. The indigenous practice of uprooting the legume crop during harvesting has been now changed to harvesting only stem above ground and leaving the root and bottom part of shoot to decay. Farmers now knew the importance of leaving the portion of plant in the field and the importance of the crop residue in supply of Nitrogen to the soil.

e) Use of livestock- Farmers usually uses their livestock as a means of fertility enhancement. They take their livestock and keep in the field for some time. According to them the use of livestock to some extent add nutrients to the soil.

f) Use of other methods like burning of weeds in the field and control of sky rain were also among the methods used by farmers as soil fertility management strategies.

Initiation and Adoption

For traditional technologies like FYM and green manuring, farmers have learned from their ancestors or forefathers. Modern technology like plastic cover for composting was introduced by Lumle similar with the use of legume in crop rotation. Farmers themselves initiated the use of chemical fertiliser. But the cropping system and its modernization was promoted by other organizations like LARS, SSMP etc. Diffusion Process in case of chemical fertiliser is on farmer to farmer basis (organizations acted as catalyst). In case of other technologies related to crop

production, plastic in composting and legume crops, ordinary farmers have observed and heard the success stories from research farmers and adopted it latter.

Reasons behind adoption

1. Low production (past technology is not sufficient for higher production – due to the fact that farmers used to buy products from neighbouring villages. A system of bartering was prevalent in the area before).
2. Population as a factor- now the demand for higher production is relatively increased despite the fact that the land is decreasing.
3. Farmyard manure alone is not sufficient for crop production.
4. Some farmers adopted technology and benefited so it was also starting point for others to adopt.
5. Lumle and other organization intervened so, it was more favourable for farmers transformation.

3. River Basin Site (CHAMBAS)

Biophysical situation

Chambas is located in Bhanu Village Development Committee (V.D.C.) ward number 6 and 7 of Tanahun district at an altitude ranging from 440-550m asl. The nearest market is Turture and motorable road to Lamjung District Headquarter passes through this site. Therefore, this site is easily accessible for all agricultural inputs. The climate of the site is sub-tropical monsoon starts from May and continues up to September with 80% annual rainfall. The dry season lasts from October to April. Maximum hailstone occurs during early monsoon (April-May).

The land types commonly known are khet (lowland, bunded terraces), Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land) and Bhir (uncultivated steep slopes with big rocks). The total cultivated land is about 47.4 ha, of which Bari land covers 32.2 ha and Khet land is 14.2 ha. An average land holding is 0.2 ha Khet and 0.4 ha Bari per family. Besides, there is about 8 ha of public forestland. Out of total cultivated khetland, 10% is fully irrigated and 90% is partially irrigated.

Socio-economic Condition

Chambas has mixed ethnic composition of 83 households, out of which, 31, 13, 11 and 28 households are Tamang, Chetri, Brahmin and others (Newars and Occupational Castes). The major occupational caste is Ironsmith (kami), who helps for making and maintaining iron-works. Newars migrated from Purkot to run their business.

On the basis of food sufficiency level, three wealth groups (food surplus, food sufficiency and food deficit) are available in the area. Food surplus group is defined as those who have enough production to support their families for the entire year and have even surplus foodstuff for selling. Food sufficient farmers are defined as those, who have sufficient food production available for at least 6-12 months per year. Food deficit farmers are those, who have limited access to food for less than 6 months a year from their own production. Out of 83 households, 38 households belong to the food surplus group, 29 households to food sufficient group and 26 households to food deficit group.

Rice and maize are the most commonly consumed staple foods. Rice is the major food item among the food surplus group throughout the year, whereas the composition of rice, maize, and millet are the subsequent food ingredients of food sufficient and deficit groups. Blackgram is the most commonly consumed legumes followed by cowpea, soybean and pigeon pea. Cauliflower, broad leaf mustard, radish, garlic and pumpkin are the common vegetables. The habit of

consumption of vegetables is the highest among food surplus farmers and decreases with reduction of food self-sufficiency because of unavailability of adequate and suitable lands for growing vegetables. Similar are the patterns of consumption of livestock products (milk, curd, ghee and meat).

The major sources of income are on-farm (cereal, livestock) and off-farm sources (service and pension priest work and occupational works). Cereal is the main source of income among all the food self-sufficiency groups. Food deficit farmers are involved in other sources of income (labour and business). The major items of expenditure include food, clothing, education, health care, agriculture inputs, festivals, rituals, social expenditure, etc. The literacy increases with self-sufficiency groups.

Women are involved in different types of farming chores such as grain storage, drying, transplanting of rice, maize sowing, legume plantation, millet transplanting, wheat sowing, kitchen gardening, weeding, harvesting, field manuring, fodder collecting and forage for the animals, cleaning and animal feeding, chicken rearing, etc., except ploughing the land.

The Khet and Bari lands are privately owned, whereas Pakho and Bhir lands are covered by forests and owned by the community. Other wastelands and river areas are owned by the government. The dominant patterns of the Khet lands are rice-potato-maize, rice-wheat-maize, rice-vegetable-maize and rice-fallow-fallow. In Bari land farmers grow maize, upland rice and black gram. Maize-black gram-fallow and upland rice-black gram-fallow is the predominant cropping patterns of Bari land.

