**Institute for Social Sciences in Agriculture**
**University of Hohenheim**

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# Conversion of Subsistence Farming to Sustainable Agroforestry in the Midhills of Nepal - Participatory Action Research in System Development

**Dissertation**

Submitted in fulfillment of the requirements for the degree
"Doktor der Agrarwissenschaften"
(Dr.sc.agr. / Ph.D. in Agricultural Sciences)

to the
Faculty of Agricultural Sciences of the University of Hohenheim

presented by
Alina Schick born in Bonn

**2015**

This thesis was accepted as a doctoral dissertation in fulfillment of the requirements for the degree “Doktor der Agrarwissenschaften” by the Faculty of Agricultural Sciences in Hohenheim on 08.04.2015.

Date of oral examination: 04.08.2015

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***"A journey of a thousand miles started with a first step."***

**(Lao Tzu)**

# Acknowledgements

In 2006, I was working with a local volunteer organization in the Midhills of Nepal. During this stay, I met a farmer in a small village called Kaule, who is practicing agroforestry in contrast to common practiced subsistence farming in this area. Agroforestry is a farming method in which different annual and perennial plants are grown on the same field. The economic and ecological advantages of the agroforestry farm were obvious: the farm was green and the soil seemed dark and rich in organic material. The oldest daughter of the household studied at the University of Kathmandu and all of the younger children went to the local school. The farm itself was in good condition and well managed.

It was possible to see with the naked eye that the farm was in better condition than the other farms in the surrounding area in which plants were struggling to grow in dry clay soil. Soon I was wondering why, as this single farm was obviously successful, no other farm in the village was following the promising example of agroforestry. The villagers told me that many years ago a foreign organization provided agroforestry training in Kaule. However, one participant after the other left the training and the program. Why did the farmers leave the program? One possible answer is that the establishment of agroforestry needs several years until the included plants have grown and the system starts to provide output. That time span is much longer than subsistence farmers usually plan their future. Therefore, the participating farmers left the program because they could not imagine its outcome.

Why was the single agroforestry farmer not also giving up at that time? Over the following years, I observed and finally understood that he has a special personality. With an open mind, he tried something unknown, having a vision of possible outcome over time. This person was able to face the challenges of the system change on his own. He went through a hard time until the new system became stable, sometimes with others laughing at him.

Nowadays, other villagers have the promising example of the agroforestry farm that shows what can be gained by overcoming the time of system change. “Kaule e.V. Organisation for socially sustainable Agro Projects” was established in 2007 in Germany with the goal of fundraising in order to provide training and material for agroforestry once again in Kaule. This time, the experiences of the agroforestry training are documented so it is possible to understand, learn and use them later.

This was the basis for this dissertation and several other scientific works[1]. They and all future studies can be seen as pieces of a puzzle and all of them together contribute to drawing a picture of Kaule’s situation and the project’s impact. These works are, in conjunctive with their scientific value, practically applicable to the farmers in Kaule and in comparable areas.

Prof. Dr. Volker Hoffman, my supervisor, helped me with his scientific input and to obtain two short-term grants from “Fiat Panis” and “Winter Stiftung”, which supported this work. Many thanks to him for sharing his valuable knowledge, for his input and help and especially for his patience.

[1] www.kauleev.org/projekte/kaule-nepal/wissenschaftliche-publikationen

Dr. Keshab Raj Pande supported me in Nepal and assured, along with Dr. Rajan Ghimire, the cooperation between the German and Nepali scientists within this work.

The biggest sponsors for the project in Kaule were “Action five e.V.” and the foundation “Ein Körnchen Reis” from Bad Honnef. Each of them contributed one third of the project budget per year. Later, the project was sponsored by "Hand in Hand Fonds" of "Deutsche Umwelthilfe" and "Rapunzel Naturkost". Without this sponsoring, the project would not be what it is today.

One of the people that made this project and dissertation possible and needs special tribute is Mrs. Charlotte Rave, my beloved grandaunt, who supported me significantly. A special thanks to her faith and generosity.

In 2011, the last year of my fieldwork, my grandfather Karl Schick died at the age of 99 years while I was in Nepal. I was not at his funeral or with my grandmother Elisabet Schick in this moment but I will not forget what I owe to them.

In Germany, several people have been working to run the organization, find support and inform others about Kaule and the project in Germany. Today, Kaule e.V. has around 40 members. During the time this study was carried out, Patrick Joisten needs to be mentioned specially for his valuable and large contribution.

Badri Rai is running a local volunteer service and placed international volunteers into the project. Badri Rai, Ritesh Kharel and Thilak Tamang held the chairmanship of the sister organization "Kaule environment Nepal" that was founded in 2009 and helped to develop local structures.

Many volunteers helped to build up the project in Kaule. Many thanks to them for their help and for their input that energized the project.

The16 project farms are of course the centrepieces of the project. I enjoyed working with them and I am gratefull for all I learned of them. Pema Sherpa and her family supported the work and helped in translation and organisation.

For all those mentioned above, I would like to give my deepest gratitude. Their contribution made the project possible and allowed me to write this study.

Alina Schick, Hohenheim, 2015.

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# Glossary of Abbreviations

| Abbreviation | Full term |
|---|---|
| % | Percent |
| °C | Degrees Celsius |
| Af | Agroforestry |
| a.s.l. | Above Sea Level |
| BMBF | German Federal Government Department for Education and Research |
| CIFOR | Centre for International Forestry Research |
| CGIAR | Consultative Group on International Agricultural Research |
| DAP | Di-Ammonium Phosphate |
| DDC | District Development Committees |
| DED | German Development Service |
| DHM NEPAL | Department of Hydrology and Meteorology, Nepal |
| ERA-Interim-Reanalysis | The latest global atmospheric reanalysis, produced by the ECMWF |
| ECMWF | European Centre for Medium-Range Weather Forecast |
| e.V. | eingetragener Verein, registered Organisation |
| FAO | Food and Agriculture Organization of the United Nations |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| HFHN | Hands for Help Nepal (Volunteer Service) |
| IAAS | Institute of Agriculture and Animal Science |
| ICIMOD | International Centre for Integrated Mountain Development |
| ICRAF | International Centre for Research in Agroforestry |
| INRES | Institute of Crop Science and Resource Conservation |
| JICA | Japan International Cooperation Agency |
| Kaule ev - Nepal | Kaule environment – Nepal (Local NGO) |
| Maoist / UCPN(M) | Unified Communist Party of Nepal |
| MTS | Modified Taungya System |
| NAF | Nepal Agroforestry Foundation |
| NAVIN | National Association of Village Development Committees in Nepal |
| Ndfa | Nitrogen derived from the atmosphere |
| NGO | Non-Governmental Organisation |
| NRS | Nepalese Rupee |
| NTFP | Non Timber Forest Product |
| SAARC | South Asian Association for Regional Cooperation |
| SOM | Soil Organic Matter |
| SWC | Social Welfare Council |
| TOT | Training of Trainers |
| UCPN(M) / Maoist | Unified Communist Party of Nepal |
| VDC | Village Development Committee |
| VIN | Volunteer Initiative Nepal |
| WWF | World Wide Fund For Nature |

# Conversion Table

| Nepalese Unity | Conversion to European Unity |
|---|---|
| 1 Nepalese Rupee (NRS) | 0.91 Euro (mean value in 2009) |
| 1 Ropani | 503.74 sq m |
| 1 Aana | 31.81 sq m |

# 1 Introduction

## 1.1 Background and Study Context

Most people worldwide live on agriculture and especially people in developing countries survive on subsistence farming. With this background, it is logical to focus in development work next to education, health and family planning especially on agriculture and rural development as a food securing action. Especially if one considers climate change and land degradation and its influence on farmers' livelihood.

The presented study deals with the introduction of an agroforestry farming system to selected farmers in the Nepalese village Kaule between 2009 and 2011. The author of this study was in charge of the project management and participative researcher at the same time. Livelihood strategies of project participating families and their adaptation of the agroforestry system were observed.

The term introduction in the context of introducing a new farming system might in a sense not be adequate, because agroforestry exists since many years in Kaule. Only one farmer (Farmer A) has already practiced it for about 15 years. Nevertheless, in 2009 agroforestry was again newly introduced to other farmers and even when they already knew about this farming system before project start, the system was just than introduced to selected parts of their own land. The reasons why other farmers never tried to established agroforestry by themselves can only be assumed. Farmers in Kaule practice subsistence farming which does not leave room for long term planning, but the establishment of agroforestry takes several years until the plants are grown and the new system produces harvest and income.

In the past, other farmers of the village advised Farmer A several times to leave his land and give up on his new and unusual farming system. Nowadays he is a well-respected man in the village and his farming system is obviously successful. All of his five children can visit the school, his oldest daughter studied at Tribhuvan University in Kathmandu, and he is continuously developing his farm. Lately the family installed a biogas plant, expanded their house and established a modern stone goat stable that allows to keep the goats outside the living room and supports better hygiene conditions in the household.

Other farmers in Kaule are nowadays also interested to practice agroforestry. This answers the question why agroforestry training has been provided especially in Kaule. The initiator of the project, a German NGO named after the village, “Kaule e.V. - Organization for socially sustainable Agro Projects”, assumed the fact that a well-developed agroforestry system already exists, provides a good initial situation to start a new agroforestry project. The goal of the project was to spread agroforestry further in the village and it seemed more likely to be achievable, having already one established agroforestry farm. This example helps farmers to imagine the outcome of the long-term project.

The purpose of the project was to offer a supporting system for the establishment of agroforestry farming. The system included technical assistance, agroforestry training, and the supply of necessary material for establishment of agroforestry to an initial group of interested and selected farmers. The project is intended and set up in a way that initial project farmers give later on their newly gained knowledge to others. This should enlarge the number of participants and its impact over time. To enable farmers, of which some did not visit a school and had no experience in knowledge transfer or the practice to “consume” heaps of theoretical information in short times, the local organization “Nepal Agroforestry Foundation” (NAF) was hired to provide “Training of Trainers” (TOT). TOT is a specific form of training that has been found effective in providing would-be trainers with the necessary knowledge and skills to become trainers themselves in different contexts (RAY *et al.* 2012).

The original plan was that the foreign organization Kaule e.V. could step out after three years and the project would go on by its own. For this reason next to the TOT training, other arrangements were done. In autumn 2009, “Kaule environment – Nepal” (Kaule ev – Nepal) was established as a local governmental registered organization. The relatively similar name to the German organisation was the choice of the project farmers and might demonstrate their attitude to it. The establishment of the local organization allowed members of Kaule e.V. in Germany to work legally with advisor status in the project in Kaule. In addition, the official establishment provides a structural platform for farmers to work together on the same field of interest. Meetings were conducted once a month from start of 2009 on to discuss common interests and for planning and implementation of other trainings and workshops.

Next to the TOT training Kaule e.V. organized together with Kaule ev - Nepal numerous trainings on topics like green manuring, composting, medicinal plants, tea cultivation, fish farming, livestock, bee keeping, etc. The project also included activities on plastic waste removal by the construction and distribution of burning drums (WEISS 1999) or a trip to Godavari, a training centre of ICIMOD, the International Centre for Integrated Mountain Development.

Furthermore, the whole project was designed to learn from each other. The project initiators are aware, that farmers in Kaule know much more about living, farming and social standards in their area than any foreigner, even on the long run. Next to personal experiences, their ancestors passed on traditions and knowledge that carry on approved techniques. In context with the project, foreigners gained knowledge on local farming methods, information on usual crop species and experience in farming under the local meteorological and geographical conditions. This was not only the case for the participatory researchers but also for numerous volunteers. Next to several “weltwärts” volunteers that the German Development Service DED placed for periods up to one year, also volunteers from all over the world came by the local volunteer organizations Volunteer Initiative Nepal (VIN) and Hands for Help Nepal (HFHN). This intercultural exchange had impacts on both sides, volunteers and local farmers. Both got new insights in the other culture, which is the basis of understanding each other.

As of now, along with this presented study, several other published research studies have been carried out in Kaule within the same project: Master theses on green manure potentials (KREMER 2010), on the comparison of agrobiodiversity and soils between conventional land, farms in transition and agroforestry farmed terraces (SCHWAB 2012), and on market access and selling markets of cash crops as part of the agroforestry system (ROTH 2012).

For this dissertation, the goal was to follow the initial three project years of the agroforestry project in a scientific manner by keeping records on interviews and selected indicators.

With the intention of better understanding the development of the project, it is evaluated against certain standards of diffusion research, following the methods of the "Hohenheim Concept" a situation specific theory of introduction of innovations that will be explained in more detail later. This documentation and evaluation is intended to help with the design of other possible future projects under comparable conditions. In addition, it may help Kaule e.V. and others to learn about the project themselves. Along with the baseline description of the project setup and the conversion of tacit local knowledge into explicit information, the focus is targeted on the dissemination of the "new" system and its impact.

The work in Kaule between 2009 and 2011 was very instructive but not always easy. One reason was the political situation in Nepal during this time. Since 1995, the Maoists or also called UCPN(M) (Unified Communist Party of Nepal) started an insurgency against the parliamentary monarchy. In May 2008, the Federal Republic was established. The largest elected party of Nepal was then the Maoists, and Pushpa Kamal Dahal (commonly known in Nepal as Prachanda) became the first Prime Minister (SHRESTA 2014). Soon a dispute between the army chief Rookmangud Katwal and Prachanda occurred in which President Ram Baran Yadav supported Mr. Katwal. As a consequence, the prime minister and his party quit the government. Madhav Kumar Nepal became the new Prime Minister. The Maoists hereupon forced general strikes – in Nepal commonly known as *bandhs* – throughout the country. The *bandhs* disabled every kind of traffic, sometimes for several days in a row. Until today, the political parties have not managed to write a constitution. Uncertainty, rising inflation, economic downturn and insecurity are problems arising from the political situation (BBC 2014).

As of 2012, Eva Wieners from the University of Hamburg was placed in Kaule to accompany the project, also in the scope of scientific work and a dissertation. During her stay, new farmers were included in the project. Some of the first participants who got TOT training gave training to new project members.

In 2014, three years after data collection for this work, the project was revisited. The project outcome was surprisingly good: trees were visibly growing on most of the project farms and biodiversity was clearly enhanced. Farmers had started independently to allocate more land to agroforestry farming.

Today, "Kaule ev Nepal" has increased to 40 members and the organisation has a good reputation in the village. Although only some families and only marginal land sizes are included within agroforestry farming, the trend seems going in the desired direction.

### 1.1.1 Effort of Transparency

Only 15 farms were selected to participate in the project at the start. To assure that no negative opinions and distrust would occur with villagers, and to prevent negative influences by the diffusion of false information, considerable effort was taken to assure a maximum of project transparency to all villagers.

Next to training, materials and workshops, a demonstration centre (democentre) was established. The villagers decided to provide a big and unused community house in the middle of the village and its surrounding land for the project. In return, Kaule e.V. promised to clean and renovate the house and the land and to keep it in good condition for the villagers.

All plants, techniques and equipment that were distributed to project participants were also stored here. The democentre had several important functions such as providing the space for training and workshops as well as for the monthly project meetings. It also provided a living space for volunteers, scientists and guests. Another important point was that the democentre made the foreigners observable to the villagers. At the project start, many villagers came and watched every step of the project and every move of the new inhabitants. Over time, the villagers understood that foreigners were living in a similar way under comparable conditions. In this respect, the democentre was the face and the bond of the project to the villagers and it facilitated the convergence of all project activities.

The children of the village were often invited to visit the centre, either for playing or for English classes that were provided by volunteers. Soon, more and more children would come, even from neighbouring villages. The contact with the children was the gateway to establishing contact with the adults who were more suspicious at the start.

To guarantee transparency of the project with other villages and to assure the dissemination of information to project farmers, a white-board was installed at the main road in Kaule. Protocols of the meetings, as well as announcements of activities, were displayed on this board. In this way, no one could say that he or she was not informed. Being informed was then the individual's responsibility.

A few times a year, additional meetings for the whole village were carried out in order to explain what the project was doing and how things were developing. Under the heading "If we work together we also celebrate together", an annual party was also arranged at the democentre for all the villagers. At this occasion, many people were eating, drinking, dancing and singing together. It helped substantially to build bonds between the villagers and the foreigners.

ALBRECHT (1964) evaluated the value and function of demonstration farms. He stated that a democentre is not per se successful in its assignment to disseminate knowledge by demonstration. He lists several examples where demonstration farms were not successful criticising the considerable amount of effort and work that has to be applied in order to establish a demonstration centre. The success of a demonstration centre, Albrecht notes, can be maintained by keeping it in a comparable standard to those farms of other villages. If the centre is comparable in size and quality to other farms, villagers might be less suspicious. If the good will and frankness of the centres operators is apparent, this can help to establish a trusting and sound relationship between locals and foreigners. Both factors can have a positive influence on the success of the project and the effectiveness of a democentre (ALBRECHT 1964).

For all above-mentioned activities, the democentre provided a platform. In this case, it not only displayed farming techniques, but also provided intercultural exchange in general. In fact, the demonstration of farming was not very successful because often children, goats and chicken of the neighbours, roaming dogs and later on a group of monkeys that moved in the surrounding trees, destroyed considerable work of the democentre. To compensate this, the agroforestry farm (compare Chapter 5.1.2.2.1) functioned partly as a demonstration farm for farming techniques.

DARR (2008) evaluated the dissemination of agroforestry innovations within several farmer groups in Kenya and Ethiopia. He determined that innovations diffused best in intermediate levels of group homogeneity, while too high or too low levels of group homogeneity seemed to hinder the diffusion process. He also found that exposure of the groups to external information sources and increased group activities both enhanced the diffusion process by overcoming diffusion barriers. There was high group homogeneity in Kaule's agroforestry project because most villagers were of the same cast. All those who carried out actions that are described above helped over time to build a better group identity feeling and a level of trust in which all project participants including locals and foreigners were able to work together.

### 1.1.2 Farm Demonstration of Agroforestry

To show agroforestry in practice, the existing agroforestry farm was willing to demonstrate its activities to certain extend. In this way, other farmers were able to experience how agroforestry looks like on a farm and is carried out as a farming system. The example of this existing farm was motivating for other project members because here they could visualise what they could gain if implementing the project successfully over the several years needed to establish agroforestry.

The agroforestry farm not only served as a visible introduction of the new farming system, it also was included in training units of the project's practical trainings in agroforestry farming.

The social prestige of the agroforestry farmer is nowadays high in the village. This is due to the visible success of his farm, which produces income, fodder and fuel. His opinion had a bigger impact than that of other project participants on project decisions and development.

However, although the agroforestry farmer was honoured by being of such high importance for the project, the high level of attention and many visits by several interested groups put certain pressure on his family.

BAREISS *et al.* (1962), defined in a study about demonstration farms that usually three different phases of impact can be found in the establishment of such farms. These are related to their development over time and are psychologically influenced. Phase 1 is the introduction of the new system. Phase 2 is where the shown example is planned for the farms of project participants or other potential adopters of the new system. Finally, phase 3 is the implementation on the farms of project participants.

Next to the typical demonstration farm establishment and development over time, the authors of the study determine material and socio-physiological factors as well as personal abilities of the responsible demonstration farmer as important for the project's development and the success or failure of the demonstration of new introduced inventions.

If extra materials or financial aid is provided to the demonstration farm, it loses credibility in the eyes of other project members. In addition, the higher the social status of the demonstration farmer, the bigger his influence on other participants and decision processes might be. Finally, it is important that the demonstration farmer has enough technical experience and is able to address others as a leading personality.

With the existing agroforestry farm the above determined factors were fulfilled, which was one of the main reasons to establish the project in Kaule and work closely together with the agroforestry farmer.

HOFFMANN (1992) explains the necessity and importance for a preceded analysis of location, economic situation as well as cultural and social conditions of project participants for the successful establishment of a demonstration farm. He supports his statement with the fact that the establishment of a demonstration farm is a time and money consuming act that produces long-lasting project conditions and factual project determination. A later project change after establishment of the demonstration farm is difficult.

He suggests as one possibility the combination of a scientific situation analysis and a practical project consultation. Institutions or individuals that have factual knowledge about the project and cultural circumstances should do this consultation.

### 1.1.3 Innovation and Diffusion – The Hohenheim Concept

In order to understand the mechanisms and impacts of the agroforestry system introduction in Kaule, and to understand if agroforestry in its complexity, is suitable for a system change that can spread out and be adopted by other farmers, observed and documented events and data are considered against the well-established theory of diffusion of innovation. The diffusion of innovation theory deals with the reasons for adoption and rate of diffusion of new ideas and technologies within a community. ROGERS (2003,5) the founder of the theory states, "*Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system*". HOFFMANN (2007) later criticised Rogers in certain parts of his considerations and presented their alternative concept called the "Hohenheim Concept". The Hohenheim Concept has a situation-specific approach, as it is appropriate for individual projects with unique situational settings.

The decision for adopting an innovation depends strongly on the constellation of a force field, derived by the subjective perceptions of potential adopters. Force fields can be produced within groups, for example by social behaviour codes or expectations, or externally by political developments or environmental events. Changes of the force field through the interactions of group participants and changes of external circumstances influence the process of diffusion. Because force fields are unique and unrepeatable, they justify the Hohenheim Concept with its situation-based approach.

In the handbook, "Rural Extension" HOFFMANN *et al*. (2009) declare the nomenclature of diffusion or adoption process research in a plausible and compact way. Accordingly, a new technique or method is called in this context an innovation, while the first person to practice and adopt the new method is the innovator. If later on more people adopt the innovation, it is then called adoption or diffusion process, while a break with the innovation is called discontinuation.

A diffusion process usually passes through several phases.

1. The innovator starts the process after determining a problem by applying a solution. He has a high level of risk because the solution is most likely not proven valuable yet. This makes him a pioneer in testing the innovation. His position is uncomfortable, because other members of the social group might look suspiciously at changes

of the old and well known. The innovator is a key personality and communication plays an important role. ALBRECHT (1974) describes how early adopters of innovations are more open to new techniques and knowledge and eventually better educated. The innovator and early adopters might have access to alternative information sources and a better social and financial status.

2. The second phase is the so-called critical phase. The diffusion might reach a self-supporting phase where an early majority of users adopt the innovation. This phase determines if the diffusion process develops or not. HOFFMANN *et al*. (2009) state that a rate of 10 – 20 % of adoption and a favourable innovation design provides a good chance of an independent diffusion process without further external input.

3. If the diffusion process is not interrupted then usually a majority of adopters will follow the first triers. Now the innovation becomes normal.

4. Finally, the latest adopters will end the diffusion process. Personal or situation related conditions might cause late adoption.

Those phases can be shown in a bell shaped curve representing an ideal course of diffusion (ALBRECHT 1974; HOFFMANN *et al*. 2009). However, diffusion processes do not in general follow the ideal curve because diffusion can be interrupted, or may only happen partly in subdomains of social groups.

The interrelationships of diverse and numerous factors influence the diffusion of an introduced technique or the development of a project in an existing social system. It is difficult to determine and understand all variables, their interactions and thus their influence (HOFFMANN 2007).

**Table 1:** Certain factors that can affect the diffusion process

| | |
|---|---|
| Comprehensibility | Do project participants understand why the innovation is a solution? Do they understand the possible outcome? |
| Complexity | How many stages does the innovation involve? |
| Divisibility | Is partial adoption possible? |
| Risk | What are the consequences of failure? |
| Observability | Are activities and results observable for others? |
| Observability of Success | How and when can success first be observed? How long are the stages between input and output? |
| Observability of failure | How is failure visible? |
| Comparability of motivation | Is the motivation of inventor and early adopters the same? |
| Comparability | Does the innovation match existing cultural practices and norms? |
| Labour input | What implications has the innovation on labour input? |
| Costs | What are the short term and long term costs? |
| Return | What are the benefits of the innovation? |

*Source:* Modified after HOFFMANN *et al*. 2009,102.

Several propulsive or inhibiting forces account for the diffusion of an innovation and determine its speed. Table 1 registers several factors that can affect the course and speed of diffusion.

KRISHAN (1965), quotes several reasons for the non-adoption of innovations. Here he gives several examples of failed programmes and the reason for their failure. Those reasons can be manifold and include, for example, inadequate resources of project participants in mean of land or finances, traditions and religious sentiments, lethargy or the personal abilities of participants. Other examples are incidents like group rivalries, natural calamities and insufficient supply of irrigation water.

The social sciences, with context-bound human actions, and the natural sciences, with its generalizing statistics do not follow the same standards (HOFFMANN 2007). Yet surely, both approaches have their value. The work presented here tries to combine both standards for a more holistic angle of perspective at the project and allows insights at an early stage of diffusion of agroforestry in Kaule. While the natural science indicator data provides a basis for situation analysis and discussion of the project, the social framework allows bonding explanations and, to some extent, a possible forecast.

## 1.2 Farming System

Traditionally agricultural systems in the Himalayan region of Nepal rely on livestock, forestry, and crop production (PILBEAM *et al*. 2000; GIRI and KATZENSTEINER 2013).

### 1.2.1 Subsistence Smallholder Farming in Kaule

In Kaule, farming-terraces are mostly small, and due to steep slopes, often hard to access. The use of agricultural mechanization (even ploughing by ox) is difficult and the use of machinery on the terraces is nearly impossible. Therefore, farming is labour intensive and mainly a family business. Only during harvest or planting periods are external workers hired, with neighbours helping each other during work intensive times.

A survey on income and expenses, on planted and harvested crops, and on access to the market was carried out in the scope of this study and by a master student (ROTH 2012). It provided an insight into the farm status of 15 selected households in Kaule that were participating in the agroforestry project, and serving as representatives for other farmers in the village and on market demand. Collected data classify Kaule residents as subsistence farmers with smallholder agriculture. “The term “smallholder agriculture” [...] describes rural producers, predominantly in developing countries, who farm using mainly family labour and for whom the farm provides the principal source of income" (MORTON 2007,1). The same author describes subsistence farming as “farming and associated activities which together form a livelihood strategy where the main output is consumed directly, where there are few if any purchased inputs and where only a minor proportion of output is marketed” (MORTON 2007,1). Typical subsistence farming is practiced on rather small land holdings and it involves mixed cultivation of traditional crops with low yield potential (BISHT *et al*. 2014). Most farmers in the Midhills of Nepal are subsistence farmers (ADHIKARI *et al.* 2007).

People who live on subsistence farming usually do not plan into the future because the everyday struggle to survive does not leave time and room for big changes or flexibility. Interviews with farmers in Kaule, and discussions with members of the former German Development Service (DED), today Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), revealed that in subsistence farming the time span of approximately half a year seems to be the absolute maximum for farmers to plan into the future. Individual life planning is also influenced by cultural circumstances. Nepal's cultural heritage includes the caste system, multiple ethnicities, gender relations and the religious plurality leads to a strong social diversity. This has a strong influence on everyday life, including farming (NIGHTINGALE, 2010). Nepal's 2001 census stated that most people in Nepal are Hindus (80.6 %), followed by Buddhist (10.7 %), Moslems (4.2 %), Kirant (3.6 %) and other groups (0.9 %) including Christians (0.2 %). The Census also enumerated 102 castes and ethnic groups. This cultural diversity does not allow an outsider to easily understand the deep connections and influences between daily life, work and spirituality. When villagers were asked about the meaning or the background of traditions and festivals, in most cases, the respondent are also not aware of it. People often just follow the traditions of their ancestors. One example is the tradition in Kaule where only men are allowed to plant potatoes. This is a tradition that farmers mentioned in an interview and a good example for a case in which they were not able to explain the reason for the tradition. The Nepalese society is in a phase of modernization. SHRESTA (2013) describes a modification in the cultural norms and traditions. Due to that, traditional background information may fall in further oblivion.

The limited ability to extend agricultural areas, because of high and growing population density (KUMAR 2006), has lead people to leave the land and move to Kathmandu. ERTUR states that already in 1994, Nepal's urban growth rate is the highest among the SAARC (South Asian Association for Regional Cooperation) countries, even so it was with an urban population of nine percent one of the least urbanized countries in South Asia (ERTUR 1994, 19).

Interviews revealed that there is sometimes little or no extra income, and that farmers do not have capital to invest into further development of their farms, into health, and even sometimes the education of their children. Between 2009 and 2012, farmers complained about rising prizes of basic supply items that are not produced within Kaule like oil, sugar, kerosene and fertilizer. Another problem is the possible alteration of the harvest calendar if unseasonal weather conditions occur, resulting also in a conflict with old cultural traditions that have a fixed calendar relation. Shifts in monsoon rainfall patterns can also have an impact on crop productivity and increased food and livelihood insecurity (KUMAR 2006). Some observed impacts of climate change in the mountains have been erratic rainfall and the unpredictable onset of the monsoon season, glacial retreat, storms, landslides, and drought (GENTLE *et al*. 2012; BAUL *et al*. 2013; BYG *et al.* 2014).

Farmers in Kaule cultivate nowadays only few plant species on their terraces. Mixed cultivation is rather unusual. Cultivation is further dependent on the location of terraces in relation to the distance from farmhouses. Typical crops on terraces that are located far from houses are wheat, radish, potato and maize and in lower altitude rice. Crops like mustard, millet, pumpkin, spinach, beans, cabbage, chilli, tomato or buckwheat are common on land nearer to the farmhouses. Especially terraces far away are fallow for several months of the year. When farmers were asked about these different planting patterns, the main reasons stated was that other people might steal crops and even whole plants, cut plants for fodder or just let their livestock directly graze in the vegetables on fields that are far from houses.

Diverse forms of soil degradation are a serious issue in terrace farming in Nepal. Soil erosion is a big threat to upland ecosystems (DHITAL *et al*. 2013). Harvesting crops removes nutrients from the soil to be replaced by fertilizers. This impact has been reported in the Midhills as even higher than nutrient loss through soil erosion (TIWARI *et al*. 2009). Runoff and soil erosion coefficients on rain fed terraces in the Midhills range from 5% to over 50% depending on the rainfall and the characteristics of the terrace. Relationships between soil loss and rainfall characteristics improve considerably when vegetation cover is included (GERRARD *et al.* 2003). Hedgerows with intercropping were tested at ICIMOD and results showed a positive effect of on runoff water volume, soil loss, crop production, soil water retention, and several soil nutrients (LAMICHHANE 2013).

Farmers in Kaule apply mineral fertilizers or animal manure, though the latter is a limited resource. Furthermore, fertilizer is expensive, not always available, and sometimes misapplication does harm to downhill users. COLLINS AND JENKINS (1996) describe the chemistry of streams draining agricultural and forested catchments in the Midhills of Nepal. They found that differences between mean stream water chemistry are attributable to the effects of the terraced agriculture and land management practices.

To meet the problems of soil degradation, KREMER (2010) tested different leguminous plants as potential green manure plants during her diploma thesis in Kaule. She described the potential of velvet bean (*Mucuna pruriens L.*) as a green manure plant with respect to its ability to fix substantial amounts of nitrogen from the atmosphere (Ndfa > 60 %) and the accumulation of biomass in the marginal soil. During her work, it became obvious that farmers were not familiar with green manure and that it was difficult to convince them to dig the plant into the soil instead of feeding it to their livestock. Another source of nitrogen is the extraction of litter, tree fodder, and grasses from the forest that ensures a net movement of carbon and nitrogen to the agricultural land (GIRI *et al*. 2013). However, the removal of greens from the forest is a threat to the community forests that often look bad.

A workshop on soil, performed by Kaule e.V. and Dr. Keshab Raj Pande, Institute of Agriculture and Animal Science, Tribhuvan University in Nepal, revealed that farmers believe that soil is an endless resource. The possible limitations of soil nutrients, and the fact that soil is precious, as the foundation of a good harvest, did not seem to be comprehended. Soil profiles showed that soils in Kaule are in many cases deeper than 1.5 m so that an end is not directly visible.

Farmers in Kaule do not sell much on the open market, though especially radish is a local cash crop and is sold in most cases to Kathmandu. In addition, strawberries are a specialty of Kaule. The Japanese Organization JICA (Japan International Cooperation Agency) introduced strawberry farming about 15 years ago as a cash crop. Many farmers cultivate strawberries as monoculture on the bigger terraces further from home. They sell them with the help of a cooperative to traders, or directly to Kathmandu. Strawberries might be the best income source in Kaule, but farmers complain about certain diseases that affect the plants and either result in the loss of the harvest or force farmers to apply bigger amounts of fungicides to the plants. Discussions revealed that farmers are often unaware of the possible toxic side effects of fungicides or pesticides.

Monoculture farming also results in lower diversity of the associated fauna. Type specific pest and diseases may occur easier when associated predators are absent. This might be "cured" by intense application of plant protecting agents that are known to be a multiple risk to users, the environment and consumers if falsely applied (BENNET *et al.* 2010). The need for reduction in pesticide use, while keeping crop pests and diseases under control, might be achieved by the conversion or introduction of plant diversity in agro ecosystems (RATNADASS *et al.* 2012). This is because faunal diversity is closely related to floral diversity and high numbers of natural enemies and beneficial insects were found in a study about silvopastoral systems (SHIBU 2012). Tree species maintained on farms as part of subsistence farming systems in this way ensure the sustainability of agricultural production and the conservation of crop diversity (ACHARYA 2006).

### 1.2.2 Agroforestry Systems

Agroforestry is the collective name for numerous different land use systems. An early definition (NIJHOFF AND JUNK 1983,269) states: "*Agroforestry is a collection name for land use systems and practices where woody perennials (trees, shrubs, bamboos, etc.) are deliberately used on the same land management unit as agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components*."

The type of agroforestry can be distinguished using several criteria. One of those criteria is structure. NAIR (1985) provides one possible means of classifying systems: He names a system including crops, trees and or shrubs as agrosilviculture; a system including pasture, animals and trees as silvopastoral; and a system including crops, pasture, animals and trees as agrosilvopastoral. In the same publication, he also suggests classifying the system into its socio-economic scale depending on its state of development, such as commercial, intermediate or subsistence. This refers to its production and level of management (NAIR 1985).

The cultivation of trees, shrubs and crops at the same place, or herding beneath trees is perhaps as old as the start of agriculture itself. In different countries worldwide, trees and crops have been grown together for many centuries, especially under subsistence farming conditions (NAIR 2011).

Agroforestry possesses several ecological advantages including higher biodiversity and biodiversity conservation, in comparison to intensive agriculture (SCHRÖDER AND HEUVELDOP 2002), (NAIR 2011). Even so, it is unlikely to reach the richness of primary or developed secondary forests (SCHRÖDER AND HEUVELDOP 2002). SHIBU (2012) describes in more detail how agroforestry can conserve biodiversity. Agroforestry provides a habitat for species and preserves sensitive species, it buffers drastically the reduction of natural habitat, and provides connectivity through corridors between habitats.

Next to biodiversity services, agroforestry is a high value tool that contributes to soil conservation. Deep rooting trees serve as nutrient pumps by cycling deep nutrient stores to the surface via leave fall, enriching at the same time organic material in the ground. Trees and shrubs that are able to fix nitrogen from the air are one additional possibility to enhance nitrogen in soils further. Arrangements of trees and shrubs also serve as rain and wind erosion protection after an agroforestry system is well established (KUMAR 2006). In this way, it contributes significantly to erosion control, enhancement of water quality and serves as carbon storage (NAIR 2011; SHIBU 2012). Agroforestry might be one of several agricultural adaptation strategies that respond to climate change (BIGGS *et al.* 2013).

Although agroforestry provides less harvest of one sort of crop at one time in comparison to monoculture farming, the diverse products of agroforestry including fruits, vegetables, spices etc. are available year-round. In this way, agroforestry has the potential not only to contribute to food security but also to ensure food and income diversity (KUMAR 2006).

During the 1980s and 1990s, national research and development agendas of several developing countries started to recognize and include agroforestry (NAIR 2011). Nowadays, several bigger and smaller research centres and facilities work on agroforestry. ICRAF (International Centre for Research in Agroforestry) also known as the World Agroforestry Centre has its headquarters in Nairobi, Kenya and was established in 1978. It has several regional offices and conducts research in 28 countries in Africa, Asia and Latin America. ICRAF focuses its research on developing countries with the goal to establishing more sustainable and productive land use. Another important international institution dealing at least to some extend with agroforestry is CIFOR (Centre for International Forestry Research). It conducts research with the goal to help policy makers and practitioners develop effective policy, and improve the management of tropical forests. Both ICRAF and CIFOR are among others members of the CGIAR (Consultative Group on International Agricultural Research), which is a global partnership that unites organizations engaged in research into food security.

Agroforestry as a farming system seems to have periodical promotion phases. After it became well known through organisations like ICRAF and CIFOR, several scientists began working in the field. It is unquestionably nature oriented, and a high potential farming system. However, depending on its setting it can also be quite complicated compared to other systems. Thus, the diffusion of innovation in the case of agroforestry is not guaranteed. In most cases, publications only report positively about successful agroforestry projects. However, it is likely that a high number of agroforestry projects were unsuccessful.

An example of failure for an agroforestry project is a rubber based agroforestry project in Chittagong Hill Tracts in Bangladesh (NATH AND INOUE 2008). Here the authors identified a low level of participation of project members, a lack of transparency regarding the project finances, a gap in communication and hindered diffusion of information between project management and participants and unskilled project staff as the main reasons for project failure.

Another more critical project analysis was done by ROS-TONENA *et al.* (2013) who describe the Modified Taungya System (MTS) in Ghana, Africa that aims to reforest and guarantee wood and forest products to rural inhabitants. The authors point out the timespan that is necessary to grow trees and thus produce income. Indeed, agroforestry is a system that needs a long period to be established.

The last example is a case study from Haiti (MCCLINTOCK 2003), which describes alley cropping with contour hedgerows of leguminous nitrogen-fixing shrubs. Shrubs are periodically trimmed and, theoretically, prunings are scattered as mulch between rows for nutrient release and contribution of organic matter (SOM) to the soil. Practical farmers instead fed prunings to their livestock. This practice is in line with our own experience regarding green manure.

### 1.2.3 The Agroforestry System in Kaule

Agricultural land is spreading out through deforestation. In the Midhills within altitudes of 1150 to 2000 meter, including the area of Kaule, about 36% of forestland was converted into agricultural land between 1990 and 2000 (BAHADUR 2011). Lost forest areas were smaller when located around high-income areas with good quality agricultural land and near to an administrative centre as compared to areas located around low-income areas with low quality agricultural land and far from administrative centres. The desired ratio between forest and cultivated land is considered to be 1/3 (NEUPANE AND THAPA 2001). Deforestation is ongoing due to the need of firewood, wood for construction, and the uncontrolled exploitation of trees for fodder. Agroforestry has special meaning for deforested and wood free land because it contributes to reforestation. (SCHRÖDER AND HEUVELDOP 2002).

Different land-use systems suit different environmental and geographical conditions. Kaule´s mid-hill terraces are often small and not accessible with machinery. Agroforestry as a mixed cultivation seems to be a suitable method using the limited amount of land in a three dimensional manner (multilayer cropping), fostering terraces through a structured arrangement of shrubs, grasses and trees and also helps to enhance the quality of depleted terrace soils and prevent erosion, depletion and desiccation.

Referring to the above stated definitions in section 1.2.2, the newly introduced agroforestry system of Kaule would be named intermediate agrosilviculture because it includes crops, trees and shrubs but no direct animal husbandry. Another common name is home garden, because the agroforestry land is in most cases near to participants' houses. Farmers do have husbandry and even so fodder plants are part of the cultivated agroforestry plants, animals are hold in stables next to farm houses and manure is not applied directly to the agroforestry project land.

### 1.2.4 Limitations of Agroforestry

Agroforestry has several advantages but it also has its restrictions. Diverse plants have competition if growing on the same land. Competition for light can affect plant sizes and harvest yields. This was documented by research results on coffee plants in an agroforestry system in Brazil. The study of plants grown in agroforestry systems in comparison to monoculture revealed that coffee plants under agroforestry conditions had an extension in the period of fruit ripening, as well as a smaller fruit retention and yield. This was explained with the lag of direct sunlight due to the shadow of trees (CAMPANHA *et al*. 2004). Next to shading, negative effects of agroforestry can also be allelopathy or pests if pests are not plant specific. (RATNADASS *et al*. 2012)  Other competitive interactions in resource acquisition are based on plant capabilities like crown spread or rooting characteristics (KUMAR 2006). These examples show that agroforestry needs a good cultivation management including suitable plant compositions as well as pruning and pollarding.

In addition, it takes a long time to establish a functioning agroforestry system, especially if it is started from a monoculture system, because of the time for perennial plants to grow to a sufficient size to engage in the system. During this relevant time span of establishment, farmers need to stay abide with the conversion of the farming system.

# 2 Research Objectives

## 2.1 Research Questions and Working Hypotheses

### 2.1.1 Overall Objective and Research Question

The overall objective of this study is to evaluate the impact of introducing agroforestry on a selection of farms as part of a group project, and to verify if the applied methods are suitable for achieving a long-term project development.

The resulting research questions are as follows:

**1. Which impact brought about through agroforestry practice has or could have a system change towards improving social, economic and ecological conditions in Kaule?**

A scientific based analysis and documentation of the system change allows learning about, and controlling, of the project work. It is expected to be a possible approach towards poverty reduction and environmental protection for Kaule's farmers and possibly for nearby located areas with comparable climatic and topographic conditions. The background for this need is that most of Nepal's population is poor and the growing population is tightening the situation (DONNER 2007).

**2. To what extent are the applied methods the right ones needed for achieving sustainability of the project?**

In the case that the agroforestry project in Kaule is successful, the results of the presented study are expected to help developing and establishing further projects. "Training of Trainers" (TOT), material distribution, the establishment of a demonstration centre and the development of the local organization Kaule environment Nepal are part of the applied methods.

### 2.1.2 Hypothesis

***Changes in the socioeconomic basis of farmers through implementing agroforestry in comparison to remaining in subsistence farming.***

- Agroforestry enhances a farmer's market for selling goods due to higher plant diversity.
- Conversion of conventional farming to agroforestry increases income and decreases expenses for farmers.
- Working hours on the farm and the necessity of external employment will be reduced.

***The impact of agroforestry on the ecological system in comparison to conventional subsistence farming with lower plant diversity.***

- System change towards agroforestry enhances biota diversity in the project area.
- Agroforestry enhances organic material in soils and helps to improve soil quality.

***Sustainability and dissemination of introduced methods by agroforestry training.***

- TOT (Training of Trainers) training empowers and motivates farmers to circulate information.
- Group formation and registration facilitates motivation and activity of project participants.

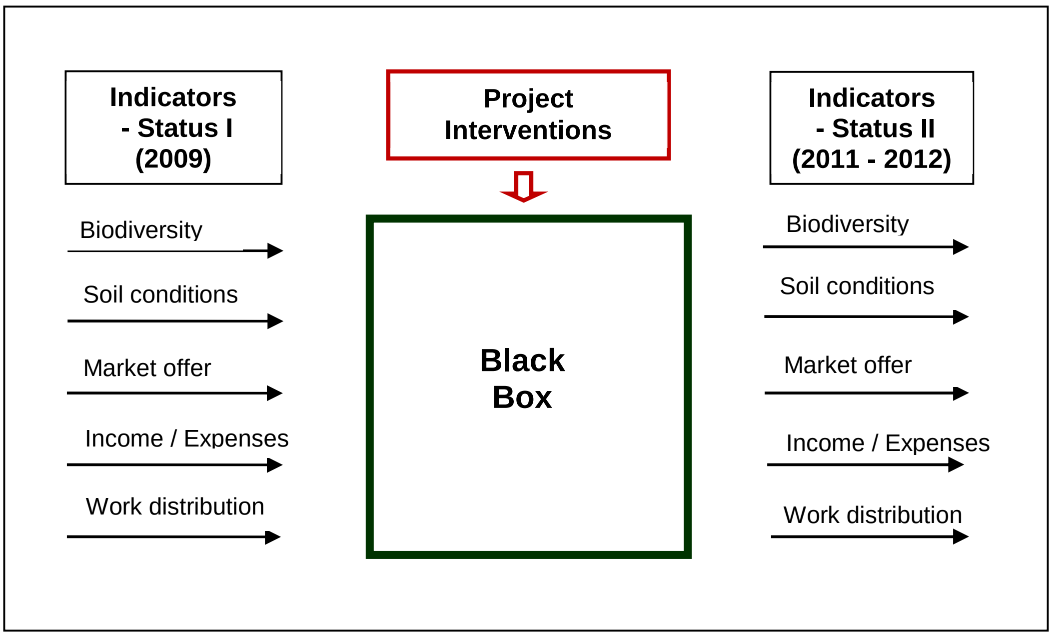
## 2.2 Structure of the Thesis

This thesis is based on data collected within a composition of different interviews and indicators regarding the agroforestry project in Kaule, with the intention to describe the outcomes of the project in a qualitative way.

In this qualitative research, problems are anticipated and reviewed in specified interviews that are compiled in case studies. Those case studies are supported with data of selected indicators. The results of the case studies and indicators are in a later stage grouped into a survey to understand them not only on an individual participator level but also on the group level.

Data was collected with indicators at the start of the project in spring 2009 and before project start in 2008. Some indicators were again collected after two years, others after three years, with the intention of comparing them to the initial data sets. The time between those events is a black box where various unknown factors like political and social events as well as weather conditions have had an influence.

**Figure 1:** Black box system in context with chosen indicators



Indicator studies as well as interviews allow a deeper understanding of a situation by providing background information on various fields. The evaluation of a development project needs interdisciplinary information gathering to understand its impacts and its weak points on multiple layers.

In total, it was intended to describe as far as possible a holistic situation including variables like weather, soil, crops, work, market and family background and set those in relation and comparison against data of one well-established agroforestry farm in Kaule that has existed for approximately 15 years.

Finally, in the discussion of the results, the reaction of farmers and the village to the introduction of the new project and new methods are specified and considered in reference to the "Hohenheim Concept" of diffusion.

## 2.3 Anticipated Results

It is interesting to be part of a project from before its start until near the end of its pilot phase. The right choice of interviews and indicators should allow an interpretation of the projects tendency towards success or failure. Participative action research allows, next to collected data, also an insider perception and deeper grasp of the interrelations between the manifold influencing factors.

It is not possible to evaluate a project's outcome after only three years, but tendencies can already be seen. These tendencies can then be placed in relation to the raised theory.

Nepal has several aspects of development that are developing in an increasingly problematic manner: a rising population, finite agriculture land, depleted soils, changing weather cycles, rising commodity prices, and for the moment an unstable political situation. In addition, it is geographically located between China and India - two huge political powers. Current farming practices result in further degradation of soils and consequently increased livelihood risks. Farmers often do not have the cash resources to invest in further farm development. One possible negative outcome of such influencing development is migration to the cities. This occurs when farmers leave their farmland and move to Kathmandu with its growing slums, or go to work overseas in the Gulf States.

In theory, agroforestry is a good alternative of farming especially for smallholder subsistence farms. If it is applied with the right structural composition of plants and management, it has the potential to protect the farmer's most important good – the soil. Agroforestry can in addition provide longer harvest periods. The size of a single harvest is smaller in comparison to monoculture harvest, but there can be a diversification of nutrition and harvest sales, which can result in improved income and health.

The ecological and socio-economic services of agroforestry imply that a community like Kaule can improve their agricultural conditions if they apply agroforestry in an appropriate way. Next to a well-done application, manifold factors like weather conditions, political and social development or market impacts affect success or failure. All these influences create a force field in which the dissemination of the agroforestry system takes place.

**Anticipated results of the system introduction are:**

- Agroforestry introduction as a new farming system needs more than three years to be well established.
- The system change as it has been set up is not harmful for participating families' livelihoods.
- TOT helps farmers to better identify with the project.
- The introduction of a defined structure like the local organisation Kaule ev helps to create motivation amongst farmers.
- Certain persons in the village try to use the system change for their personal advantage by local political action.

**Three alternative outcomes over the long run could be:**

- The local organization grows stronger whereby the focal farmers pass on their knowledge to other interested individuals and the system spreads out.
- Local political conflicts decelerate the project and system development, which results in the disappearance of the project.
- The project fails in the holistic concept but certain methods stay and spread out.

# 3 Location, Institution, Research Setting

## 3.1 Research Area

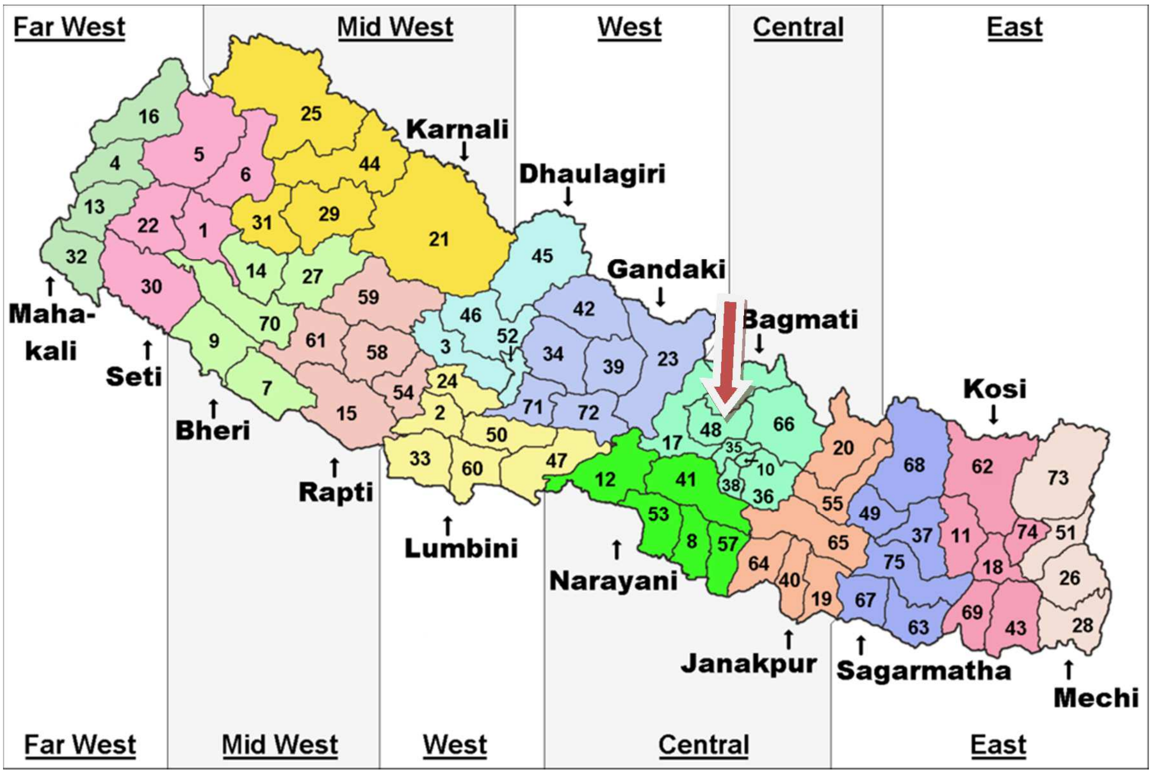
### 3.1.1 Location of Kaule

Kaule is a small village situated about 25 km northwest of Kathmandu (27° 48′ 55.83″ N, 85° 14′ 16.04″ E) in the Midhills of Nepal at a height of around 1.860 m.

The village centre is located in a mountain pass and its sloping farmland mostly faces the southeast and southwest. Farming land is organized into lots of terraces that are cut into the loamy soil without any further anchor and stabilization.

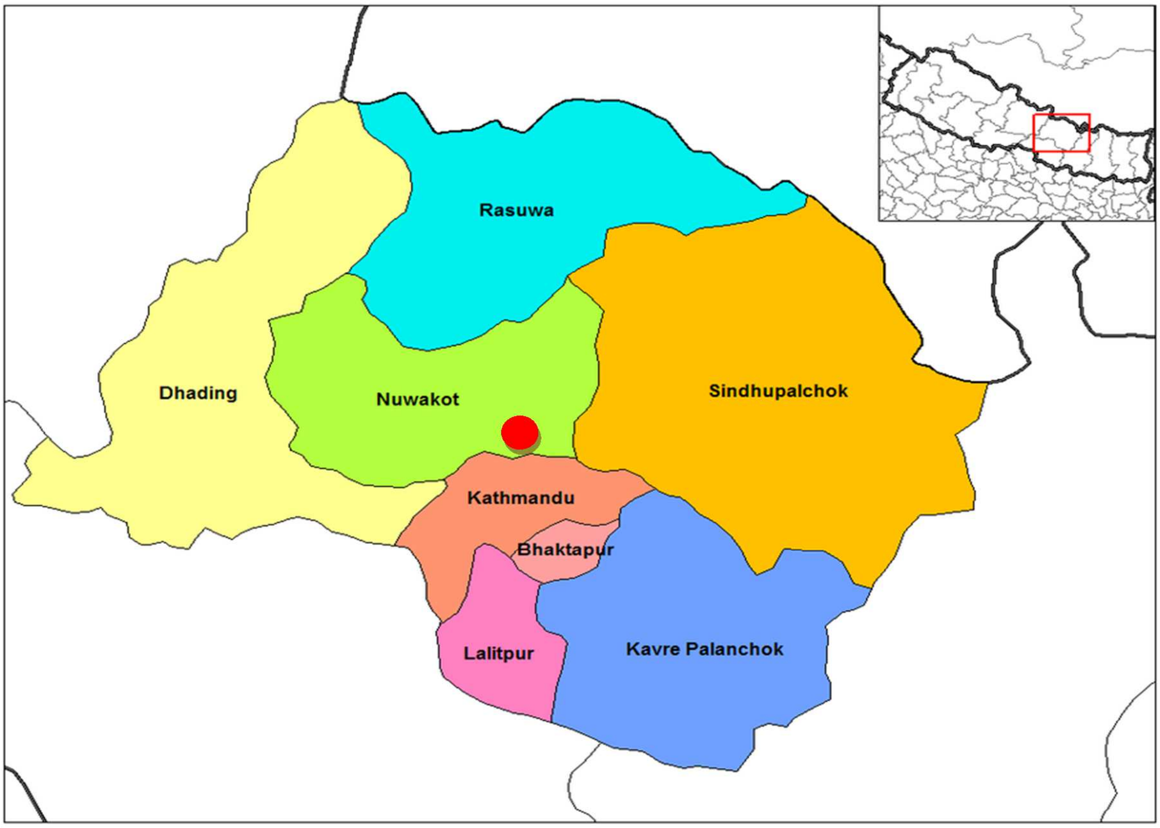
Nepal has five development regions that are divided into 14 administrative zones. Those zones are again subdivided into 75 District Development Committees (DDC). Kaule lies in the Central Development Region, in the Baghmati Zone, in Nuwakot District with the district number 48. Figure 2 shows a map of subdivisions of Nepal including development regions, zones and districts.

**Figure 2:** Map of the subdivisions of Nepal




*Source:* HÉGÉSIPPE CORMIER (2007).

**Figure 3:** Map of the districts in the "Baghmati Zone"



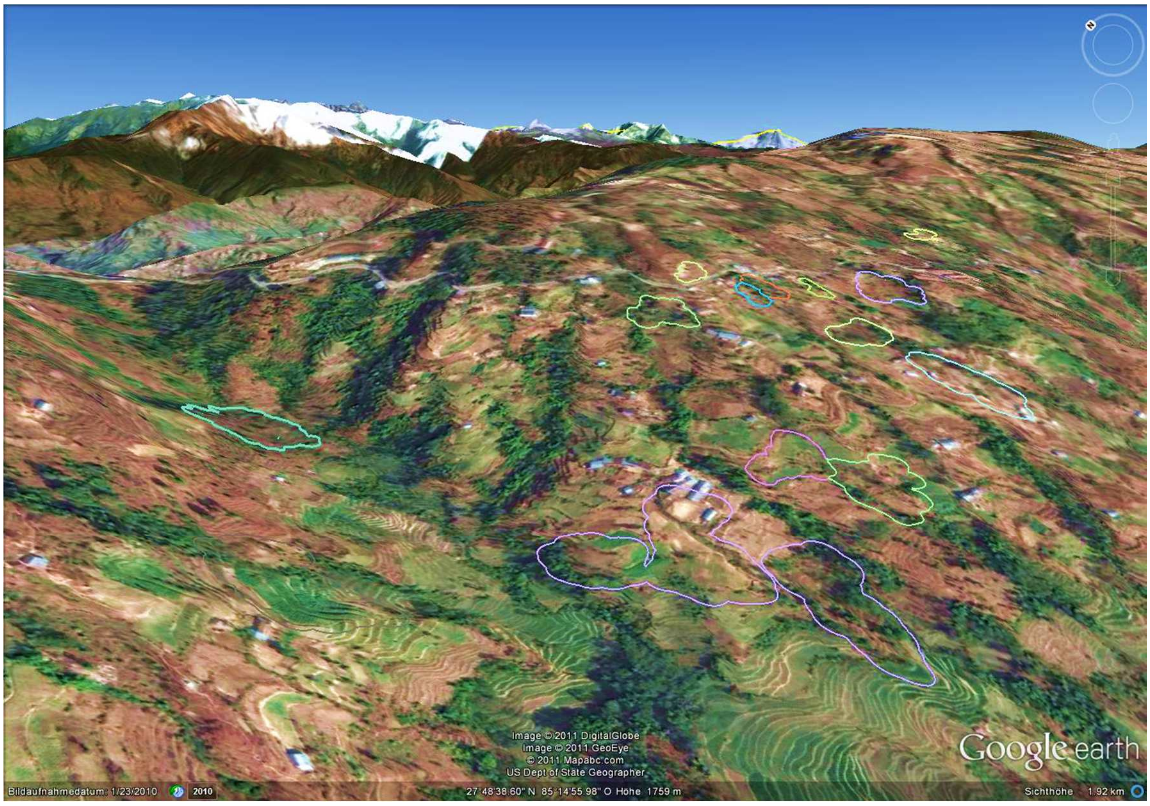

*Source:* RARELIBRA (2006). The red mark indicates the approximate location of Kaule within the Nuwakot District.

The districts are further divided into Village Development Committees (VDC) and those are again subdivided into the smallest governmental organizational units called wards. Kaule is part of the Okarpauwa VDC and has the ward number 3 (MINISTRY OF LOCAL DEVELOPMENT 2012).

The Village Development Committee's (VDC) function is to organize village people structurally at a local level. It allows villagers to participate in and to be responsible for development of their region. The VDC is also meant to ensure proper utilization and distribution of state funds and a greater interaction between government officials, NGOs and agencies. The VDC discusses topics like education, water supply, basic health, sanitation and income and also monitors and records progress, which is displayed in periodical census data (NAVIN 2011). International or local organizations need to inform the VDC and sometimes the DDC in order to ensure transparency of their projects and to be under a certain protection by informing officials.

The study sites for this research are different fields of farmland owned by the participants of the project, mostly situated in the southeast exposure in Kaule. Maps of the included fields can be found in the annex (see Annex 2). In the first interview in 2008, farmers reported that they would altogether provide 35.262 square meter of agricultural land for the process of converting land to agroforestry. Later in 2009, at the start of the project, only 17.178 square meter were provided (see Table 2). However, during the project, several farmers devoted more land to the project.

**Figure 4:** Agroforestry transition land of different project participants in Kaule




*Source:* “Kaule Nuwakot district” 27°48´38.60´´N and 85°14´55.98´´O. Google earth. January 23, 2010. July 02, 2011. Colored areas are under transition to agroforestry.

The Google Earth picture shows the scattered and different sized agricultural land areas that have been dedicated by farmers to the transition to agroforestry cultivation. Variable colours indicate different landowners.

**Table 2:** Included land in agroforestry project at project start in spring 2009

| Participant | No. of terraces | Slope (%) | Minor terrace ($m^2$) | Major terrace ($m^2$) | Total land ($m^2$) | Position to the house |
|---|---|---|---|---|---|---|
| Farm 1 | 24 | 17 | 5 | 191 | 1.675 | far |
| Farm 2 | 10 | 39 | 5 | 451 | 688 | far |
| Farm 3 | 5 | 21 | 38 | 116 | 307 | near |
| Farm 4 | 6 | 10 | 18 | 193 | 784 | near |
| Farm 5 | 19 | 22 | 12 | 295 | 1.057 | near |
| Farm 6 | 4 | 24 | 59 | 604 | 2.274 | far |
| Farm 7 Land No. 1 | 10 | 20 | 10 | 798 | 2.407 | far |
| Farm 7 Land No. 2 | 25 | 26 | 9 | 207 | 1.888 | far |
| Farm 8 | 8 | 25 | 71 | 787 | 1.646 | near |
| Farm 9 | 1 | 31 | 424 | 424 | 424 | near |
| Farm 10 | 4 | 12 | 62 | 133 | 308 | near |
| Farm 11 | 5 | 14 | 36 | 119 | 361 | near |
| Farm 12 | 6 | 22 | 5 | 662 | 805 | near |
| Farm 13 | 17 | 30 | 21 | 276 | 1.284 | near |
| Farm 14 | 7 | 24 | 29 | 448 | 800 | far |
| Farm 15 | 5 | 44 | 17 | 193 | 470 | near |
| **Farm A (Agroforestry)** | **24** | **21** | **63** | **241** | **6.922** | **near** |
| **Total (without Farm A)** | **180** | | | | **17.178** | |

The agroforestry farm was already practicing agroforestry at the project start. This farmer still participated in all trainings and activities of the project. The table shows that in general the number of terraces, the size of terraces and the slope of the land that farmers provided for agroforestry differ strongly.

### 3.1.2 Climate

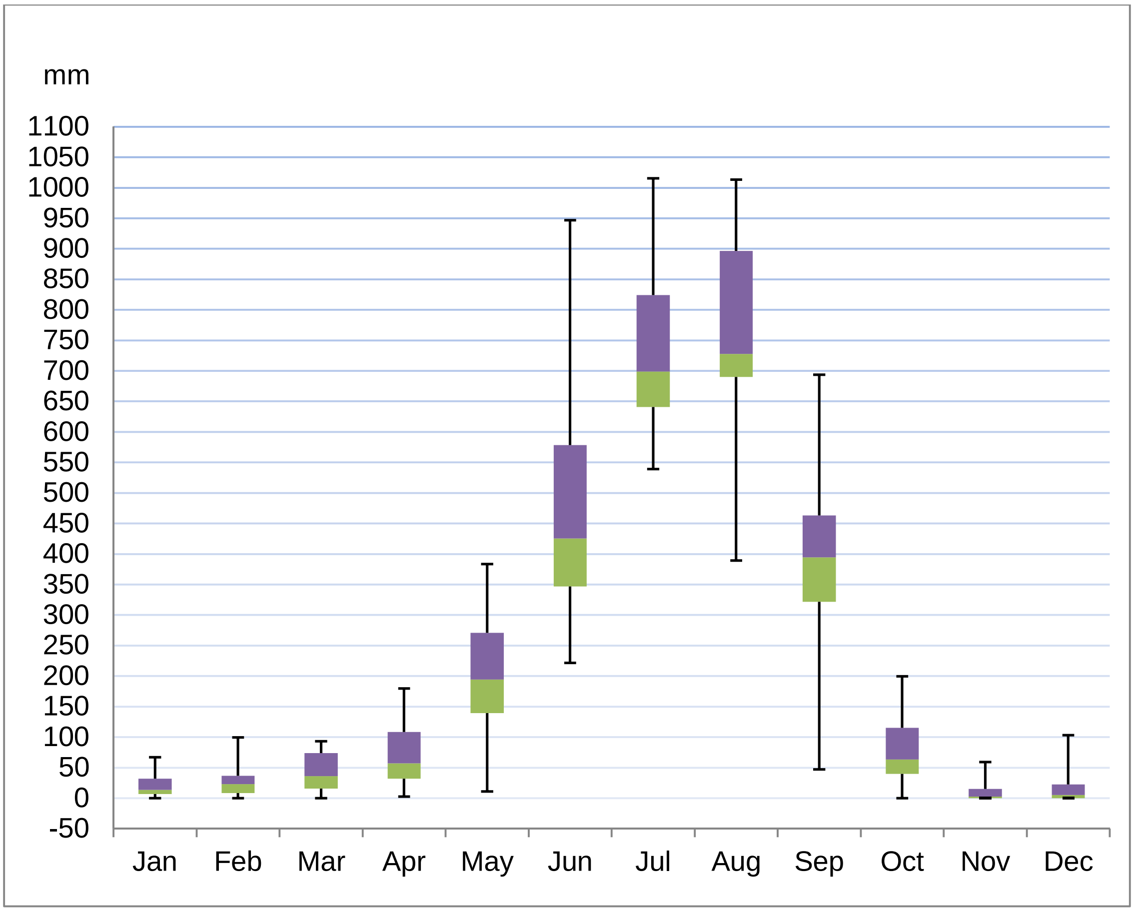
Monsoonal circulation typical for tropical fringes characterizes the climate of Nepal. Due to the country's topography, including orographic barriers, the climate is modified, where the Himalayas acts like a barrier blocking air masses to and from central Asia. This keeps cold air from central Asia out of the subcontinent, and the moist monsoonal air masses from the south away from Tibet. The elevations in Nepal range from 30 m to 8.848 m within 150 km, which leads to numerous small climatic differences within short distances, and the presence of nearby all types of climate in Nepal. In the Midhills a temperate climate prevails (MANANDHAR, 2002; GERLITZ, 2011).

Agriculture in Nepal is strongly dependent on the monsoon climate (MAJUPURIA 1999). During the monsoon period between June and September, 80 % of the country's annual precipitation occurs. The amount of rainfall differs strongly within the country, depending on the orographic ascent, the exposure of hillsides (to north or south) and other factors like the maximum moisture advection of air masses. In general, the intensity of monsoon precipitation differs as a function of longitude. While the eastern part of the country is affected by monsoon rains from June to October, the western parts are characterised by a shorter monsoon period with less intensive precipitation events.

ICHIYANAGI *et al*. (2007) evaluated data from 1987 to 1996 of 274 rain gauge stations in Nepal. They examined the variability of precipitation with elevations and regions (Western 80°E-82°E, Central 83°E-85°E and Eastern 86°E-88°E) and found that maximum annual precipitation increased linearly with altitude for elevations below 2.000 m and decreased for elevations above 2.000 m. Mean annual precipitation was almost 2.000 mm/year below 3.000 m. They indicate that maximum annual precipitation occurs in Central Nepal between 1.000 and 2.000 m elevation with precipitations of 3.000 – 5.500 mm/year.

The rhythm of the monsoon climate can be generally divided into pre-monsoon (April - May), monsoon (June - September), post monsoon (October - December) and winter (January - March). The warmest months are in the pre-monsoon period between April and May. January and February are usually the coldest months. The first heavy convective precipitations occur during the pre-monsoon due to intense insolation.

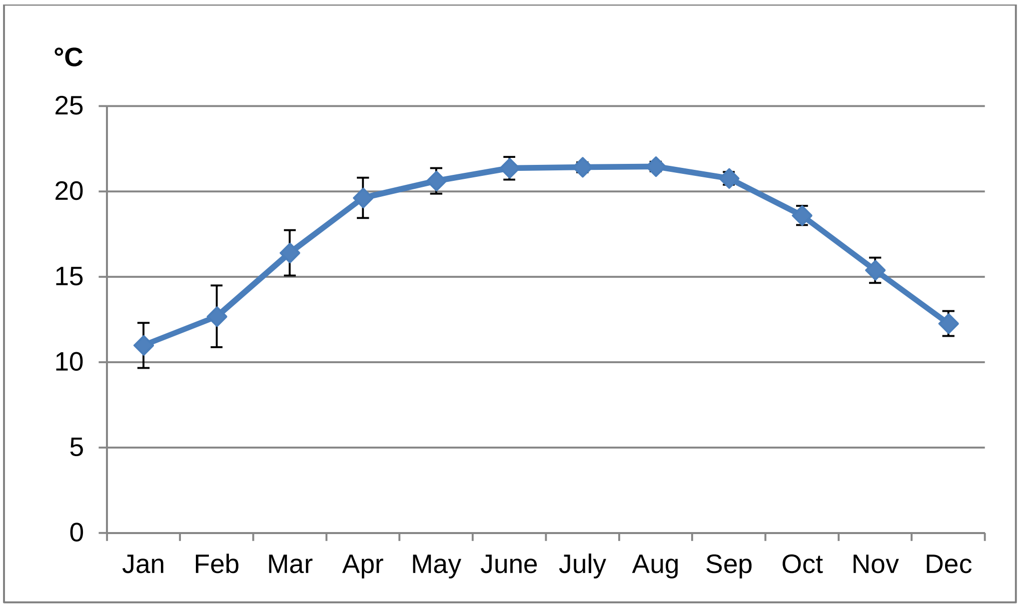
**Figure 5:** Precipitation in Kakani, Nuwakot District between 1976 and 2005




*Source:* DHM NEPAL (2012). Purchased data from DHM, Nepal. The intersection line between the green and purple boxes represents the median.

Kakani, a village approximately 3.65 km by land, or 1.75 km by air (source Google Earth 2012) from Kaule has an installed governmental weather station (meteorological registration number 1007). Figure 5 shows precipitation data from this weather station between 1976 and 2005. The unusual format of the box plot chart is used to illustrate the typical monsoon curve with its maximum in summer but also the huge variance in minimum and maximum precipitation.

**Figure 6:** Bias-adjusted ERA-Interim-Reanalysis of long time mean for temperature

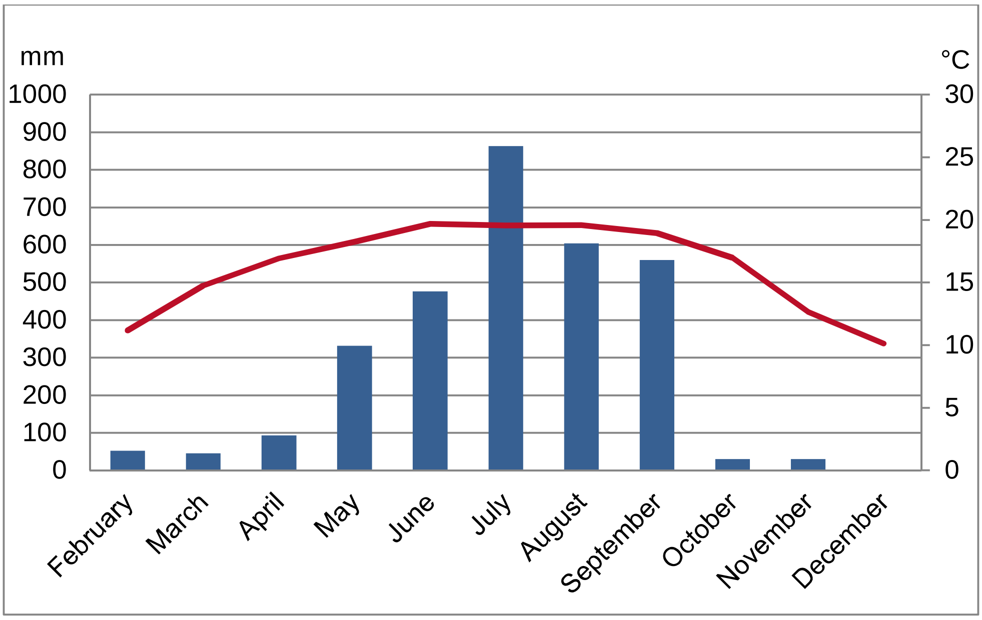



Source: (GERLITZ *et al*. 2014)

The temperature data in Kaule are model data, based on Bias-adjusted ERA-Interim-Reanalysis with a resolution of 1 km². Basic data are short-term measurements at a weather station that has been installed in the context of the agroforestry project at the projects demonstration centre in Kaule in 2010.

ERA-Interim are reanalysis or climatic models for past data by the ECMWF (European Centre for Medium-Range Weather Forecasts). They usually have a spacial resolution of 0.75°. Here they have been altitude adjusted by GERLITZ (2011) for a 1.000 m-raster and crosschecked with Kaule station data. Finally, residuals have been adjusted on a monthly basis.

**Figure 7:** Monthly mean temperature and precipitation sum in Kaule for 2011



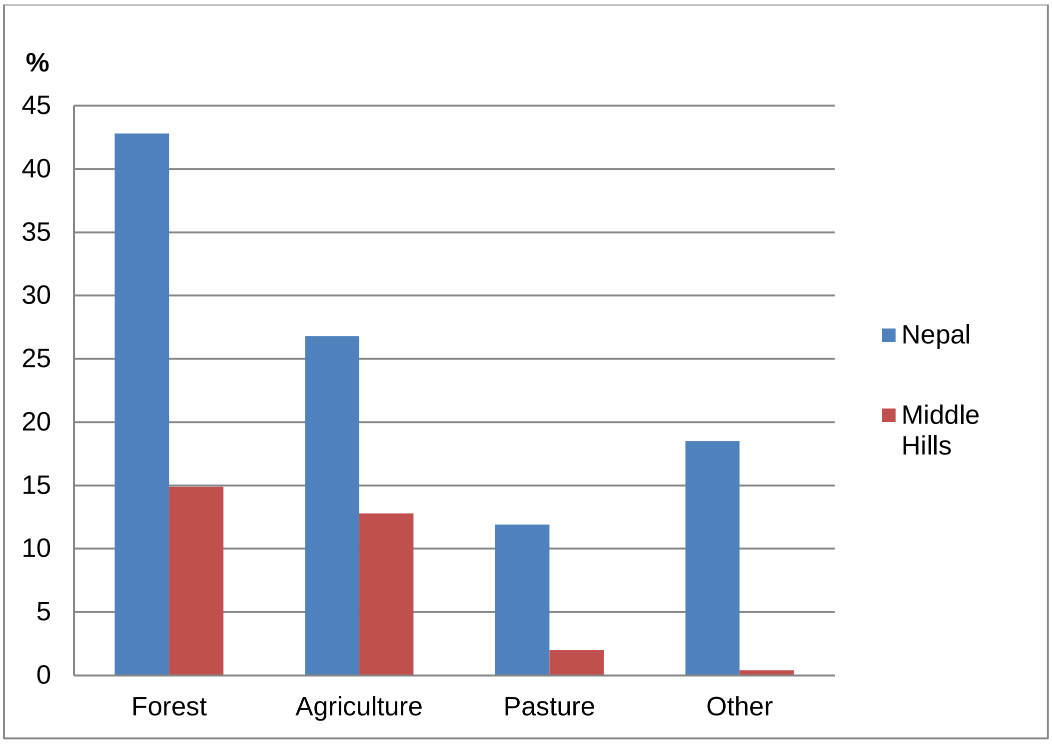

*Source:* Weather Station Kaule e.V. at Kaule demonstration centre. Data is available only from February till December.

Figure 7 shows the monthly precipitation and temperature in the project year of 2011. In comparison to Figure 5 and Figure 6 showing the temperature and precipitation trend for several years, Figure 7 shows that the months of maximum precipitation in Kaule in 2011 were July, August and September. Extreme precipitation can reach up to a daily rainfall of 95.4 mm as it was measured at June 27th 2011. For the short term observations of a development project, the particular situation per year regarding the climate may need to be taken into account so as to evaluate the quality or quantity of the harvest. For long term observations, the meteorological trend is of importance. According to GERLITZ et al. (2014) a trend of increasing winter temperatures of approximately 0.8° C per decade while summer temperature is not significantly increasing.

### 3.1.3 Land Management in the Midhills

Nepal has a total area of 147.181 sq. km and the Midhills make up 30.1 % of it. In 2010, 14.9 % of Nepal's forest, 12.8 % of the total agricultural land, and 2 % of the countries pasture were situated in the Midhills (SHARMA 2010).

**Figure 8:** Percentage of land use in Nepal and its share of the Midhills




*Source:* (Sharma, 2010) District and VDC profile of Nepal.

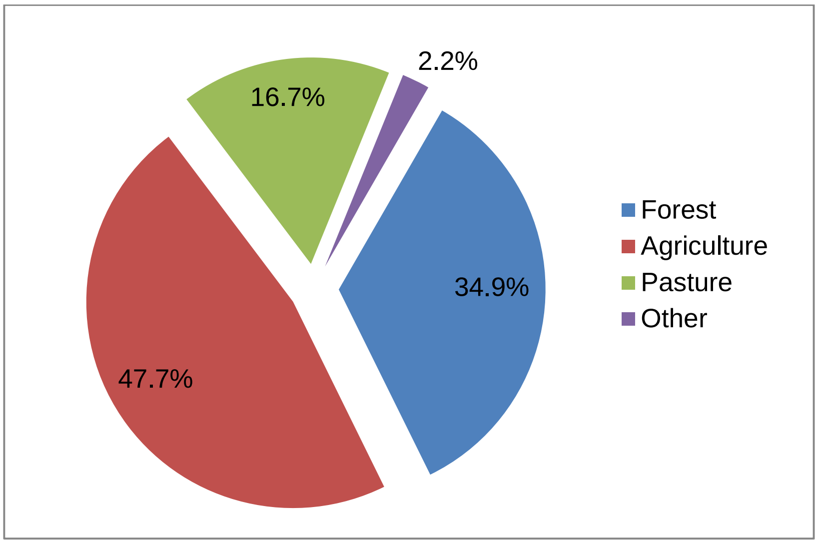
The Midhills include 34.9 % of Nepals forest, 47.7 % of its agricultural land and 16.7 % of the nations pasture. This shows how important this area is for the rural population. Due to the "District and VDC Profile of Nepal" of 2010, agricultural land in the Midhills covers 1222.3 ha of cultivated and 665.5 ha of uncultivated land (SHARMA 2010).

Figure 9 shows percentage of land use in the Midhills in 2010 related to total area of land use category.

Several bigger international and national organisations like WWF, FAO, Forestry Nepal, as well as several scientists report that rapid deforestation is occuring in the "Central

Development Region" within areas outside the national parks and wildlife reserves (CHAUDHARY 2000; PEDLEY *et al*. 2007; BHATTARAIA *et al*. 2009; DHITAL 2009). The Department of National Parks and Wildlife Conservation in Nepal indicates on their webpage in total two national parks in the Midhills. Khaptad National Park with 216 sq.km and Shivapuri Nargun National Park with 159 sq.km (DEPARTMENT OF NATIONAL PARKS AND WILDLIFE CONSERVATION 2012). Shivapuri Nargun National Park borders directly on a neighbouring village of Kaule, called Kakani. The distance by air between the extensions of Shivapuri National Park and the long time established agroforestry farm is only about 400 m.

**Figure 9:** Percentage of land use in the Midhills of Nepal in 2010




Source: (SHARMA, 2010) District and VDC profile of Nepal.

### 3.1.4 Natural Vegetation in the Midhills and near Kaule

Parallel to the diversity of Nepal's climate is also its vegetation that varies strongly depending on elevation, temperature and rainfall. From south to north, the natural vegetation zones range from subtropical monsoon rain forest through various kinds of forest belts to the timberline at 4.000 – 5.000 m and further vegetation cultures up to 5.000 – 5.500 m where permanent ice and rocks limit vegetation growth (MANANDHAR 2002).

It is not easy to classify the vegetation in Nepal as scientists apply many approaches. An approach can be based on the physiognomy of vegetation, vegetation structure, or environmental factors. In addition, the scale of approach is important, depending on whether small or broad areas are assessed. Several scientists have classified Nepal's vegetation into a number of divisions (SCHWEINFURTH 1957; DOBREMEZ 1972; STAINTON 1972, LILLESØ *et al*. 2005). These divisions are based on geographical, climatic and/or biotic conditions. For smaller areas and fine scales an approach to vegetation based on the species composition of plant communities is basic. The most widely used system for defining plant communities is a classification based on species dominance.

One more simplified focus on vegetation classification is based on forest types. Again, different authors propagate different vegetation zones. Following the zoning of (SHRESTA 1991) the forest vegetation up to 1.200 m is classified as evergreen tropical and subtropical vegetation usually containing sal, semal, sisso, khair and other trees. From 1.200 m to an altitude of 2.100 m, deciduous monsoon forest contains oak, elm, beech, birch, maple and alder. The zone between 2.100 m and 3.300 m is evergreen coniferous forest including pine, fir, spruce, deodar, larches and rhododendron. An area up to 5.000 m contains alpine grassland.

Kaule is situated between 1.800 – 1.900 m in the upper sub-tropical zone. Visual observations of vegetation around Kaule by the author seem to present a dominance of alder and pine. In reference to the above defined schema that would classify the area of Kaule as deciduous monsoon forest at the border to evergreen coniferous forest.

As the vegetation type is an expression of climate and soils, similar combinations of species appear under certain environmental conditions. A human dominated landscape is often composed of discrete patches and remnants, including natural vegetation and farm fields. Any classification of vegetation types is not only influenced by environmental impacts but also by humans. The fragmentation of habitats can cause biodiversity erosion and may result in shifts in species compositions (LILLESØ *et al*. 2005).

A complete vegetation map of Kaule is not available but SCHWAB (2012) has sampled vegetation at conventional farming, farming in transition to agroforestry and agroforestry farming on 24 sampling plots in Kaule during the end of the monsoon season in 2010. Out of the sampled plant species, trees and shrubs have been identified and arranged based on abundance- and continuity- ranking.