Buffaloes and bullocks are the most important animals raised by the farmers. The other animals are goat, pig, rabbit and fowl, which are raised mainly for selling to local as well as other domestic market. Demand of milk and eggs are fulfilled by the production of their own, whereas 25% meat demand is fulfilled from outside. Main livestock feed are rice straw, maize stalk, maize husk, thinned plants of maize, millet straw, wheat straw, fodder trees, forest grasses, etc. There is no common grazing land available at the site. Animals are either stall-fed or taken to Pakho and Bhir lands for grazing. The fodder is collected from private lands and community forests. In addition to dry and green fodder, lactating buffaloes are sometimes fed concentrated feed, oil cakes, rice bran, maize flour and wheat flour mixed with water.

There is acute shortage of water for irrigation in Tar land (ancient river basin). The southwestern part is fully covered by the public forest. Almost 85% of the fuel woods were supplied from public forests and the rest 15% was met from private forests or from trees on the farm near the homestead.

An agricultural service and livestock service centres are located at Sepabagaincha (Balbhanjyang VDC) which is located at 2.5 km walking distance. A sub-health post has been established at Khahare (Bhanu-1 VDC) in 2052. Lack of irrigation is the most serious problem of the farmers. In case of livestock, both small and large ruminants have food and mouth disease (FMD), parasite, infertility, mastitis in buffalo, white diarrhea in fowl and fodder and forage scarcity in winter and summer.

Existing Soil Fertility Management Technologies

a) Use of FarmYard Manure – This is traditionally being used by farmers. This system is very common in Chambas and all farmers use this system. Farmers still regard Farmyard manure as the most suitable manure for the soil and crop. Due to decrease in forest, grazing land and livestock population, farmers looked for alternatives to combine FYM with other fertilisers.

b) Use of compost manuring- in the past, some farmers started to use compost manure but this was not the common practice among majority farmers. Lumle's intervention in compost

manuring has encouraged farmers to use plastic cover technology for composting. Farmers regard the use of plastic as the best innovation. Some of the farmers have already tried using plastic and it is spreading in a very quick manner. Plastic cover was regarded as very effective and efficient technology with less input from farmers and farmers even expressed that it is easier to rot, good for earlier production (use) and of quality.

c) Use of Legumes- The use of legumes was very common in the area but the method of use was new. The farmers perceived Lumle's intervention in the proper use of legumes in crop rotation as very positive technology for soil fertility management. Farmers have already abandoned their previous method of uprooting the legume plants during harvesting instead they now cut the shoot and leave root in the field. This method of leaving roots in the land is of additional fertilization process. Farmers have already tried this technique and have reported that it is good for soil because it was observed that during ploughing the soil becomes lighter and the production was increased. Farmers use legume crops like Maas, bhatmaas, bodi, etc.

d) Use of lime- Farmers has even adopted using lime in their field in place of chemical fertiliser. Lumle has introduced this technology. Farmers who have adopted this technique expressed that the use of lime is better than the use of chemical fertiliser.

e) Use of Chemical Fertiliser- Farmers have been using chemical fertiliser since 2029. The introduction of wheat is a major factor in the usage of chemical fertiliser. Individual farmers went to cooperatives and bought some fertilisers and it then speeded rapidly to other farmers. Farmers now regard the use of chemical fertiliser as necessity. According to them, chemical fertiliser is necessary for top dressing. Another reason for farmers to adopt this technology is production. Chemical fertiliser like Urea and DAP are commonly used in tori, rice and wheat. Farmers used to apply chemical fertiliser in haphazard way before but since LARS intervened they now know the proper method of using. Farmers still perceive that FYM is better than chemical fertiliser and they have already experienced some negative impact of chemical fertiliser like they said that it destroys the quality of soil, it is difficulty to tillage and the soil compaction is very hard. Farmers even complained that the production is only short term and they observed the decrease in production in their Pakho bari.

f) Use of Asuro as fertility enhancing method- Some farmers have even used asuro as manure which they mixed in the soil and according to them, it adds additional nutrients to the soil.

g) Use of improved variety of crops- Since Lumle's intervention, farmers have been using improved variety of crops. Farmers use local variety of rice in bari but use improved variety in khet. Similarly, development institutions have introduced variety of vegetables and even organized training and tour for farmers and these seems to have positive impact on soil. New vegetables like onion, garlic, cabbage, cauliflower, radish, tomato have been introduced. Farmers have commercialised these products in small scale.

Initiation and Adoption

For traditional technologies like FYM and even with the initial use of chemical fertiliser farmers have initiated themselves. Modern technology like plastic cover for composting was introduced by Lumle similar with the use of legume in crop rotation. The use of chemical fertiliser was initiated by farmers themselves but the proper method of use was demonstrated by Lumle. Furthermore, Lumle promoted the cropping system and its modernization.

Diffusion of the technology was farmer to farmer basis (organizations acted as catalyst) in case of chemical fertiliser but incase of other technologies related to crop production, plastic in composting and legume crops, trial farmers acted as catalyst to disseminate their success to other farmers and other farmers through observation adopted the technology.

Reasons behind adoption

1. Low production; past technology was not sufficient for higher production.
2. Population is also a factor- now the demand for higher production is relatively increased despite the fact that the land is decreasing.
3. Farmyard manure alone is not sufficient for crop production.
4. Some farmers adopted technology and benefited so it was also starting point for others.
5. Lumle and other organization intervened so, it was more favourable for transformation.
6. Farmers field visit and training advantages.