**Table 3:** The 10 most significant tree and shrub species in Kaule

| Abundance | | No. of Individuals | Rank | | No. of Plots | % |
|---|---|---|---|---|---|---|
| 1 | Buddleja asiatica | 88 | 1 | Ficus neriifolia | 17 | 71 |
| 2 | Ficus neriifolia | 79 | 2 | Buddleja asiatica | 16 | 67 |
| 3 | Flemingia macrophylla | 48 | 3 | Prunus persica | 11 | 46 |
| 4 | Albizia julibrissi | 30 | 4 | Alnus nepalenis | 10 | 42 |
| 5 | Aconogonum molle | 27 | 5 | Aconogonum molle | 9 | 38 |
| 6 | Prunus persica | 23 | 6 | Albizia julibrissin | 9 | 38 |
| 7 | Maesa chisia | 21 | 7 | Maesa chisia | 8 | 33 |
| 8 | Alnus nepalenis | 16 | 8 | Bauhinia purpurea | 7 | 29 |
| 9 | Arundinella nepalensis | 15 | 9 | Flemingia macrophylla | 6 | 25 |
| 10 | Capsicum annuum | 15 | 10 | Choerospondias axillaris | 6 | 25 |

*Source:* (SCHWAB 2012)

The focus of Schwab's study was perennial plants including multipurpose trees and other woody species because of their dominant role in the agroforestry project of Kaule. Table 3 shows the 10 most frequent and persistent species.

Relatively undisturbed natural vegetation can be found within 144 sq. km of the nearby Shivapuri National Park. The park was founded as a watershed and wildlife reserve in 1976 and later in 2002 established as a national park. In the Shivapuri National Park, there are an estimated 2.122 species of flora, whereof sixteen species are recorded as endemic flowering plants. Around 449 vascular plants are recorded including 4 gymnosperms, 313 dicots, and 132 monocots (BHUJU *et al*. 2007).

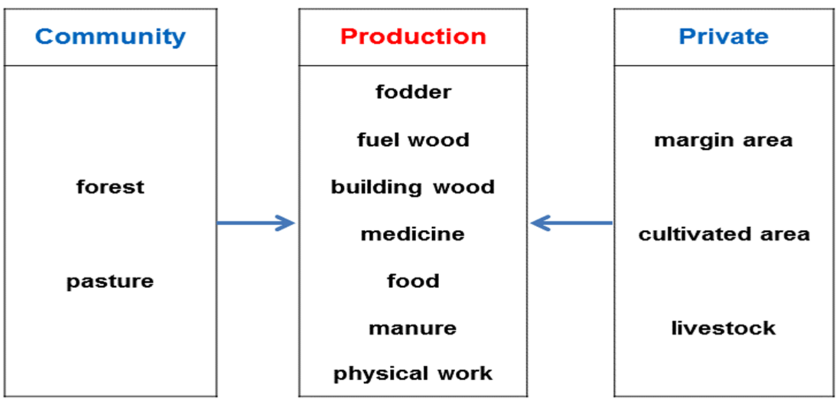
### 3.1.5 Farming Practices in Nepal an Kaule

Traditional agriculture in Nepal has been closely adapted to climatic conditions and to the turn of the seasons. Between the altitudes of 1.300 m and 2.800 m, rain-fed agriculture is common the whole year around in the form of rotation systems that include potato, maize and millet in summer and wheat in winter. During the winter dry season 90 % of the monsoonal rice and maize fields are fallow (HAFFNER 1984). Below 1.300 m, rice-cultivation is dominant.

The hills and mountains of the Midhills have been built into innumerable terrace constructions over the centuries. Terraces that are under irrigation are called *khet*. *Khet* terraces are cultivated with rice during the rainy season and afterwards with wheat. They are situated in the lower slopes due to climate and water access. On *khet* terraces are no trees and shrubs. Terraces that are non-irrigated and used for rain-fed agriculture are called *bāri*. *Bāri* terraces are situated higher up the hill slopes and are usually cultivated with maize, finger millet, wheat and mustard. Terrace borders are sometimes covered with grasses, trees and shrubs. The top of the slopes are often community land, where trees and shrubs grow and villagers use patches as grazing areas for their goats. Illegal tree cutting is a problem and punished by authorities through fines. Trees and shrubs also cover the land that is too steep or stony for agriculture (see Figure 4) where permanent vegetation covers the sheer rocks and gorges. It is generally accepted that there is no noteworthy space to extend the area of agricultural acreage in the Midhills (HAFFNER 1984).

All different areas like forest, pasture, *khet*, *bāri* and marginal land are connected and dependent on each other in the Midhills. The fodder for livestock is derived from nearby forest and pasture and livestock manure is an important fertilizer for the cultivated fields. The fields deliver food for humans. Trees and shrubs from forest and marginal land produce wood for fuel and construction. Livestock also provides physical work, for example, if oxen are used for ploughing. Hill agriculture is characterized by low productivity and traditional technology (DHAKAL *et al*. 1987). Due to the difficult access, bullock ploughs only reach the bigger and less sloping terraces.

**Figure 10:** Production of the community and the private sector in Kaule




*Source:* Modified after (KOLLMAIR 1999).

Not every farmer is planting and harvesting all kinds of plants. During interviews in 2008, farmers in Kaule were asked about plant species they are cultivating. 15 farmers listed a total of 37 different kinds of plants. An average of five (4.8) plant species were cultivated per family in Kaule with a maximum of ten species by one farmer, and a minimum of one species (maize) by another farmer. It is important to remember that farmers with suitable field conditions can cultivate certain crops. Rice is for example cultivated only up to an altitude of 1.600 m (KOLLMAIR 1999).

**Table 4:** Planted and harvested crops in Kaule

| | | | |
|---|---|---|---|
| 1. | aubergine | 20. | mustard |
| 2. | bean | 21. | onion |
| 3. | big bean | 22. | pea |
| 4. | bitter gourd | 23. | potato |
| 5. | broom | 24. | pumpkin |
| 6. | buckwheat | 25. | radish |
| 7. | cabbage | 26. | rice |
| 8. | cauliflower | 27. | soya bean |
| 9. | chili | 28. | strawberry |
| 10. | cow pea | 29. | spinach |
| 11. | coriander | 30. | sweet potato |
| 12. | cucumber | 31. | taro |
| 13. | garlic | 32. | timbur |
| 14. | ginger | 33. | tomato |
| 15. | green bean | 34. | tree tomato |
| 16. | iskus | 35. | turmeric |
| 17. | lentil | 36. | turnip |
| 18. | maize | 37. | wheat |
| 19. | millet | | |

*Source:* Based on an open interview with 15 farmers in Kaule in 2009 and 2011.

During open interviews in Kaule in 2009 and 2011, the participating farmers were again asked what plants they plant and harvest during the year. Table 4 lists the plants indicated by them in both interviews. Newly introduced plants by the agroforestry project were not included in this list because it displays the possible diversity of available plants without external influence.

Livestock husbandry is an important part of Nepal's agriculture and as in other villages nearby, all families in Kaule have some chickens, goats or buffalos. Few farmers in Kaule have cattle. The quantity depends on a family's living circumstances. Livestock is a source for milk, eggs and meat that can be consumed or sold. Manure is used as fertilizer. During festivals, livestock is also used as sacrifices to the gods.

Especially goats can be a threat to agriculture. Fencing is not common and they are often running free or are brought to the community forest or neighbour's ground for grazing. Particular fodder plants for goats and other livestock are usually not grown on agricultural terraces or home gardens of farmers. Instead family members spend several hours every day collecting fodder in surrounding areas.

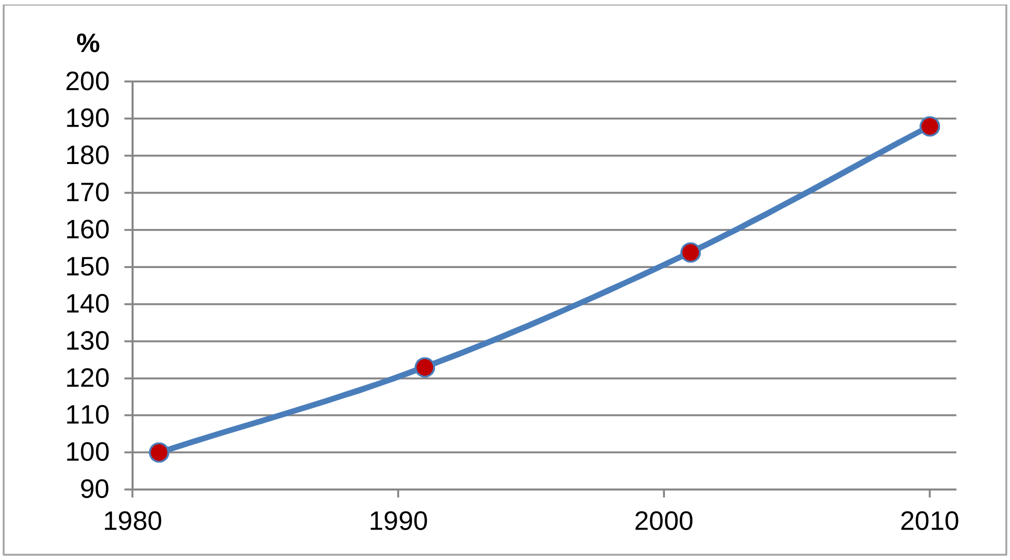
Governmental programs on improved livestock breeds are available but most farmers are not aware of such programs.

## 3.2 Project Participants

### 3.2.1 Population

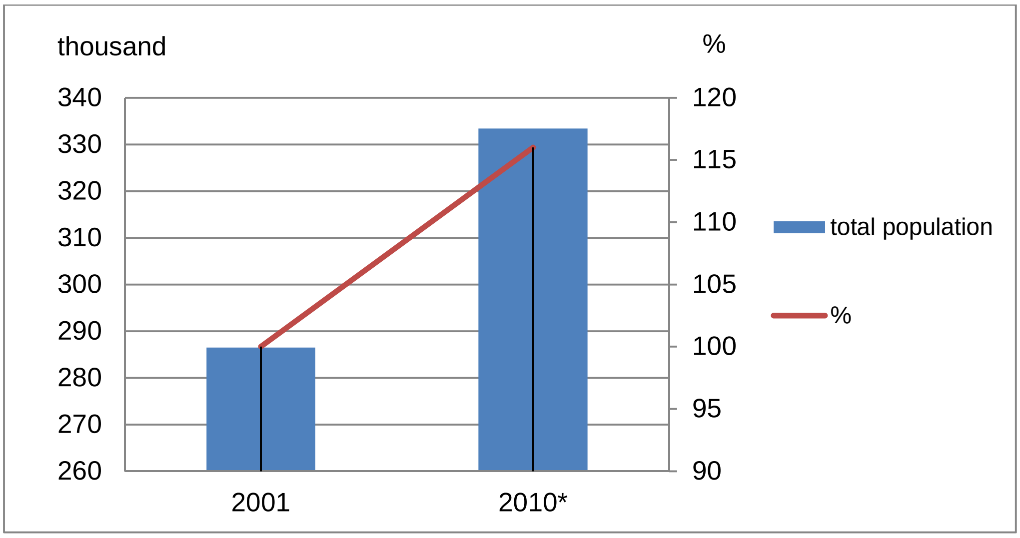
Nepal's population is constantly growing. HAFFNER (1984) stated already in 1984 that Nepal's population doubled during the past 20 years, between 1964 and 1984. Recent data shows a slower growth rate but still a rapid increase. In 2001 according to the DDC and VDC profile the total population equalled more than 23 million people in over 4 million households. This corresponds to a population density of 157 people per sq.km (SHARMA 2010).

**Figure 11**: Population growth trend in Nepal from 1981 - 2010




*Source:* (SHARMA,2010) Data for 2010 is projected data. District and VDC profile of Nepal.

**Figure 12:** Increase of population in Nuwakot District between 2001 and 2010




*Source:* (SHARMA,2010) *Data for 2010 is projected data. District and VDC profile of Nepal.

In Nuwakot District, the population density raised about 16 % between 2001 and 2010.

The population in Nepal is rising but there is no more free area for the extension of agriculture, especially not in the Midhills (HAFFNER 1984). This puts stress on families because more individuals need to be fed by the harvest of the same land area. One consequence is the migration of families or family members to Kathmandu. Another result is the increasing rate of workers that move to foreign countries for a certain time, especially to the Gulf States or India.

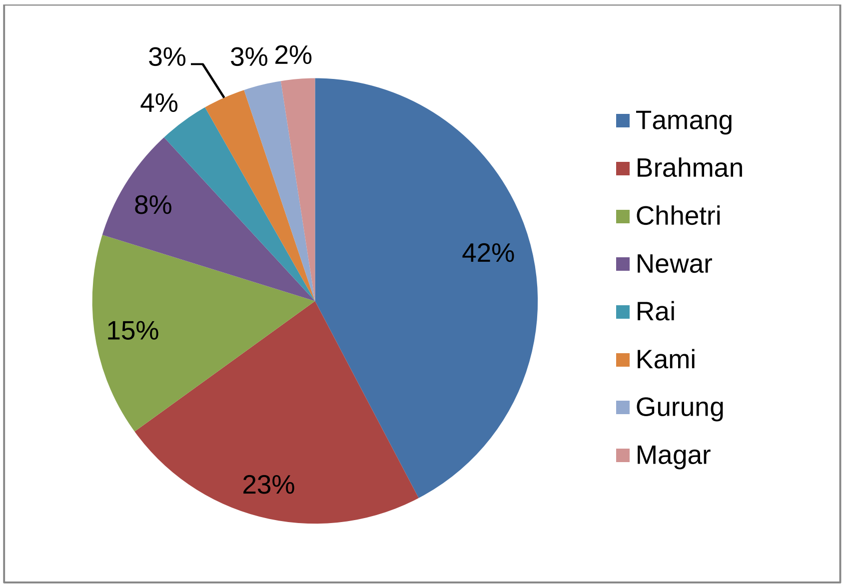
### 3.2.2 Kaule - People and Village

Kaule village is situated at the Trisuli Highway approximately between 1.600 m – 1.800 m a.s.l and 25 km northwest of Kathmandu at the boarder of Kathmandu valley. In 2001, the population census counted 7.277 inhabitants in 1.274 households in Okharpauwa VDC (SHARMA 2010). Official data on household and population numbers for Kaule Ward 3 is not available, but personal investigations of Kaule members show an estimated 898 inhabitants and 143 households in 2010 (SCHWAB 2012).

Most of Kaule's inhabitants are farmers, shop owners or both. Along the streets, shops and stalls offer regional vegetables and other groceries, stationary and every day household items (ROTH 2012). Kaule also has two mills, two tailors, a chicken farm, a butcher, a black smith, a carpenter, a garage and welding shop, a shop that sells pharmaceuticals, a shop that sells electric equipment and hardware, two souvenir and gift shops, and since 2011 an internet cafe. At least six restaurants entertain locals. A few tourists pause in Kaule on their way to the trekking area of Langtang. The next health post exists in Ranipauwa, a neighbouring village of Kaule.

A village chairperson, a village council, the Forest Community Group, a VDC Officer, the Forest Officer and a police station, present Kaule's official structures. Kaule also has a primary school and a private boarding school that has been established by an initiative of JICA (Japan International Cooperation Agency).

**Figure 13:** Different caste and ethnic groups in the Nuwakot District




*Source:* (SHARMA, 2010), District and VDC profile of Nepal.

Figure 13 shows the variety of castes and ethnic groups in the Nuwakot District. Sherpa are not listed in the profile data even though several Sherpa families have their residence in Kaule. The inhabitants of Kaule are mainly Tamang. Some villagers are Brahman, Sherpa and Newar. Most villagers are Buddhists and Hindu, while a minority is Christian.

All participants of the agroforestry project in Kaule are Tamang and Buddhists apart from one Newar and Hindu family. Both castes are of comparable high ranking within Nepal's caste system. While Tamang are originally from Tibet, Newar are the native inhabitants of the Kathmandu valley.

### 3.2.3 Kaule e.V. "Organization for Socially Sustainable Agro Projects"

In November 2007 the NGO Kaule e.V. – "Organization for socially sustainable Agro Projects" was founded as a non-profit institution in Cologne, Germany. The founding members of the organisation indicate the aim of promoting socially sustainable agricultural projects mainly in developing countries. The organization was founded in order to support an agroforestry pilot project in Kaule. Fundraising was accomplished in Germany and the author of this thesis was sent to Kaule to accompany farmers while launching the project. This provides the background for the participatory action research. In addition, it made it possible to be on the spot and participate from the start. Dr. Pande from the Institute of Agriculture and Animal Science (IAAS) in Rampur, Nepal officially supported the research. This cooperation legalised the action.

In Germany, Kaule e.V. is composed of three board members and several common members. Communication between the agroforestry project in Kaule and Kaule e.V. was done through written reports and talks. Transparency for donors was provided by a webpage of the organization (www.kaule ev.org) and by lectures and talks that were given at the Universities of Hamburg, Siegen and Bonn to inform about the conditions of Nepal's agriculture and farmers and to raise awareness.

The German way of time management and rating of values differs strongly from the Nepalese perception. Care was given for the difference in culture, language and experience. The Nepal Agroforestry Foundation (NAF) as a local NGO was employed to implement training on agroforestry with project participants.

After Kaule e.V. learned that another organization had provided agroforestry training for over 15 years, but that nowadays the name of the organization is unknown, the idea was raised to accompany the project with several scientific documentations and analyses. This has been done in the form of several master thesis and this present dissertation. All written works together can be seen like a puzzle where the single works are the puzzle pieces and in total give an interesting view from several angles on the project. The master thesis of Vera Kremer at the Institute of Crop Science and Resource Conservation (INRES) addresses the potential of green manure plants for soil improvement (KREMER 2010). The master thesis of ROTH of the Institute of Geography, University of Erlangen-Nürnberg explores market access and the need for agroforestry cash crops in accessible areas near Kaule (ROTH 2012). The master thesis of SCHWAB from the Institute of Geography at the University of Hamburg deals with the comparison of soils and geographical vegetation between conventional terraces to agroforestry and terraces in transition (SCHWAB 2012). Next to the present study covering the project start until 2011, another dissertation is in progress done by WIENERS from the Institute of Geography at the University of Hamburg to document farmer ideas, interests and strategies for accomplishing their goals.

### 3.2.4 Kaule ev (environment) – Nepal

In autumn 2009, the Nepalese organization Kaule ev – Nepal (ev stands for environment) was founded as a local partner organization to its affiliate in Germany. One reason for its foundation was the fact that foreign development organizations are not allowed to work in Nepal until they are registered with the Social Welfare Council (SWC). Because registration with the SWC would have required a much higher financial investment than the three years project budget, registration by a local partner organization was a good alternative. Hence, Kaule e.V. is working as an advisor while Kaule ev – Nepal is reporting annually to the Nepalese government. The combination of both affiliated organizations seems to be favourable because knowledge transfer can be done in a more structured way. Kaule e.V. gains a legal platform from which to contribute, and Kaule ev – Nepal receives input to build and run a local organization, an occurrence that cannot be taken for granted for many farmers. Even when considering the starting problems, there are long term benefits of supporting a local organization of farmers to run the project in a stable and organised way.

The project has been designed to work with a limited amount of participants. This was because the agroforestry project is a pilot project and the organizers took the responsibility with caution. The project was initially limited to 15 families plus one existing agroforestry practicing farm. Those families comprised around 100 individuals, plus or minus, due to births and deaths. The farmers organised themselves into the "Agroforestry User Group" that has met since 2009 on a monthly basis to discuss issues regarding the project and to plan further action.

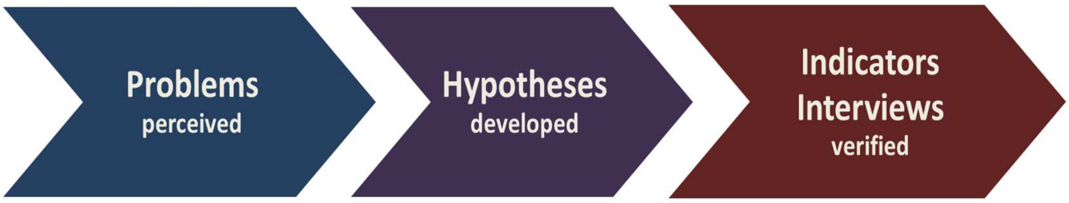
Another strategy for risk minimization was that participating farmers were not transforming all their land to agroforestry. Participants were asked to include as much of their land in the project as they would feel comfortable with. The idea was that later farmers would be able to transform more land on their own if they remained positive about agroforestry. In addition, this allowed farmers to work in parallel with their usual farming practices ensuring there would be no threat to their livelihoods created by the project if unforeseen circumstances should appear. Such circumstances could be weather conditions, or political developments. The political situation in Nepal is complicated and has not relaxed since Nepal became a federal democratic republic in 2008.

# 4 Methodology

## 4.1 Approach

This study is based on an interdisciplinary and participatory approach with qualitative and quantitative research methods. As main tools, interviews were conducted and socio-economic and ecological indicators assessed. These interviews and indicator assessments were applied in the following periods of autumn 2008, spring 2009 till spring 2011, and spring 2012, during the initial time of the newly introduced farming system of agroforestry to 15 households in Kaule. Initially a problem statement for farmers and farming in Kaule was elaborated on the basis of open interviews in which hypotheses were designed and then developed with case studies and indicators.

**Figure 14:** Study approach




The background information for those assumed problems were also attained through participative observation and open interviews in Kaule before the project started in 2006, and 2007 and 2008 during several stays of two to three months. In addition, a literature review on the situation of farmers in Nepal was carried out.

## 4.2 Setup Description

In Kaule, one farmer called Farmer A has been practicing agroforestry for over 15 years (estimated by himself). Other farmers in Kaule were asked at an early stage through open interviews about their farming background and their interest in agroforestry. Based on these interviews, and in addition to the investigator's personal observations, problems regarding livelihood and farming in Kaule were identified and hypotheses were developed. The German non-profit organization Kaule e.V. organized and conducted an agroforestry project in Kaule starting in spring 2009. Kaule e.V. hired the Nepal Agroforestry Foundation (NAF) to perform agroforestry training. Farmers received theoretical and practical information on agroforestry farming. Afterwards, plants as well as seeds suitable for agroforestry were distributed. Since spring 2011, all farmers were accompanied by Kaule e.V. during the system conversion to agroforestry on the farmland they devoted to this project. Within this framework and in the first three years of the project, the data for the present study was collected.

## 4.3 Methods, Data Processing and Analysis

### 4.3.1 Descriptive Data

#### 4.3.1.1 Weather Station

Meteorological data has been monitored in Kaule in order to describe the weather influence in the relevant years of the project. In Nepal, due to the diverse topography, weather conditions can change over short distances. This is the reason why data was collected by the author rather than buying data from the governmental weather station in the neighbouring town of Kakani. In 2009, a simple station was placed at the demo centre in Kaule but it soon became obvious that the measurements were too inaccurate. A professional weather station was than purchased from eco Tech Umwelt- Messsysteme GmbH in Bonn, Germany. The system consists of a precipitation and temperature analyser and recorder. The data logger used in the setup is referred to as a "HOBO". It was included in the installed weather station, recording data for temperature and rainfall. The logger is a compact, battery-powered device equipped with an internal microprocessor, data storage, and two sensors. The data logging software is called “HOBOware Pro”.

Lars Gerlitz from the Geographical Institute of the University of Hamburg, who did his master thesis in meteorological studies in Nepal at this time, installed the station. It was placed at the demonstration centre in an open space that assures that no shadowing by trees or buildings occurs and that the station is fully exposed to wind and rain. The station was set up to log data in 3-hour intervals. It was launched at February 26th 2010. Between September 15th 2010, and February 3rd 2011, no data was logged because an error occurred due to false operation of the data logger setup. Also, between July and August 2011, data was not logged due to false equipment use and unauthorised intervention.

Because of the incomplete data series, additional weather data was finally bought from the Department of Hydrology and Meteorology (DHM). The data was taken at a governmental weather station (meteorological registration number 1007) in Kakani. Kakani is a village, approximately 3.65 km by land, or 1.75 km by air from Kaule (source Google Earth image in 2012). The weather station in Kakani is installed at an altitude of 1.812 m while the demonstration centre in Kaule is situated at 1.680 m.

Precipitation and temperature data was evaluated and presented in charts using Microsoft Excel. For precipitation, daily data and monthly precipitation sums were calculated. Temperature data was evaluated calculating the daily and monthly mean temperature and the corresponding standard deviation. The long-term mean temperature in Kaule from 1989 - 2010 presented in Figure 6 are model data based on bias-adjusted ERA-Interim-Reanalysis with a resolution of 1km². This data model has been provided by GERLITZ et al. (2014) and was generated within the German federal government department for education and research (BMBF), and funded by the CLASH project. CLASH stands for climate variability and landscape dynamics in Southeast-Tibet and the eastern Himalaya during the Late Holocene reconstructed from tree rings, soils and climate modelling.

### 4.3.2 Interviews

Structured, semi-structured and open interviews were conducted with all participants on several topics. Interviews are a valuable qualitative method, whereby open interviews are a good choice to understand the theme if the interviewer is not familiar with the problem. In contrast, structured interviews are the method of choice if the problematic is already known (WESTBROOK 1994).

The interviews were held in English and Nepali where the interviewer asked the question in English, whereby it was then translated by a local interpreter into Nepali. The interviewee answered in Nepali and the interpreter again translated the answer into English. The interviews were first recorded on a voice recorder and then transferred into written documents. To minimize mistakes by translation, the interpreter got an introduction and training about the value of factual and unpersuasive interpretation. Interview time was between 1 hour and 1.5 hours per interview due to the time consuming translation process. In most cases, it was not possible to get interviews of all participants, because farmers were too busy with their everyday work.

The following interviews were taken:

1. Open interviews on social and environmental topics.
2. Structured interviews on social topics at the start of project in 2009.
3. Structured interviews on social topics at the end of the pilot project phase in 2011.
4. Structured Interviews on farming and environmental topics at the start of the project in 2009.
5. Structured interviews on farming and environmental topics at the end of the pilot project phase in 2011.
6. Structured interviews in 2009 about agroforestry (AF) training of trainers (TOT) evaluation.

Table 5 shows an overview of all recorded interviews between 2006 and 2011 that provided information for this study.

**Table 5:** Overview of interview topics and participants

| | Open base interview 2006 /2007 | AF TOT training 2009 | Plant use and harvest 2009 | Plant use and harvest 2011 | Social structure 2009 | Social structure 2011 |
|---|---|---|---|---|---|---|
| Farm A (AF) | x | x | x | x | x | x |
| Farm 1 | x | x | x | x | x | x |
| Farm 2 | x | x | x | x | x | x |
| Farm 3 | x | - | x | x | x | x |
| Farm 4 | x | - | - | x | - | x |
| Farm 5 | x | x | x | x | x | x |
| Farm 6 | x | - | x | x | x | x |
| Farm 7 | x | x | x | - | x | - |
| Farm 8 | x | - | x | x | x | x |
| Farm 9 | x | - | - | - | - | - |
| Farm 10 | x | - | x | x | x | x |
| Farm 11 | x | - | - | x | - | x |
| Farm 12 | x | x | x | x | x | x |
| Farm 13 | x | x | x | x | - | x |
| Farm 14 | x | x | x | x | x | x |
| Farm 15 | x | - | x | x | x | x |

Open interviews were conducted in group meetings at the demonstration centre and on the farm. They were used to describe the situation and to develop the hypotheses. Structured interviews were performed in the private atmosphere of the participant's house with the exclusion of other project members or uninvolved persons (as far as possible) to minimise unwanted influences.

The answers to the structured interviews were used to create case studies of each household in order to understand the individual participating household's background. In the second step, the interview data was compiled into a framework (see Table 83). This framework was designed to sort answers into categories and to detect possible linkages between household livelihood strategies and project performance. This attempt was done to gain a more generalised level of observation, not at a single household level but at the group level. In the third step, indicator data were integrated in the context of the group level analysis to aid the observations. These categorisations were finally used to make assumptions about progress or reversal of the project depending on the households and group background and performance.

#### 4.3.2.1 Open and Semi-Structured Background Interviews

Open and semi-structured background interviews were conducted in 2006 and 2007 before the project started. They were taken within group talks together with all later project participants and additional farmers of the village.

The aim of these open background interviews on social structure (Table 7), school and education (Table 8), medical care (Table 9), acquirement (Table 10), nutrition (Table 11), farm income and infrastructure (Table 12) and finally an interview about agroforestry versus common farming (Table 13) was to understand the living situation and self-awareness of farmers. Questions were partly prepared and /or raised naturally within the discussions. Usually the group discussed until they agreed on an answer. Thus, the answers represent the expressed opinion of the whole group.

#### 4.3.2.2 Agroforestry TOT

Data on agroforestry training and TOT evaluation were collected from eight families including the agroforestry Farm A (see Table 5). The interviews were conducted in a structured way using a standardized questionnaire (see Annex1).

The following topics were covered by the interviews: general assessment, evaluation of topics and lessons, impact of training, evaluation of teachers and participants. The results are presented in Table 82.

#### 4.3.2.3 Plant Use and Harvest

Data on types and quantity of cultivated plant species (apart from distributed agroforestry plants) and additional information on planting and harvesting times were collected in May 2009 and again in April 2011. Fifteen families including the agroforestry farmer were interviewed (see overview Table 5). The interviews were done in a structured way using a standardized questionnaire (see Annex 1). Data for planting time and harvest were transferred into a planting and harvesting calendar for Kaule that was distributed to farmers (see Table 14 and Table 15).

The following topics were covered by the interviews: Quantity of plant species for own use or for income generation (Table 16), planting and harvesting times, cultivation of plants that are used for religious ceremonies or for medicinal use.

#### 4.3.2.4 Social Structure

Data on working hours and workload of family members was collected by interviews on social structure in May 2009 and again in April 2011. Sixteen families including the agroforestry farm were interviewed (see overview Table 5). The interviews were conducted in a structured way using a standardized questionnaire (see Annex 1).

The following topics were covered by the interviews: family composition, working hours on the farm, working hours off the farm, and distribution of workloads between family members.

## 4.3.3 Indicators

Several indicators were selected representing different disciplines. The category ecological indicators includes soil quality, soil living coleopteran and plant species. The category socio-economic indicators includes farm income and expenses, and changing market prices.

### 4.3.3.1 Soil Quality

Soil samples were collected in March 2009 and again in April 2011 on the fields of 12 farms in transition to agroforestry and on the agroforestry Farm A.

For soil sample collections, squares of 10 by 10 meters were staked on each farm. Within these 100 $m^2$ plots, 10 samples were taken randomly using a soil sampler (see Figure 15). The probes were taken from the top 20 cm of the soil. The soil of all 10 samples per sampling round were then thoroughly shuffled in a bucket. Afterwards, 500g of the mixed soil was filled in a plastic bag and labelled with name and date.

**Figure 15:** Soil sampling in Kaule (2009)

While the soil probes of 2009 were tested by Dr. Rajan Ghimire at the Soil Science Laboratory of the Tribhuvan University in Rampur, the soil probes of 2011 were stolen off the bus during their transportation to Rampur. The soil results of 2009 were used for the comparison of the different farmland categories: agroforestry land versus non-agroforestry land.

The lack of 2011 data makes it impossible to compare the change of soil quality over time. SCHWAB's results who also did soil testing in Kaule in 2010 within the work of his diploma thesis (SCHWAB 2012) can give a hint on the tendency of soil quality development in transition fields compared to agroforestry. However, data cannot be directly compared because soil-testing methods differ too much. SCHWAB took soil samples in Kaule from the agroforestry farm, from farmland that is in transition towards agroforestry and from land that is under conventional farming methods. He tested soil pH, organic matter, nitrogen and available phosphate and several other soil contents. The samples were not taken in the exact same spots like the samples from 2009 but still at the same fields. SCHWAB compared data over time and was able to show that even after 2 years a significant (Anova and H-test) change in soil data values could be seen in comparison to conventional farming land, indicating that agroforestry practices enhance soil quality even after a short time (SCHWAB, 2012).

Soil probes of 2009 was analysed for soil pH, total available nitrogen, available phosphorus and soil organic matter (SOM).

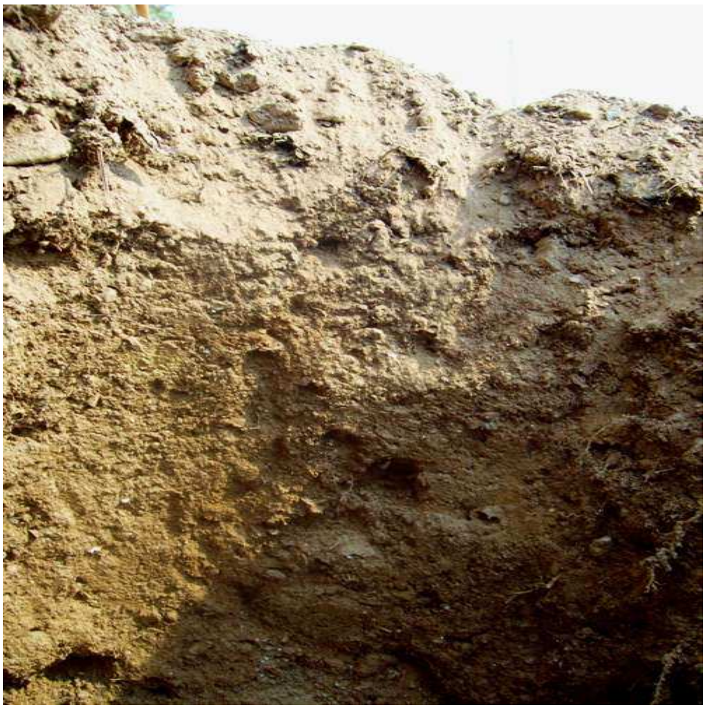
Soil pH was determined using a glass-calomel electrode pH Meter on 1:1 soil water ratio (WRIGHT, 1939). Total nitrogen was measured with the macro-Kjeldahl distillation unit method (BREMNER 1965). Available phosphorus was determined with a modified Olsen bicarbonate method (WHATNABLE AND OLSEN 1965). Organic carbon was analysed with Graham's colorimetric method (GRAHAM 1948).

Soil data was delivered in common standard measuring units used in Nepal presenting phosphorus in $P_2O_5$ (kg/ha). This was first transferred into $P_{avail}$ (kg/ha) and then transformed into $P_{avail}$ (mg $kg^{-1}$).

Nutrient status was classified using a rating chart (see Table 75) for the classification of fertility status of the study soils according to Soil Science Division in Khumaltar, Lalitpur.

The concentration of SOM in the surface soil mass varies depending on the soil and climate. SOM ranges usually from 1 % to 6 %. Soils that consist of less than 1 % organic matter are mostly limited to deserts. Soils that contain 12-18 % SOM are classified as organic soil (TROEH AND THOMPSON 2005).

**Figure 16:** Soil profile in Kaule, 2009



A soil profile was created by digging a 1m wide by 1m long and 1m deep hole. The soil texture was analysed using the mechanical analysis method of Day (DAY 1965).

#### 4.3.3.2 Insects

Between autumn 2008 and spring 2011, insect traps (barber traps) were placed to collect soil living coleopteran with the goal of comparing the quantity and appearance of species on the agroforestry farm, on seven farmlands in transition to agroforestry and on two spots of conventional farmland. On every placement, three traps were placed randomly, with a minimum of 5 m between them.

Tenebrionids are commonly called darkling beetles because of their nocturnal habits and their dark colour. They live on the ground, under logs, stones and litter and in or under bark on trees and are associated with dead wood and ground litter (MICHAELS, 2007). *Gonocephalum* is suggested in the literature (MIEHE *et al*. 2003) as an indicator for disturbed habitat conditions when it appears in high quantities.

The pitfall traps were produced out of plastic water bottles. The bottles were cut at a height of 15 cm and had a diameter of 10 cm. Bottles were sunk into the soil in such a way that their open sides were even with the ground level.

**Figure 17:** Pitfall trap (barber trap)

Around the bottle opening, three small stones were placed with their longitudinal side to minimize a barrier effect. These three stones serve as bearers for a covering stone that hinders leaves and dirt from falling into the traps.

The traps were filled with a saturated salt solution. The traps were placed in 2008, 2009, 2010 and 2011 during spring (between April and May) and autumn (between September and October). Traps were emptied after 7 days, refilled with saturated salt solution and again emptied after 7 days.

Table 6 gives an overview of collected insect traps between 2008 and 2011 in Kaule. Per farmland three traps were placed, which are indicated with a), b), c) under the farm name. Collected traps are marked in grey and labelled with an X. Lost and destroyed traps are labelled with minus.

**Table 6:** Overview of collected insect traps between 2008 and 2011

| | Agroforestry | | | Control | | | Demo Center | | | Farm 12 | | | Farm 2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a) | b) | c) | a) | b) | c) | a) | b) | c) | a) | b) | c) | a) | b) | c) |
| 14.10.2008 | - | - | - | - | - | - | - | - | - | X | X | X | X | X | X |
| 21.10.2008 | X | X | X | - | X | X | - | - | - | X | X | X | X | X | X |
| 08.05.2009 | X | X | X | X | X | X | - | - | - | X | X | X | X | X | - |
| 14.05.2009 | X | X | X | X | X | X | - | - | - | X | X | X | X | X | - |
| 31.10.2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 07.11.2009 | X | X | X | X | X | - | X | X | X | X | X | X | X | X | X |
| 14.05.2010 | X | X | - | X | X | X | - | - | - | X | X | X | X | X | X |
| 21.05.2010 | X | X | X | X | X | X | - | - | - | X | X | X | X | X | X |
| 19.10.2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 26.10.2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 17.04.2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 24.04.2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

| | Farm 7 Land a | | | Farm 7 Land b | | | Farm 7 Land c | | | Farm 8 | | | Farm 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a) | b) | c) | a) | b) | c) | a) | b) | c) | a) | b) | c) | a) | b) | c) |
| 14.10.2008 | - | X | X | X | X | X | X | X | - | - | - | - | - | - | - |
| 21.10.2008 | X | X | X | X | X | X | X | X | X | - | - | - | - | - | - |
| 08.05.2009 | X | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 14.05.2009 | X | - | - | X | X | X | X | X | X | X | X | X | X | X | X |
| 31.10.2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 07.11.2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 14.05.2010 | - | - | - | - | - | - | - | - | - | X | X | X | X | X | X |
| 21.05.2010 | - | - | - | - | - | - | - | - | - | X | X | X | X | X | - |
| 19.10.2010 | - | - | - | - | - | - | - | - | - | - | - | X | X | X | X |
| 26.10.2010 | - | - | - | - | - | - | - | - | - | - | - | X | X | X | X |
| 17.04.2011 | - | - | - | - | - | - | - | - | - | X | X | X | X | X | X |
| 24.04.2011 | - | - | - | - | - | - | - | - | - | X | X | X | X | X | X |

After the traps were collected, those with insects were carefully cleaned with clear water. Finally, the insects were placed in small containers with moist salt for further conservation and transport.

Insects were sorted, counted and listed and identified with the help of Dr. Wolfgang Schawaller, the head of the entomology department of the Stuttgart State Museum of Natural History and an expert of Coleoptera in Nepal (SCHAWALLER 2005).

As Table 6 shows, there only exists complete data sets from two farms in transition, the agroforestry farm and one conventional farm between 2008 and 2011. This is due to the disturbance or even destruction of traps by unknown others. Due to the loss of data, it was decided to give up the comparison of different field types and instead only provide an overview of coleopteran species that were collected in Kaule.

#### 4.3.3.3 Plants

In spring 2009, the project farmers received a three-week intensive training by NAF (Nepal Agroforestry Foundation) on agroforestry farming with a focus on how to cultivate newly introduced plants and where to place them on their fields. In addition, theoretical and practical training on nursery and seed treatment was provided.

During and after the agroforestry training in spring 2009, the farmers received 26 different kinds of plant species in the form of young plants, seedlings or seeds to be seeded in newly established nurseries, or planted on their farm in order to start their own agroforestry project. In 2010, five different fruit trees were additionally distributed. In total, 31 different kinds of seeds and seedlings (compare Table 79) and about 100 individual plants and different seed varieties have been distributed to each household of the project.

From autumn 2009 until spring 2012, plant monitoring was carried out on the farms to monitor the quantity of plants and plant species that survived.

The quantity of plants in 2009 on different project lands was quite diverse between farmers because a large amount of plants were distributed as seeds, and germination of seeds determined the amount of available plants per farm. Due to this fact, only plant material distributed as seedlings was used to evaluate the increasing diversity of plants between 2009 and 2012.

To evaluate and compare the performance of the transformation of conventional subsistence farmland into agroforestry land by participants, three groups were classified as to the survival of chosen introduced agroforestry plants between 2009 and 2012. This indicator was chosen because high quality datasets for 15 families were available for both years.

Table 85 illustrates the number of plant species that survived, and the average percentage of total plants that survived. With this data, three different groups were formed based on the performance in percentage of plant survival.

To understand the reasons why plants died, farmers were individually interviewed so as to gain their opinion. Answers were placed in a table (see Table 81) to give a more detailed overview into why plants did not survive.

#### 4.3.3.4 Income and Expenses

Between 2009 and 2011, information on income and expenses of family and farm were collected weekly from the agroforestry farm and the other participants, based on a data entry form. For this, notebooks and pens were distributed and a local assistant and translator visited every household once a month to collect the gathered data. The assistant explained and trained the participants the way of data recording. Handwritten data by farmers were translated into English. Data was than digitalized by entering it into excel tables. Changes in income and expenses over time were analysed and illustrated using excel charts. Out of all collected data, eight households delivered usable data from June 2009 until spring 2011.

The average of eight household income and expenses in comparison to data of the agroforestry Farm A is represented for a period of 22 months.

For the year 2010, income and expenses for every household was then categorised. Percentage of income categories were evaluated for nine households and percentage of expense categories was evaluated for 10 households including the agroforestry farm.

In addition, changes in market prices on selected items over time were registered and used to document the rise in living costs between 2008 and 2011 (Figure 28).

### 4.3.4 Field Notes and Protocols

Field notes were written, including background data on observations and experiences by the investigator. This data is included in the case studies.

Once a month, group meetings took place at the demonstration centre with the project members and other interested individuals. During these meetings topics of the project, opinions and needs of the farmers and sometimes the whole village were discussed. For every meeting a short protocol was written between 2009 and 2011. The discussions and protocols helped in understanding the situation in Kaule.

## 4.4 Overall Framework

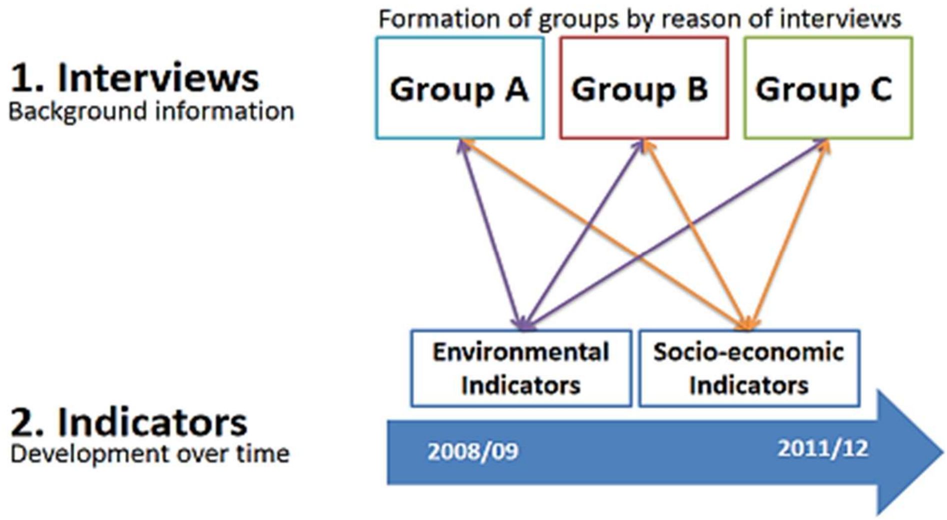
In order to connect all interview data and indicators, the results were added into two frameworks, based on interviews and indicators. For this, the data was processed through content analysis based coding (WESTBROOK 1994) by identifying patterns in the given information. Units of data were compared to each other and placed into the coding scheme of the framework. These coding units are also called categories.

Data in the framework of interviews describes the given living situations of farmers living in Kaule. Based on this data, the research problems were identified and the research questions and hypotheses were defined.

Categories of the indicator framework show additional information on social and environmental conditions of the agroforestry farm compared to farms in transition towards agroforestry. Suitable indicators or categories were chosen to be grouped into clusters of categories so as to build groups. (WESTBROOK 1994).

Figure 18 shows group A, group B and group C connecting family background and project performance. Background data signifies the family’s financial situation as well as the family size and the way families organize their daily life routine and workload distribution among their members. Performance data show development over time where possible. All 16 families were placed into one of the groups based on background and performance.

**Figure 18:** Overall framework of data compilation




The data groups are then interpreted to see if ability and circumstances can be connected to a grade of success or failure in project development. These findings are finally reviewed to the criteria of the "Hohenheim Concept" (Table 1) to describe the status of diffusion of the newly introduced agroforestry system.

## 4.5 Reliability and Validity of Data

Efforts have been made to obtain data integrity. These efforts include a prolonged contact to the project with constant note taking, writing protocols and collecting data. The participative approach and exposure to local settings and situations allowed an ongoing built-up of understanding by learning from observation. Together with the theoretical approach, the complexity of the setting is reflected.

For research, an objective view on a situation and on data is necessary. However, in participatory field research the fact cannot be excluded that a subjective view will also influence the conclusions. This is because the researcher as a human is living in the community and interacting with it. To provide trust to villagers it is necessary to involve oneself. Trust is necessary because it increases the chance that participants open up and share information with the researcher.

Not all project families participated in all the interviews and it was not possible to collect all planned indicators due to unforeseen disturbances. This in some cases resulted in incomplete data and made it hard to integrate all participants in the framework with the same quality of information.

Finally, political and social experiences and factors influence the perception and interpretation of situations and associations. Interviews and protocols might have been different with different investigators.

In the following section, a few considerations will be offered on each part of the method:

**Meteorological data:** The first attempt was done with an amateur weather station that was not accurate enough for scientific purpose. The second attempt was done with the right equipment but because several (unauthorised) people interacted with it, incorrect operation caused interruptions in data sequences. The third attempt involved buying data of a governmental weather station in a neighbouring area. This gave a good idea of weather trends but differences in exposure and altitude weakened the comparability. The fourth attempt using model data was eventually the most accurate approach to real weather conditions in Kaule and the snapshot of weather conditions during the project. To understand the weather is important for an agriculture-based project but the amount of effort might have been disproportional. It became evident that no extreme weather conditions occurred that influenced the data collection.

**Interviews:** Because interviews could not be conducted directly, but had to be done through an interpreter, distortion cannot be ruled out. This complicated and inaccurate procedure was necessary because farmers were not able to speak English, and the interviewer was not able to speak adequate Hindi, Nepali or Tamang. Effort was taken to avoid a persuasive and affected interpretation by giving training and introduction into the importance of factual and unaffected translation to the interpreter. Still, it is assumed that the abilities for translation evolved over time. Therefore, later translations might be demonstrating the farmer's opinions and situations more accurately and less filtered than earlier translations. Also, the fact that interviews took sometimes 1 – 1.5 hours might have influenced the concentration of all participants.

Another point is the influence by other participants and the village. Especially in open group interviews farmers discussed until they all agreed on one statement. Less expressive members might have been be too shy to express individual opinions against a group opinion.

**Indicators:** It was surprisingly hard to gain a complete data set out of the indicators because the probe collection was in most cases disturbed. Trend lines over time can only be displayed for indicator data sets that are complete. Originally, the plan was to place greater focus on development over time based on indicators but finally, a big proportion of indicator data could just be used to explain circumstances and background better.

**Soils:** Soils were collected and analysed by several people and in several laboratories in the scope of their master thesis. The most reliable results are usually gained by one person doing all analysis in the same laboratory. The earlier mentioned stolen soil samples were recovered by the police and analysed, but the results were not be considered because they were so much out of line that most likely the soil samples were mixed.

**Insects:** Insect collection was hindered by the fact that sometimes traps were obviously disturbed by humans or animals. In some traps, contaminants like cigarette stubs were found or traps were filled up with soil. Due to this, serious gaps appeared in the data series. Another problem was that insects follow clear development periods in their life cycles. It was often not possible to place traps exactly at the same days in the month over the years due to political situations or weather conditions. As the population dynamics of most of these insects are unknown, an interpretation of their different abundance is problematic.

**Plants:** Plant indicator data is the best timeline that exists, including all participants. Because plants were distributed by the project, the exact number was known and monitoring was comparably easy.

**Income and expenses data:** The fact that local participants needed time to develop faith in the investigator can explain to some degree the differences in results of interviews or indicators (income/expenses) in 2009 and 2011. At the start the data was rather incomplete. Another reason was that farmers were not used to register their income and expenses.

In general, a project is a battlefield of interests, and this can easily result in strategic instead of open and honest communication. Careful triangulation, especially with observation is therefore necessary so as to arrive at valid interpretations and conclusions.

# 5 Results

The first step of this research involved conducting open group-interviews so as to understand the situation of farmers in Kaule and their problems. In a later stage, the interviewer worked with structured interviews on individual participants and families. In addition, indicators were collected. The data was finally compiled, grouped and put in the context of the "Hohenheim Context" to analyse and understand coherence of performance, personal backgrounds and other influences.

## 5.1 Interviews

### 5.1.1 Open and Semi Structured Group Interviews

Open interviews revealed the following information about common living standards of farmers in Kaule.

Households are commonly composed of grandparents, parents and children. When children grow up, daughters marry and leave the household to live with their husband's family. Here it is her basic duty to look after the parents and the household. The usual age for getting married is around 20 years for women and between 20-22 years for men. If a household has more than one son, the household's land is divided between them. This is the main reason why land areas for farming are getting smaller per household over time and why it is getting increasingly difficult to keep the families livelihood (related to farm income) at an adequate level. This again explains why family members need to work outside their farms more frequently to earn additional income. Women can also own land and bring it into the marriage, especially if she has no brothers. In comparison to other castes, Tamang have the regulation that women can divorce their husband without being castigated. In addition, they also get their land back after a divorce, which gives them a stronger and more independent position in their society compared to other casts where this is not common.

The only other way to increase land within a family is to buy land. The price for land in and around Kaule is remarkably high because it is a popular area for richer townspeople due to its close vicinity to Kathmandu. Land prices are rising constantly over the years. In 2009, one hectare of land had a value of around 40.000 €.

Other ways of increasing farming activities are, for example, a greater concentration of livestock for additional income from milk, and more chickens to increase sales of eggs. In 2009, the price for one goat was 20 €, for an ox 50 €, a buffalo 250 € and a chicken 2 €. Cows can traditionally not be sold as they have a holy and divine status, while a buffalo has rather the counterpart status of a beast of burden. Therefore, buffalos are used for meat production and sacrificial ceremonies. Another tradition and belief that has an effect on agriculture is the holiness of monkeys. Hanuman the monkey god has a strong protection, for example, over the *Macaca mulatta*, a common rhesus macaque in Nepal. Farmers told interviewers that the monkeys are a serious threat for farmers in Kaule and also other parts of Nepal because they march in groups over the fields and destroy young germinating plants, and later on the harvest. Once a monkey family settles at one place they like, as happened at the project demonstration centre in Kaule, it is nearby impossible to chase them away. Legally it is not allowed to catch or kill a monkey. There is not much that can be done against this threat as long as there is not a change of policy or another form of government help.

Living costs are increasing (see figure 28) placing farmers under financial stress. Main categories of living costs are for food, medicine, education and festivals or ceremonies. Farmers complain especially about rising costs for food that need to be purchased at local shops. This includes goods like rice, flour, other cereals, eggs, salt, vegetables and fruits, chillies and other spices, cooking oil, sugar, tea, cigarettes and sometimes meat. Farmer's grow during a 3 - 6 month period fresh food like vegetables or crops on their farms. Some food is preserved for the winter. Other food needs to be purchased. If families have land that lies in a lower altitude they build water terraces and grow their own rice. Usually higher rice quality is grown and sold and lower quality is kept or bought for own consumption. The food market is either directly in Kaule, or 1 – 2 km away in the village Ranipowa, which is bigger than Kaule and also has a bigger market. Certain harvest goods like strawberries or peas are sold in Kathmandu about 25 km away, which can be reached by bus. Farmers are not satisfied with prices that they receive when they sell their vegetables. In addition, price fluctuation occurs due to demand and supply of vegetables, which is often dependent on weather conditions.

A typical daily meal of farmers in Kaule is a flour paste or rice (*bhat*), lentils (*dal*), pickle (a spicy sauce) and other vegetables. Meat is expensive and usually only consumed at festivals and ceremonies. Some children have swelled stomachs as signs for under-nutrition. Doctors at the Civic Clinic in Kathmandu explained that the traditional meal *Dal Bhat* includes all the necessary nutrients for a healthy diet. However, often the lentil sauce is bulked up with too much water, which contributes to malnutrition when children eat only rice with this thin sauce.

The usual workday of a farmer is around 15 hours. Typical work tasks of women include farm work, household care, preparation of food and childcare. Men work on the farm and help in food preparation. They additionally often work outside the farm on construction sites, as bus drivers, housekeepers or on poultry farms. Women also work sometimes outside the farm but not as often and usually only the daughters before they get married. Working for a certain time outside of Nepal, for example in the Gulf States, is increasingly attractive because it allows earning a higher income in a shorter time. Typical examples of work in other countries are construction, plumbing, being a chauffeur or housekeeping. Interviews demonstrated that farmers were not fully aware of threats that might be connected with working abroad like unsafe working conditions or the spread of sexual diseases.

If children go to school, which is usually the case, then they spend most of their time per day at school. Usually they help only to a small extend in farm-, or housework. While adults have only very limited time for recreation, children often have several hours of free time per day for playing. "Devi Primary School" is the governmental school in Kaule that can be reached by foot by all children of the surrounding area. A secondary school is located in the neighbouring village Ranipowa that can be reached by bus. A private primary school in Kaule that was built by foreign aid also offers education at a higher level but is more costly. School education lasts for 10 years, and is free at the governmental school until the 5$^{th}$ grade for girls and until the 3$^{rd}$ grade for boys. Afterwards the school fee is 10 cent (€) per month. This governmental program tries to increase the educational status of girls. Farmers stated that the ratio of girls and boys education is nowadays equal. Education is an important good in their opinion and they believe that attending school will help their children to better run the farm later. It is unusual for children to continue with a higher education after they finish school.

Health insurance or a comparable facility is not available for farmers. The next village called Ranipowa does provide a medical installation called "Ranipowa Primary Health Centre" which is the first place to go in case of illness, but the facility is not sufficient for major or continuative treatment. Hospitals in Kathmandu offer free treatment to people who cannot afford it, but farmers are either unaware of this or they do not believe in it because the capacity of such facilities is in most cases overloaded. This results in burdensome travel with local busses without achieving treatment. In case of illness, a local pharmacy in Kaule provides medical treatment. Some medical plants are also grown on farms like peppermint against colds, bananas against diarrhoea and ficus against stomach problems. The village medicine man is called in to perform ceremonies and rituals that are meant to appease good spirits and chase bad spirits away. Family members or neighbours support each other in cases of illness by taking care of children and helping on the farm. Often no funds are available to cover costs for treatments and loans are taken in such cases.

When farmers where asked what they would spend their money for if they had a bigger income, they replied that they would invest in better education for their children, in bigger houses and better animal stables and they would buy more land for agriculture

**Table 7:** Results of interviews into the social structure of the community

| | |
|---|---|
| Q<br>A | **Do the brothers/sisters, aunts/uncles, grandparents share the same farm?**<br>*Brothers separate after their marriage, grandparents live with their sons.* |
| | |
| Q<br>A | **If a parent falls ill, how does the family adapt/ help each other?**<br>*The family helps each other. Their sons, daughters and neighbours will help to run the household and look after the farm and children.* |
| | |
| Q<br>A | **At what age do most daughters/sons get married?**<br>*Daughters usually get married at age 20, and sons between the ages of 20 - 22 years.* |
| | |
| Q<br>A | **Are marriages commonly arranged?**<br>*Commonly there exists freedom of choice, but sometimes the parents choose the partner.* |
| | |
| Q<br>A | **Do married couples live after the marriage on their parent's farm?**<br>*After their marriage, they move out and claim land from their parents.* |

| | |
|---|---|
| **Q** | **Implications for recreation: what activities do farmers spend their time doing?** |
| **A** | *Mostly they need to work. If they do have time they go to neighbours, friends or their family to talk.* |
| | |
| **Q** | **What is the breakdown of a typical woman's day?** |
| **A** | *a) Preparing food — 1.5 hours*<br>*b) Farm work — 12 hours*<br>*c) Collecting water — 20 minutes further to walk in*<br>*d) Cleaning — 2 hours*<br>*e) Recreation — 30 minutes* |
| | |
| **Q** | **What is the breakdown of a typical child's day?** |
| **A** | *a) School — 7 hours*<br>*b) Farm work — 15 minutes*<br>*c) Preparing food — None*<br>*d) Help cleaning (daughters) — 1.5 hours*<br>*e) Recreation — 3 hours* |

**Table 8:** Results of interviews into school / education

| | |
|---|---|
| **Q** | **How many years do the children spend in school?** |
| **A** | *Usually 10 years.* |
| | |
| **Q** | **How often do children go to school?** |
| **A** | *Every day apart from Saturday. Saturday is the day off.* |
| | |
| **Q** | **What are the costs of sending children to school?** |
| **A** | *Daughters are free until the 5th grade and sons are free until the 3rd grade. After this 0.10 cent (€) / month for every child, boy or girl.* |
| | |
| **Q** | **What is the distance and location to the local school?** |
| **A** | *It is near and can be reached on food.* |
| | |
| **Q** | **What is the location of the next school?** |
| **A** | *Devi Primary School in Kaule.* |
| | |
| **Q** | **How long does it take for children in average to get there?** |
| **A** | *20 minutes by foot.* |
| | |
| **Q** | **What are the costs associated with the transport to school?** |
| **A** | *None.* |
| | |
| **Q** | **Do farmers consider education to be important?** |
| **A** | *Yes, they think in general it is important.* |
| | |
| **Q** | **Do farmers think that going to school will help the children on the farm in future?** |
| **A** | *Yes, they do. They learn in school how to grow food and vegetable for their farm.* |
| | |
| **Q** | **What do children like most to learn?** |
| **A** | *Nepali language, math and agriculture.* |

| | |
|---|---|
| | |
| **Q**<br>**A** | **Are children sent to higher education/ university?**<br>*Normally not, only few children can go to the university in Kathmandu.* |
| | |
| **Q**<br>**A** | **Is the educational ratio between boys and girls the same?**<br>*The ratio is equal.* |

**Table 9:** Results of interviews into medical care

| | |
|---|---|
| **Q**<br>**A** | **Where is the closest medical facility for families?**<br>*The Rani Power Primary Health Centre in Kakani.* |
| | |
| **Q**<br>**A** | **How long does it take to get there?**<br>*A 60 minute walk for women, a 40 minute walk for men.* |
| | |
| **Q**<br>**A** | **How often does the family visit the medical centre on average?**<br>*3 times per month if a disease occurs. They do not go just for checking if no one is ill.* |
| | |
| | **Costs associated with getting medical attention.** |
| **Q**<br>**A** | **a) How much money does it cost to see the doctor?**<br>*0.05 € / ticket (5 NRS). Patients have to buy tickets for the entrance and for for administration fees, but do not pay the doctor directly.* |
| **Q**<br>**A** | **b) Costs of transportation to medical centre?**<br>*10 NRS for the bus.* |
| **Q**<br>**A** | **c) Possibility for health insurance and if so how much does it cost?**<br>*No.* |
| | |
| **Q**<br>**A** | **If the costs or distances were less, would they go to the doctor more often?**<br>*No.* |
| | |
| **Q**<br>**A** | **Do farmers think that it would be better for them to see the doctor more often?**<br>*Yes, they think it would give them more information but they would not go if no one is ill.* |
| | |
| **Q**<br>**A** | **What is the most common illness?**<br>*Common cold, headache, stomach ache, diseases and fever.* |

**Table 10:** Results of interviews on acquiring land and other expenses

| | |
|---|---|
| **Q**<br>**A** | **How does one acquire land?**<br>*Buyer and seller need to go to the land reform department to register the new ownership.* |
| | |
| **Q**<br>**A** | **How much does it cost to purchase land?**<br>*~ 40.000 € / ha (200.000 NRS / ropani).* |
| | |
| **Q**<br>**A** | **How much does it cost to purchase cow, goat, ox, buffalo, rabbit, chicken, seeds?**<br>a) *A cow can't be sold due to an old tradition*<br>b) *A goat costs 20 € (2000 NRS)*<br>c) *An ox costs 50 € (5000 NRS)*<br>d) *A buffalo costs 250 € (25.000 NRS)*<br>e) *A rabbit costs 5 € (500 NRS)* |

| | | |
|---|---|---|
| | f) | *A chicken costs 2 € (200 NRS)* |
| | g) | *1 kg maize seeds cost 0.75 € (75 NRS)* |
| | | |
| **Q** | | **What is the breakdown of expenses for food, medicine, education, marriages and funerals?** |
| **A** | a) | *Food costs approximately 100 € / year (10 000 NRS) for a family with 7 people.* |
| | b) | *Medicine costs approximately 15 € /year (1500 NRS) for a family with 7 people.* |
| | c) | *Education costs approximately 36 € / year (3600 NRS) for three children.* |
| | d) | *40 € / year (4000 NRS) is in average needed for ceremonies, like funerals or marriages for a family with 7 people.* |

**Table 11:** Results of interviews into nutrition, medical-, and cultural- plants

| | |
|---|---|
| **Q** | **What is the typical meal for a Nepali farming family?** |
| **A** | *Flour paste, vegetable, lentils (dal), pickles, and sometimes rice (bhat)*.* |
| | |
| **Q** | **How often do farmers eat meat? (chicken, rabbit, cow, buffalo, etc.)** |
| **A** | *Once a week.* |
| | |
| **Q** | **How much food do farmers purchase from the market?** |
| **A** | *Weekly: rice. Sometimes: salt, chillies, spices, cooking oil, sugar, tea leaves, cigarettes.* |
| | |
| **Q** | **What is the quantity of food that families consume off their farm?** |
| **A** | *Farmers consume for 3-6 month per year fresh food from their farm. Afterwards they need to buy food at the market. Some food will be preserved for winter.* |
| | |
| **Q** | **Do farmers plant any medical plants and, if so, which ones?** |
| **A** | *They have medical plants but they do not know which ones. Farm A (AF) has some trees and herbs for medical reasons.* |
| | |
| **Q** | **What functions do medical plants have?** |
| **A** | *Peppermint and titephati help against the common cold, banana helps against diarrhoea, titephati helps against headache, wild yam and ficus help against stomach problems.* |
| | |
| **Q** | **Would farmers like to plant more medical plants?** |
| **A** | *They would like to know more about it and grow more but they would need training.* |
| | |
| **Q** | **Do farmers sell these plants? How much?** |
| **A** | *They use them themselves.* |
| | |
| **Q** | **Which other cultural (religious)/medical plants would they use/plant?** |
| **A** | *Uerphobia** for worshiping. Bhimsen pati (false daisy (Eclipta prostrata L.) in food for worshiping.* |

* Dal Bhat is the typical national dish containing rice and lentils.
** It was not possible for the author to identify this plant.

**Table 12**: Results of interviews into farm income and infrastructure

| | |
|---|---|
| Q<br>A | **How far is the market to sell the crops?**<br>*1 km away is a very small marked (Ranipowa). A bigger market is in Kathmandu about 25 km away.* |
| | |
| Q<br>A | **How long does it take to get there?**<br>*1 hour by bus to Kathmandu. There is no other transportation possibility.* |
| | |
| Q<br>A | **Which transportation systems are used?**<br>*Bus: 0.30 € (30 NRS)/person one way and 0.20 € (20 NRS)/ basket.* |
| | |
| Q<br>A | **Do farmers feel that they receive enough money for their crops?**<br>*The market price is not satisfying.* |
| | |
| Q<br>A | **Does the price received for crops change? How much?**<br>*The price for vegetables is increasing. 0.15 € (15 NRS)/kg difference this year because vegetable is not growing well this season.* |
| | |
| Q<br>A | **What (future) equipment would help the most and in what way?**<br>*Agroforestry: Light, small and pointed tools for digging*<br>*Monoculture: Digging instruments.* |
| | |
| Q<br>A | **If farmers had a greater income, what would they spend money on?**<br>*Agroforestry: Child education, to build a nicer house and animal stable, to buy land for a bigger agroforestry system. Monoculture: A new house.* |

**Table 13:** Results of interviews into agroforestry versus monoculture farming

| | |
|---|---|
| Q<br>A | **What do farmers like most about the agroforestry system?**<br>*To grow fodder and burning materials.* |
| | |
| Q<br>A | **What do they not like about the agroforestry system?**<br>*They do not know.* |
| | |
| Q<br>A | **What do farmers like about monoculture farming?**<br>*The income generating activity: For example to grow radish or millet, and food sustainability.* |
| | |
| Q<br>A | **What do they not like about monoculture farming?**<br>*They do not* |
| | |
| Q<br>A | **Comparison between agroforestry system and mono crop farming system?**<br>*Agroforestry: Easy workload after it is running; the farmers do not need to go and collect animal feed and wood outside their farm.*<br>*Monoculture: Logging problems, the insect pest attraction is high and goods need to collected outside the farm.* |

## 5.1.2 Structured Interviews

### 5.1.2.1 Structured Group Interviews

To understand the rhythm of farming in Kaule, structured group interviews were conducted on harvest and the use of cultivated plants. After development of a planting calendar (Table 14) and a harvest calendar (Table 15), both were reviewed with all participants to assure the validity.

Table 14 shows cultivated plants in Kaule and their time for planting during the year. The calendar was composed by following the Nepali calendar starting in the month Baishak. Our calendar month differ by 2 weeks to the Nepali calendar. The month Baisakh for example includes the two last weeks of April and the two first weeks of May.

**Table 14:** Planting calendar for Kaule

| | | Bai. | Jesth | Ashad | Saw. | Bha. | Ashw. | Kart. | Mang. | Poush | Magh | Fal. | Chai. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Vegetable | A.-M. | M.-J. | J.-J. | J.-A. | A.-S. | S.-O. | O.-N. | N.-D. | D.-J. | J.-F. | F.-M. | M.-A. |
| 1. | aubergine | | | | | | | | | | ■ | ■ | ■ |
| 2. | bean | ■ | | ■ | ■ | ■ | ■ | ■ | | | ■ | ■ | ■ |
| 3. | big bean | | | | | ■ | | | | | | | |
| 4. | bitter gourd | ■ | | | | | | | | | ■ | | ■ |
| 5. | broom | | | | ■ | | | | | | | | |
| 6. | buckwheat | ■ | | | ■ | ■ | ■ | | | | | | |
| 7. | cabbage | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| 8. | cauliflower | ■ | | | | ■ | ■ | ■ | | | | | |
| 9. | chili | ■ | ■ | | | | | | | | nursery | nursery | ■ |
| 10. | cow pea | | | | | | | | | | ■ | ■ | |
| 11. | coriander | | | | ■ | | | ■ | | | | | |
| 12. | cucumber | ■ | | | | | | | | | ■ | ■ | ■ |
| 13. | garlic | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| 14. | ginger | ■ | | | | | | | | | | ■ | ■ |
| 15. | green bean | | | | | | | | | | ■ | ■ | |
| 16. | iskus | | | | | | | | | | | ■ | |
| 17. | lentile | | | | | | | | | | ■ | | |
| 18. | maize | ■ | | | | | | | | | ■ | ■ | ■ |
| 19. | millet | | ■ | nursery | ■ | | | | | | | | |
| 20. | mustard | | | | ■ | ■ | ■ | ■ | ■ | | | | |
| 21. | onion | | | | | ■ | ■ | ■ | ■ | ■ | | ■ | |
| 22. | pea | ■ | | ■ | ■ | ■ | ■ | ■ | | | | ■ | |
| 23. | potato | | | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ |
| 24. | pumpkin | ■ | | | | | | | | | ■ | ■ | ■ |
| 25. | radish | | ■ | ■ | ■ | ■ | | | | | | | ■ |
| 26. | rice | nursery | ■ | ■ | ■ | | | | | | | | nursery |
| 27. | soja bean | ■ | | | | | | | | | ■ | ■ | ■ |
| 28. | spinach | ■ | | nursery | ■ | ■ | ■ | ■ | ■ | | | ■ | |
| 29. | sweet potato | | | | ■ | | | | | | | | |
| 30. | taro | | | | | | | | | | ■ | ■ | |
| 31. | timbur | ■ | | | | | | | | | | | |
| 32. | tomato | | | ■ | | | | | | | ■ | | |
| 33. | tree tomato | | | | | | | | | | | ■ | |
| 34. | turmeric | | | | | | ■ | | | | | | |
| 35. | turnip | | | | | ■ | | | | | | | |
| 36. | wheat | | | | | ■ | ■ | ■ | ■ | | | | |

| | | Bai. | Jesth | Ash. | Saw. | Bha. | Ashw. | Kart. | Mang. | Poush | Magh | Fal. | Chai. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fruit | A.-M. | M.-J. | J.-J. | J.-A. | A.-S. | S.-O. | O.-N. | N.-D. | D.-J. | J.-F. | F.-M. | M.-A. |
| 1. | strawberry | | | | ■ | ■ | | | | | | | |

Established 12.07.2011

The planting calendar of Kaule revealed a total of 36 vegetables and 1 fruit that are commonly planted by farmers in Kaule. Other fruits are perennial and not planted per year. Not every farmer is cultivating every kind of crop, as is shown in Table 16. On average 10.8 plants per year are cultivated in 2009 and 10 plants per year in 2011 by farmers that are in transition to agroforestry. The agroforestry farm cultivated in 2009 double (and in 2011 2,5 times) the number of vegetable compared to the average of the other project farmers (compare Table 16).

The usual planting time for crops are all year round. However, during early winter in November until January, and again in the early monsoon time between May and July, only a few crops are planted.

**Table 15:** Harvesting calendar for Kaule

| | Vegetable | Bai. A.-M. | Jesth M.-J. | Ashad J.-J. | Saw. J.-A. | Bha. A.-S. | Ashw. S.-O. | Kart. O.-N. | Mang. N.-D. | Poush D.-J. | Magh J.-F. | Fal. F.-M. | Chai. M.-A. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | aubergine | | | | ■ | | | | | | | | |
| 2. | bean | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | | |
| 3. | big bean | | | | | | | | | | | | |
| 4. | bitter gourd | | | | | ■ | | | | | | | |
| 5. | broom | | | | | | | | | ■ | | | |
| 6. | buckwheat | | | | | | | | ■ | | | | |
| 7. | cabbage | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| 8. | cauliflower | | ■ | ■ | ■ | | | | ■ | ■ | ■ | | |
| 9. | chili | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| 10. | cow pea | | | ■ | | | | | | | | | |
| 11. | coriander | | | | | | | ■ | | | ■ | ■ | |
| 12. | cucumber | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | ■ |
| 13. | garlic | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 14. | garlic leaf | | | | | | | | ■ | | | | |
| 15. | ginger | | | | | ■ | ■ | | | | | | |
| 16. | green bean | | | ■ | | | | | | | | | |
| 17. | iskus | | | | | ■ | | | | | | | |
| 18. | lentile | ■ | | | | | | | | | | | |
| 19. | maize | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | |
| 20. | millet | | | | | | ■ | ■ | ■ | ■ | ■ | | |
| 21. | mustard | | | | | | | | ■ | | | ■ | |
| 22. | onion | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | |
| 23. | pea | | | | ■ | | | | | | | | |
| 24. | potato | | | | | | | | ■ | ■ | ■ | ■ | |
| 25. | pumpkin | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | | | |
| 26. | pumpkin leaf | | | | | | ■ | | | | | | |
| 27. | radish | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | |
| 28. | rice | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | |
| 29. | soja bean | | | | | ■ | | | | | | | |
| 30. | spinach | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | |
| 31. | sweet potato | | | | | | ■ | ■ | ■ | | | | |
| 32. | taro | | | | | ■ | ■ | | ■ | | | | ■ |
| 33. | timbur | | | | | ■ | | | | | | | |
| 34. | tomato | | | | ■ | ■ | ■ | ■ | ■ | | | | |
| 35. | tree tomato | | | | | ■ | ■ | | | | | | |
| 36. | turmeric | | | | | ■ | ■ | | | | | | |
| 37. | turnip | | | | | | | ■ | | | | | |
| 38. | wheat | ■ | | | | | | | | | ■ | ■ | ■ |

| | Fruits | Bai. A.-M. | Jesth M.-J. | Ash. J.-J. | Saw. J.-A. | Bha. A.-S. | Ashw. S.-O. | Kart. O.-N. | Mang. N.-D. | Poush D.-J. | Magh J.-F. | Fal. F.-M. | Chai. M.-A. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | lemon | | | | | | | ■ | | | ■ | | |
| 2. | pear | ■ | | | | | | | | | | | |
| 3. | plum | ■ | | | | | | | | | | | |
| 4. | strawberry | | | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

Established 12.07.2011

In Table 16, the number of different kinds of cultivated plant species are shown, subdivided into plants that are grown for own nutrition and plants that are grown for income generation. This table does not include the newly introduced agroforestry plants but displays plants that are generally planted on the farms.

**Table 16:** Number of different cultivated crops in 2009 and 2011

| | | total | | own nutrition | | market sale | |
|---|---|---|---|---|---|---|---|
| | | 2009 | 2011 | 2009 | 2011 | 2009 | 2011 |
| 1. | Farm A (AF) | 20 | 25 | 20 | 25 | 19 | 23 |
| 2. | Farm 1 | 21 | 13 | 11 | 12 | 9 | 6 |
| 3. | Farm 2 | 12 | 10 | 10 | 7 | 2 | 3 |
| 4. | Farm 3 | 7 | 12 | 6 | 8 | 2 | 5 |
| 5. | Farm 4 | - | 6 | - | 5 | - | 4 |
| 6. | Farm 5 | 11 | 22 | 9 | 18 | 2 | 10 |
| 7. | Farm 6 | 12 | 14 | 6 | 11 | 5 | 5 |
| 8. | Farm 7 | 12 | - | 10 | - | 4 | - |
| 9. | Farm 8 | 8 | 12 | 7 | 8 | 2 | 9 |
| 10. | Farm 10 | 5 | 5 | 4 | 2 | 4 | 2 |
| 11. | Farm 11 | - | 10 | - | 6 | - | 3 |
| 12. | Farm 12 | 10 | 6 | 7 | 3 | 3 | 3 |
| 13. | Farm 13 | 8 | 6 | 3 | 4 | 4 | 2 |
| 14. | Farm 14 | 13 | 10 | 5 | 6 | 2 | 6 |
| 15. | Farm 15 | 10 | 4 | 9 | 4 | 1 | 0 |
| Average Farm 1- 15 | | 10.8 | 10 | 7.2 | 7.2 | 3.3 | 4.4 |

Farm 9 did not provide data on cultivated crops. Table 16 shows that Farm A (agroforestry) has a much higher diversity of cultivated crops than other farms. Exceptions are Farm 1 in 2009 and Farm 5 in 2011. In general, the amount of different cultivated crops on transitional land farms is quite diverse and ranges from four crops (Farm 15 in 2011) to 22 crops (Farm 5 in 2011). Out of the 15 represented farmers, including Farm A (agroforestry), 5 farms cultivated more plant species in 2011 than in 2009, while 5 farms cultivated less crop species in 2011 than in 2009. One farm (Farm 10) cultivated the same amount of different species in both years. Three farms provided only data for one year and are not comparable in terms of a cultivation trend.

In general, all transitional farms cultivated a similar number of crops for personal use and market sale between 2009 and 2011, while Farm A enhanced the cultivation for all categories by several crop species.

#### 5.1.2.2 Structured Personal Interviews and Case Studies

The results of structured personal interviews are presented as case studies that reflect the situation of the different farms between 2009 and 2011. The interviews covered two topics: “social family structure” and “plant use and sale.” The case studies are further supported by cross-referencing to indicator data in chapter 5.2. For privacy protection, farmer names were replaced by aliases. Farmer A stands for the agroforestry farm and Farmer 1 to Farmer 15 represent project participants that transform part of their land to agroforestry.

#### 5.1.2.2.1 Case Study Farm A (Agroforestry)

Farm A was the only farm in Kaule that already practiced agroforestry, stating that agroforestry was established 15 years ago. This gives the farmer an outstanding position in Kaule. When Farmer A was asked how he got his knowledge about agroforestry, he explained that over the years he has participated in many trainings and workshops like green farming techniques, livestock management, or the introduction of new techniques like biogas plants. For some trainings, he even travelled several hours to the Nuwakot district village Trisuli. Trainings where offered by the DDC Forest Office or by other NGOs. Over the years, he constantly integrated learned lessons into his farm work. His sons continue his work.

Already with the bare eye, the agroforestry farm looks very green and well developed in comparison to other farms in Kaule. One can see that the soil is dark, loose and has a high concentration of organic material. Also noticeable is that the plants grow in mixed arranged cultures more bulky in comparison to those of other farmers. Next to vegetables, fodder plants, medicinal plants and shrubs, Farmer A cultivates different kinds of trees on his land that are sometimes grown to great height until they are harvested by pollarding. The trees produce fruits, fodder and construction wood. The income of harvested wood, fruits and vegetables allow the family to develop their farm further. The agroforestry farm is the only farm that produces all the fodder for its animals on the own land, which is a very timesaving setup.

Farmer A stated in an interview that in the past he often received negative feedback from other villagers. People told him to leave his land and move to Kathmandu in the initial time of the system change. His wife also worried about the possible failure of his new farming technique in the beginning and about the family’s livelihood. Nowadays, Farmer A’s farm is well established, he is a well-respected person in the village, and he works as the secretary of the VDC (Village District Committee) office.

In 2010, the family established a biogas plant on their land and connected it to their toilet. Not every farmer in Kaule has a toilet. The produced gas of the biogas plant is directed into the kitchen, connected to the gas cooker, and used for cooking. This saves further wood for cooking. Farmer A also was the first farmer that built a solid goat stable out of stone so that the animals can permanently live outside the farmhouse, while being protected from predators like leopards. The stable is a good contribution to raising the standard of hygiene in the farmhouse, where commonly goats and chickens are kept overnight in the living room that is also the kitchen.

All children of the household go to school. The oldest daughter has completed her studies at the University of Kathmandu. Between 2009 and 2011, she was teaching adult classes in Kaule.

Farmer A serves nowadays as a good example for other farmers that want to establish their farms in the same way.

**a) Structured interview on social topics in 2009 and 2011 with Farm A**

The household had seven members in 2011. Farmer A, his wife and their five children. Two children were adults, while the others went to the local school. Other elderly family members like aunts, uncles or grandparents did not share the household.

Farm work is divided between women, men and children. The following table shows the work categories of men, women and children in the agroforestry farm household as stated in the interview by Farmer A and one of his daughters.

**Table 17:** Work distribution at the agroforestry farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | x | x | x |
| 2. | Water Collection | - | x | x |
| 3. | Harvesting | x | x | - |
| 4. | Irrigation | x | x | - |
| 5. | Manure Collection | x | - | - |
| 6. | Manure Transport | - | x | - |
| 7. | Manure Application | - | - | x |
| 8. | Nursery | x | x | - |
| 9. | Planting | x | x | - |
| 10 | Ploughing | x | x | - |
| 11 | Weeding | x | x | - |
| 12 | Construction Work | x | - | - |
| 13 | Pest Monitoring | - | x | - |
| 14 | Cleaning (household) | - | x | x |
| 15 | Cooking | - | x | - |
| | **Total No. of Categories** | **9** | **12** | **4** |

Out of the 15 stated work categories, seven are done by both men and women, two categories are only done by the men, and five other categories are only done by women. Children help with four categories only to a limited extend.

Family members also work outside the farm. Farmer A works daily from 10:00 to 16:00 at the Village District Committee (VDC) office, and his daughter teaches from 07:00 until 09:00 adult education in Kaule. In 2010, 45% of the household's income was generated by external work (see Figure 25). No member of the family works outside of Nepal.

External workers are hired to help on farm during times of ploughing, seeding, planting and harvesting. Generally, 3-4 persons are hired at a rate of ca. 1 €/ day (100 NRS / day) (7 hours) during several days in Oct/Nov, Nov/Dec, and Jan/Feb.

The household has about 0.69 ha of land which is a middle range size compared to those of other project farmers.

### b) Structured interview on plant use and harvest in 2009 and 2011 with Farm A

In 2009, the agroforestry farm cultivated 20 different kinds of crops, and in 2011, 25 different kinds of crops. Most crops and fruits where cultivated in both years.