4. Sloping Agriculture Land Technology Area (Paireni)

Bio-physical characteristics

Paireni is located in Chandibhanjayang Village Development Committee (VDC), ward number 9 of Chitawan district. The area lies in northern facing aspect with more than 30 to 40% slopes. Altitude ranging from about 300 m asl to about 350m asl. The annual mean rainfall is 2000 mm. The nearest market is Mugling bazaar, which is just ten minutes drive from the place. Furthermore, the place is just above the highway and Trisuli river. The climate of the site is sub-tropical, monsoon starts from May and continues upto mid September. Dry season starts from October to April.

The soil types in Paireni ranges from loamy to sandy loam. Since the land was previously under shifting cultivation, soil fertility status of soil is very low. Gravel soil is also evident in the place with higher susceptibility to soil erosion. There are mainly two types of cultivated land found in the area. The upland (rainfed cultivated land, unbunded terraces) where maize is the base crop is commonly known as *bari* or *Pakho bari.* Another type of land is commonly known as *kharbari* (steep slope with less fertile marginal land) where farmers grow grasses as thatching materials for household construction as well as used as a forage grass for livestock's. Bari land comprises of 85%, 5% Kharbari and rest is forestland.

Socio-economic Condition

Paireni has multi-ethnic communities consisting of 2 ethnic groups i.e Gurung and Chettri. The total household in the area is 20 in which both ethnic groups are of equal number. The settlement pattern of the village is quiet scattered. Majority of household members can at least read and write. Since the place is very accessible, smaller children have alot of opportunity to study. The health status of family members is average. The transportation advantage has provided some exposure to the farmers.

Agriculture is the main occupation in the area. Besides, some people have gone to abroad for work. People highly depend upon agriculture products for survival. People have 5 month of food deficit. Majorities of households are owner cultivators. The average land holding is 8 ha per family. Maize is the main crop grown in the *bari* land. Major cropping patterns in bari land are as follows:

a) Maize-Millet- Fallow
b) Maize-Millet-Potato
c) Maize-vegetables- winter maize

Major crops grown in the area are maize, millet, potato, tori etc. Vegetables include broad beans, pumpkin, brinjals, chilli, lady's finger, mustard broad leaf mustard, cucumber, sponge gourd etc. Buffaloes, cattle, goat, pig and chicken are the most common animal kept by the community

people. Main livestock feeds are maize husk, rice straw, maize stalk, millet straw, wheat straw, fodder and forage grasses, etc. Buffaloes are kept in stall-feeding system where as goat and others are kept in both stall-feeding as well as grazing systems.

Fodder is collected from their private lands as well as from the nearest forest. Every household has large number of fodder trees. Major species includes: Tanki, Badahar, Kimbu, Kutmero, Harro and Barro. Various trees are also found in the area like Ipil-Ipil, eucalyptus, Teak, Siris, Simal etc. Grasses like Napier, seteria, asuro, babiyo etc are also evident in the area.

Irrigation depends upon the rainfall during the season. B*ari land* is totally rainfed. Due to some programmes by SAPPROS, farmer has a good supply of drinking water for whole day. This water appears to be sufficient for the kitchen gardening or even more if they build water reserve tank to reserve the water.

The farming at Paireni is largely subsistence based and contributes quite a small proportion of the cash income of the villagers. On-farm sources contribute a small amount in cash income for the farming households. Off-farm sources are also very limited in the area. The major source of cash income comes from livestock products and vegetables. Paireni is very accessible and one can use any means of transportation to reach there. Vehicle passes through the place and takes only 10 minutes from Mugling bazar. Thire is no any electricity in the area.

There are some local groups in the area. Siddhadevi Mahila Samuha is one women group that is very active in the area. The group is established by the initiation of SAPPROS. There is also a youth club in the area. SAPPROS field office, ICIMOD and NARC trial support office are located in the village. ICIMOD and NARC have introduced- SALT 1-4 technology (3 plots- 3 replications- 1 demonstration [bio-fencing]) in the area. SAPPROS is working for livelihood support of communities like vegetable production and other development oriented works.

Sloping Land Related Technologies adopted by Farmers

a) Use of hedgerow technology- the area was under shifting cultivation before 2027 but after that the government scheme forced the farmers to change their farming system, they started to settle in a place and do regular farming activities. The population growth and need for production forced farmers to intensify their cropping pattern. Farmers have not used hedgerow technology before but since ICIMOD and NARC established trial plots in the area, now they have been slowly adopting this technology. In hedgerows they plant Ipil-Ipil, Teak, Bhatmase and Siris. According to farmers, the use of hedgerows does not have any constraint. Only early plantation can be problematic but after it is established it will be good. Shading is only a negative aspect of this technology. Farmers perceive that the use of hedgerow species will add nitrogen to soil and enrich soil, control soil erosion, increases production as well as can be good for livestock feed too. According to farmer, intervention has increased net production and soil is stabilized. But farmers do not use hedgerow in bari land because of shading problem.

b) Use of Legumes like bhatmas, bodi etc.- Farmers have been using these legumes and said that it adds nitrogen to the soil.

c) Use of farmyard manure- since livestock is an integral part of farming system, farmyard manure is traditionally used as home manure and they really give priority to this.

d) Use of chemical fertiliser- The use of chemical fertiliser is very rare. Farmers use only in fewer amounts.

e) Use of Stone barriers – Use of stone barriers was only the sloping land related technology that farmers have adopted since generations. It was commonly used before the

introduction of hedgerow technology. Farmers also reported that they used fodder trees in the terrace risers or at the end of fields to protect soil erosion.