**Table 18:** Cultivated crops in 2009 and 2011 on Farm A

| | 2009 | 2011 |
|---|---|---|
| 1. | Bamboo (*Bambusa spec.)* | Apricot (*Prunus armeniaca*) |
| 2. | Cabbage (*Brassica oleracea var. capitata.)* | Bamboo (*Bambusa spec.)* |
| 3. | Carrot (*Dacus carota*) | Bean (*Vicia faba spec.)* |
| 4. | Cauliflower (*Brassica oleracea var. botrytis L.*) | Cauliflower (*Brassica oleracea var. botrytis L.*) |
| 5. | Chayote (*Sechium edule* (Jacq.) Sw.) | Chayote (*Sechium edule* (Jacq.) Sw.) |
| 6. | Chili (*Capsicum annuum*) | Chili (*Capsicum annuum*) |
| 7. | Cucumber (*Cucumis sativus*) | Coriander (*Coriandrum sativum* L.) |
| 8. | Fig (*Ficus auriculata)* | Cucumber (*Cucumis sativus*) |
| 9. | Garlic *(Allium sativum)* | Fig (*Ficus auriculata)* |
| 10. | Hog Plum (*Choerospondias axillaris)* | Garlic *(Allium sativum)* |
| 11. | Mint (*Mentha spicata)* | Hog Plum (*Choerospondias axillaris)* |
| 12. | Walnut (*Juglans regia)* | Mint (*Mentha spicata)* |
| 13. | Onion *(Allium cepa)* | Walnut (*Juglans regia)* |
| 14. | Peach (*Prunus persica*) | Onion *(Allium cepa)* |
| 15. | Pear (*Pyrus spec.*) | Peach (*Prunus persica* ) |
| 16. | Plum (*Prunus spec.)* | Pear (*Pyrus spec.*) |
| 17. | Pumpkin (*Cucurbita pepo* L.) | Pea (*Pisum sativum* L.) |
| 18. | Spinach / Mustard (S*inapis spec*.) | Plum (*Prunus spec.)* |
| 19. | Tarot (*Alocasia indicum*) | Potato (*Solanum tuberosum*) |
| 20. | Tree tomato (*Cyphomandra betacea)* | Pumpkin (*Cucurbita pepo* L.) |
| 21. | | Radish (*Raphanus sativus*) |
| 22. | | Spinach / Mustard Leaves (S*inapis spec*.) |
| 23. | | Tarot (*Alocasia indicum*) |
| 24. | | Tomato *(Lycopersicon esculentum)* |
| 25. | | Tree tomato (*Cyphomandra betacea)* |

Out of the 27 cultivated plants in 2009 and 2011, 25 crops were used for personal consumption as well as market sale. This is in comparison to other farms a high rate of plant use for both purposes. Out of all the plants, only coriander (*Coriandrum sativum L.*) was cultivated for personal consumption and only apricot (*Prunus armeniaca*) was exclusively cultivated for selling. This implicates a diverse nutrition for the family.

**Table 19:** Cultivated crops in 2009 and 2011 on Farm A

| | Consumption | Market | Consumption and Market |
|---|---|---|---|
| 1. | Coriander (*Coriandrum sativum* L.) | Apricot (*Prunus armeniaca*) | Bamboo (*Bambusa spec.)* |
| 2. | | | Bean (*Vicia faba spec.)* |
| 3. | | | Cabbage (*Brassica oleracea var. capitata.)* |

| | | | |
|---|---|---|---|
| 4. | | | Carrot (*Dacus carota*) |
| 5. | | | Cauliflower (*Brassica oleracea var. botrytis L.*) |
| 6. | | | Chayote (*Sechium edule* (Jacq.) Sw.) |
| 7. | | | Chili (*Capsicum annuum*) |
| 8. | | | Cucumber (*Cucumis sativus*) |
| 9. | | | Fig (*Ficus auriculata)* |
| 10. | | | Garlic *(Allium sativum)* |
| 11. | | | Hog Plum (*Choerospondias axillaris)* |
| 12. | | | Mint (*Mentha spicata)* |
| 13. | | | Walnut (*Juglans regia)* |
| 14. | | | Onion *(Allium cepa)* |
| 15. | | | Peach (*Prunus persica* ) |
| 16. | | | Pear (*Pyrus spec.*) |
| 17. | | | Pea (*Pisum sativum* L.) |
| 18. | | | Plum (*Prunus spec.)* |
| 19. | | | Potato (*Solanum tuberosum*) |
| 20. | | | Pumpkin (*Cucurbita pepo* L.) |
| 21. | | | Radish (*Raphanus sativus*) |
| 22. | | | Spinach / Mustard Leaves (S*inapis spec*.) |
| 23. | | | Tarot (*Alocasia indicum*) |
| 24. | | | Tomato *(Lycopersicon esculentum)* |
| 25. | | | Tree tomato (*Cyphomandra betacea)* |

Religion and ceremonies are of high importance and have a great impact on the daily life in Kaule, like in the rest of the country. The family is cultivating several plants for religious purpose (see Table 20). All religious plants are used for worshipping in temples and ceremonies. Plants are also distributed to other people for such purposes. The following are medical plants cultivated on the farm: Asuro (*Justicia adhatoda* L.), furauli (not identified), gogan seeds (*Sauraria nepalensis*) and bandhar (*Melinis minutifolia* P. Beauv.). They are used for fever, throat aches, colds, cuff, and headaches.

**Table 20:** Plants used for religious purposes on Farm A

| | | |
|---|---|---|
| Lalupate | Christmas Star | *Euphorbia pulcherrima* |
| Bhimsen pati | False Daisy | *Eclipta prostrata L.* |
| Sayapatri | Marigold | *Tagetes erecta L.* |
| Narenpatri * | - | - |
| Makahamali | Globe Amaranth | *Gomphrena globosa L.* |

* Narenpatri was mentioned by the daughter but could not be identified.

The harvest is sold at the market in Ranipowa, about 2 km away, or at Balaju Bypass in Kathmandu, around 25 km from Kaule. In months with low or no harvest (Table 14), the family consumes soybean, rice and lentils that can be purchased at the market in Kaule all year round. Figure 26 shows that in 2010, Farmer A's highest expense was for cereals.

The agroforestry farm's soils are acidic, high in soil organic matter, low in total nitrogen and high in available phosphorus (see Table 74 and 76). In comparison to the mean value of 12 soil samples of farms in transition, the soil values of Farm A show double the amount of organic matter, 3.5 times more total nitrogen and about double the amount of available phosphorus. The soil pH is slightly less acidic (see Table 74). The farm has fewer *Gonocephalum* than other tested farms, a darkling beetle that occurs in high amounts if soil habitats are disturbed (see Figure 19).

In 2009 and 2010, a total of 31 different kinds of plants were distributed within the project (see Table 79). Up until 2012, 88% of the distributed species and 67% of all plants have survived on his farm. Farm A is the only farm of project participants that was able to increase more than 50% of all distributed indicator plants until 2012 (see Table 80).

An overview of income and expenses data from autumn 2009 until spring 2011 (see Figure 23) shows that Farm A does not have higher incomes in all months over the year compared to other farms but if the income was higher it was significantly higher. Sometimes more than double in March 2010 due to wood harvest even 10 times higher than other farms average income. Figure 24 shows that the farm in 2010 had more than double the income and about double the expenses compared to the average of the eight other farms. A closer look at income categories in the same year (see Figure 25) explains that 36% of the income was generated by wood harvest, which is a clear assignment to agroforestry, though it only occurs periodically. External income was 45% of total income and 55% of income was generated by farm work (see Figure 26).

In conclusion, compared to the evaluated farms in transition, Farm A is a middle-sized farm and is 100 % assigned to agroforestry. Family size is one child more than other families in average. The total number of perceived work categories on the farm is one above average. However, distinguished work categories carried out by men or women is higher than average in both cases. This might give a hint into the work distribution and work management on Farm A. More work categories assigned to family members might be a sign of more well-regulated and elaborated work processes on the farm. The number of work categories that are done mutually on the farm is higher than average, which implies a joint engagement of the work force. External work is done to a balanced extent and is a solid and important contribution for the household's income.

The farm has a remarkably high diversity of cultivated plants that are used for both personal consumption and for income generation. During the project time, the amount of cultivated plants increased. However, it cannot be clearly distinguished if the higher production is connected to project activities. Still, a connection can be assumed because the farm received more attention by other farmers due to its model status. Soils are in better conditions than the soils of transition farms. Even though the living soil insect study is considered as weak evidence, the darkling beetle *Gonocephalum* was found to a lesser extent than in other farms, which could hint at a better status of the ecosystem than other farms.

Next to a better soil and ecosystem status, it is also notable that Farm A has the highest rate of plants survival of newly distributed plants. This can eventually be assigned to two different factors. On the one hand, Farm A provides a better ecosystem status, which promotes the surrounding conditions of soil, water and physical protection and enhances the survival of new plants. On the other hand, Farmer A and his family might be more experienced in cultivating different plants and are skilled in raising new plant species.

In 2010, Farm A only spent half the amount of expenses on food, in relation to their total expenses, compared to the average of the other evaluated farms. This could be an indicator that Farm A is a good self-catering system that produces food more efficiently than other farms. Finally, in 2010 Farm A invested 5 % of the total expenses in further farm development. Most other farms did not invest at all in farm development. This in addition indicates a forward-looking perspective of the household members.

#### 5.1.2.2.2 Case Study Farm 1

Farmer 1 stayed relatively distant to the project. She was the only participant that represented her household as a single person. Her husband and children did not participate in any meetings, training or other project activity. She was relatively often in conflict with other project members and had an open and talkative temper. She surprisingly cleared the total land that she assigned to agroforestry in 2011. When she was asked what the reasons were, she replied that other people in the village told her to do so. Already at the start of the project, her project performance was often not convergent with the projects concept. When she received plants to be planted on her land assigned to agroforestry, she instead planted most of them on other peoples' farms. She explained that she was afraid the plants might be stolen from her land. In addition, it was not evident to her that agroforestry would mean that different plants would be grown on the same spot of land. After it became obvious that Farmer 1 followed her own method and that this was not according to the agroforestry principles, it was discussed in a common meeting with her and all other participants and decided that she would not participate further in the project. Nevertheless, she was still occasionally participating in meetings and discussions. In addition, she agreed to participate in 2011 in some interviews.

**a) Structured interview on social topics in 2009 and 2011 with Farm 1**

Farmer 1's household had six members in 2011. Herself, her husband, one adult son and one daughter. The grandparents (Farmer 1's father and mother) were also living on the farm.

Farm work was unevenly divided between women, men and children according to Farmer 1. She stated that her husband did not help her to a great extent on the farm and that she had to do most work on her own. Farmer 1 further stated that her family has a fish farm and her husband stays most of the day there, because the fish needs to be fed every three hours. Sometimes he looks after the children or helped Farmer 1 on the farm.

The following table shows the work distribution in the family.

**Table 21:** Work distribution at Farm 1

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | x |
| 2. | Water Collection | - | x | x |
| 3. | Irrigation | x | - | - |
| 4. | Manure Transport | - | x | - |
| 5. | Ploughing | x | x | - |
| 6. | Digging | x | - | - |
| 7. | Seeding | - | x | - |
| 8. | Nursery | - | x | - |
| 9. | Planting | - | x | - |
| 10. | Potato Planting | x | - | - |
| 11. | Weeding | - | x | - |
| 12. | Harvesting | x | x | - |
| 13. | Fish Farming | x | - | - |
| 14. | Cleaning (Household) | - | x | x |
| 15. | Cooking | x | x | - |
| 16. | Watch over the House | x | - | - |
| | **Total No. of Categories** | **8** | **11** | **3** |

While both Farmer 1 and her husband carry out field preparation, Farmer 1 does the work on crops like nursery work, seeding, planting and weeding. She explained that she spends around 7-8 hours per day on farm work. Her husband spends around 2-3 hours per day on farm work and 5 hours per day on watching the family's fish farm and the house. No family member worked outside the farm apart from fish farming and no family members worked abroad.

The family hired external workers for planting and harvesting of wheat, rice and strawberries. They hire 4-5 workers for between 21-30 days per year.

The farm has about 0.4 ha of land. This is a small size in relation to other project farms. Farmer 1 assigned 42 % of the total land to be converted into agroforestry which is in comparison to other farmers a high proportion.

### b) Structured Interview on environmental topics in 2009 and 2011 with Farmer 1

While 21 different kinds of crops and fruits were cultivated in 2009, only 13 different kinds of crops were cultivated in 2011.

**Table 22:** Cultivated crops in 2009 and 2011 on Farm 1

| | 2009 | 2011 |
|---|---|---|
| 1. | Balsam Apple (*Momodica balsamina*) | Chili *(Capsicum annuum)* |
| 2. | Bamboo (*Bambusa spec.)* | Coriander (*Coriandrum sativum L.)* |

| | | |
|---|---|---|
| 3. | Cabbage (*Brassica oleracea var. capitata*.) | Cucumber *(Cucumis sativus)* |
| 4. | Cauliflower (*Brassica oleracea var. botrytis L.*) | Garlic *(Allium sativum)* |
| 5. | Chayote *(Sechium edule (Jacq.) Sw.)* | Ginger (*Zingiber officinale*) |
| 6. | Chili *(Capsicum annuum)* | Maize (*Zea mays L.)* |
| 7. | Cucumber *(Cucumis sativus)* | Onion (*Allium cepa*) |
| 8. | Garlic *(Allium sativum)* | Pea (*Pisum sativum L*.) |
| 9. | Ginger (*Zingiber officinale*) | Potato (*Solanum tuberosum*) |
| 10. | Maize (*Zea mays L.)* | Radish (*Raphanus sativus*) |
| 11. | Onion (*Allium cepa*) | Rice (*Oryza sativa L.)* |
| 12. | Peach (*Prunus persica*) | Spinach (*Sinapis spec*.) |
| 13. | Pear (*Pyrus spec*.) | Strawberry (*Fragaria L.)* |
| 14. | Plum (*Prunus spec.*) | |
| 15. | Potato (*Solanum tuberosum*) | |
| 16. | Pumpkin (*Cucurbita pepo L.*) | |
| 17. | Rice (*Oryza sativa L.)* | |
| 18. | Strawberry (*Fragaria L.)* | |
| 19. | Tree Tomato (*Cyphomandra betacea*) | |
| 20. | Turmeric (*Curcuma longa L.)* | |
| 21. | Tree tomato (*Cyphomandra betacea)* | |

Out of 24 different cultivated kinds of plants in 2009 and 2011, 17 were used for personal consumption and 13 kinds were produced for income generation.

**Table 23:** Cultivated crops in 2009 and 2011 on Farm 1

| | **Consumption** | **Market** | **Consumption and Market** |
|---|---|---|---|
| 1. | Balsam Apple *(Momodica balsamina)* | Bamboo (*Bambusa spec.)* | Cucumber *(Cucumis sativus)* |
| 2. | Chayote *(Sechium edule (Jacq.) Sw.* | Cabbage (*Brassica oleracea var. capitata*) | Garlic *(Allium sativum)* |
| 3. | Chili *(Capsicum annuum)* | Cauliflower (*Brassica oleracea var. botrytis L*.) | Maize (*Zea mays L.)* |
| 4. | Ginger (*Zingiber officinale)* | Peach (*Prunus persica*) | Pea (*Pisum sativum L*.) |
| 5. | Onion (*Allium cepa*) | Pear (*Pyrus spec*.) | Radish (*Raphanus sativus)* |
| 6. | Potato (*Solanum tuberosum*) | Plum (*Prunus spec.*) | Rice (*Oryza sativa L.)* |
| 7. | Pumpkin (*Cucurbita pepo L.*) | Strawberry (*Fragaria L.)* | |
| 8. | Tree Tomato (*Cyphomandra betacea*) | | |
| 9. | Turmeric (*Curcuma longa L.)* | | |
| 10. | Coriander (*Coriandrum sativum L.)* | | |
| 11. | Spinach (*Sinapis spec*.) | | |

Farmer 1 sold the crops at the local market in Kaule. In months with low or no harvest, (see Table 14) the family buys dried pulses and vegetables like lentils, onion and beans at the local shop.

Farmer 1 cultivates several religious plants for worshipping (see Table 24) and marigold (*Tagetes erecta L.)* as a medicinal plant, which is used for earache.

**Table 24:** Plant use for religious purposes at Farm 1

| | | |
|---|---|---|
| Korpur | Tulsi | *Ocimum tenuiflorum L.* |
| Lalupate | Christmas Star | *Euphorbia pulcherrima* |
| Narenpatri | - | - |
| Sayapatri | Marigold | *Tagetes erecta L.* |

Because Farmer 1 left the project after a short period and most of the distributed plants she did not plant in the transfer land, it was pointless to monitor any data on plant survival. In 2011, she finally cleared the appointed land. Before this, the transition land already included bigger trees.

In conclusion, compared to other farms and households, Farmer 1 owns a small portion of land, but she initially wanted to assign a high percentage of her land to agroforestry. Her family size and number of children is slightly below average. She identified many different work categories on her farm and in the household. In 2009, she cultivated almost double the number of plant species compared to other farms, and although fewer in 2011, the number was slightly more than the average of the other farms. Farmer 1 seemed to be isolated from other group members and unsure in what she was doing. As she expressed it herself, others left her on her own and she had the feeling of lacking support. It was reported by other participants, that villagers not participating in the project ridiculed the projects activities. For example, at the start of the project, different fodder plants for livestock were distributed. Other villagers mocked the project farmers by asking if they planned to eat grass in the future as participants reported. The opinions of other villagers might have influenced Farmer 1's perception also as her group integration seemed to be weak.

#### 5.1.2.2.3 Case Study Farmer 2

Farmer 2 seemed to be a very passionate farmer that one could often find in his fields and that gave great attention to his plants. He was the only farmer that constructed at the project start a climbing frame for his kiwi plants on own initiative. Farmer 2 cultivated strawberries on terraces above the land he transferred to agroforestry. The agroforestry plants he planted developed faster and stronger in comparison to those of the other farms. Finally, the idea emerged that the fertilizer he applied on his strawberry field was being washed by the rain to the lower fields, so that the agroforestry fields were also being fertilised. Hence, his agroforestry terraces were better covered than those of the other farmers. Farmer 2 attended project activities frequently, displaying an interested, calm and pronounced friendly personality. He was a well-respected member of the group. The farm and farmland is situated on a hill and to reach it one needs to climb for about 30 minutes down a steep hill from the main road.

### a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 2

Farmer 2 had a big household with 11 members. In total nine adults, including him and his wife, five sons and one daughter, as well as the wife of one son and two children including one 10-year-old son and one granddaughter lived in the household in 2011.

Children did not participate in the farm work. Work categories on the farm were relatively equally divided between men and women. Categories like fodder and wood collection, manure transport, cleaning and cooking were women tasks. Typical tasks for men were ploughing, potato planting and pest monitoring.

**Table 25:** Work distribution on Farm 2

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Irrigation | x | x | - |
| 3. | Manure Transport | - | x | - |
| 4. | Ploughing | x | - | - |
| 5. | Digging | x | x | - |
| 6. | Planting | x | x | - |
| 7. | Potato Planting * | x | - | - |
| 8. | Weeding | x | x | - |
| 9. | Harvesting | x | x | - |
| 10. | Pest Monitoring | x | - | - |
| 11. | Cleaning (Household) | - | x | - |
| 12. | Cooking | - | x | - |
| | **Total No. of Categories** | **8** | **9** | **0** |

Some of Farmer 2's sons work outside the farm as bus driver or in construction work. One son worked in 2011 abroad in India.

The household hires external workers for 10 – 15 days per year. They help in ploughing, planting rice and millet, and weeding the maize.

### b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 2

**Table 26:** Cultivated crops in 2009 and 2011 on Farm 2

| | 2009 | 2011 |
|---|---|---|
| 1. | Spinach / Mustard (*Sinapis spec.*) | Apricot (*Prunus armeniaca*) |
| 2. | Cabbage (*Brassica oleracea var. capitata.)* | Spinach/Mustard (*Sinapis spec.*) |
| 3. | Cauliflower *(Brassica oleracea var. botrytis L.)* | Coriander (*Coriandrum sativum* L.) |
| 4. | Chili *(Capsicum annuum)* | Garlic *(Allium sativum)* |
| 5. | Garlic *(Allium sativum)* | Ginger (*Zingiber officinale*) |
| 6. | Maize (*Zea mays L.)* | Onion *(Allium cepa)* |
| 7. | Millet (*Eleusine coracana L.*) | Pea (*Pisum sativum L.*) |

| | | |
|---|---|---|
| 8. | Onion *(Allium cepa)* | Plum (*Prunus spec.)* |
| 9. | Peach (*Prunus persica* ) | Strawberry (*Fragaria L.)* |
| 10. | Potato (*Solanum tuberosum*) | Tomato *(Lycopersicon esculentum)* |
| 11. | Strawberry (*Fragaria L.)* | |
| 12. | Rice (*Oryza sativa L.)* | |

Farmer 2 cultivates most plants for own consumption. There is no crop grown only for income generation. Even so, rice, strawberries, tomatoes and peas are also cultivated for the market.

**Table 27:** Cultivated crops in 2009 and 2011 on Farm 2

| | **Consumption** | **Consumption and Market** |
|---|---|---|
| 1. | Apricot (*Prunus armeniaca*) | Rice (*Oryza sativa L.)* |
| 2. | Spinach / Mustard Leaves (*Sinapis spec*.) | Strawberry (*Fragaria L.)* |
| 3. | Cabbage (*Brassica oleracea var. capitata.)* | Tomato *(Lycopersicon esculentum)* |
| 4. | Cauliflower *(Brassica oleracea var. botrytis L.)* | Pea (*Pisum sativum L*.) |
| 5. | Chili *(Capsicum annuum)* | |
| 6. | Coriander (*Coriandrum sativum* L.) | |
| 7. | Garlic *(Allium sativum)* | |
| 8. | Ginger (*Zingiber officinale*) | |
| 9. | Maize (*Zea mays L.)* | |
| 10. | Millet (*Eleusine coracana L.*) | |
| 11. | Onion *(Allium cepa)* | |
| 12. | Plum (*Prunus spec.)* | |
| 13. | Peach (*Prunus persica* ) | |
| 14. | Potato (*Solanum tuberosum*) | |

Farmer 2 sold peas in Balaju Bypass, a transfer site at the boarder of Kathmandu city. Tomatoes were sold in Ranipowa, and strawberries at a fruit and vegetable market in Kathmandu.

Several ornamental plants for festivals and religious reasons were cultivated on the farm, as well as medicinal plants like stinging nettle (*Urtica dioca*) as an insect repellent or mugwort, (*Artemisia indica*) against skin problems.

**Table 28:** Plants used for religious purposes grown on Farm 2

| | | |
|---|---|---|
| Godavari | Chrysanthemum | *Chrysantemum indicum* |
| Makhamali | Amaranthus | *Gomphrena globosa* |
| Sayapatri | Marigold | *Tagetes erecta* |

Soil data (see Table 74 and 76) in comparison to the mean value of 12 farms in transition shows that the farm's soil contains 1.7 times more organic material, slightly less total nitrogen and slightly higher available phosphorus concentrations. The soil pH was slightly less acidic. The indicator of soil living coleopteran showed that Farmer 2 had, compared to the agroforestry farm, a higher concentration of *Gonocephalum* in autumn 2009 and 2010 (see Figure 19).

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. Until 2012, out of the selected indicator plants, 74 % of the distributed plant species and 25 % of all plants survived on his farm (see Table 80).

Farmer 2's household did not provide a sufficient amount of income data to be evaluated, but data on expenses was provided. The highest spending of the household in 2010 was on cereals, followed by expenses for fertilizer (see Figure 27).

The family has 1.11 ha of land, which is one of the bigger sized farms. The assigned 6 % of land for conversion to agroforestry land are in comparison to others a small proportion. With 11 members, the household is also one of the biggest with an average number of children but a higher number of adults. Identified numbers of work categories were rather small and work categories are clearly divided between family members, while children do not work on the farm. Presumably, due to the big family size, three family members work off the farm to support the household. The number of cultivated plants in 2009 and 2011 are about average. More plants than in average are used for personal consumption and less plants exclusively for income generation. Farm 2's comparatively high content of organic material might be connected to good coverage by plants due to fertiliser aggradations from strawberry fields. The comparably low nitrogen content is surprising in this regard. On Farm 2, more plants survived than on average. This also might be due to good coverage, which keeps moisture in the soil and to the high attention Farmer 2 spends on his cultivated plants. The family spent an average amount of their expenses on food. They also invested in 2010 in the development of the farm, which suggests long-term perspective and planning. In total, Farmer 2 seems to be an interested and active member of the project.

#### 5.1.2.2.4 Case Study Farmer 3

The household of Farmer 3 gave the impression of strong solidarity and clear structures. The farm looked well organised and next to farm work, the household members produced bamboo mats, baskets and watches. With this, they were the only family who produced refined products out of their harvest, apart from alcohol production which is done by all households in form of raksi, a distilled alcohol from millet, or chang a fermented alcohol made with maize. Since 2011, Farmer 3 did not participate in any more meetings. He then worked fulltime as a housekeeper and gardener looking after flowers and beehives for a bigger and newly built hotel and restaurant in the village. Instead of him, other family members participated with interest in all project activities.

#### a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 3

In 2009, seven members were living in Farmer 3's household consisting of five adults including himself, his wife, his sister, his parents and two small children. In 2011, the household consisted of 14 members including seven adults composed of Farmer 3's parents, Farmer 3 and his wife, his brother and brother's wife, and one daughter. The household had seven children at this time.

Farm work is divided between men and women. Children do not work on the farm apart from fodder collection and braiding of bamboo baskets. All children go to school. Table 29 shows 16 identified work categories, whereof men and women do six together. Work categories that are done exclusively by men are potato planting, harvesting and cropping. Women are especially responsible for water collection, livestock care, and cooking. The women and men's day starts at 6 am and ends at 21:00 pm.

**Table 29:** Work distribution at Farmer 3's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | x | x | x |
| 2. | Water Collection | - | x | - |
| 3. | Feeding Livestock | - | x | - |
| 4. | Manure Transport | x | x | - |
| 5. | Ploughing | x | x | - |
| 6. | Digging | x | x | - |
| 7. | Seeding | - | x | - |
| 8. | Planting | x | x | - |
| 9. | Potato Planting * | x | - | - |
| 10. | Weeding | x | x | - |
| 11. | Harvesting | x | - | - |
| 12. | Cropping | x | - | - |
| 13. | Herd Livestock | - | x | - |
| 14. | Braiding Bamboo Baskets | - | - | x |
| 15. | Selling Harvest at Market | x | - | - |
| 16. | Cooking | - | x | - |
| | **Total No. of Categories** | **10** | **11** | **2** |

Some family members work outside the farm. Farmer 3's father helps ploughing fields of other farms; one sister worked fulltime as a tailor in Kaule village. Farmer 3 worked as a housekeeper and gardener. Still, in 2010, only 17 % of all household income was gained by external work (see Figure 25). None of the family members work outside of Nepal.

The family hires about 25 workers during the year in several months to help with planting, harvesting, ploughing and manuring.

The farm size, at 0.6 ha is rather small.

### b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 3

The family cultivated more plant species in 2011 than in 2009 as Table 30 illustrates. Most plants are cultivated for own consumption. There is no crop grown only for market sale (see Table 31), though especially rice and strawberries are cultivated in higher quantity to be sold at the market in 2009 and in 2011. In addition, plums, apricots, tomato and spinach were sold at the market.

**Table 30:** Cultivated crops in 2009 and 2011 on Farmer 3's farm

| | 2009 | 2011 |
|---|---|---|
| 1. | Spinach / Mustard (*Sinapis spec.)* | Apricot (*Prunus armeniaca*) |

| | | |
|---|---|---|
| 2. | Coriander (*Coriandrum sativum L.*) | Bean (*Vicia faba spec.)* |
| 3. | Maize (*Zea mays L.)* | Coriander (*Coriandrum sativum L.*) |
| 4. | Millet (*Eleusine coracana L.*) | Garlic *(Allium sativum)* |
| 5. | Rice (*Oryza sativa L.)* | Onion *(Allium cepa)* |
| 6. | Wheat (*Triticum L.* spec.) | Plum (Prunus spec.) |
| 7. | Strawberry (*Fragaria L.)* | Potato (*Solanum tuberosum*) |
| 8. | | Pumpkin (*Cucurbita pepo* L.) |
| 9. | | Radish (*Raphanus sativus*) |
| 10. | | Spinach / Mustard (S*inapis spec*.) |
| 11. | | Strawberry (*Fragaria L.)* |
| 12. | | Tomato *(Lycopersicon esculentum)* |

Ranipowa is the family's usual market for selling their harvest, though strawberries are sold in Kathmandu and in Balaju Bypass at the periphery of Kathmandu.

**Table 31:** Cultivated crops in 2009 and 2011 on Farmer 3's farm

| | **Consumption** | **Consumption and Market** |
|---|---|---|
| 1. | Apricot (*Prunus armeniaca*) | Apricot (*Prunus armeniaca*) |
| 2. | Bean (*Vicia faba spec.)* | Plum (*Prunus spec.)* |
| 3. | Coriander (*Coriandrum sativum* L.) | Rice (*Oryza sativa L.)* |
| 4. | Garlic *(Allium sativum)* | Spinach / Mustard (S*inapis spec*.) |
| 5. | Maize (*Zea mays L.)* | Strawberry (*Fragaria L.)* |
| 6. | Millet (*Eleusine coracana L.*) | Tomato *(Lycopersicon esculentum)* |
| 7. | Onion *(Allium cepa)* | |
| 8. | Plum (*Prunus spec.)* | |
| 9. | Potato (*Solanum tuberosum*) | |
| 10. | Pumpkin (*Cucurbita pepo* L.) | |
| 11. | Radish (*Raphanus sativus*) | |
| 12. | Rice (*Oryza sativa L.)* | |
| 13. | Spinach / Mustard (S*inapis spec*.) | |
| 14. | Strawberry (*Fragaria L.)* | |
| 15. | Tomato *(Lycopersicon esculentum)* | |
| 16. | Wheat (*Triticum L.* spec.) | |

For those months with low or no harvest the family stores certain crops. If the amount is not enough they buy additional food at the market. In 2010, 23 % of expenses were spent on cereals (Figure 27).

Next to plants that are used for personal consumption or to generate income, also ornamental plants were grown. The family cultivates different kinds of plants for decoration at festivals and for religious ceremonies (see Table 32). Some plants are grown for medicinal use. Banana (*Musa paradisica*) for example is used to clear ears and finger millet (*Eleusine coracana*) is a medicine against the cold as Farmer 3 explained.

**Table 32:** Plants used for religious purposes on Farmer 3's farm

| | | |
|---|---|---|
| Bhimsen pati | False Daisy | *Eclipta prostrata L.* |
| Godavari | Chrysanthemum | *Chrysantemum indicum* |
| Sayapatri | Marigold | *Tagetes erecta L.* |

Farm 3 was part of the indicator studies. Soil data values (see Table 74), in comparison to the average value of 12 soil samples of farms in transition, show that the soil contains about the average amount of organic material, 3.5 times more total nitrogen and about double the amount of available phosphorus. Soil pH is slightly less acidic than in average.

In 2009 and 2010, a total of 31 different kinds of plants were distributed within the project (see Table 79). Until 2012, 88 % of the distributed indicator species and 25 % of all plants survived on the farm. This is a high percentage in comparison to the results of other farms (see Table 80).

Farmer 3's household had the second highest income in 2010, after the household of Farm A (see Figure 24). His income was double that of the average income of eight other farms in transition. The same figure also shows that the expenses were about 1.3 times higher than the average expenses of other farms. A closer look at income categories in the same year (see Figure 25) shows that 81% of income was earned by farmwork, and 17 % of income was generated by external work (see Figure 26). The family took a loan of 2 % of the total income.

In conclusion, compared to the average of all evaluated farms, the household has a small farm size, and their assignment of 5 % of their total land to the project represented a comparably small portion to agroforestry transition. The household is one of the biggest of all participating households, regarding the number of members in 2011 after the family merged from family members that were in 2009 separated. Comparably high number of identified work categories on farm and work division between men and women might express a well-organised work structure. Even though several members work off the farm, still the main income source is farm work. This is most likely due to a specialisation in strawberry production. From all participants in transition, Farm 3 had the highest survival rate of distributed plants. This could be due to good care and to slightly better soil conditions. In 2010, a lower portion of total expenses was spent on food compared to other households. Further investment in farm development was not done. The family seemed to have a successful livelihood in contrast to other households due to a strong and lively family structure and a disciplined and focused work culture, as well as a good social integration that allows helpful connections, for example, for the transport of strawberries to Kathmandu.

#### 5.1.2.2.5 Case Study Farmer 4

Farmer 4 was the representative of her household in most cases. She was a reliable attendee of all project activities, though displayed timid and sometimes even anxious behaviour especially at the project start. Over time, she became more confident and open. The household made a rather simple impression. Farmer 4 stated that the men in her family would not help her on the farm. Missing support in the family eventually led to her anxiousness and careful behaviour.

Volunteers helped Farmer 4 to build a fence at the neighbouring boarder of her land because the neighbours would send their livestock for gazing on her land. The livestock would kill the agroforestry plants. A while after the bamboo fence was built it began to rot. While the fence was being built, big amounts of pure clay was found on her land. One volunteer told her that maybe she could use the clay for pottery or sell it as raw material to Kathmandu in order to gain extra income. However, she had no time or not the right impulse to organise this at that time.

### a) Structured Interview on Social Topics in 2011 with Farmer 4

Farmer 4 was not present for the first interview in 2009, so only data of 2011 are displayed.

The household consists of five members in 2011 including Farmer 4, her husband, two grown up sons and one young son. The child did go to school.

Farmer 4 stated that her husband and her elder sons do not help her with the farm work and she has to do most farm work on her own as Table 33 illustrates. The younger son helps in certain chores on the farm.

**Table 33**: Work distribution at Farm 4

| | | **Men** | **Women** | **Children** |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | x |
| 2. | Irrigation | - | x | - |
| 3. | Manure Transport | - | x | - |
| 4. | Manuring | - | - | x |
| 5. | Ploughing | x | x | - |
| 6. | Digging | - | x | - |
| 7. | Nursery | - | x | - |
| 8. | Seeding | x | x | x |
| 9. | Planting | - | x | - |
| 10. | Weeding | x | x | x |
| 11. | Harvesting | x | x | x |
| 12. | Cropping | - | - | - |
| 13. | Pest Monitoring | - | x | - |
| 14. | Cleaning (Household) | - | x | - |
| 15. | Cooking | - | x | - |
| | **Total No. of Categories** | **4** | **13** | **5** |

Farmer 4’s husband works outside the farm in construction work. The grown up sons both work on a nearby poultry farm.

When Farmer 4 was asked if any of the family members work outside of Nepal she replied that she did not understand the question. Quite often, she seemingly was too shy to answer questions. One sometimes got the impression that she was frightened to give a wrong answer.

In Bhadau (June and July) and again in Ashad (November / December) external workers are hired for planting rice and to help on the farm.

The household, with 0.34 ha of land, was the smallest land size of all project members.

**b) Structured Interview on Environmental Topics in 2011 with Farmer 4**

Only six kinds of crops were cultivated in 2011, all for own consumption, and four for income generation.

**Table 34:** Cultivated crops in 2011 on Farm 4

| | **2011** |
|---|---|
| 1. | Chili (*Capsicum annuum*) |
| 2. | Garlic *(Allium sativum)* |
| 3. | Onion *(Allium cepa)* |
| 4. | Pea (*Pisum sativum* L.) |
| 5. | Spinach / Mustard Leaves (*Sinapis spec*.) |
| 6. | Tomato *(Lycopersicon esculentum)* |

Most plants are used for own consumption as well as for selling.

**Table 35:** Cultivated crops in 2011 on Farmer 4's farm

| | **Consumption** | **Consumption and Market** |
|---|---|---|
| 1. | Chili *(Capsicum annuum)* | Chili *(Capsicum annuum)* |
| 2. | Garlic *(Allium sativum)* | Pea (*Pisum sativum L*.) |
| 3. | Onion (*Allium cepa*) | Spinach (*Sinapis spec*.) |
| 4. | Pea (*Pisum sativum L*.) | Tomato *(Lycopersicon esculentum)* |
| 5. | Spinach (*Sinapis spec*.) | |
| 6. | Tomato *(Lycopersicon esculentum)* | |

Tomatoes and spinach are sold in Ranipowa, chilli is sold in Kaule and peas are sold in Kathmandu. In months with low or no harvest additional food is bought at the local shops.

Farmer 4 is not cultivating any plants that are used for religious ceremonies or festivals and she has no knowledge about medicinal plants.

As Farmer 4 did not participate in interviews and data acquisition in 2009, some information is not available. However, indicator data was collected.

The farm's soil measurement data (see Table 74) in comparison to the mean value of 12 soil samples of farms in transition shows that the soil had an average value of organic material, less than half the concentration of total nitrogen and a low amount of available phosphorus. The acidic soil pH was had an average value. Data on soil living insects was not collected at her farm.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. Until 2012, 65 % of the distributed species and 7 % of all plants survived on her farm (see Table 80).

The household did not provide any data on income or expenses. Farmer 4 stated that she was not able to provide this data because of illiteracy.

In conclusion, compared to other participants, the farm is small, but at 23 % a high percentage of land was assigned for transition to agroforestry. The household is relatively small and has only one child. It is unusual that the child is not attending school. All three men have external work. The woman of the household does the farm work. Only six kinds of crops are cultivated in 2011. Although there is no data that show percentages of income from farm work or external work and no data on expenses, a bigger quantity of food most likely needs to be purchased from the market. Distributed plants had a low survival rate but a comparable higher survival of plant species was given and might express the will and interest of Farmer 4 in project participation, even so she got little help from her family.

#### 5.1.2.2.6 Case Study Farmer 5

The household of Farmer 5 was one of the most interested and connected households to the project and the foreigners that were part of it. Farmer 5 and his wife, together with some of their children, visited the demonstration centre several times. Farmer 5 was very open-minded and interested in the habits and general information about other cultures. They also quite often invited the inhabitants of the demonstration centre to their household. This connection allowed a better understanding and exchange between the cultures and created an amicable environment. Volunteers were often placed on Farm 5 to help and learn. The farm is rather steeply situated and to reach it one needs to descend for about 20 minutes downhill from the main road.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 5**

Farm 5’s household is one of the bigger ones and next to Farmer 5 and his wife, five adult sons and three of their wives are part of it. In total, there are 10 adults and three children. The children visit the school in Kaule and help only to a small extent on the farm, mostly to learn farm work from their mother.

Both men and women are responsible for manuring, planting and harvesting. Women are responsible for all work regarding maize, including weeding, seeding, manuring and harvesting. The men especially do the hard physical work like ploughing and digging.

**Table 36:** Work distribution at Farmer 5's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Manure Transport | x | x | - |
| 3. | Ploughing | x | - | - |
| 4. | Digging | x | - | - |
| 5. | Nursery | x | - | - |
| 6. | Seeding | - | x | - |

| | | | | |
|---|---|---|---|---|
| 7. | Planting | x | x | x |
| 8. | Potato Planting | x | - | - |
| 9. | Weeding | - | x | - |
| 10. | Harvesting | x | x | - |
| 11. | Herd Livestock | - | x | - |
| 12. | Cooking | - | x | - |
| 13. | Cleaning (Household) | x | x | - |
| 14. | Accompany Mother to Learn | - | - | x |
| | **Total No. of Categories** | **8** | **9** | **2** |

Farmer 5's wife and his daughter in law work for between 12 to 15 days per month on the neighbour's farm. One son works at the poultry farm in Kaule and one son works at a construction site in Tinpiple, a village about 8 km away. Figure 25 shows that only 16 % of the year's income in 2010 was generated by external work. Most of the income was earned by strawberry farming. None of the family members worked outside of Nepal.

During five months of the year, external workers were hired for 2 - 3 days per month to help in planting, ploughing, manuring and carrying the harvest.

The farm size of 1.16 ha is bigger than the average project members.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 5**

The household cultivated 11 crops in 2009, and 22 kind of crops in 2011.

**Table 37:** Cultivated crops on Farmer 5's farm in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Bean (*Vicia faba spec.)* | Apricot (*Prunus armeniaca*) |
| 2. | Cabbage (*Brassica oleracea var. capitata*) | Bean (*Vicia faba spec.)* |
| 3. | Cauliflower (*Brassica oleracea var. botrytis L.*) | Buckwheat (*Fagopyrum esculentum*) |
| 4. | Chili *(Capsicum annuum)* | Cabbage (*Brassica oleracea var. capitata*) |
| 5. | Garlic *(Allium sativum)* | Cauliflower (*Brassica oleracea var. botrytis L.*) |
| 6. | Maize (*Zea mays L.)* | Chili *(Capsicum annuum)* |
| 7. | Millet (*Eleusine coracana L.*) | Coriander (*Coriandrum sativum L.*) |
| 8. | Onion *(Allium cepa)* | Cowpea (*Vigna unguiculata*) |
| 9. | Potato (*Solanum tuberosum*) | Garlic *(Allium sativum)* |
| 10. | Rice (*Oryza sativa L.)* | Ginger (*Zingiber officinale*) |
| 11. | Strawberry (*Fragaria L.)* | Hog Plum (*Choerospondias axillaris)* |
| 12. | | Maize (*Zea mays L.)* |
| 13. | | Millet (*Eleusine coracana L.*) |
| 14. | | Onion *(Allium cepa)* |
| 15. | | Pea (*Pisum sativum L.*) |
| 16. | | Potato (*Solanum tuberosum*) |
| 17. | | Radish (*Raphanus sativus*) |

| | | |
|---|---|---|
| 18. | | Rice (*Oryza sativa L.)* |
| 19. | | Spinach / Mustard Leaves (S*inapis spec*.) |
| 20. | | Strawberry (*Fragaria L.)* |
| 21. | | Tomato *(Lycopersicon esculentum)* |
| 22. | | Wheat (*Triticum L.* spec.) |

Most plants are cultivated for own consumption which hints at a balanced and varied diet. Fruits and radish are especially cultivated for income generation. Kaule is next to the cultivation of strawberries also well known for radish cultivation.

**Table 38:** Cultivated crops in 2009 and 2011 on Farmer 5's farm

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Bean (*Vicia faba spec.)* | Bean (*Vicia faba spec.)* | Apricot (*Prunus armeniaca*) |
| 2. | Buckwheat (*Fagopyrum esculentum*) | Maize (*Zea mays L.)* | Hog Plum (*Cherospondias axillaris)* |
| 3. | Cabbage (*Brassica oleracea var. capitata*) | Millet (*Eleusine coracana L.*) | Radish (*Raphanus sativus*) |
| 4. | Cauliflower (*Brassica oleracea var. botrytis L.*) | Pea (*Pisum sativum L*.) | Strawberry (*Fragaria L.)* |
| 5. | Chili *(Capsicum annuum)* | Rice (*Oryza sativa L.)* | |
| 6. | Coriander (*Coriandrum sativum L.*) | Wheat (*Triticum L.* spec.) | |
| 7. | Cowpea (*Vigna unguiculata*) | | |
| 8. | Garlic *(Allium sativum)* | | |
| 9. | Ginger (*Zingiber officinale*) | | |
| 10. | Maize (*Zea mays L.)* | | |
| 11. | Millet (*Eleusine coracana L.*) | | |
| 12. | Onion *(Allium cepa)* | | |
| 13. | Pea (*Pisum sativum L*.) | | |
| 14. | Potato (*Solanum tuberosum*) | | |
| 15. | Rice (*Oryza sativa L.)* | | |
| 16. | Spinach / Mustard (S*inapis spec*.) | | |
| 17. | Tomato *(Lycopersicon esculentum)* | | |
| 18. | Wheat (*Triticum L.* spec.) | | |

The family cultivates amaranths and marigold for religious ceremonies but they had no knowledge about medicinal plants, which is surprising if one considers Farmer 5's status as a village healer.

**Table 39:** Plants used for religious purposes on Farm 5

| | | |
|---|---|---|
| Makhamali | Amaranths | *Gomphrena globosa* |
| Sayapatri | Marigold | *Tagetes erecta* |

While strawberries are sold in Kathmandu, the market for other crops is in Kaule or in Ranipowa. In times of low or no harvest, the family buys food at the local shops in Kaule and in Ranipowa. The main expense was on cereals representing 30 % of the total year expenses in 2010 (compare Figure 27).

The farms soil data (see Table 74), in comparison to the mean value of 12 soil samples of farms in transition, shows that the soil contains low organic material, 1.16 times more total nitrogen and 0.78 times the available phosphorus. The soil pH is the most acidic of all tested farms.

The indicator of soil living coleopteran exists for Farm 5 only for 2010 and 2011, as the traps of 2009 were either destroyed or disturbed. Farmer 5 had an extraordinary high occurrence of *Gonocephalum*, a darkling beetle on his transition land compared to others (see Figure 19). This beetle is suggested as an indicator for disturbed ecological habitats if it occurs in higher amounts.

70 % of the distributed species and 15 % of all plants survived on his farm during the evaluation period (Table 80). This might be correlated to the soil quality but Farmer 5 also explained that pests like red ants killed certain plants.

An overview of income and expense data from 2010 (see Figure 23) shows that Farm 5 had a higher income and higher expenses than the average of the eight other farms. A closer look on his income categories in the same year (see Figure 25) shows that 53 % of his income was generated by selling fruits (mainly strawberries) and just 16 % was earned by external work. In total, 84 % of income was generated by farm work (see Figure 26).

In conclusion, compared to others project farms, the farm is relatively big in land size, and with 9 % of the total land, half the average amount of land was given for conversion to agroforestry. The household is one of the biggest within the project. There is an average number of specified work categories, and both men and women do farm work. A high percentage of expenses was spend on food, even though the farm uses a bigger portion of their cultivated plants for own consumption. However, the land size is probably not big enough to produce enough crops to feed all family members, especially because strawberry fields take up most of the space. Plant cultivation rose during the project time. Even so, there is no proof that this is directly connected to the project. Still Farmer 5 and his family had a very positive approach towards the agroforestry project. The plant survival rate was slightly better than average.

#### 5.1.2.2.7 Case Study Farmer 6

Farmer 6 was noticeably one of the better off farmers that participated in the project. This was also expressed in a self-confident personality. Due to this, it was possible to talk relatively frankly with her. The family lives in a village house and their fields are far from their home. Farmer 6’s husband never participated in the project activities, and during talks it became obvious that he considered the project to be suspicious. Farmer 6, Farmer 1, and Farmer 7 are close relatives. Farmer 6 participated about 50 % of the time in project meetings, discussions and activities. This was due to the distance of her house to the democentre and to the fact that her husband sometimes forbade her to participate.

The family has no farmhouse but only a barn in the fields. The families living is so far not on farm but rather in the village. Farm work is concentrated mainly on certain income generating activities like cash crops.

### a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 6

There lived four members in Farmer 6's household in 2011: Farmer 6, her husband, and two daughters aged 9 and 12 years old.

As Farmer 6 and her husband do not have a farmhouse and the farm work is concentrated on certain main income generating crops like radish and strawberries, the work categories are rather few and clearly divided between men and women.

In general, certain farm work categories like digging and ploughing are typical men work. For this work, the family hires external workers. Farmer 6s' husband does not work on the farm. However, as Farmer 6 explained, he fosters business relations in Kathmandu for selling cash crops. The children help with weeding and during the harvest time.

**Table 40:** Work distribution at Farmer 6's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Water Collection | - | x | - |
| 3. | Irrigation | - | x | - |
| 4. | Ploughing | x | - | - |
| 5. | Digging | x | - | - |
| 6. | Nursery | - | x | - |
| 7. | Potato Planting | x | - | - |
| 8. | Weeding | - | x | x |
| 9. | Harvesting | - | - | x |
| 10. | Selling Harvest at Market | x | - | - |
| 11. | Customer Networking | x | - | - |
| 12. | Cooking | - | x | - |
| 13. | Cleaning (Household) | - | x | x |
| | **Total No. of Categories** | **5** | **7** | **3** |

Farmer 6's husband and her brother sometimes work in Dubai in the United Arab Emirates as plumbers. Working abroad generates more income and partly explains the comparable wealth of the family.

In Baishak (April / May), and Falgun (February / March) external workers are hired for the whole month to weed strawberries and to plant maize.

### b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 6

In 2009, Farmer 6 cultivated 12 kinds of crops, and in 2011 a total of 14 different kinds of crops. Next to the usual cash crops like strawberries, rice and radish, she established a field of asparagus, which is one of the introduced cash crops by the agroforestry project. In addition, the cultivation of ginger was a suggestion of the project.

**Table 41:** Cultivated crops in 2011 on Farmer 6s' farm

| | 2009 | 2011 |
|---|---|---|
| 1. | Chili *(Capsicum annuum)* | Asparagus (*Asparagus L. spec.*) |
| 2. | Coriander (*Coriandrum sativum L.*) | Bamboo (*Bambusa spec.)* |
| 3. | Garlic *(Allium sativum)* | Bean (*Vicia faba spec.)* |
| 4. | Ginger (*Zingiber officinale*) | Chili *(Capsicum annuum)* |
| 5. | Maize (*Zea mays L.)* | Coriander (Coriandrum sativum L.) |
| 6. | Onion *(Allium cepa)* | Garlic *(Allium sativum)* |
| 7. | Pea (*Pisum sativum L*.) | Ginger (*Zingiber officinale*) |
| 8. | Potato (*Solanum tuberosum*) | Maize (*Zea mays L.)* |
| 9. | Radish (*Raphanus sativus*) | Pea (*Pisum sativum L*.) |
| 10. | Rice (*Oryza sativa L.)* | Radish (*Raphanus sativus*) |
| 11. | Strawberry (*Fragaria L.)* | Rice (*Oryza sativa L.)* |
| 12. | Spinach / Mustard (S*inapis spec*.) | Spinach / Mustard (S*inapis spec*.) |
| 13. | | Strawberry (*Fragaria L.)* |
| 14. | | Tomato *(Lycopersicon esculentum)* |

Most crops are cultivated in smaller quantities for the family's own consumption. Other crops are cultivated in bigger amount for income generation. Crops like ginger, radish and rice are consumed to some extent, but are mainly sold. Crops like maize, pea and strawberry are only cultivated for sale on the market. Asparagus was meant by the project as a cash crop but was consumed by the family. The reason for this is that the asparagus plants are newly introduced and as a vegetable unknown to farmers. They first need to collect some experiences with this plant.

**Table 42:** Cultivated crops in 2009 and 2011 on Farmer 6's farm

| | Consumption | Consumption and Market | Market |
|---|---|---|---|
| 1. | Asparagus (*Asparagus L. spec.*) | Ginger (*Zingiber officinale*) | Maize (*Zea mays L.)* |
| 2. | Bamboo (*Bambusa spec.)* | Radish (*Raphanus sativus*) | Pea (*Pisum sativum L*.) |
| 3. | Bean (*Vicia faba spec.)* | Rice (*Oryza sativa L.)* | Strawberry (*Fragaria L.)* |
| 4. | Chili *(Capsicum annuum)* | | |
| 5. | Coriander (*Coriandrum sativum L.)* | | |
| 6. | Garlic *(Allium sativum)* | | |
| 7. | Onion *(Allium cepa)* | | |
| 8. | Potato (*Solanum tuberosum*) | | |
| 9. | Spinach / Mustard (S*inapis spec*.) | | |
| 10. | Tomato *(Lycopersicon esculentum)* | | |

Rice and maize are sold at the local market in Kaule, while strawberries, radish and pea are sold in Kathmandu. In months with no harvest, the family buys additional food at the market in Ranipowa.

Farmer 6 knows about the use of roses, tutti (a not closer specified pine species) and butterfly bush (*Buddleja asiatica*) for religious ceremonies. As medicinal plants, she knows marigold (*Targetes erecta*) that is used for ear problems.

**Table 43:** Plants used for religious purposes on Farmer 6's farm

| | | |
|---|---|---|
| Bhimsen pate | Butterfly bush | *Buddleja asiatica* |
| Makhamali | Amaranthus | *Gomphrena globosa* |
| Sayapatri | Marigold | *Tagetes erecta* |

The household did not take part in data acquisition for soil and insects or in the income and expenses survey.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. Until 2012, 43 % of the distributed species and 12 % of all plants survived on the farmland (see Table 80).

In conclusion, compared to other project farms, Farmer 6 has a small farm. She originally dedicated 57 % of her total land, which was the largest proportion of all participants for transition to agroforestry. However, later she used less land and focussed on the boarders and marginal parts of fields so that she did not lose any space for cash crop cultivation. Her household is rather small, while the number of work categories is just below the average. It is unusual that her husband does not participate at all on the farm and that two family members occasionally work abroad.

It is not possible to compare Farm 6 to other participants in the case of indicator data. However, observations gave the impression that the main difference of Farmer 6's household to those of other participating ones is mainly in the separation of household and farmwork. While the everyday life of other farmers is concentrated on their farm – which connect living and working – Farmer 6 has a village life rather than a farm life. The farm also produces for own consumption, but biggest amounts of harvest were clearly for income generation. Unfortunately, no income data is available, though it was observed that, for example, radish was harvested in huge amounts. This would suggest that the farm appears to be organised more in a business style than as subsistence farming. Remarkable was also the fact that Farmer 6 produced a whole field of asparagus and consumed it. Also, immediately at the project start, she adapted ginger as a cultivation crop and partly sold it.

#### 5.1.2.2.8 Case Study Farmer 7

Farmer 7 was one of the wealthier project members. He had the biggest amount of land of all the participants. Following an old tradition of Nepal, he is head of two families, because he has two wives. This is nowadays rather unusual but legally still possible. The families live in two big farmhouses that are located next to each other. They own, besides the usual livestock of goats and buffalos, also a cow that allows them to sell milk which is a good income source. Cows have a special significance in Nepal and it is not possible to buy or sell them. Farmer 7 left the project early, just a few months after the training and the distribution of the agroforestry plants. The plants were never planted but died in their poly bags while they were lying on the field waterless and in direct exposure to the sun. Framer 7 stated that he had no time to plant them.

### a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 7

In both households of Farmer 7 lived a total of seven adults, four children and occasionally the grandfather and grandmother. A granduncle and his wife sometimes also shared one of the households.

The children attended the local school in Kaule and only marginally helped on the farm, mostly to learn from their mothers. Farmer 7 stated that he is mainly involved with his strawberry farming in the morning and helps with other fieldwork in the afternoon. The women do most of the farm work. Men and women only do weeding and seeding together.

**Table 44:** Work distribution at Farmer 7's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | x |
| 2. | Water Collection | - | x | - |
| 3. | Feeding Livestock | - | x | - |
| 4. | Milking the cow | - | x | - |
| 5. | Selling Milk in Kaule | x | x | - |
| 6. | Seeding | x | x | - |
| 7. | Potato Planting | x | - | - |
| 8. | Weeding | x | x | - |
| 9. | Pest Monitoring | x | - | - |
| 10. | Harvesting | - | x | - |
| 11. | Cleaning (Household) | - | x | - |
| 12. | Cooking | - | x | - |
| 13. | Accompany Mother to Learn | - | - | x |
| | **Total No. of Categories** | **5** | **10** | **2** |

None of the family members worked outside the farm or outside of Nepal.

Farmer 7 has 1.76 ha of irrigated land. For work like digging, ploughing, and transferring rice seedlings, he hires in total about 150 workers in June and July.

### b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 7

Farmer 7 only participated in the interview in 2009. Afterwards he left the project. In 2009 he cultivated 12 different crops.

**Table 45:** Cultivated crops in 2011 on Farmer 7's farm in 2009

| | 2009 |
|---|---|
| 1. | Bamboo (*Bambusa spec.*) |
| 2. | Bean (*Vicia faba spec.)* |
| 3. | Cabbage (*Brassica oleracea var. capitata*) |
| 4. | Cauliflower (*Brassica oleracea var. botrytis L.*) |

| | |
|---|---|
| 5. | Cucumber *(Cucumis sativus)* |
| 6. | Garlic *(Allium sativum)* |
| 7. | Ginger (*Zingiber officinale*) |
| 8. | Maize (*Zea mays L.)* |
| 9. | Pumpkin (*Cucurbita pepo* L.) |
| 10. | Radish (*Raphanus sativus*) |
| 11. | Rice (*Oryza sativa L.)* |
| 12. | Strawberry (*Fragaria L.)* |

As Table 46 below shows, most crops are cultivated for personal consumption. Maize and radish are grown for personal consumption as well as for income generation. Rice and strawberries are exclusively cultivated for income generation. Rice is part of the daily diet of all families and the family cultivates high quality rice to sell. They then buy rice of lower cost for own nutrition.

**Table 46:** Cultivated crops in 2009 on Farmer 7’s farm

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Bamboo (*Bambusa spec.)* | Maize (*Zea mays L.)* | Rice (*Oryza sativa L.)* |
| 2. | Bean (*Vicia faba spec.)* | Radish (*Raphanus sativus*) | Strawberry (*Fragaria L.)* |
| 3. | Cabbage (*Brassica oleracea var. capitata*) | | |
| 4. | Cauliflower (*Brassica oleracea var. botrytis L.*) | | |
| 5. | Cucumber *(Cucumis sativus)* | | |
| 6. | Garlic *(Allium sativum)* | | |
| 7. | Ginger (*Zingiber officinale*) | | |
| 8. | Pumpkin (*Cucurbita pepo* L.) | | |

The family sell strawberries in Kathmandu, while other crops were sold at the markets in Kaule or Ranipowa.

Farmer 7’s family does not explicitly grow plants for religious ceremonies but Farmer 7 stated that all blossoming plants are used for those purposes. He is very interested in cultivating roses.

As Farmer 7 is one of two farmers that left the project there is no indicator data available for him. As table 80 shows, 100 % of the distributed plants died.

In conclusion, compared to other participating farms, Farmer 7 has the biggest amount of farmland. It is situated on a downhill gradient and one needs to descend steeply for 30 minutes to reach it on foot from the main road. The land is partly irrigated and used for rice plantation as an income source. By assigning 24 % of his land he gave a large portion for transition to agroforestry. The land was not cultivated extensively as it already incorporated aspects of agroforestry. It included trees and some maize, while cash crops and other crops for nutrition were not included.

The household size was of average size, considering that they were two households. Farm work categories were slightly under average and the women did most of the work. The number of cultivated crops were slightly below average. Strawberries, radish and rice cultivation were the biggest income sources next to the sale of cow milk.

#### 5.1.2.2.9 Case Study Farmer 8

Farmer 8, his wife and his daughter all took vividly part in the project and gave input during meetings and discussions. They invited foreign volunteers several times to their house to eat together. Apart from this, the family was relatively unobtrusive. Interestingly, Farmer 8 stated at the project start that most of the participants would not be successful in agroforestry. When he was asked why he said this he replied that other participants would be either too lazy or not able to succeed as had Farmer A.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 8**

The interview was done with the daughter in law of Farmer 8 who lives in his household. In 2011, three adults including Farmer 8, his wife, the daughter in law, as well as two children lived in the household. Sometimes an uncle temporarily stayed in the household.

Farm work was carried out together by household members and equally divided. Table 47 shows that all adults carry out seeding, planting and harvesting. The children collect water but otherwise do not work on the farm.

**Table 47:** Work distribution on Farmer 8's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Water Collection | - | - | x |
| 3. | Feeding Livestock | - | x | - |
| 4. | Irrigation | x | x | - |
| 5. | Manure Transport | - | x | - |
| 6. | Ploughing | x | - | - |
| 7. | Digging | x | - | - |
| 8. | Nursery | - | x | - |
| 9. | Seeding | x | x | - |
| 10. | Planting | x | x | - |
| 11. | Potato Planting | x | - | - |
| 12. | Weeding | - | x | - |
| 13. | Harvesting | x | x | - |
| 14. | Cropping | x | - | - |
| 15. | Pest Monitoring | x | - | - |
| 16. | Cooking | x | x | - |
| 17. | Cleaning (Household) | - | x | - |
| | **Total No. of Categories** | **10** | **11** | **1** |

Farmer 8 sometimes works outside the farm in construction work and his brother works abroad but the country was not further specified. In 2010, 21% of the household's total income was generated by external work (see Figure 25).

In June, July and August, external workers were hired for around 8-10 days for ploughing and to plant maize and strawberries.

The land size, at 0.76 ha, is about average in size.

**b) Structured Interview on environmental topics in 2009 and 2011 with Farmer 8**
Farmer 8's household cultivated more plants in 2011 than in 2009.
The majority of cultivated plants on were used for own consumption. Several crops were grown for both own consumption and market sale. Only maize, rice, strawberries and tomatoes were cultivated for income generation. The family bought rice of lower quality and price for own nutrition after selling the better quality cultivated rice

**Table 48:** Cultivated crops in 2011 on Farmer 8's farm in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Bamboo (*Bambusa spec.)* | Buckwheat (*Fagopyrum esculentum*) |
| 2. | Bean (*Vicia faba spec.)* | Cabbage (*Brassica oleracea var. capitata*) |
| 3. | Chili *(Capsicum annuum)* | Cauliflower (*Brassica oleracea var. botrytis L.*) |
| 4. | Coriander (*Coriandrum sativum L.*) | Coriander (*Coriandrum sativum L.)* |
| 5. | Onion *(Allium cepa)* | Garlic *(Allium sativum)* |
| 6. | Potato (*Solanum tuberosum*) | Maize (*Zea mays L.)* |
| 7. | Spinach / Mustard (*Sinapis spec*.) | Onion *(Allium cepa)* |
| 8. | Strawberry (*Fragaria L.)* | Potato (*Solanum tuberosum*) |
| 9. | | Rice (*Oryza sativa L.)* |
| 10. | | Spinach / Mustard (*Sinapis spec.*) |
| 11. | | Strawberry (*Fragaria L.)* |
| 12. | | Tomato *(Lycopersicon esculentum)* |

**Table 49:** Cultivated crops in 2009 and 2011 on Farmer 8's farm

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Bamboo (*Bambusa spec.)* | Cabbage (*Brassica oleracea var. capitata*) | Maize (*Zea mays L.)* |
| 2. | Bean (*Vicia faba spec.)* | Cauliflower (*Brassica oleracea var. botrytis L.*) | Rice (*Oryza sativa L.)* |
| 3. | Buckwheat (*Fagopyrum esculentum*) | Garlic *(Allium sativum)* | Strawberry (*Fragaria L.)* |
| 4. | Cabbage (*Brassica oleracea var. capitata*) | Onion *(Allium cepa)* | Tomato *(Lycopersicon esculentum)* |
| 5. | Cauliflower (*Brassica oleracea var. botrytis L.*) | Spinach / Mustard (*Sinapis spec*.) | |
| 6. | Chili *(Capsicum annuum)* | | |
| 7. | Coriander (*Coriandrum sativum L.*) | | |

| | | | |
|---|---|---|---|
| 8. | Garlic *(Allium sativum)* | | |
| 9. | Onion *(Allium cepa)* | | |
| 10. | Potato (*Solanum tuberosum*) | | |
| 11. | Spinach / Mustard (S*inapis spec*.) | | |

Strawberries were sold in Kathmandu, and other crops in Ranipowa.

The family grew butterfly bush and marigold for the use in religious ceremonies. As medicinal plants, they knew of finger millet *(Eleusine coracana L.)* used against colds, sichuan pepper (*Zanthoxylum simulans*) to help against digestive disorders, and neem (*Azadirachta indica*) to cure diarrhoea.

**Table 50:** Plants used for religious purposes on Farmer 8's farm

| | | |
|---|---|---|
| Bhimsen pate | Butterfly bush | *Buddleja asiatica* |
| Sayapatri | Marigold | *Tagetes erecta L.* |

The farm's soil data (see Table 74), in comparison to the mean value of 12 soil samples of farms in transition, show that the soil contains very low amounts of organic material, low amount of total nitrogen and an average amount of available phosphorus. The soil pH was slightly more acidic than other farms.

Farmer 8 was only included in soil living coleopteran collection after Farmer 7 left the project. Data is therefore not compared and displayed.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. Until 2012, 45 % of the distributed species and 8 % of all plants survived on the farm (compare Table 80).

Figure 24 shows that in 2010, the household had a higher income and about twice the expenses compared to the average of the other eight farms. A closer look at the income categories in the same year (see Figure 25) shows that 22 % of income was a loan, 21 % was earned by external work, and 55 % of income was generated by farm work, of which selling fruit generated 20 % of the farm income (see Figure 26).

In conclusion, compared to the other farms that participated in the agroforestry project, Farmer 8's household has an average sized farm, whereof a slightly higher percentage of land was assigned for transition to agroforestry land compared to other farms. The family size was smaller than average. The distinction of 17 work categories was the highest of all participants, while work was evenly distributed between the members of the household.

#### 5.1.2.2.10 Case Study Farmer 9

Farmer 9 participated actively in project discussions and meetings and integrated her own opinion in a self-confident way. As there were some conflicts about land within her family, she finally moved with her husband and children to a new farmhouse and changed the farmland. The conflict and changes kept her busy. Even so, she participated in the trainings, planted the distributed agroforestry plants at her original land and later transferred certain plants to the new land. As it was not possible to make a total inventory of her land and plants, because of the change in location, she was in the end not evaluated.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 9**

Farmer 9 did not participate in the interviews on social topics in 2009 and 2011.

She had a land size of 1.51 ha before she changed her land, and decided to transform 3 % of it to agroforestry land. This was the smallest portion a participant decided to transfer.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 9**

Farmer 9 did not participate in the interviews on environmental topics in 2009 and 2011.

The land that was used at the start of the project had a comparably high amount of organic matter and available phosphorus, and a lower than average amount of available nitrogen. She transferred certain plants to her new land so that in 2012 she still had 26 % of distributed agroforestry plant species but only 2 % of the total plants.

In conclusion, Farmer 9 seemed interested in the project, she asked good questions and she showed up from time to time for meetings, but she was very involved with her own tasks.

#### 5.1.2.2.11 Case Study Farmer 10

Farmer 10 was the youngest farmer participant, appointed by his family to represent the household. His family is closely related to Farmer 3's household and both farms are located next to each other and next to the main road with easy access. Farmer 10 was strongly supported by his mother who gave the impression that she wanted him to be more integrated in the work at the farm.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 10**

The interview was done with Farmer 10 and his mother. The household consisted of four people including the mother, father and their two sons. After marrying, the sons will bring their wives into the household, and the land will be divided into two parts.

Farm work like manure transportation, ploughing and digging were done by the mother and her husband. The mother cooks lunch and her husband cooks dinner. The children are responsible for adding manure and helping with seeding. The mother looks mainly after the animals and her husband also occasionally works outside the farm in construction work.

Farmer 10 sometimes helps in fieldwork and sometimes he works as a bus driver. His brother goes to school.

**Table 51:** Work distribution at Farmer 10's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Water Collection | - | x | - |
| 3. | Irrigation | - | x | - |
| 4. | Herd Livestock | - | x | - |
| 5. | Feeding Livestock | x | - | - |
| 6. | Manure Transport | x | x | - |
| 7. | Adding Manure | - | - | x |

| | | | | |
|---|---|---|---|---|
| 8. | Ploughing | x | x | - |
| 9. | Digging | x | x | - |
| 10. | Seeding | - | x | x |
| 11. | Potato Planting | x | - | - |
| 12. | Weeding | - | x | - |
| 13. | Terrace Construction | x | - | - |
| 14. | Cooking | x | x | - |
| 15. | Cleaning (Household) | - | x | - |
| | **Total No. of Categories** | **7** | **11** | **2** |

One son and one daughter of the parents work abroad. Figure 26 shows that 80 % of the total income was achieved by external work in 2010.

For two whole months during the year, the family hires external workers to help in planting, adding manure, ploughing and harvesting. Farmer 10 explained that nowadays it is getting more and more difficult to hire external workers. He did not know the reason.

The total land size of the household, at 0.6 ha, is smaller than the average of the other evaluated farms.

### b) Structured interview on environmental topics in 2009 and 2011 with Farmer 10

In 2009 and in 2011, the family planted only five kinds of crops for harvest. Apart from rice, the kinds of cultivated crops differed between those years.

**Table 52:** Cultivated crops on Farmer 10's farm in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Maize (*Zea mays L.)* | Garlic *(Allium sativum)* |
| 2. | Millet (*Eleusine coracana L.*) | Onion *(Allium cepa)* |
| 3. | Rice (*Oryza sativa L.)* | Rice (*Oryza sativa L.)* |
| 4. | Wheat (*Triticum L.* spec.) | Spinach / Mustard (*Sinapis spec.*) |
| 5. | Strawberry (*Fragaria L.)* | Tomato *(Lycopersicon esculentum)* |

Most cultivated plants are used for own consumption. Only strawberry and tomato were cultivated exclusively for selling. Rice is grown for own consumption and selling.

**Table 53:** Cultivated crops in 2009 and 2011 on Farmer 10's farm

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Garlic *(Allium sativum)* | Rice (*Oryza sativa L.)* | Strawberry (*Fragaria L.)* |
| 2. | Maize (*Zea mays L.)* | | Tomato *(Lycopersicon esculentum)* |
| 3. | Millet (*Eleusine coracana L.*) | | |
| 4. | Onion *(Allium cepa)* | | |
| 5. | Rice (*Oryza sativa L.)* | | |
| 6. | Spinach / Mustard (S*inapis spec*.) | | |
| 7. | Wheat (*Triticum L.* spec.) | | |

Tomatoes are sold in Ranipowa and all other crops at the local market in Kaule.
In times of no harvest, the family purchases beans and vegetables from the shops in Kaule. The main expenditure with 20 % of total expenses in 2010 was cereals (see Figure 27).

For use in religious celebrations, the family cultivated butterfly bush and marigold. For medicinal purposes, balsam apple (*Momodica balsamina*) was grown which is used against fever.

**Table 54:** Plants used for religious purposes on Farmer 10's farm

| | | |
|---|---|---|
| Bhimsen pate | Butterfly bush | *Buddleja asiatica* |
| Sayapatri | Marigold | *Tagetes erecta L.* |

The household's soil data (see Table 74) in comparison to the mean value of 12 soil samples of farms in transition shows that his soil contains lower amounts of organic material and total nitrogen (%) and about higher concentrations of available phosphorus. His soil pH is slightly less acidic. The indicator of soil living coleopteran was not taken from Farmer 10's land because it is close to the main road where traps might be disturbed by passing persons.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 83 % of the distributed species and 14 % of all plants survived on his farm during the evaluation time.

An overview of income and expenses data in 2010 (see Figure 23) shows that Farmer 10 had a lower income and expenses than the average of the eight other farms. The household's income was higher than the expenses. A closer look at the income categories in the same year (see Figure 25) show that 80 % of his income was generated by external work and about 20 % of income was generated by farm work (see Figure 26).

In conclusion, compared to the other evaluated farms, the household has a small piece of land and, with 5 %, gave the same amount of land for transition as his neighbour and cousin Farmer 3. The household is also comparably small in numbers of members. Identified work categories on the farm are slightly higher than average and work is mainly done by Farmer 10. Only half the number of crops were cultivated compared to other farms. External work and work abroad is the main income source for the household. Plant survival is in comparison to others, and next to Farmer 3's household, the highest. In total, one got the impression that Farmer 10's mother was interested to integrate her son closer into the farm while he himself seemed only semi interested. The mother strongly helped in the farm work and the close relations between Farmer 3's family and Farmer 10's family explain certain parallels in decisions and probably also in performance.

#### 5.1.2.2.12 Case Study Farmer 11

The household of Farmer 11 seemed to be in strong hands, guided by the women of the household. Still, Farmer 11 and her husband were working on the farm conjointly. The grandmother was, in spite of her fragile health, still included in farm work and looked after her grandchildren. The grandmother participated frequently and interested in all project activities. Farmer 11 participated in meetings and workshops though so she seemed at first quite critical about the project but in the later stages she gradually grew more confident.

Later on, foreign project members where even invited to participate in private ceremonies of the family.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 11**

Farmer 11 participated only in the 2011 interviews, probably due to her cautious attitude at the project start. The household consisted of eight members: the grandmother, her daughter, her son and her son in law. There were also four children, one younger daughter and three grandchildren.

Men and women worked together the whole day on the farm. They did the same kind of work. The children helped in weeding, planting and fodder cutting. During the school holidays, they also looked after the goats.

**Table 55:** Work distribution at Farmer 11's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | - | x |
| 2. | Irrigation | x | x | - |
| 3. | Manure Transport | x | x | - |
| 4. | Nursery | x | x | - |
| 5. | Ploughing | x | x | - |
| 6. | Digging | x | x | - |
| 7. | Cropping | x | - | - |
| 8. | Seeding | x | x | - |
| 9. | Planting | x | x | x |
| 10. | Potato Planting | x | - | - |
| 11. | Weeding | x | x | x |
| 12. | Pest Monitoring | x | x | - |
| 13. | Harvesting | x | x | - |
| 14. | Cooking | - | x | - |
| 15. | Cleaning (Household) | - | x | - |
| | **Total No. of Categories** | **12** | **12** | **3** |

Farmer 11's husband works sometimes outside the farm in Kaule, but the kind of work was not specified. None of the family works abroad.

From July until September, external workers are hired for weeding the rice plants, and from October to November for the rice harvest.

The family has an average land size of 0.76 ha. It is located next to the main road and is easy to access. The farmhouse is built directly next to the main road.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 11**

In 2009, Farmer 11 did not provide data for cultivated crops. The family cultivated eight different crops in 2011. Rice, tomato and chilli are cultivated for income generation. They are sold in Kathmandu, Ranipowa or directly to neighbours. Other crops are used for own consumption. Spinach was cultivated for own consumption and for selling.

**Table 56:** Cultivated crops on Farmer 11's farm in 2009 and 2011

| | 2009 | 2011 |
|---|---|---|
| 1. | - | Bean (*Vicia faba spec.)* |
| 2. | - | Spinach / Mustard (S*inapis spec*.) |
| 3. | - | Chili *(Capsicum annuum)* |
| 4. | - | Cucumber (*Cucumis sativus*) |
| 5. | - | Pumpkin (*Cucurbita pepo L.*) |
| 6. | - | Radish (*Raphanus sativus*) |
| 7. | - | Rice (*Oryza sativa L.)* |
| 8. | - | Soybean (*Glycine max L.*) |
| 9. | - | Tomato *(Lycopersicon esculentum)* |

**Table 57:** Cultivated crops in 2009 and 2011 on Farmer 11's farm

| | Consumption | Consumption and Market | Market |
|---|---|---|---|
| 1. | Bean (*Vicia faba spec.)* | Spinach / Mustard (S*inapis spec*.) | Chili (*Capsicum annuum*) |
| 2. | Cucumber (*Cucumis sativus*) | | Tomato (*Lycopersicon esculentum*) |
| 3. | Pumpkin (*Cucurbita pepo L.*) | | Rice (*Oryza sativa L.)* |
| 4. | Radish (*Raphanus sativus*) | | |
| 5. | Soybean (*Glycine max L.*) | | |

In times of no harvest, the family buys vegetables or pulses like lentils at the shops. For those times, they also preserve food like soybeans, dried radish and dried spinach. In 2010, the expenditures for cereals were 32 % of the total year's expenses (compare Figure 27). There is no information provided by the family about plants for religious or medicinal use.

In comparison to the mean value of 12 soil samples of other farms in transition (see Table 74), the soil has a slightly higher amount of organic material, after Farmer 4's soil the lowest available nitrogen concentration of all farmers, and a low amount of available phosphorus. The soil with a pH of 5.8 was the most acidic of all tested farms.

As with Farmer 10, the indicator of soil living coleopteran was not taken from Farmer 11's land because it is situated close to the main road where traps might have been disturbed by passing pedestrians.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 74% of the distributed species and 17 % of all plants survived on the farm during the evaluation time.

Figure 24 shows that in 2010, Farmer 11 had a lower income but about the same amount of expenses compared to the average of the eight other farms. A closer look at the income categories in the same year (see Figure 25) shows that 73 % of the household's income was generated by selling fruit. Farm work generated 82 % of the total income while 18 % was earned by external work (see Figure 26).

In conclusion, compared to other evaluated farms of the agroforestry project, Farmer 11's household has an average sized farm with a comparably low portion of 5 % land assigned for transition to agroforestry land. The family size is slightly above average. There is a balanced work distribution and men and women do the farm work jointly. In addition, an average number of plant species were cultivated in 2011. Even though the farm soils had a very low concentration of nitrogen and a high acidity, in comparison to other farms, more than the average number of plants survived. The agroforestry plants were planted very close to the house on land that already included several bigger trees and shrubs. The low nitrogen content of the soil is quite surprising due to these facts.

The household is clearly focussing on farming rather than on income generation by external work.

#### 5.1.2.2.13 Case Study Farmer 12

Farmer 12 was participating regularly in all project activities. She had a rather quiet and reserved behaviour. She explained that her husband worked outside the farm on construction sites but did not bring the earned income into the household. Instead, he spent bigger amounts on his own interests. She organised and carried out farm work together with a sister in law.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 12**

Farmer 12 had two sons and one daughter in 2011. One sister in law also shared the household.

The women do most of the farm work, the childcare and the household work. The husband helps in pest monitoring, digging and ploughing.

**Table 58:** Work distribution on Farm 12

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Water Collection | - | x | - |
| 3. | Feeding Livestock | - | x | - |
| 4. | Irrigation | - | x | - |
| 5. | Nursery | - | x | - |
| 6. | Ploughing | x | x | - |
| 7. | Digging | x | x | - |
| 8. | Planting | - | x | - |
| 9. | Potato Planting | x | - | - |
| 10. | Weeding | - | x | - |
| 11. | Pest Monitoring | x | - | - |
| 12. | Harvesting | - | x | - |
| 13. | Cleaning (Household) | - | x | - |

| | | | | |
|---|---|---|---|---|
| 14. | Babysitting | - | - | x |
| 15. | Accompany Mother to Learn | - | - | x |
| | **Total No. of Categories** | **4** | **11** | **2** |

Farmer 12 and her husband help neighbours on their farms 5-6 days per month. Sometimes the husband works as a carpenter or in construction. The income of external work in relation to total income in 2010 is 49 % (see Figure 25). None of the family members worked abroad.

No external workers are hired to work on the farm, although neighbours help in exchange work with weeding, sowing and cultivation practices around eight to nine times per month.

The household's land size is below average at 0.55 ha. Farmer 12 owns a second farm further downhill from the farm. The land size was not reported because Farmer 12 was not sure about it.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 12**

In 2009, the household cultivated 10 different crops on the farm and, in 2011, six different crops. Farmer 12 explained that she does crop rotation. After harvesting maize, she grows potatoes and cauliflower. She also has irrigated land for rice and wheat.

**Table 59:** Cultivated crops in 2011 on Farm 12 in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Cauliflower *(Brassica oleracea var. botrytis L.)* | Cabbage (*Brassica oleracea var. capitata.)* |
| 2. | Garlic *(Allium sativum)* | Cauliflower<br>*(Brassica oleracea var. botrytis L.)* |
| 3. | Maize (*Zea mays L.)* | Garlic *(Allium sativum)* |
| 4. | Onion *(Allium cepa)* | Pea (*Pisum sativum L*.) |
| 5. | Peach (*Prunus persica*) | Potato (*Solanum tuberosum*) |
| 6. | Plum (*Prunus spec.)* | Spinach / Mustard (S*inapis spec*.) |
| 7. | Potato (*Solanum tuberosum*) | |
| 8. | Rice (*Oryza sativa L.)* | |
| 9. | Strawberry (*Fragaria L.)* | |
| 10. | Wheat (*Triticum L.* spec.) | |

Several plants were cultivated for own consumption and certain others only for selling. Cauliflower is grown for both consumption and selling

**Table 60:** Cultivated crops in 2009 and 2011 on Farm 12

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Garlic *(Allium sativum)* | Cauliflower *(Brassica oleracea var. botrytis L.)* | Cabbage (*Brassica oleracea var. capitata.)* |
| 2. | Maize (*Zea mays L.)* | | Pea (*Pisum sativum L*.) |
| 3. | Onion *(Allium cepa)* | | Peach (*Prunus persica*) |
| 4. | Potato (*Solanum tuberosum*) | | Plum (*Prunus spec.)* |

| | | | |
|---|---|---|---|
| 5. | Rice (*Oryza sativa L.)* | | Strawberry (*Fragaria L.)* |
| 6. | Spinach / Mustard (S*inapis spec*.) | | |
| 7. | Wheat (*Triticum L.* spec.) | | |

The family sells fruit at the local market in Kaule and cabbage and cauliflower in Kathmandu.
During a period of three to four months every year, there is no harvest. Especially during this time, Farmer 12 buys food at the local market in Kaule. Cereals are, at 28 % of the total expenses in 2010, the biggest expenditure (see Figure 27).
Farmer 12 grows rhododendron *(Rhododendron arboretum)* for religious ceremonies. Rhododendron is the national plant of Nepal. She is aware of several other plants for use in worshipping like Marigold (*Tagetes erecta L.),* Amaranths (*Gomphrena globosa*) and Chrysanthemum (*Chrysantemum indicum*). Farmer 12 does not grow any plants for medicinal use, but she knows about the use of Chiraito (*Swertia chirayita*) against coughing.

**Table 61:** Plants used for religious purposes on Farmer 12's farm

| | | |
|---|---|---|
| Lali gurans | Rhododendron | *Rhododendron arboreum* |

The farm's soil data (see Table 74), in comparison to the mean value of the 12 soil samples of farms in transition, show that the soil contains less than half the amount of organic material and available phosphorus and an average amount of total nitrogen. The soil pH is slightly higher than average.