Initiation and Adoption process

ICIMOD and NARC did the initiation in the use of hedgerow technology in sloping land. Regarding other fertility related technology agencies like SAPPROS and a local Club from Naranghat have intervened. Adoption Process occurred in farmer-to-farmer basis. The success stories were shared by research farmer to others and other farmers observed and verified the technology and later adopted it.

Reasons behind adoption

1. Low production (past technology is not sufficient in meeting production demand).
2. Erosion problem- the land that farmers are cultivating has been under threat of soil erosion.
3. Research intervention- Organizations intervention in the site has stimulated the interest of farmers in adopting the diffused technology.

5. SALT Area (Nayatola, Palpa)

Bio-Physical condition

Nayatola (Ward no.4 and 5) village is located in Kusumkhola Village Development Committee (VDC) of Palpa district. The area is extended between 27^{o} 50.899' N latitude and 83^{o} 26.977' E longitude. Altitude ranging from 1000 m asl to 1500m asl. The annual mean rainfall is 1591mm (mean over three years from 1997-1999). The nearest market is Kusumkhola and Harthok in the way to Tansen by motorable road. The climate of the site is sub-tropical, monsoon starts from May and continues upto mid September with about 1591mm per year. In winter season, rainfall is very low and uncertain. Dry season starts from October to April. Heavy wind blow occurs in the month of February and March.

There are mainly two types of cultivated land found in the area. The upland (rainfed cultivated land, unbunded terraces) where maize is the base crop is commonly known as *bari* or *Pakho bari.* In the other hand, low land (bunded terraces with seasonal or year round irrigation facilities to cultivate rice) is called as *khet.* Another type of land is commonly known as *kharbari* (steep slope with less fertile marginal land) where farmers grow grasses as thatching materials for household construction as well as used as a forage grass for livestock's. Bari land comprises of 75%, Khet land comprises of 10% and Kharbari is of 15% *(Source: Synthesis of the findings of PRA conducted at Nayatola by LI-BIRD).*

Socio-economic Condition

Nayatola has multi-ethnic communities consisting of 5 ethnic groups/castes. The total households in the area is 68 in which Magar is the single most dominant ethnic group comprising of 54 households followed by Chhetri (6 households), B.K (5 hoseholds), Brahamin (2 households) and Damai (one household).

Participating farmers work out three wealth categories during the PRA session. Farmer themselves set criteria for ranking the farmers in different categories. Major criteria are Land holdings, Cash generation, Pension, Job, livestock rearing etc. 68 farmers falls in three different categories. 11 households fall in the A category that is Rich, 27 households fall in the B category that is Medium and 30 households fall in the C category that is Poor. People who fall on category A have food sufficient from their own production, where as B & C categorical households have food deficit of 3-6 months and more than 6 months respectively. This figure is rough estimation

provided by the people during the PRA survey and food sufficiency up to this level is only from their own production.

Maize is the main crop grown in the *bari* land and rice is another staple crop grown in the *khet* land. Major cropping patterns in bari land are as follows:

- Maize+Ricebean+Cowpeas+Beans+Pumpkins+Cucumber-Wheat+Mustard or Rape+/or Peas
- Maize+Cowpea+Beans+Soyabean-Wheat+Mustard or Rape+/or Peas
- Maize+Ricebean+Cowpea+Beans+pumpkin+cucumber-Barley or naked barley=/or Peas
- Maize/Fingermillet-wheat or barley+mustardor rape+/or peas
- Maize+beans+cowpea-Lentilor potato or broad beans or chick pea or peas
- Maize+ginger or taro or turmeric-fallow

Cropping patterns in khet land are:

a. Normal rice*-Wheat-Fallow

b. Normal rice*-Barley-Fallow

Broad-beans, pumpkin, brinjals, chilli, lady's finger, mustard broad leaf mustard, cucumber, sponge gourd, cauliflower, cabbage, bitter gourd, radish, garlic, potato etc. are the common vegetables grown in the area for family consumption level where as Mandarin and pears are grown for commercial purpose by almost all the households. Guava, peach, lime, lemon, banana, and plums are also commonly available fruits in the area. A large number of farmers are growing ginger as a cash crop.

Buffaloes, cattle, goat, pig and chicken are the most common animal kept by the community people. Only the Magars and B.K ethnic group keep pigs. Most of the family sell the male goat (khhasi) as a cash-generating source where as few farmers are also selling milk and its product in the market as cash income. Main livestock feeds are maize husk, rice straw, maize stalk, millet straw, wheat straw, fodder and forage grasses, etc. Buffaloes are stall-feeding where as others are both stall and grazing systems. Lactating animals are also provided with concentrated feed, rice bran, maize and wheat flour, oil cakes, sometimes-even rice is fed to them. Ox is used as a draft power for ploughing the field.