The indicator of soil living coleopteran showed that in comparison to Farm A, *Gonocephalum*, a darkling beetle, occurred in higher concentrations on Farm 12, but in lower concentrations compared to the other three farms in transition (see Figure 19).

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 52 % of the distributed species and 7 % of all plants survived on the farm during the evaluation time.

Figure 24 shows that in 2010, the household had less than half income, but relatively high expenses, in comparison to the average of the other eight farms. A closer look at the income categories in the same year shows that 49 % of income was generated by external work and 51 % was earned by farm work (see Figure 26), with livestock as the biggest income source, generating 18 % (see Figure 25).

In conclusion, compared to the other evaluated farms in transition to agroforestry, the household has a small portion of land and with a 15 % assignment, an only slightly lower proportion of transition to agroforestry than the average of other farms. The household is of comparable size in terms of members with a higher adult/child ratio. Defined work categories are slightly above average. The women are responsible for the work on the farm, but the husband earns about half of the household's income with external work. However, he uses bigger portions of this for his own interests. Cultivation of plants is below average. Agroforestry plant survival was below average but higher than expected considering the low soil quality. In 2010, 20 % of the total expenses were spent on renovation of the farm's roof. This is the highest percentage of investment of all evaluated farms. Farmer 12 explained that the roof was in very bad conditions and rain came in.

#### 5.1.2.2.14 Case Study Farmer 13

Farmer 13 is ethnically from another caste than other villagers. Her cast is Shresta, the native caste of Kathmandu Valley. She participated in every meeting and activity. At first, she was very sceptical about the project but over time, she became more friendly, open and relaxed. Farmer 13 had two babies at this time. Her husband was most of the time outside the farm. He never participated in any project activities. Somehow, Farmer 13 always seemed slightly isolated of the group. It was eventually deduced that this was due to her different cast.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 13**

Farmer 13 and her husband had two daughters in 2011.

Her husband carried out the harder work such as terrace construction, ploughing and digging, while child caring, household maintenance and cooking were the domains of Farmer 13. Other farm work was carried out together. Even so, it was reported that Farmer 13’s husband was participating in many farm activities (compare Table 62) he was in most of the time outside the farm. Farmer 13’s husband also works every day in construction work in the village of Kaule. The farm seemed to be in a rather poor status.

**Table 62:** Work distribution at Farmer 13's farm

| | | **Men** | **Women** | **Children** |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | - | x |
| 2. | Nursery | x | x | - |
| 3. | Terrace Construction | x | - | - |
| 4. | Ploughing | x | - | - |
| 5. | Digging | x | - | - |
| 6. | Planting | x | x | - |
| 7. | Potato Planting | x | - | - |
| 8. | Weeding | x | x | - |
| 9. | Harvesting | x | x | - |
| 10. | Cooking | - | x | - |
| 11. | Childcare | - | x | - |
| 12. | Cleaning (Household) | - | x | - |
| 13. | Selling Harvest | x | - | - |
| | **Total No. of Categories** | **9** | **7** | **1** |

In 2010, 99 % of the total income was achieved by external work (see Figure 26). None of the family members lives or works outside of Nepal. External workers are hired for planting vegetables and manure transport for several months of the year. More specified information was not provided.

The farmland size, at 0.38 ha, is one of the smallest of all participants. Later it became clear that not all land was reported and the land size was in reality bigger.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 13**

In 2011, fewer crops were cultivated than in 2009.

**Table 63:** Cultivated crops on Farmer 13's farm in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Cabbage (*Brassica oleracea var. capitata.)* | Cabbage (*Brassica oleracea var. capitata.*) |
| 2. | Cauliflower *(Brassica oleracea var. botrytis L.)* | Cauliflower *(Brassica oleracea var. botrytis L.)* |
| 3. | Ginger (*Zingiber officinale*) | Coriander (*Coriandrum sativum* L.) |
| 4. | Maize (*Zea mays L.)* | Garlic *(Allium sativum)* |
| 5. | Peach (*Prunus persica*) | Radish (*Raphanus sativus*) |
| 6. | Plum (*Prunus spec.)* | Spinach / Mustard (S*inapis spec*.) |
| 7. | Radish (*Raphanus sativus*) | |
| 8. | Potato (*Solanum tuberosum*) | |

In 2009 and 2011, the family cultivated different crops for own consumption, income generation or for both.

**Table 64:** Cultivated crops in 2009 and 2011 on Farmer 13's farm

| **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|
| Coriander (*Coriandrum sativum* L.) | Radish (*Raphanus sativus*) | Cabbage (*Brassica oleracea var. capitata.*) |
| Garlic *(Allium sativum)* | | Cauliflower *(Brassica oleracea var. botrytis L.)* |
| Maize (*Zea mays L.)* | | Ginger (*Zingiber officinale*) |
| Peach (*Prunus persica*) | | Potato (*Solanum tuberosum*) |
| Plum (*Prunus spec.)* | | |
| Spinach / Mustard (S*inapis spec*.) | | |

Farmer 13's husband sells radish, cabbage, cauliflower and ginger at the Kali Mati market in Kathmandu, where they have relatives. Other vegetables are sold at Kaule's market. Rice and other vegetables for own consumption were bought at the local market in Kaule.

Farmer 13 explained that all blossoming flowers are used for worshiping in the temple. She grows mug-wort (*Artemisia indica*) and naranpathi (not identified) for this purpose.

**Table 65:** Plant used for religious purposes on Farmer 13' farm

| | | |
|---|---|---|
| Narenpatri | - | - |
| Titepathi | Mug-wort | *Artemisia indica* |

Soil data (see Table 74) in comparison to the mean value of 12 soil samples of farms in transition shows that the soil contains high amounts of organic material and total nitrogen, and above average amounts of available phosphorus. The soil pH is slightly more acidic.

Farmer 13's farm lies relatively near to the main road and because of the easy access for people passing by, it was decided not to place insect traps on her property.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 50 % of the distributed species and 12 % of all plants survived on the farm during the time of evaluation.

Figure 24 shows that in 2010, the household had half of the income, but also less than half the expenses, of the average of the eight other farms. A closer look on her income categories in the same year (see Figure 25) shows that 99 % of income was earned by external farm work and only 1 % by farm work (see Figure 26).

In conclusion, compared to the other evaluated farms of the agroforestry project, the household reported a farm size half that of the average project size, and is small in the number of its family members. The husband earns the household’s income by external work. Farm work is only done to a small extent. Less than average plants were cultivated for nutrition and income generation. With 85 % of the household’s total expenses, the investment in food was very high. The results show that the household’s livelihood strategy is not based on farm work. The slightly isolated situation of Farmer 13 in the village community might be the reason for her distressed behaviour at the project start.

#### 5.1.2.2.15 Case Study Farmer 14

Farmer 14 displayed an interested and open character. He was one of the politically active men in the village. He constructively participated in all project activities. Even so, he changed the focus of his income from farming to a newly established shop selling general goods. In Kaule there already exist many shops for food or for mixed general goods, so competition was high. Farmer 14’s wife also participated in the project, though she was more reserved than her husband.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 14**

Farmer 14 and his wife had one adult son and two younger daughters that live in their household in 2011.

Farmer 14 and his wife both worked on their farm. The working categories were strictly divided between them. The daughters helped with the weeding of plants.

**Table 66:** Work distribution on Farmer 14's farm

| | | Men | Women | Children |
|---|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x | - |
| 2. | Feeding Livestock | x | - | - |
| 3. | Ploughing | x | - | - |
| 4. | Digging | x | - | - |
| 5. | Seeding | - | x | - |
| 6. | Planting | - | x | - |
| 7. | Potato Planting | x | - | - |
| 8. | Weeding | - | x | x |
| 9. | Cooking | - | x | - |
| 10. | Cleaning (Household) | - | x | - |

| | | | | |
|---|---|---|---|---|
| 11. | Looking after the Shop | x | - | - |
| | **Total No. of Categories** | **5** | **6** | **1** |

Farmer 14 in addition works outside the farm in construction work. Out of the total income in 2010, 91 % was earned by the shop and by external work (see Figure 25). None of the family members work outside of Nepal.

During three months of the year, external workers were hired for helping in work like digging. More detailed information was not provided.

The farm size, at 0.6 ha, is smaller than the average. This might be one reason for the decision to become a shop owner. The shop is included in the farmhouse and is located directly next to the main road. The land that was selected for transition to agroforestry was located quite far from the farm and one needed to walk for about 30 minutes to reach it.

**b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 14**

In 2009, a total of 13 different crops were cultivated. Cultivation decreased to 10 different kinds of crops in 2011. This decline was due to the new additional work in the shop.

**Table 67:** Cultivated crops on Farmer 14's farm in 2009 and 2011

| | **2009** | **2011** |
|---|---|---|
| 1. | Bean (*Vicia faba spec.)* | Bean (*Vicia faba spec.)* |
| 2. | Cowpea (*Vigna unguiculata*) | Cowpea (*Vigna unguiculata*) |
| 3. | Garlic *(Allium sativum)* | Garlic *(Allium sativum)* |
| 4. | Ginger (*Zingiber officinale*) | Ginger (*Zingiber officinale*) |
| 5. | Maize (*Zea mays L.)* | Peach (*Prunus persica*) |
| 6. | Millet (*Eleusine coracana L.*) | Rice (*Oryza sativa L.)* |
| 7. | Peach (*Prunus persica*) | Soybean (*Glycine max L.*) |
| 8. | Plum (*Prunus spec.)* | Spinach / Mustard (S*inapis spec*.) |
| 9. | Pumpkin (*Cucurbita pepo L.*) | Strawberry (*Fragaria L.)* |
| 10. | Rice (*Oryza sativa L.)* | Tomato *(Lycopersicon esculentum)* |
| 11. | Soybean (*Glycine max L.*) | |
| 12. | Spinach / Mustard (S*inapis spec*.) | |
| 13. | Strawberry (*Fragaria L.)* | |

Most plants were cultivated for own consumption.

**Table 68:** Cultivated crops in 2009 and 2011 on Farmer 14's farm

| | **Consumption** | **Consumption and Market** | **Market** |
|---|---|---|---|
| 1. | Cowpea (*Vigna unguiculata*) | Peach (*Prunus persica*) | Tomato *(Lycopersicon esculentum)* |
| 2. | Garlic *(Allium sativum)* | Rice (*Oryza sativa L.)* | Strawberry (*Fragaria L*.) |
| 3. | Ginger (*Zingiber officinale*) | Spinach / Mustard (S*inapis spec*.) | |
| 4. | Maize (*Zea mays L.)* | Bean (*Vicia faba spec.)* | |
| 5. | Millet (Eleusine coracana L.) | | |

| | | | |
|---|---|---|---|
| 6. | Plum (*Prunus spec.)* | | |
| 7. | Pumpkin (Cucurbita pepo L.) | | |
| 8. | Soybean (*Glycine max L.*) | | |
| 9. | Wheat (*Triticum L.* spec.) | | |

Spinach was sold at the local market in Kaule, rice and peach in Ranipowa and strawberries and tomatoes at the fruit and vegetable market in Kathmandu.

During three months of the year, the household buys vegetables and pulses like chickpea, pea, lentil, rice and onion at the market in Kaule to enrich the family's nutrition. The main expenses in 2010 were cereals at 32 % of total expenses (see Figure 27).

Plants for religious or medicinal use were not cultivated.

Soil data (Table 74) in comparison to the mean value of 12 soil samples of farms in transition shows that it contains the lowest amount of organic material of all farms, lower total nitrogen and about 1.6 times of available phosphorus. The soil pH is slightly more acidic. Farmer 14's data on soil living coleopteran was not included, because traps were disturbed and in some cases destroyed.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 64 % of the distributed species and 10 % of all plants survived on the farm during the time of evaluation.

Figure 24 shows that in 2010, the household had a higher income but only slightly higher expenses than the average of the other eight farms. A closer look at the income categories in the same year (see Figure 25) show that 91 % of income was generated by external work including the shop. Farm work contributed 9 % to the income (see Figure 26).

In conclusion, compared to the other evaluated farms of the agroforestry project, the household had a small portion of land, whereof slightly less than the average was assigned to agroforestry. The family size is smaller than average. Farm work categories were also less than average though they were divided equally between men and women. Even though a new shop was opened that surely bound up more time and energy, still an average number of plants for own consumption and income generation were cultivated. Plant survival of distributed agroforestry plants was higher than average, but individual plant survival was lower. A high proportion of the household's expenditure was spent on food. After Farmer 13's household, Farmer 14 had the clearest focus on income generation from work outside the farm.

#### 5.1.2.2.16 Case Study Farmer 15

Farmer 15 is one of the most educated women in Kaule. She is a school teacher. Additionally, she was participating in a further education in finances and management in Ranipowa. As her father was already quite old, and mother had died unexpectedly, she had to look after most of the farm, next to her job as a teacher and her additional education.

**a) Structured Interview on Social Topics in 2009 and 2011 with Farmer 15**

In 2011, the household consisted of Farmer 15 and her father. Due to the father's age, he could not participate fully in the fieldwork and Farmer 15 did most work.

**Table 69:** Work distribution at Farmer 15's farm

| | | Men | Women |
|---|---|---|---|
| 1. | Fodder and Wood Collection | - | x |
| 2. | Feeding Livestock | - | x |
| 3. | Irrigation | - | x |
| 4. | Ploughing | - | x |
| 5. | Potato Planting | x | - |
| 6. | Weeding | x | x |
| 7. | Pest Monitoring | - | x |
| 8. | Herding Livestock | x | - |
| 9. | Cooking | x | x |
| 10. | Cleaning (Household) | - | x |
| 11. | Looking after the House | x | - |
| | **Total No. of Categories** | **5** | **8** |

Farmer 15 worked from Sunday to Friday, between 10 am to 4 pm, as a teacher in Kaule's primary school. From 4 pm to 6 pm she worked on her farm. The father looked after the household and animals and helped to a certain extent in the farm work. No family members worked outside of Nepal.

External workers were hired for seeding, weeding, harvesting, manure application and ploughing. Data for number of workers and time of hiring were not provided.

### b) Structured Interview on Environmental Topics in 2009 and 2011 with Farmer 15

The number of cultivated plants declined from 10 species in 2009 to four species in 2011.

**Table 70:** Cultivated crops on Farmer 15's farm in 2009 and 2011

| | 2009 | 2011 |
|---|---|---|
| 1. | Apricot (*Prunus armeniaca*) | Garlic *(Allium sativum)* |
| 2. | Garlic *(Allium sativum)* | Onion *(Allium cepa)* |
| 3. | Ginger (*Zingiber officinale*) | Potato (*Solanum tuberosum*) |
| 4. | Maize (*Zea mays L.)* | Spinach / Mustard Leaves (S*inapis spec*.) |
| 5. | Millet (*Eleusine coracana L.*) | |
| 6. | Onion *(Allium cepa)* | |
| 7. | Peach (*Prunus persica* ) | |
| 8. | Plum (*Prunus spec.)* | |
| 9. | Rice (*Oryza sativa L.)* | |
| 10. | Wheat (*Triticum L.* spec.) | |

Only rice was cultivated for selling at the local market in Kaule, while everything else was cultivated for own consumption.

**Table 71:** Cultivated crops in 2009 and 2011 on Farmer 15's farm

| | Consumption | Market |
|---|---|---|
| 1. | Apricot (*Prunus armeniaca*) | Rice (*Oryza sativa L.)* |
| 2. | Garlic *(Allium sativum)* | |
| 3. | Ginger (*Zingiber officinale*) | |
| 4. | Maize (*Zea mays L.)* | |
| 5. | Millet (*Eleusine coracana L.*) | |
| 6. | Onion *(Allium cepa)* | |
| 7. | Peach (*Prunus persica* ) | |
| 8. | Plum (*Prunus spec.)* | |
| 9. | Wheat (*Triticum L.* spec.) | |

In months with no harvest, Farmer 15 bought vegetable or dried pulses in Kaule.
She cultivated roses for worshipping in the temple. She is aware of Godawari (*Chrysantemum indicum)* and Sayapatri (*Tagetes erecta*) as other plants used for religious ceremonies. There are no medicinal plants grown on farm, but Farmer 15 knows about the antiseptic effects of Tithephati (*Artemisia indica*) and the medicinal use of Chiraito (*Swertia chirayita*) and Asuro (*Justicia adhatoda*).

**Table 72:** Plants used for religious purposes grown on Farmer 15's land

| | | |
|---|---|---|
| Gulaph | Rose | *Rosa alba* |

The farms soil data (see Table 74) in comparison to the mean value of 12 soil samples of the farms in transition show that the soil contains an average amount of organic material, slightly less total nitrogen and less than half the amount of available phosphorus. The available phosphorus value is the lowest of all farmers. The soil pH is slightly more acidic.

The indicator of soil living coleopteran was not assessed because Farmer 15's farm is located next to the road so that disturbance of traps by passers-by was likely.

In 2009 and 2010, a total of 31 different kinds of plants (see Table 79) were distributed within the project. 75 % of the distributed species and 30 % of all plants survived on her farm during the time of evaluation.

Due to the workload, Farmer 15 was not able to provide indicator data like income or expenses.

In conclusion, compared to other farms that were in transition to agroforestry, the household's land was smaller than average, and with a comparably small percentage assigned for transformation. The household was in terms of members the smallest of all participants and the only one without any children. Defined work categories on the farm was lower than average, and most work outside the farm was done by Farmer 15 even though she also had external work. Due to the sudden death of her mother and the corresponding increase of workload on Farmer 15, a decreasing number of plants were cultivated and most of them were used for own nutrition. Farmer 15 was definitely in exceptional circumstances shortly after the project started but she tried to comply with all tasks.

## 5.2 Indicators

The goal of collecting indicator data was to monitor the impact of the agroforestry project on a farmer's situation over time. For this reason, several indicators were defined and data was collected at the project start and, depending on the indicator, again after two years (2011) or three years (2012). The indicators were selected from interdisciplinary categories to create a wider angle of observation and to measure an impact or a development on different sectors. Indicators were divided into two main disciplines: a) ecological indicators, and b) socio-economic indicators. While indicator data was being collected and analysed, it became clear that it was extremely difficult to collect complete data sets over time and for the full number of participating farms. This was due to disturbances that occurred because of social, political or environmental reasons. Finally, it became obvious that the indicator data cannot be used to show development over time, like originally planned. Still, this data provides valuable background information to support interviews and case studies, and helps to understand the situation of farmers and the environment in Kaule.

### 5.2.1 Ecological Indicators

#### 5.2.1.1 Soils

The collection of soil data on certain selected attributes was chosen as an indicator to compare the soil of Farm A (agroforestry) to the soils of farms that finally really went in transition (12 farms) and to look into the project's effects on soil quality. Samples were taken in 2009 and in 2011. Probes of 2011 were stolen on their transportation to the laboratory, and therefore, only soil data from 2009 was evaluated, and hence changes of soil quality over time could not be determined.

In an interview in 2010, the farmers stated that usually di-ammonium phosphate (DAP) and urea are applied as mineral fertilizers. Apart from this, compost is also used before seedlings are planted. Farmer A declared in the same interview that he solely uses compost as fertilizer and no mineral fertilizer for his vegetables.

In 2009, a soil profile was done in Kaule in collaboration with Assistant Professor Rajan Ghimire from the soil science laboratory of Tribhuvan University in Rampur. The soil profile revealed a very shallow soil with weakly developed horizons. Especially the A-horizon was not strongly differentiated which may hint at erosion processes (Figure 16) [2].

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[2] An A horizon is a mineral horizon. This horizon always forms at the surface and is often referred to as topsoil. Natural events, such as flooding, volcanic eruptions, landslides, and dust deposition can bury an A horizon so that it is no longer found at the surface.

A B horizon is typically a mineral subsurface horizon and is a zone of accumulation, called illuviation. Materials that commonly accumulate are clay, soluble salts, and/or iron. Minerals in the B horizon maybe undergoing transformations such as chemical alteration of clay structure. In human modified landscapes, processes such as erosion can sometimes strip away overlying horizons and leave a B horizon at the surface. Such erosion is common in sloping, agricultural landscapes.

A C horizon consists of parent material, such as glacial till or lake sediments that have little to no alteration due to the soil forming processes.

**Table 73:** Soil character of Kaule, Nuwakot District

| | |
|---|---|
| Physiographic Region: | Middle Mountain |
| Soil Order: | Inceptisols |
| Suborder: | Ochrepts |
| Great Group: | Dystrochrepts |
| Terrace Type: | High Terrace |

**Table 74:** Soil measurement results of project farms in 2009

| Participant | Texture | pH | SOM % | $C_{org}$ (%) | $N_{tot}$ % | $P_2O_5$ (kg/ha) | $P_{avail}$ (kg/ha) | $P_{avail}$ (mg kg -1) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Farm 2 | SL | 5.4 | 2.79 | 1.62 | 0.014 | 383.93 | 168.93 | 56.31 |
| Farm 3 | SL | 5.1 | 1.74 | 1.01 | 0.028 | 401.81 | 176.80 | 58.93 |
| Farm 4 | SL | 5.2 | 1.6 | 0.93 | 0.007 | 280.8 | 123.55 | 41.18 |
| Farm 5 | SL | 4.9 | 1.41 | 0.82 | 0.021 | 281.6 | 123.90 | 41.30 |
| Farm 8 | SL | 5.1 | 0.98 | 0.57 | 0.014 | 358.02 | 157.53 | 52.51 |
| Farm 9 | SL | 5.4 | 2.27 | 1.32 | 0.035 | 487.57 | 214.53 | 71.51 |
| Farm 10 | SL | 5.3 | 1.48 | 0.86 | 0.014 | 501.04 | 220.46 | 73.49 |
| Farm 11 | SL | 5.8 | 1.7 | 0.99 | 0.007 | 323.77 | 142.46 | 47.49 |
| Farm 12 | SL | 5 | 0.75 | 0.43 | 0.018 | 172.51 | 75.90 | 25.30 |
| Farm 13 | SL | 5 | 2.29 | 1.33 | 0.035 | 393.3 | 173.05 | 57.68 |
| Farm 14 | SL | 5.1 | 0.59 | 0.35 | 0.014 | 580.93 | 255.61 | 85.20 |
| Farm 15 | SL | 5.1 | 1.61 | 0.94 | 0.014 | 145.21 | 63.89 | 21.30 |
| **Mean Value** | **SL** | **5.2** | **1.6** | **0.93** | **0.018** | **359.21** | **158.05** | **52.68** |
| Farm A (AF) | SL | 5.4 | 3.17 | 1.84 | 0.063 | 688.86 | 303.10 | 101.03 |

*Source:* Assist. Prof. Rajan Ghimire, Soil Science Laboratory of the Tribhuvan University at Rampur Campus, Nepal.

The soil analysis results were compared against a rating chart of the "Soil Science Division" of the Nepal Agriculture Research Council in Table 75.

**Table 75**: Soil property rating chart

| Status of Soil | Parameters | | | |
|---|---|---|---|---|
| | SOM | Total N % | Available $P_2O_5$ kg/ha | Soil pH |
| Low | < 1.5 | < 0.07 | < 30 | < 6.0 (acidic) |
| Medium | 1.5 - 3.0 | 0.07 - 0.15 | 30 - 55 | 6.0 - 7.5 (neutral) |
| High | > 3.0 | > 0.15 | > 55 | > 7.5 (alkaline) |

*Source:* Soil Science Division, Nepal Agriculture Research Council, Khumaltar, Nepal.

In 2009, among the twelve transition farms and Farm A, five were low, seven farms were medium and Farm A was high in organic matter. All farm soils including Farm A were low in total nitrogen, indicating a major limitation to crop production in the area. All soils were lower than pH 6 and hence acidic. Correlated to the low pH is a high concentration of plant available phosphorus for all soils.

**Table 76:** Soil property ratings for Kaule soil samples

| Participant | Texture | pH | SOM % | $N_{tot}$ % | $P_2O_5$ (kg/ha) |
|---|---|---|---|---|---|
| | | | | | |
| Farm 2 | SL | acidic | medium | Low | high |
| Farm 3 | SL | acidic | medium | Low | high |
| Farm 4 | SL | acidic | medium | Low | high |
| Farm 5 | SL | acidic | low | Low | high |
| Farm 8 | SL | acidic | low | Low | high |
| Farm 9 | SL | acidic | medium | Low | high |
| Farm 10 | SL | acidic | low | Low | high |
| Farm 11 | SL | acidic | medium | Low | high |
| Farm 12 | SL | acidic | low | low | high |
| Farm 13 | SL | acidic | medium | low | high |
| Farm 14 | SL | acidic | low | low | high |
| Farm 15 | SL | acidic | medium | low | high |
| Farm A (AF) | SL | acidic | high | low | high |

$P_{avail}$ of Farm A as well as SOM nearly doubled the mean value of the twelve other farms; $N_{tot}$ of Farm A was more than three times higher than the mean value of the transition farms as can be seen in Table 74.

Altogether, in comparison to the other farmers' soil, the agroforestry farm (Farm A) is in better condition for measured factors. Still, the soils of all farms in Kaule are in a poor status, especially in terms of total nitrogen. Enhancement of nitrogen content should also increase harvest yield. Arrangements to lower the acidity of soils could further enhance soil quality. Although a high concentration of phosphorus might be connected to acidic soils, it usually does not harm plants. A direct connection between soil status per farm and plant survival per farm was not found.

#### 5.2.1.2 Insects

Soil living insects were chosen as an indicator with the intention of drawing conclusions on the ecosystem status, because soil and flora as well as flora and fauna are closely related.

Ground beetles are affected by agriculture due to soil management, but the assemblages of coleopteran in general are not connected to certain crop types (KROMP 1999). Still, crop shifts can alter coleopteran dominance. Dominance can be connected to crop specific rhythms of cultivation, crop phenology and changes of microclimate.

The idea was to investigate if the applied farming method (either agroforestry, transition to agroforestry or common farming) might influence the appearance of coleopteran species. Kaule seemed to be suitable for such investigations, as the nearby-located national park provides a source of insects for re-colonisation.

Between autumn 2008 and spring 2011, insect traps (barber traps) were placed to collect soil living insects with the goal of comparing the quantity of species and appearances of coleopteran at the agroforestry farm, on seven farms in transition to agroforestry and on one conventional farm. Per farm, three traps were placed at large intervals. Due to festivals, unforeseen national strikes (*banda*) and weather conditions, it was difficult to collect insects at the exact same period of time in different years. To compare the appearance of soil living coleopteran over several years, it is extremely important to compare data of the same date per year, because of their precise lifecycle. Even short time delays can change the result. In addition, the insect traps appeared to be of high interest to other people, and were often disturbed or even destroyed. In the end, indicator data was better used as an overview of coleopteran in Kaule, and to a weak extent for the comparison of the occurrence of beetles on different farms.

The following table shows that between 2009 and 2011, 74 different species of coleopteran were collected.

**Table 77:** Ground living coleopteran in Kaule between autumn 2008 and spring 2011

| No | Family | Sub Family | Genus | Species |
|---|---|---|---|---|
| 1. | Anthicidae sp1 | | | |
| 2. | Carabidae sp1 | | | |
| 3. | Carabidae sp2 | | | |
| 4. | Carabidae sp3 | | | |
| 5. | Carabidae sp4 | | *Bembidion sp1* | |
| 6. | Carabidae sp5 | | *Bradycellus sp1* | |
| 7. | Carabidae sp6 | | *Drypta sp1* | |
| 8. | Carabidae sp7 | | *Claenius sp1* | |
| 9. | Carabidae sp8 | | *Dyschirius sp1* | |
| 10. | Carabidae sp9 | Harpalinae sp1 | | |
| 11. | Cerylonidae sp1 | | | |
| 12. | Chrysomelidae Larve | | | |
| 13. | Chrysomelidae sp1 | | | |
| 14. | Chrysomelidae sp2 | Alticinae sp1 | | |
| 15. | Chrysomelidae sp3 | Alticinae sp2 | *Altica sp1* | |
| 16. | Chrysomelidae sp4 | Galerucinae sp1 | | |
| 17. | Chrysomelidae sp5 | | *Phyllotreta sp1* | |
| 18. | Cicindelyde sp1 | | | |
| 19. | Coccinellidae sp1 | | | |
| 20. | Coccinellidae sp2 | | *Coccinella sp1* | *septempunctata* |
| 21. | Coccinellidae sp3 | | *Coccinella sp2* | |
| 22. | Coccinellidae sp4 | | *Lithophilus sp1* | |
| 23. | Coccinellidae sp5 | | *Scymnus sp1* | |
| 24. | Cryptophagidae sp1 | | | |
| 25. | Curculionidae sp1 | | | |

| | | | | |
|---|---|---|---|---|
| 26. | Curculionidae sp2 | | | |
| 27. | Dermestidae sp1 | | *Attagenus sp1* | |
| 28. | Elateridae sp1 | | | |
| 29. | Elateridae sp2 | | *Zorochrus sp1* | |
| 30. | Georissidae sp1 | | | |
| 31. | Histeridae sp1 | | | |
| 32. | Histeridae sp2 | | *Onthophilus sp1* | |
| 33. | Hydrophilidae sp1 | | | |
| 34. | Lampyridae sp1 | | | |
| 35. | Lathridiidae sp1 | | | |
| 36. | Leiodidae sp1 | | *Agathidium sp1* | |
| 37. | Limnichidae sp1 | | | |
| 38. | Lycidae Larve | | | |
| 39. | Lycidae sp1 | | | |
| 40. | Malachiidae sp1 | | | |
| 41. | Nitidulidae sp1 | | | |
| 42. | Pselaphidae sp1 | | | |
| 43. | Scaphidiidae sp1 | | | |
| 44. | Scarabeidae Larve | | | |
| 45. | Scarabaeidae Larve | Melolonthinae | | |
| 46. | Scarabaeidae sp1 | Anomalinae sp1 | *Anomala sp1* | |
| 47. | Scarabaeidae sp2 | Aphodinae sp1 | *Aphodius sp1* | |
| 48. | Scarabeidae sp3 | Coprinae sp1 | *Onthophagus sp1* | |
| 49. | Scarabaeidae sp4 | Melolonthinae sp1 | | |
| 50. | Scarabaeidae sp5 | Melolonthinae sp2 | | |
| 51. | Scarabaeidae sp6 | Sericinae sp1 | | |
| 52. | Scydmaenidae sp1 | | | |
| 53. | Silphidae Larve | | *Silpha* | |
| 54. | Silphidae sp1 | | | |
| 55. | Staphylinidae Larve | | | |
| 56. | Staphylinidae sp1 | | | |
| 57. | Staphylinidae sp2 | | | |
| 58. | Staphylinidae sp3 | | | |
| 59. | Staphylinidae sp4 | | | |
| 60. | Staphylinidae sp5 | | | |
| 61. | Staphylinidae sp6 | | | |
| 62. | Staphylinidae sp7 | | | |
| 63. | Staphylinidae sp8 | Oxytelinae sp1 | | |
| 64. | Staphylinidae sp9 | | *Ocypus sp1* | |
| 65. | Staphylinidae sp10 | | *Philonthus sp1* | |

| | | | | |
|---|---|---|---|---|
| 66. | Staphylinidae sp11 | | *Stenus sp1* | |
| 67. | Tenebrionidae sp1 | | | |
| 68. | Tenebrionidae sp2 | | *Caedius sp1* | |
| 69. | Tenebrionidae sp3 | | *Gonocephalum sp1* | |
| 70. | Tenebrionidae sp4 | | *Gonocephalum sp2* | |
| 71. | Tenebrionidae sp5 | | *Gonocephalum sp3* | *bilineatum* |
| 72. | Tenebrionidae sp6 | | *Indenicmosoma sp1* | |
| 73. | Tenebrionidae sp7 | | *Luprops sp1* | *yunnanus* |
| 74. | Tenebrionidae sp8 | | *Pseudethas sp1* | |

The table is filled out as far as it was possible to determine the family, subfamily, genus and if possible the species. The most abundant beetle family collected in Kaule was the Staphylinidae (rove beetle) with 11 species. Staphylinidae are, with over 47.000 species, the largest family of beetles. They are usually predators of insects and other invertebrates. Carabidae (ground beetle) was the second most abundant family with nine collected species. They are also a very large family worldwide with more than 40.000 species. They are predators and hunt insects and other invertebrates. Tenebrionidae (darkling beetle) was the third most frequent family with eight collected species. Worldwide there exists more than 20.000 species. The darkling beetle is an omnivore.

The darkling beetle Tenebrionidae of the genus *Gonocephalum* can be used as an indicator for ecosystem habitat conditions as its presence indicates a disturbed habitat when occurring in high numbers. Therefore, *Gonocephalum* is compared in Figure 19 for several farms. Scarabaeidae (scarab beetle) is a family that was represented with six species in Kaule. Worldwide over 30.000 species belong to this family. They are also omnivores. Chrysomelidae (leaf beetle) and Coccinellidae (ladybird beetle) are two families of which five species were collected in Kaule. There exists worldwide more than 35.000 species of Chrysomelidae, and more than 5.000 species of Coccinellidae. Chrysomelidae feed on plant tissue. Coccinellidae are predators of other insects and are especially known for feeding on aphids and scale insects. It is not surprising that beetles from families with such high frequency occur in larger numbers.

Table 78 shows the number of coleopteran species for two farms in transition, between 2008 and 2011, in comparison to agroforestry and conventional land. Data from Farm 12 and Farm 2 can only be seen as transition land from autumn 2009 on, because the project started in spring 2009. Before autumn 2009, these farms counted as conventional land. The highest number of different species occurred in spring 2011 on Farm A and the lowest number, with four species, on Farm 2 before transition in 2008. A clear distinction between occurrence patterns is not possible between the different farm types.

**Table 78:** Number of different coleopteran species on different land types

| | 2008 | 2009 | | 2010 | | 2011 |
|---|---|---|---|---|---|---|
| | autumn | spring | autumn | spring | autumn | spring |
| Farm A (Agroforestry) | 6 | 7 | 13 | 7 | 9 | 17 |
| Farm 2 (Transition) | 4 | 12 | 8 | 6 | 6 | 9 |
| Farm 12 (Transition) | 9 | 9 | 8 | 9 | 5 | 9 |
| Conventional Farm | 8 | 13 | 12 | 11 | 8 | 10 |

Even though the comparison of all collected species did not show distinction or difference related to different land types, the comparison of a single species, here the darkling beetle *Tenebrionidae Gonocephalum*, does show differences when farm types are compared.

**Figure 19:** Quantity of *Tenebrionidae Gonocephalum* on different land types

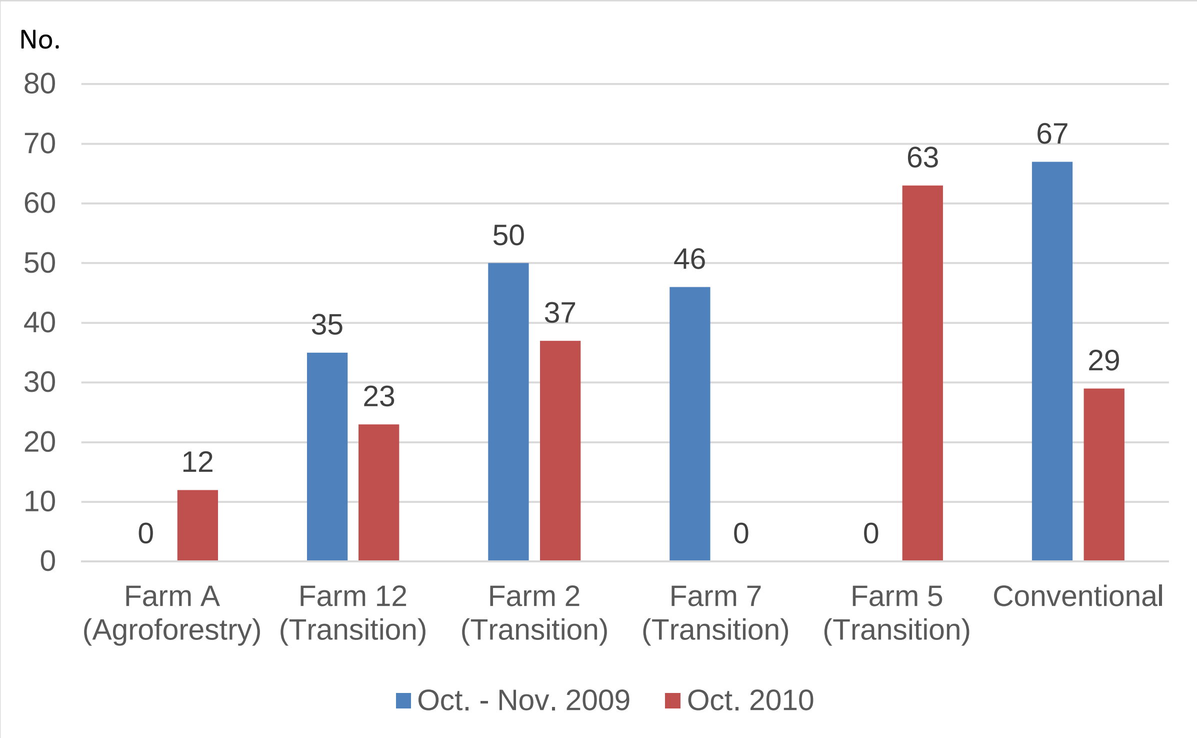



Figure 19 illustrates that *Tenebrionidae Gonocephalum* appears in high number during autumn collections. The number of individuals is on conventional farmland and on transition farmland in autumn 2009, 100 percent higher and in autumn 2010, two to five times higher than on agroforestry land.

In October 2009, there was no darkling beetle in Farm A traps. The trap of Farm 7 in 2010 and the Farm 5 trap of 2009 were both destroyed so only one data set is available for both farms.

In conclusion, although insufficient data sets were available to give a supported statement, still a tendency can be seen, when Farm A is compared to other farms. If *Gonocephalum*, really can serve as an indicator for disturbed habitats and if a high number of individuals indicates a disturbed habitat, the ecosystem status of Farm A appeared to be in a better status than the other tested farms.

#### 5.2.1.3 Plants

Plant survival was chosen as an indicator because it was directly connected to the primary outcome of the agroforestry project. In spring 2009, the project farmers received a three-week intensive training by NAF (Nepal Agroforestry Foundation) on agroforestry farming with a focus on plant treatment and their structural placement in fields. In addition, theoretical and practical training on nursery and seed preparation was provided.

During and after the agroforestry training in spring 2009, 26 different plant species were distributed to participating farms in the form of seedlings or slightly bigger plants. Additional seeds were provided to be seeded in newly established nurseries. The distributed plants were planted on the farm's land assigned for transition to agroforestry. In 2010, another five different fruit trees were distributed. In total 12 different kind of seeds, 6 different kinds of seedlings and 13 kind of plants were distributed to each household of the project.