Fodder is collected from their private lands as well as from the nearest forest. Every household has large number of fodder trees. Major species includes: Khari, Khanuim, Kutmiro, Fosro, Nimaro, Dabdabe, Pakhuri, Kavro, kimbu etc. Farmers are also growing improved grass like Seteria, Napier etc.

Irrigation depends upon the rainfall during the season. *Khet* land has rainy season irrigation system where as *bari* is totally rainfed. In winter season, irrigation is a major problem due to low rainfall and no other source of irrigation supplement. Farmer has a good supply of drinking water for whole day. This water appears to be sufficient for the kitchen gardening or even more if they build water reserve tank to reserve the water.

The farming at Nayatola is largely subsistence based and contributes quite a small proportion of the cash income of the villagers. On-farm sources contribute a small amount in cash income for the farming households. Off-farm sources are also very limited in the area. The major source of cash income comes from working in India. It is reported that, at least one member of majority of the households work in India. Few farmers also have a source of pension (Retired army) as a cash income.

Jeep and buses are the means of transportation. Vehicle passes through Tansen to Kusmkhola (17 kms) by grabbled road and takes around 45 minutes. The national greet network of Nepal Electricity Authority is connected in the area but only few people have connected the line in their home. One health care center (private) is in kusumkhola and health post is in khasauli, which is just 2.5 kms. There is one primary school in the village, and for higher studies, villagers have to go Kusumkhola which is about half an hour walking distance.

There are three local groups or samuha. Out of those, two are women groups (Mahila Jagrity Aaya Arjan Samuha and Kalika Mahila Aaya Arjan Samuha). The group is operating a saving and credit programme. On the other hand, the male farmers in the locality operate Chandika Aaya Arjan Samuha. There is one youth club known as Laligurans yuba club. Agriculture service center and Livestock service center are located in Harthok of Khasauli VDC (about 4 kms from the village). But, Agriculture Research Station, Lumle and Local Initiatives for Biodiversity Research and Development (LI-BIRD) also assist the farmers in that area providing the technical support in agricultural sector.

Soil Fertility Related Technologies Adopted by Farmers

a) Use of improved soil and water conservation strategy- farmers are now using the hedgerow cropping method in their sloping land. LI-BIRD and LARS introduced the technology. The technology was new in the place since farmers have not used hedgerow species before in their sloping land. The hedgerow consist mainly of leguminous species that combine multiple crops like fodder, grasses, cash crops and other economic value crops. The technology is being very popular but it is too early to predict its impact. The initial signal shows that promising results will come in near future.

b) Use of farmyard manure- the application of FYM is the main means of manuring *bari* land. It is applied to *bari* land only during maize planting. FYM is not applied in winter crop as well as *khet* land. Generally, FYM heaped for the whole year near the animal shed, and before maize sowing it is carried in the *bari* land and spread on the field.

c) Use of Legume and chemical fertiliser -farmers in the area also reported that they use legume crops because it enhances the soil fertility. Chemical fertiliser is not applied in the *bari* land. A small quantity is, however, applied by some farmers in *khet* land especially for the rice crop fertiliser like Urea is immediately after weeding.

d) Other technologies – the flooding of khet land with bhal is one method used by farmers for enhancing soil fertility. Farmers also burn the weeds and crop residues before sowing the crop. Diversion of excessive rainwater is also another method adopted by farmers for fertility enhancement.

Initiation and Adoption process

LI-BIRD in collaboration with Lumle initiated the project in 1999. Some farmers were selected for the purpose of research on use of hedgerow technology.

Table 2. Summary of factors predisposing towards and constraints on adoption of LMS technologies in field sites

LMS Site No.	Factors Responsible for adoption of new technology	Indicators of Success in the Technology	Constraints on the adoption process	Expectations of Farmer
1a	Population growth Land shrinkage Decrease in livestock number Low quantity of FYM availability Research interventions (introduction of improved variety/technology) Adoption of new crops and varieties	High production Community interest and awareness Exploration of new techniques and varieties Irrigation facility Existing community level organizations Education status Economic status	Reasons for Legumes not in Use Less Pakho bari No research and extension activities Farmers are not aware	Need more support in introducing new technologies and varieties ADO must support farmers. More action-based research is needed.
1b	Support from various organizations like Lumle, PDDP, etc. Fodder deficit Production demand Land shrinkage	Higher rate of farmers adoption Farmers positive attitude and awareness Motivated farmers High production Growth of organizations Existing irrigation facilities High economic status of farmers High education level of communities	local variety is disappearing more labor intensive more high input attack of insect pest and diseases The use of chemical fertiliser has negative impact on soil High cost of plastic technology	DADO has not contributed in any kind Supporting organization has only concentrated on research work but no extension activities were prioritized. Need more support (not only for target communities but also should be for other farmers too).
2	Need for higher Production Population boom Support from organizations Motivation and awareness among farmers Existence of community organizations Livestock number declined so with lower FYM	Higher production – Farmers now have a problem with market because they now have sufficient amount of millet and corn that is surplus. But it is not the case of rice because farmers do not have enough Khet so, they need to buy from market or nearby. More organized and motivated women group- the success lies in the establishment of women group. The members of the women group are very motivated, aware and enthusiastic. The cooperation among members' shows that they are all committed to make changes in their livelihood. Education- all the female members of community can at least read and write. They all have taken adult education classes (praud education). Economic status- most of the community members have their family member working abroad so, they all are quiet good in terms of income status. This is also an important factor for adoption. Experimental site- Many organizations including the district level GO's are interested in the community and the technology the community is adopting. They have regarded this as demonstration village. Good irrigation facility – at least for some months community members have 3a good source of irrigation.		
4	Need for higher Production Population boom	Higher production – Farmers now have variety of crops and vegetables and the production has also increased.	Irrigation problem No telephone and post	

	Support from organizations especially LARS Motivation and awareness among farmers Existence of community organizations Livestock number declined so with lower production of FYM Training and field visits	More organized and motivated farmers group. The success lies in the establishment of farmers group. The members of group are very motivated, aware and enthusiastic. Accessibility – The area is accessible and Dumre-Besisahar highway has intersected the village so farmers have every sort of facilities and communication with outsiders. Education is also another factor. At least majority of the population can read and write. Economic status- most of the community members have their family member working abroad so, they all are quiet good in terms of income status. This is also an important factor for adoption. Experimental site- Many organizations including the district level GO's are interested in the community and the technology that the community is adopting. They have regarded the site as demonstration village. Farmers exposure to technological interventions- Farmers have got enough opportunity to visit successful trials, farmers practices and got a lot of training regarding improved technologies.	office Quiet far from the district headquarter Low male labor in the village
5	Production Support from organizations Motivation and awareness among farmers Existence of community organizations Training and field visits Success of research trials (impact)	Production – farmers now have variety of crops and vegetables and the production has also increased. Erosion control- due to adoption of the hedgerow technology, farmers have observed that the soil loss is checked. More organized and motivated group- the success lies in the establishment of farmers group. The members of the group are very motivated, aware and enthusiastic. The cooperation among members shows that they are all concerned with their livelihood. Accessibility – the area is accessible and Mugling-Narayanghat highway has intersected the village so farmers have every sort of facilities and communication with outsiders. Education is also another factor. At least majority of the population can read and write. Experimental site- many organizations and groups visited the site and appreciated farmers' effort.	Some farmers do not want to take risk Unwillingness to spend time. Highly technical and low incentives.
6	Good technology for making terraces. Biomass from the hedge can used as a fodder for the livestock Controls the soil erosion Enhance the soil fertility due to leguminous plant Surface runoff controls that ultimately control the manure washed out.	Farmers are now using legume species in hedgerow. Farmers have perceived that the technology is low-input but highly beneficial. The multiple uses of hedgerow species in soil fertility enhancement, fodder supply and in control of soil erosion.	

2. PRELIMINARY INFORMATION ABOUT NON-INTERVENTION SITES

The information regarding the intervention sites (where the technology is not adopted) which have socio-economic as well as geo-physical settings almost similar with the successful LMS site was collected. The preliminary idea was constructed before identification of specific locations. The preliminary information was collected by interacting with officials in the District Agriculture Development Office (DADO).

People of the intervention sites were also consulted during the information gathering due to the fact that those communities might have more information since it is their neighboring village. Among the consulted communities, women were given priority since some belong to the place. The District Agriculture Development Offices (DADOs) did not provide detailed information about the sites so, all information were based on communities version and literature reviewed.

1. River Basin (Bhansar VDC- Ward Nos. 6 & 7)

Biophysical situation

The newly identified site is located in Bhansar village Development Committee (V.D.C.) ward number 6 and 7 of Tanahun district at an altitude of 500m asl. The nearest market is Turture and motorable road to Lamjung District Headquarter passes through this site. Therefore, this site is easily accessible for all agricultural inputs. The climate of the site is sub-tropical with 80% annual rainfall. The land types are commonly known are khet (lowland, bunded terraces), Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land) and Bhir (uncultivated steep slopes with big rocks).

Socio-economic Condition

Brahmin, Chetri, Newar, Gururng and Magar are the major caste group found in the area. Around 21.5 percent of the male population are illiterate whereas more than 39.1 percent of female members do not have school education. The site has relatively low education level.

Population distribution of the site

Ward No	Male	Female	Total
6	733	868	1601
7	454	567	1021

Rice and maize are the most commonly consumed staple foods. Rice is the major food item among the food surplus group throughout the year, whereas the composition of rice, maize, and millet are the subsequent food ingredients of food sufficient and deficit groups. Mustard, radish, garlic and pumpkin are the common vegetables. Similar are the patterns of consumption of livestock products (milk, curd, ghee and meat).

The major sources of income are on-farm (cereal, livestock) and off-farm sources (service and pension priest work and occupational works. The dominant patterns of the Khet land are rice-potato-maize, rice-weat-maize, rice-vegetable-maize and rice-fallow-fallow. In Bari land farmers grow maize, upland rice and blackgram. Maize-blackgram-fallow and upland rice-blackgram-fallow is the predominant cropping patterns of bari land. Buffaloes and bullocks are the most important animals raised by the farmers. The other animals are goat, pig, rabbit and fowl, which are raised mainly for selling to local as well as other domestic market.

2. SALT Area (Duwabesi and Purbabesi)

Biophysical situation

The newly identified site is located in Abukhaireni Village Development Committee (V.D.C.) ward number 9 of Tanahun district at an altitude of 300m to 500m asl. The nearest market is Mugling bazaar, which takes only half an hour from the place. Therefore, this site is easily accessible.

The climate of the site is sub-tropical with 30-40% slope. The area lies in southern facing slopes. The land types commonly known are Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land), Bhir (uncultivated steep slopes with big rocks) and most abundantly khoria (sloping land).

Socio-economic information

There are all together 19 households in the area. Purbabesi has 10 households and duwabesi has 9. In Purbabesi all Gurung communities are recorded whereas 6 Kami and 3 Gurung ethnic groups are found in Duwabesi. Almost one third of the population are illiterate. But the trend of sending children to school has recently been increased.

Maize, blackgram and millet are the common crops grown in the area. Fruit trees include guava, citrus and lemon. Fodder trees like khanu, dabdabe, gidari, badahar and tanki are also found. Farmers also depend on wild foods in their deficit period. They go and collect githa, bhaykur and sisno for their survival. Communities can only sustain 6 months a year by their crops. Remaining period they depend upon wage labor and selling of their farm and livestock products like chicken, goat etc. Cropping pattern includes; Maize-blackgram – fallow (Regular cropping pattern) and Maize-Til/Millet- fallow. Shifting cultivation is prevalent in the area. Farmers practice three years of cultivation practice and leave fallow. Slash and burn is also prevalent in the region. Little has been done in conservation of soil. Farmers plant grasses and use of stone barriers for the purpose.

There are some local organizations in the area. Ama samuha and water user group is some of the organizations prevalent in the area. Red Cross has supported in drinking water schemes but other organization has not reached there yet.

3. High Mountain (BARAUMJA)

Bio-physical Situation

The identified site is located in Baraumja village Development Committee (V.D.C.) ward number 8 of Myagdi district at an altitude of 1500 m asl. It takes 4-5 hours trek from the district headquarters i.e. Beni bazar. The climate of the site is semi-temperate. The area lies in northern facing slopes. The land types commonly known are Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land), Bhir (uncultivated steep slopes with big rocks), and communal owned forest.

Socio-economic Condition

Baraumja has mixed ethnic composition. The dominant ethnic group is Magar. I.e. 95% and 2% Brahmin chetri and 3% schedule caste. Out of total population only 40% of population can at least read and write. But very few numbers of household members have a college degree. Very few social organizations are located in the site. These include VDC office, Health post, post office, high school, women Group etc.

Rice, maize, millet, wheat, potato, soybean and barley are the major crops grown in the area. Rice, maize and millet are the subsequent food ingredients. Cabbage, radish, broad leaf mustard, and pea are some common vegetables grown in winter season whereas, cucumber, sponse

gourd, chayote, bottle gourd, brinjal, tomato and okra are grown in summer season. As Bhakimle, the major sources of income are on-farm (cereal, livestock) and off-farm sources (service, pension,others). Higher percentage of male members is working in foreign countries like Middle East and south Asian countries. Most of the farmers are owner cultivator. Khet and Bari lands are privately owned, whereas Pakho and Bhir lands are covered by forests and owned by the community.

The dominant patterns of khet lands are rice-wheat-fallow, rice-potato-vegetables, rice-tori-vegetable, and rice-fallow. In bari land farmers grow maize/millet-fallow, and maize-potato-wheat. Cattle, Buffalo, chicken, sheep, and goat, are the most important animals raised by farmers. Many farmers of site sell livestock products in nearby market. Farmers fulfill their animal feed from their own domestic sources. Major livestock feeds include rice, straw, maize husk, maize stover, millet straw, fodder trees (bamboo, dudhilo, khanim, chuletro, bains etc.) and seasonal forage grasses.

4. Low Hill (PANG)

Bio-physical situation

The explored area lies in ward number 1 and 2 of Pang village development (VDC) of Parbat district. The place is very accessible. It takes about 5-30 minutes from Kushma bazaar to the site. The climate of the area is sub-tropical with an altitude ranging from 600m to 800m asl. The soil types of the area are red soil and clay with low pH and relatively acidic in nature. The vegetation includes a larger portion of Sal forest with some mixed forest of Schima and Castonopsis.

Socio-economic Situation

Out of the population, around 95% are Brahmin and 5% are other occupational castes. About 65% of population can at least read and write. There is one high school and one primary school in the area. The major occupation in the area is farming. Besides, some people have other occupation like service, abroad work, business etc.

The major crops grown in the area are rice, wheat, millet, maize and potato. Vegetables are also grown in the area. People do not have sufficient production for their consumption so, they substitute the deficit months with other incomes like selling the livestock products etc. The cropping pattern is similar with lower Pakuwa. In Khet, rice-wheat and maize is grown whereas in bari land maize-millet-fallow/pea is grown. Fertiliser application is based entirely on fresh farmyard manure but since the area is very accessible to the road head, some farmers use chemical fertiliser. The use of chemical fertiliser is however in a haphazard manner.

Support service is available in the site. There is high school and other government office like post office, electricity, drinking water and public telephone services. Only one local organization is prevalent in the site. ADO office has started to support the community but that is only limited to certain aspects. No other organization has reached the site yet.

5. Mid hill site (SHANKER POKHERI)

Biophysical Situation

The identified site is located in Shanker Pokhari Village Development Committee (V.D.C) of Parbat district at an altitude of 1000m asl. The climate of the site is sub-tropical with medium type of soil. The soil of this site is also highly acidic in nature. The land types are commonly known as khet (lowland, bunded terraces, Bari (rainfed, unbunded terraces), Pakho (uncultivated barren land) and sloping land.

Socio-economic Condition

The site can be reached within one and half-hour from the district headquarters Kusma. Pakuwa has mixed ethnic composition of Brahmin, and Chhetri. The dominant ethnic group is Brahmin. Out of total population 55 percent can at least read and write but majority of female members can not read and write (low female literacy). There are very minimal local organizations in the area. Ama samuha and community forestry user group exists in the area. There are some services like school and health post located in the area.

Local variety of crops like maize, corn, and paddy are commonly grown in the area. Vegetables like cabbage, radish and potato are commonly found. The Cropping pattern in khet includes rice-wheat-maize and in bari maize-millet-fallow/pea. Majority of farmers has subsistence level of production. The community members also keep livestock. The income from livestock products is very important for families to sustain their living. The use of farmyard manure is of traditional type and some farmers use chemical fertiliser but in small amount.

6. SALT Area (Kusumkhola-2)

Bio-physical situation

Pipal Danda and Duhurthung villages are located in Kusumkhola Village Development Committee (V.D.C) of Palpa district. The nearest market is kusumkhola and motorable road to tansen bazzar passes just above the site. This site is accessible for all agricultural inputs. Sub-tropical type of climate is found in the area, monsoon starts from may and continues upto September. Annual rainfall is low in the area, dry season start from Oct-April and maximum hailstone occurs during March April. Three types of land found in the area are khet, bari and kharbari in which about 50% area is covered by bari land, 15% by khet land and rest 35% is covered by kharbari. Land is registered in the district land revenue office. There is one community forest user group (Bhairab community forest users group) with the coverage of t 13.76-hectare.

Socio-economic situation

A total of 58 households are the residence of the village with mixed type of ethnic composition. Magar is the dominant ethnic group comprising 26 households followed by Brahmin 16, B.K 15 and only one household is Chhetri. At the community level, there is one community forest users group (Bhairab community forest group) comprising all 58 households with the coverage of 13.76 hectares of forestland is located in the area. One bhairab temple also exists in the village. Students have to go nayatola for primary level education and kusumkhola for high school level education. 10+2 is located in the khasauli VDC in the way to Tansen.

Transportation facilities are available in the area but depend upon the availability of passenger. Jeep is available as a major means of transportation. Buses are available once in a day. The area lies 17 Km. far from the Tansen bazzar towards southwest direction. Electricity facility is connected in the site. Nearest market is Kusumkhola bazaar attached with the village. Another market is Harthok and tansen bazaar. One health center is in kusumkhola and one health post is in Harthok of Khasauli VDC.

Maize is the most common crop in terms of cultivation and production followed by wheat and rice. Mustard, Pigeon pea, horsegram, soybean, potato and fingermillet is also grown in the area as a mixed crop or relay crop depending upon the time and season. Buffaloes, Goats and Cattle are the major livestock reared by the community people. Other animals like pig, ducks and poultry are also raised for the meat and cash-generating source. Milk and meat are also an important source of cash generation activity. Livestock feed are forage grass, fodder grass, rice straw, maize stalk, and maize husk. Buffaloes are kept in stall-feeding system and other animals are grazed in the lean period of time.

The farming contributes a small proportion of the cash income of the villagers. The major sources of on farm products are Zinger, Goats, Citrus and Maize. The off-farm sources of cash income are also very limited. Of these sources, services in India are the main source of cash income in the site. Pension is also another source of cash income but it benefits very limited people. Few of them are also jobholder in school and campus.

Table 4. Summary of reasons for non-adoption of LMS technology and existing problems of the site

LMS Non-intervention site No.	Reasons behind low adoption among farmers
1	Farmers are unaware about any of the improved technologies.
	Lack of development interventions-farmers usually have poor experience with the development organizations.
	Poor information flow within the community.
	Lack of irrigation facility.
	Khet land is quiet limited so farmers do not use chemical fertiliser and so on.
	Lack support from district level governmental organizations.
2	No support from organizations
	Low education level among wider populace
	Limited land under cultivation
	Unwillingness to spend time
	Risk of failure or achieving low yields
	Dis-advantaged groups with low exposure to outside world
	Low awareness and motivation among farmers
	Farmers are less responsive to change as they can not replace their traditional crops/cropping pattern.
3	Lack of irrigation
	Few or negligible organizations involved in the development process.
	Majority are ethnic Magar community
	Low awareness and motivation among farmers
	Mostly affected by Maoist movement
	Lack of male manpower
	Difficult terrain and remote from the district headquarter.
	Low support services like schools and other government offices
4	Attack of White gruves in millet
	No Variety selection
	Lack of fodder and fuel alternatives
	Lack of Soil fertility management related technologies.
	Use of fresh farm yard manure
	Negligible support from organizations
5	Fertiliser management
	variety selection
	Lack support services
	Not so accessible from the district headquarter
	Low support from district level offices
	Maoist movement
	Negligible support from ADO office
6	Low rainfall (irrigation problem)
	Lack of improved crop varieties
	Low Support services
	Lack of technological intervention from GO's and NGOs
	Land having very Steep Slope