**Table 79:** Distributed plants and seeds in 2009 and 2010 in Kaule

| # | Nepali Name | English Name | Scientific Name | Use | Area | No. of Plants | Distribution |
|---|---|---|---|---|---|---|---|
| **I.** | **Non Timber Forest Products (NTFPs)** | | | | | per family | |
| 1. | Amriso | Broom Grass | *Thysanolena maxima* | broom | corner edge | 5 | Mar. 2009 |
| 2. | Lemon Grass | Lemon Grass | *Cymbopogon citratus* | tea, spice cash crop | riser slope | 10 | Mar. 2009 |
| 3. | Tejpata | Cinnamon Leaf | *Cinnamomum tamala* | spice | corner | 2 | Mar. 2009 |
| 4. | Timbur | Nepal Pepper | *Zanthoxylum armatum* | spice medicine | corner | 1 | Mar. 2009 |
| **II.** | **Fodder Plants** | | | | | | |
| 5. | Bakaino | China-Berry | *Melia azederach* | fuel wood pesticide | edge | seed | Apr. 2009 |
| 6. | Bhatmase | Soya Bean | *Glycine max (L.) Merr.* | fodder green | edge riser | seed | Mar. 2009 |
| 7. | Epil Epil | White Leadtree | *Leucaena leucocephala* | fuel wood fodder | edge riser | seed | Mar. 2009 |
| 8. | Mendola | Not available | *Tephrosia candida* | hedge-row nitrogen | edge | seed | May 2009 |
| 9. | Nimaro | Giant Indian Fig | *Ficus auriculata* | livestock fodder | edge riser | seed | May 2009 |
| 10. | Rai Khanayo | Nepal Fodder Fig | *Ficus semicordata* | fuel wood fodder | corner | seed | Mar. 2009 |
| 11. | Siris | Women´s Tongue | *Albizia lebbeck* | erosion resistant | edge corner | seed | Mar. 2009 |
| 12. | Tanki | Butterfly Tree | *Bauhinia purpurea* | fuel wood fodder | edge riser | seed | Apr. 2009 |
| 13. | Badame | Peanut | *Arachis hypogaea* | livestock fodder | edge riser | seed | May 2009 |
| 14. | Molasses | Melinies Grass | *Melinis minutifolia* | livestock fodder | edge riser | seed | May 2009 |
| 15. | NB21 | Napier Grass | *Pennisetum purpureum* | livestock fodder | edge riser | seed | May 2009 |
| **III.** | **Vegetables** | | | | | | |
| 16. | Farshi | Pumpkin | *Curcurbita pepo* | vegetable | plain | seed | Mar. 2009 |
| 17. | Kankro | Cucumber | *Cucumis sativus* | vegetable | plain | seed | Mar. 2009 |
| 18. | Khursani | Chilli | *Capsicum annuum* | vegetable | plain | seed | Mar. 2009 |
| 19. | Kurilo | Garden Asparagus | *Asparagus officinalis* | vegetable cash crop | plain | 60 | July 2009 |
| 20. | Rahari | Pigeon Pea | *Cajanus cajan* | vegetable fodder | edge | seed | May 2009 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21. | Simi | Lablab | *Dolichos lablab* | vegetable | plain | seed | Mar. 2009 |
| 22. | Tamatar | Tomato | *Lycopersicon esculentum* | vegetable | plain | seed | Mar. 2009 |
| **IV.** | **Fruit Trees** | | | | | | |
| 23. | Amba | Guava | *Psidium gaujava* | fruit | plain | 2 | July 2009 |
| 24. | Anar | Pome-granate | *Punica granatum* | fruit | plain | 2 | Aug. 2010 |
| 25. | Avocardo | Avocardo | *Persea americana* | fruit | plain | 5 | Aug. 2010 |
| 26. | Kaagati | Lime | *Citrus aurantifolia* | fruit pickles | plain | 5 | July 2009 |
| 27. | Kera | Banana | *Musa paradisiaca* | fruit | plain | 1 | May 2009 |
| 28. | Kubi | Kiwi | *Actinidia deliciosa* | fruit cash crop | plain | 3 | Aug. 2010 |
| 29. | Lapsi | Nepali Hog Plum | *Choerospondias axillaris* | fruit pickles | plain | seed | Mar. 2009 |
| 30. | Litchi | Lychee | *Litchi chinensis* | fruit | plain | 2 | Aug. 2010 |
| 31. | Nibuwa | Lemon | *Citrus limon* | fruit pickles | plain | 2 | Aug. 2010 |

Table 79 shows which kinds of seeds or plants were distributed. Non-timber-forest-products (NTFPs) are useful non-wood substances or materials that can be obtained from forests. They include different components like nuts, berries, mushrooms, oils, foliage, medicinal plants, and forage. Their usual use is for income generation. In this case, they were intended for medicinal use, tea or for brooms. Lemon grass was also planned as a cash crop. NTFPs were planted at edges, corners, risers or slopes.

Fodder plants included several grasses, herbs, shrubs and trees that primarily provided fodder for livestock. Additionally they can be used as firewood, for countering pests, or were planted as hedge rows to stop erosion. Emphasis was placed on fodder plants to enable farmers to cultivate livestock fodder on their own land. This would save considerable time because plants did not need to be collected on other lands and fodder available on the farm would protect vegetation in the surrounding community land because farmers do not need to cut plants for fodder outside their land. Fodder plants were planted at the edges, corners and rises on the farm.

Different kinds of vegetables were mainly distributed for personal consumption. Only asparagus was introduced as an intended cash crop. There is a market especially for organically grown asparagus in Kathmandu tourist restaurants and for medicinal use as the so-called “golden asparagus”. Different merchants mentioned the use of “golden asparagus” but the exact use was never investigated. Vegetables were planted on plain fields.

Most of the fruit trees were distributed in 2010. It was possible to buy them of the Forest District in Trisuli. Fruits were intended for own consumption or for selling. Especially kiwi (*Actinidia deliciosa*) was provided as a cash crop. Farmers also use fruits to produce pickles that are a side dish for their meals. All fruit trees were planted on plain fields.

From autumn 2009 until spring 2012, plant monitoring was carried out on participating farms to monitor the quantity of plants and plant species that survived. This monitoring data was used to create indicator data.

**Figure 20:** Number of total and percentage of deceased cultivated plant species

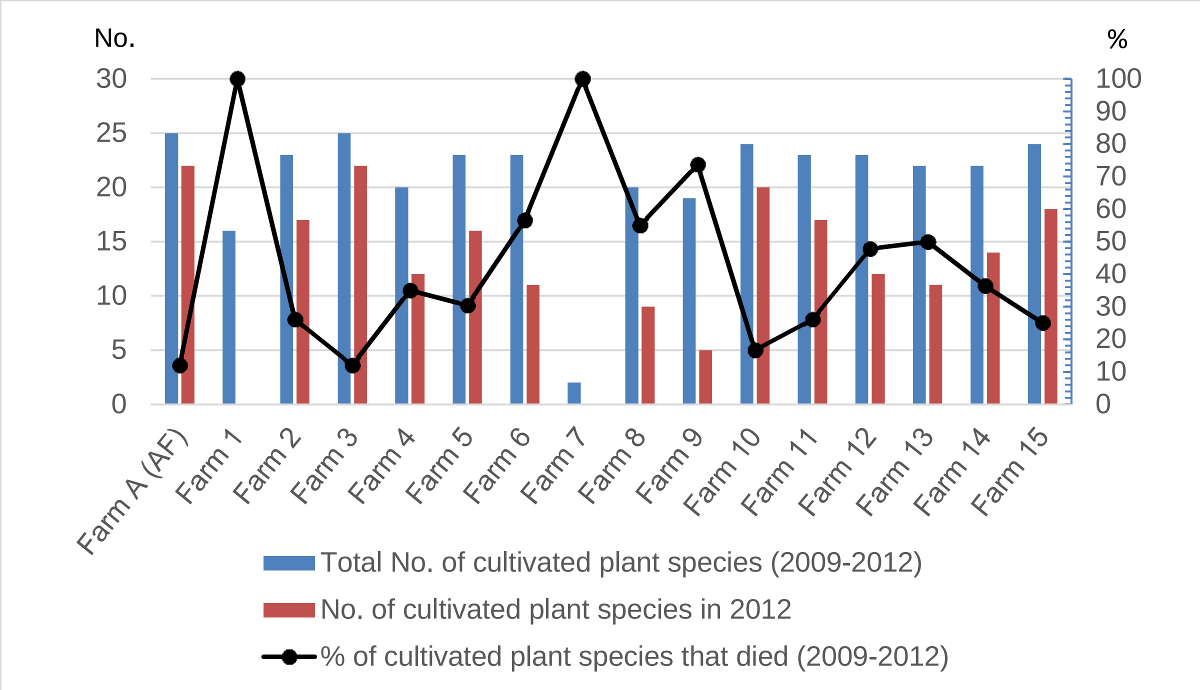



Figure 20 shows that the number of cultivated plant species was already quite diverse at the project start among the different farms. This was because a large number of plants were distributed as seeds (compare Table 79) and germination of seeds as well as survival of seedlings in the nursery determined the available plant number per farm at the project start. The number of cultivated species in 2012, and the percentage of plant species that survived, was taken as success indicators during the course of the first project phase.

**Figure 21:** Number of individual plants and percentage of plant mortality (2009 to 2012)

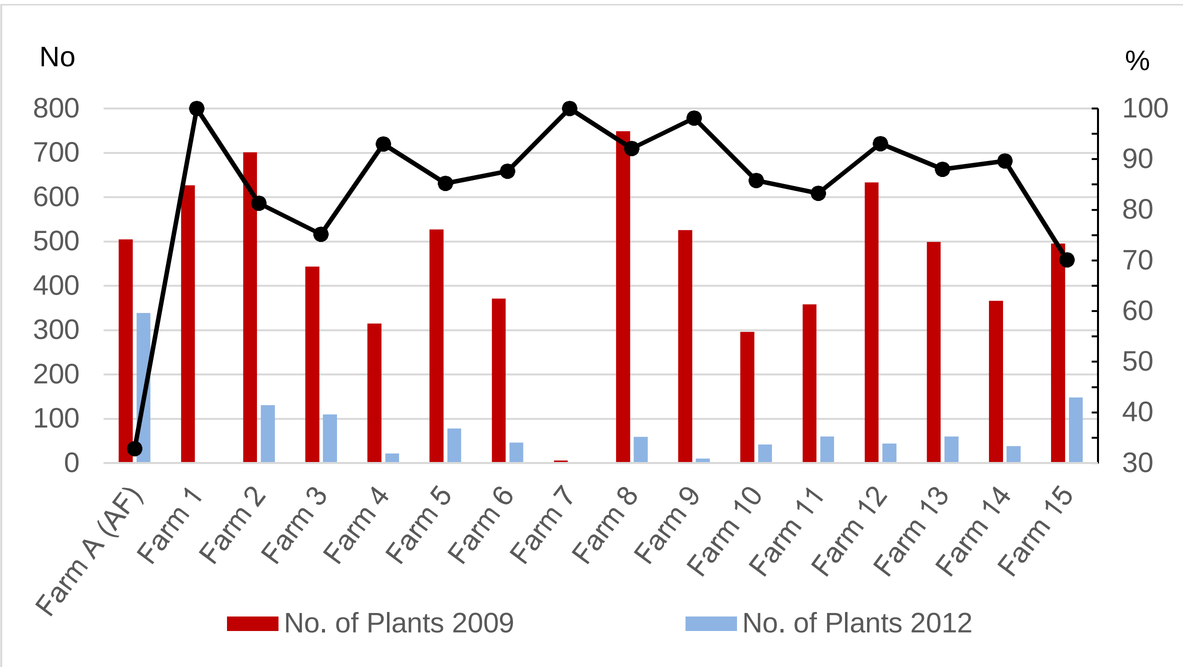


Figure 20 and Figure 21 illustrate that many plant species and individual plants died on all farms in transition. The agroforestry farm was able to save more than 50 % of planted and raised plants. Still 12 % of all plant species died.

The following table gives an overview of farms and performance in terms of species and plant survival.

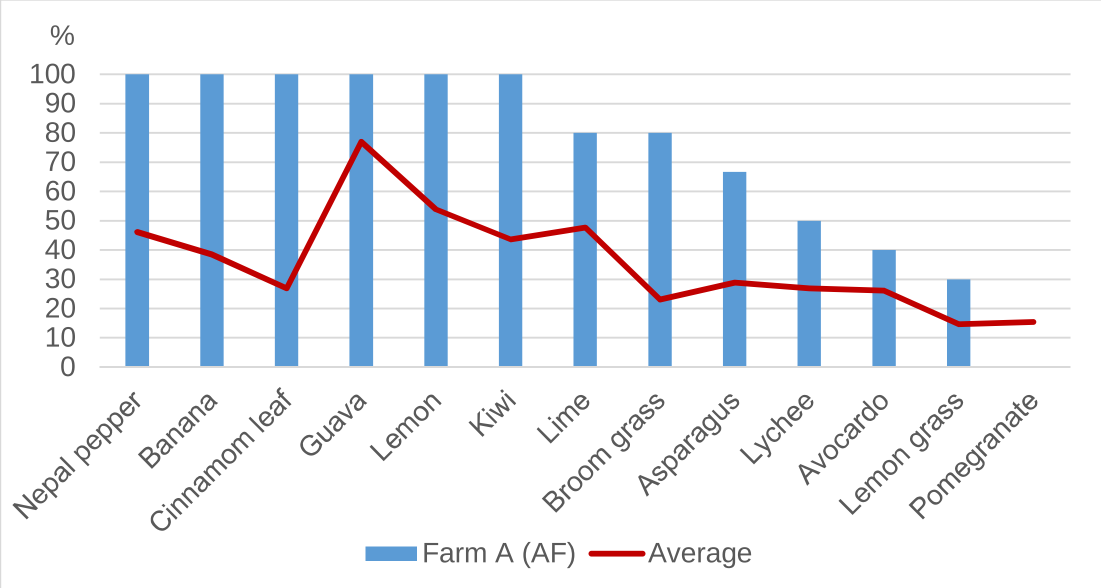
**Table 80:** Survival percentage of total plant species and individual plants

| | Species survival % | Plant survival % |
|---|---|---|
| Farm A (AF) | 88 | 67 |
| Farm 3 | 88 | 25 |
| Farm 10 | 83 | 14 |
| Farm 15 | 75 | 30 |
| Farm 2 | 74 | 25 |
| Farm 11 | 74 | 17 |
| Farm 5 | 70 | 15 |
| Farm 4 | 65 | 7 |
| Farm 14 | 64 | 10 |
| Farm 12 | 52 | 7 |
| Farm 13 | 50 | 12 |
| Farm 8 | 45 | 8 |
| Farm 6 | 43 | 12 |
| Farm 9 | 26 | 2 |
| Farm 1 | 0 | 0 |
| Farm 7 | 0 | 0 |

Because the number of survived plant species and individual plants were so diverse on different farms, it was difficult to compare the performance of farms due to plant survival. Hence, it was decided that for the plant indicator only the number of plants that were distributed are used and not plants that were cultivated out of seeds. This indicator was then the one with the most complete data rows in terms of period of time as well as number of included farms. This data is used in Chapter 5.3.4 and in Table 85 to form different groups of plant survival performance.

Figure 22 shows the percentage of plant survival for a selection of 13 plant species that were distributed in number of plants on the AF farm in comparison to the average of the other project farms. These plants include selected NTFPs, vegetables and fruit trees.

**Figure 22:** Survival percentage of 13 selected plant species in 2010




The average value that is compared to the AF farm only includes the data of 13 farms. Farmer 7's and Farmer 1's data are not included because one of them left the project before plant distribution, and the other did not plant them on their own land.

To understand the reasons why the number of most plants and species diminished, some households were individually interviewed. In many cases they answered that they did not know the reason why the plants died. Table 81 shows an overview with more detailed reasons given by farmers on individual plant species.

**Table 81:** Farmer opinions about reasons for plant diminution

| I. | NTFP | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | Broom Grass | *Thysanolena maxima* | too shady | drought | unknown | | |
| 2. | Lemon Grass | *Cymbopogon citratus* | stolen | un-known | did not grow | mouse | weeded |
| 3. | Cinnamon Leaf | *Cinnamomum tamala* | unknown | roots died | only got one | trodden down | |
| 4. | Nepal Pepper | *Zanthoxylum armatum* | red ants | stolen | roots died | drought | |
| **II.** | **Fodder Plants** | | | | | | |
| 5. | Chinaberry | *Melia azederach* | did not sprout | insects | | | |
| 6. | Soya Bean | *Glycine max (L.) Merr.* | was cut | | | | |
| 7. | White Lead Tree | *Leucaena leucocephala* | was cut | | | | |
| 8. | - | *Tephrosia candida* | pest attack | few sprouts | red ants | children | did not sprout |
| 9. | Giant Indian Fig | *Ficus auriculata* | unknown | few sprout | did not sprout | drought | died |
| 10 | Nepal Fodder Fig | *Ficus semicordata* | few sprouts | did not sprout | weed cover | | |
| 11 | Women´s Tongue Tree | *Albizia lebbeck* | red ants | did not sprout | drought | was cut | un-known |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12 | Butterfly Tree | *Bauhinia purpurea* | was cut | few sprouts | | | |
| **III.** | **Vegetables** | | | | | | |
| 13 | Garden Asparagus | *Asparagus officinalis* | unknown | | | | |
| 14 | Pigeon Pea | *Cajanus cajan* | did not sprout | few sprouts | forgot to seed | | |
| **IV.** | **Grasses** | | | | | | |
| 15 | Peanut | *Arachis hypogaea* | did not sprout | | | | |
| 16 | Melinies Grass | *Melinis minutifolia* | did not sprout | few sprouts | unknown | | |
| 17 | Napier Grass | *Pennisetum purpureum* | careless | un-known | | | |
| **V.** | **Fruit Trees** | | | | | | |
| 18 | Guava | *Psidium gaujava* | livestock | | | | |
| 19 | Pomegranate | *Punica granatum* | did not receive it | stolen | | | |
| 20 | Avocado | *Persea americana* | red ants | stolen | unknown | weeded | |
| 21 | Lime | *Citrus aurantifolia* | ploughed | trodden down | | | |
| 22 | Banana | *Musa paradisiaca* | planted late | | | | |
| 23 | Kiwi | *Actinidia deliciosa* | drought | | | | |
| 24 | Nepali Hog Plum | *Cherospondias axillaris* | red ants | died in nursery | ploughed | | |
| 25 | Lychee | *Litchi chinensis* | livestock | stolen | | | |
| 26 | Lemon | *Citrus limon* | drought | | | | |

The table shows the main reasons given by farmers for plant diminution. One early reason was that seeds did not germinate, or only germinated in low numbers in the nurseries. Pests also diminished the number of plants and species, as well as grazing livestock from own or neighbouring farms. During the dry months, a lack of water for watering was a limiting factor. In some cases, children or neighbours mistakenly cut plants for livestock fodder, or confused the plant with weeds and weeded them. Some plants were victims of ploughing or just trodden on. Certain plants of higher value were stolen from the fields.

In conclusion, on Farm A the plant survival was clearly higher than on other farms. This could be because of a better soil and ecosystem status in comparison to other farms that provided a better starting position for seedlings. In addition, it might be possible that Farmer A is a more experienced farmer due to the diverse cultivation he is practicing.

Plants were at the project start in 2009 distributed without charging any fees. Later on it became clear that a free plant did not have the same value as a plant had has a price. From 2010 onwards, farmers had to contribute with some rupees when new plants were purchased.

### 5.2.2 Social and Economic Indicators

Next to indicators on farming and the environment, data on the social and economic sectors were also collected to be used as indicators. These were meant to provide information on the living circumstances of farmers and the possible changes due to project activities.

#### 5.2.2.1 Income / Expenses

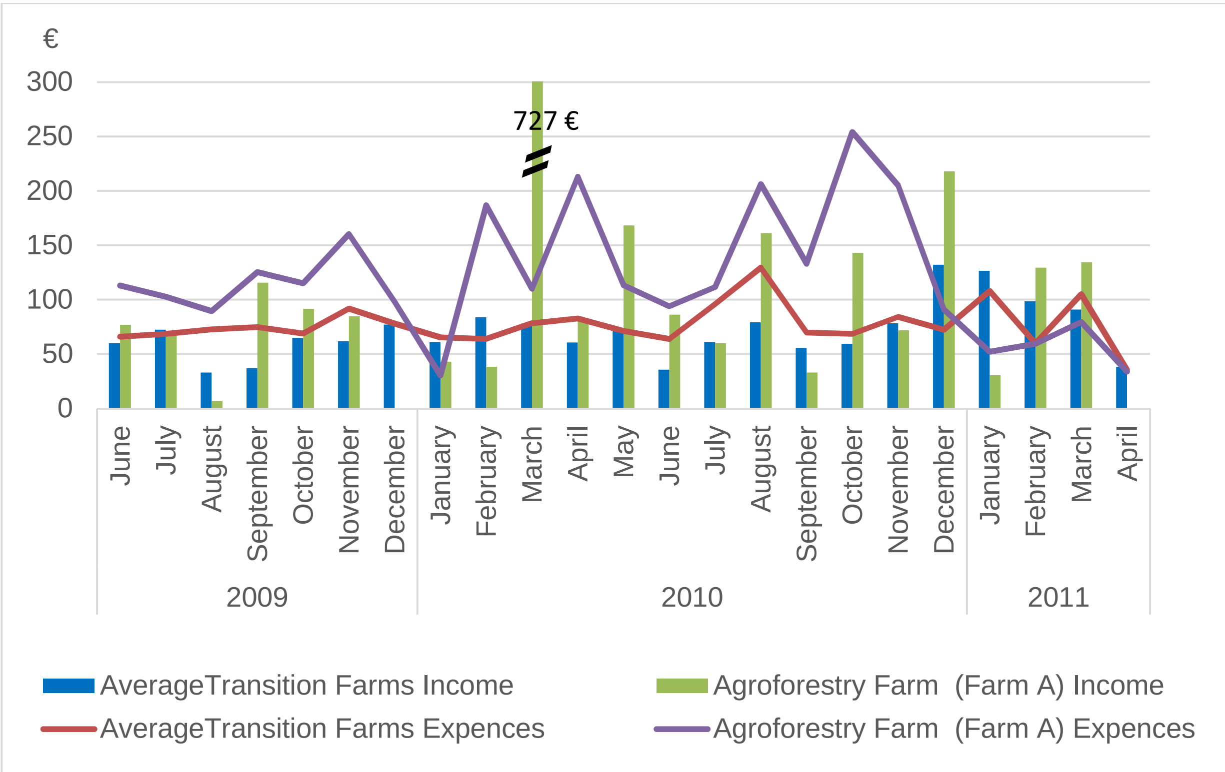
The collected data is of value in order to understand how farms generate income and what their main expenditures are. This information will surely be valuable for future project planning because it might explain the motivation of farmer behaviour and decisions.

Reasons for fragmentary data sets were, on one side, the fact that participants needed time to build up trust with the project and its researchers before they would share a deeper and more holistic view of their financial data. Another reason was that farmers were not used to recording data. It needed some training until records were usable. Some households later reported that they carried on data collection after the project was completed, recording income and expenses data for themselves because they found it useful for their own household planning.

Between 2009 and 2011, information on income and expenses were collected from Farm A (agroforestry) and other farms in transition on a bi-weekly basis. Out of all collected data, eight transition households delivered usable data from June 2009 until spring 2011.

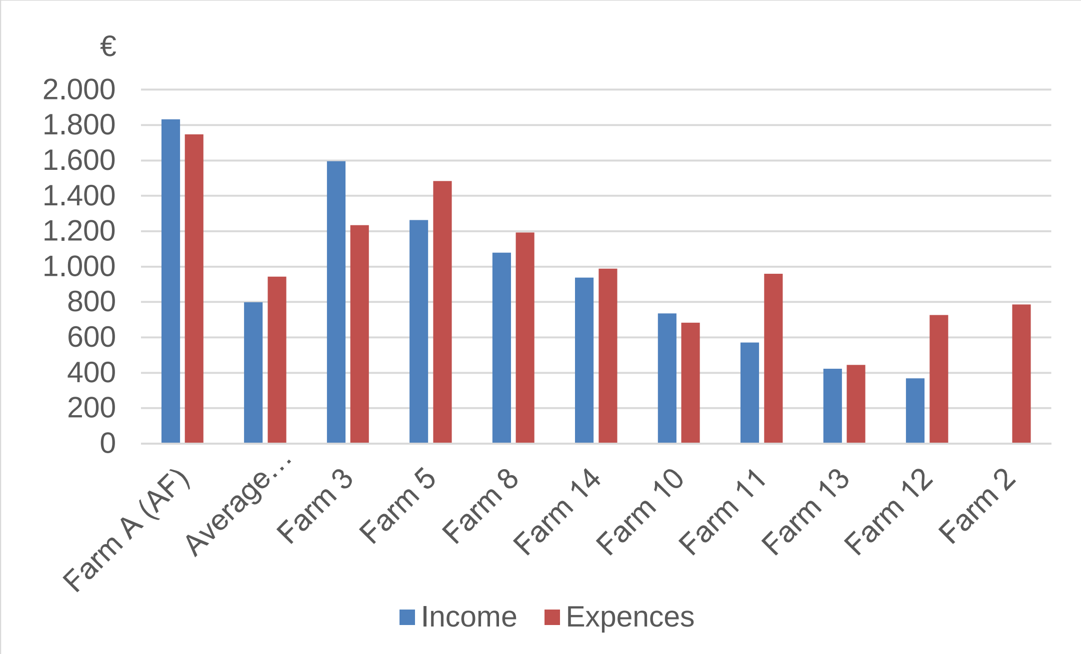
Figure 23 shows income data and expenses for Farm A in comparison to the average of eight households in transition during a period of 22 months.

**Figure 23:** Comparison of average income and expenses of different farms over time




Out of the 22 recorded months, Farm A's income was higher than the average of other farms during 13 months, lower during eight months and the same for one month. The most distinct peak of Farm A's income was in March 2010 with 727 €, where the household sold a large amount of pollard wood. In addition, the peaks in May, August and December 2010 show income generated by selling wood. The peak in October displays salary and advanced salary for external work.

**Figure 24:** Income and expenses of the agroforestry farm and other farms in 2010




In August 2010, Farm A had lower income because of a loss of cauliflower and cabbage harvest. In October 2010, a bigger amount of expenses was spent for new cloth, meat and other shopping goods due to Dashain, the most important festival in Nepal (08 – 22nd of October).

In total, Farm A generated more than double the income in 2010 compared to the average of the other eight transition farms as Figure 24 illustrates. Even so, the income of farmers in transition also differed quite significantly.

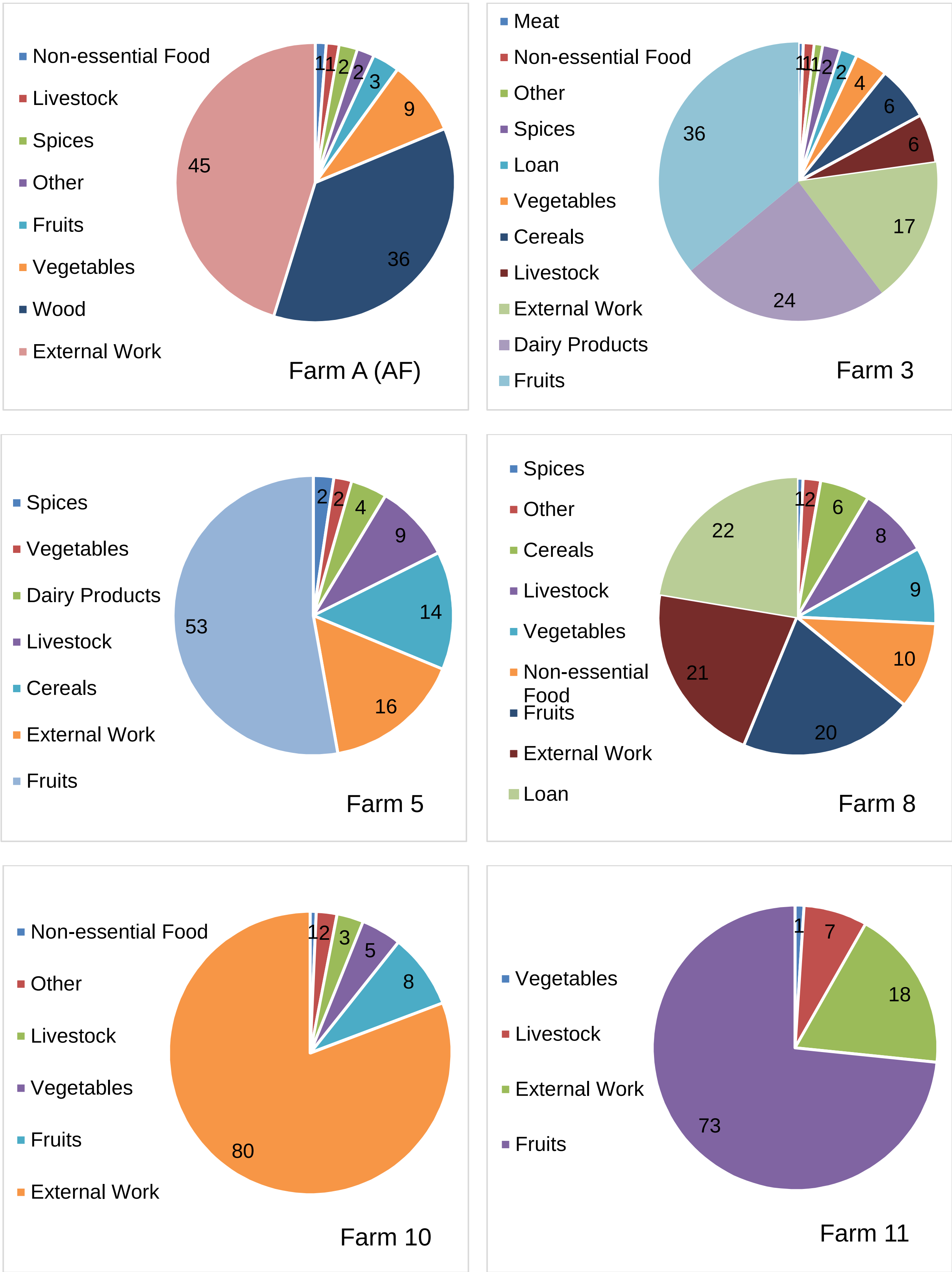
Farm A expenses in 2010 were nearby double as high as the average of the nine transition farms.

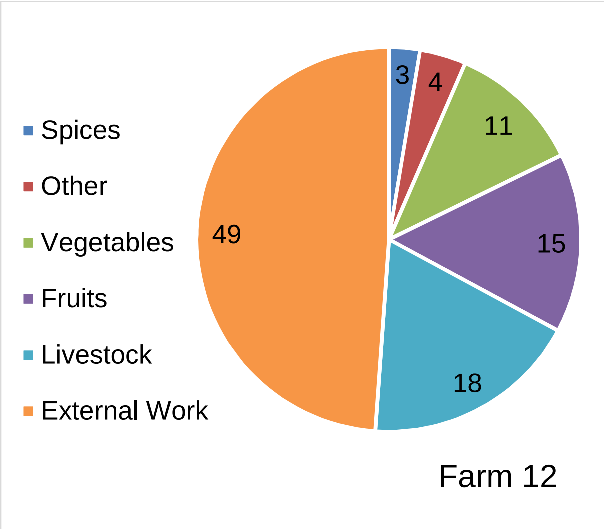
Reasons for the high expenses of Farm A were payments in a cooperative saving scheme, loans to other people, expenses for construction materials for farm development and payments for seasonal field workers.

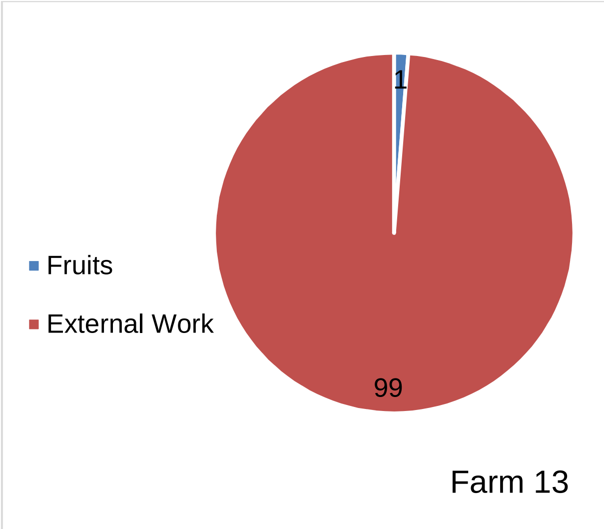
Figure 24 shows that only Farm A and two other farms in transition (Farm 3 and Farm 10) had a positive balance in 2010. All other households had higher expenses than income, according to their stated data. The displayed data also includes taking loans in income data, and given loans in expenses.

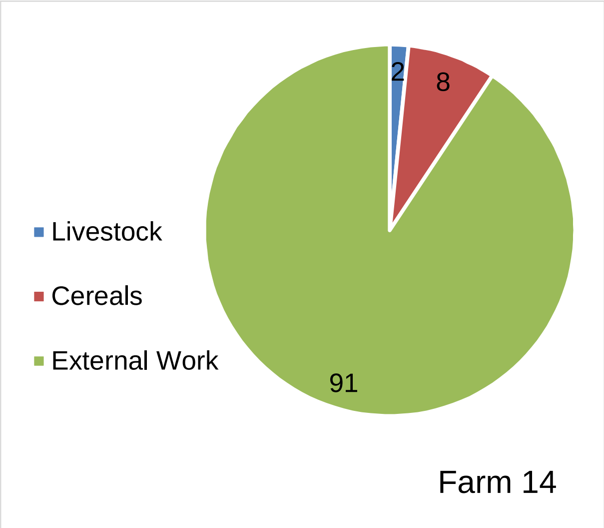
The following diagrams in Figure 25 display the categories of income per household in percentage of the total income.

**Figure 25:** Percentage of income in different categories in 2010 per household





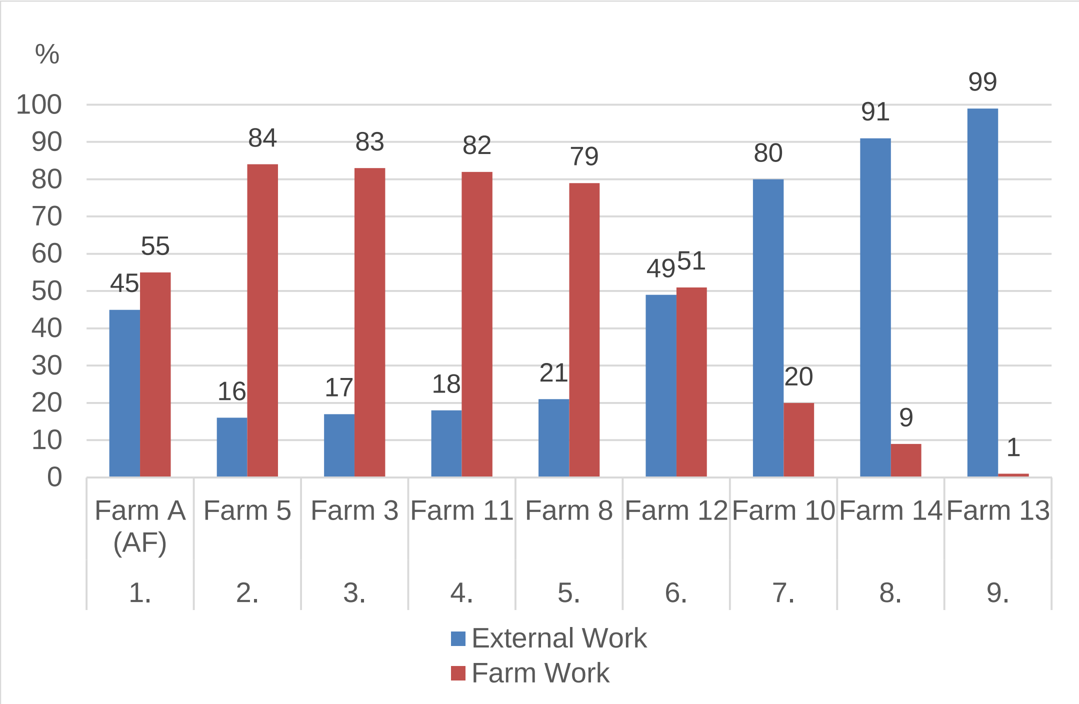




The major income sources for Farm A in 2010 were external work with 45 %, sale of wood with 36 %, and sale of vegetables and fruits with 12 %. The mean income sources for other farms in the same year need to be distinguished between farms that have their main income source by farm work or farms that generate their main income by external work.

For farms where farm work is the main income source, usually fruit and vegetable sales rank first. Fruits with high-income value are strawberries. In one exceptional case, a farm's biggest financial income was a loan. Dairy products were only of higher relevance at one farm. Cereals and livestock production are in all cases of less importance. In one case non-essential food production, which stands for alcohol production, added to a lower extent.

Occasional external work includes employment in construction work, being a bus driver or housekeeper. Full time work includes employment categories like being a teacher, secretary or tailor.

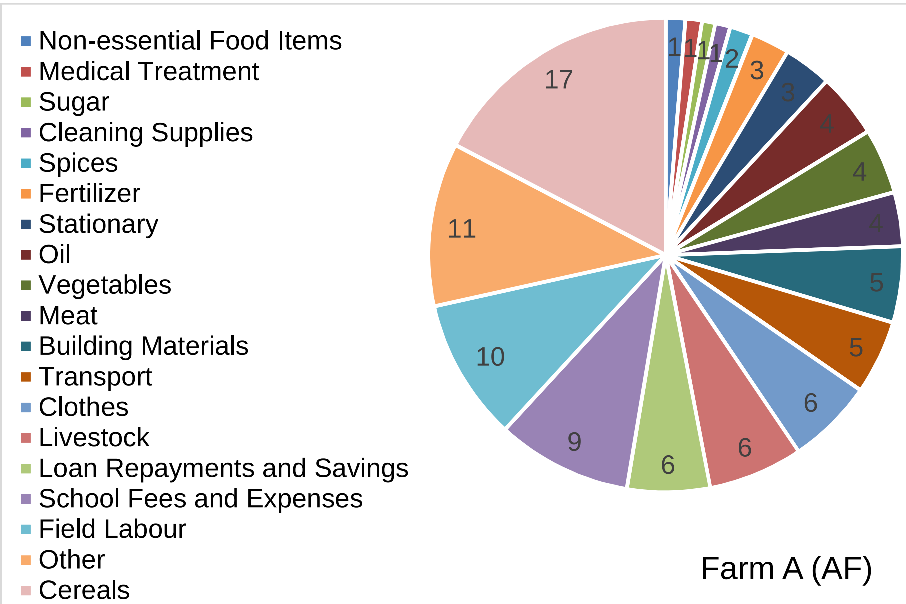
**Figure 26:** Percentage of income by farm work and external work in 2010

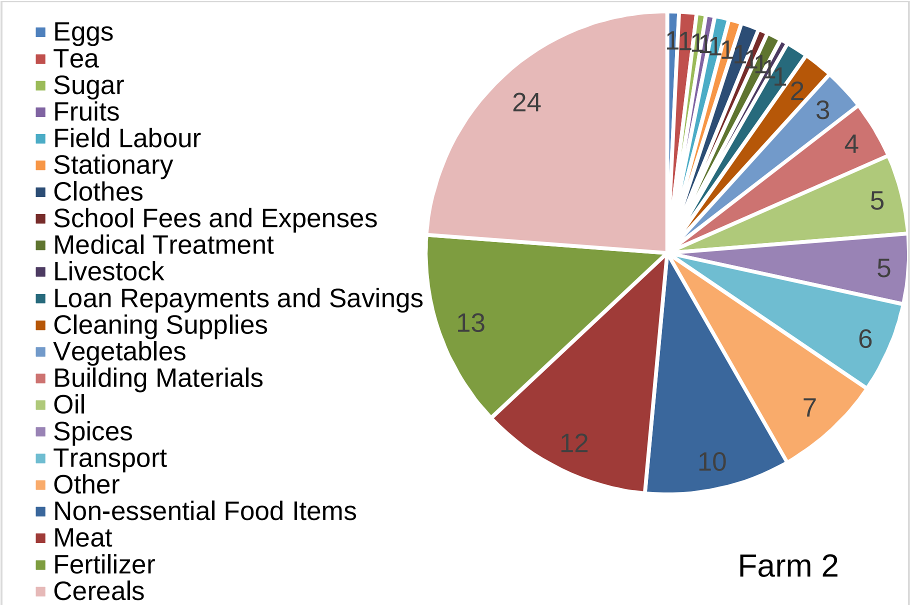


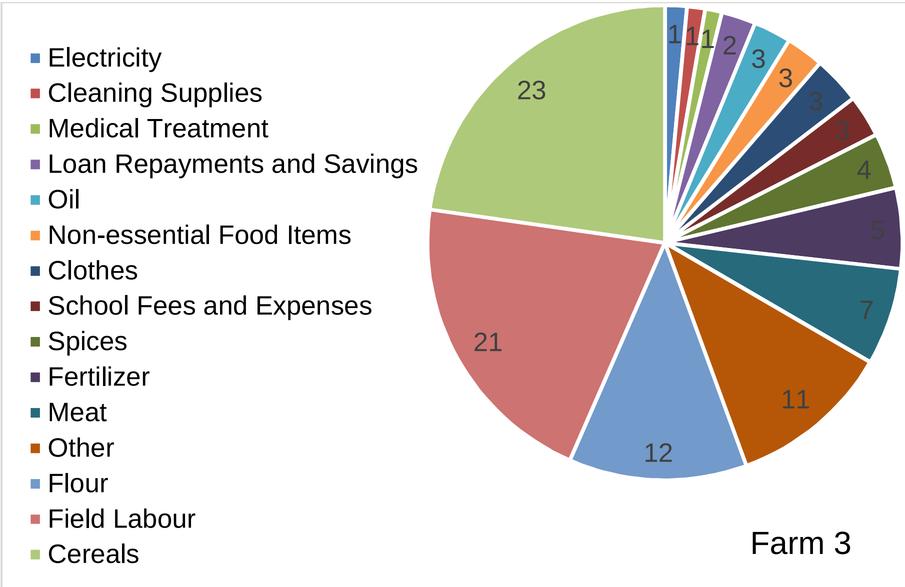

Out of the nine displayed households, four produced around 80 % of their income by farm work, two produced around 50% of the total income with farm work and three households only 20 % or less. One farm generated 99 % of all income by external work.

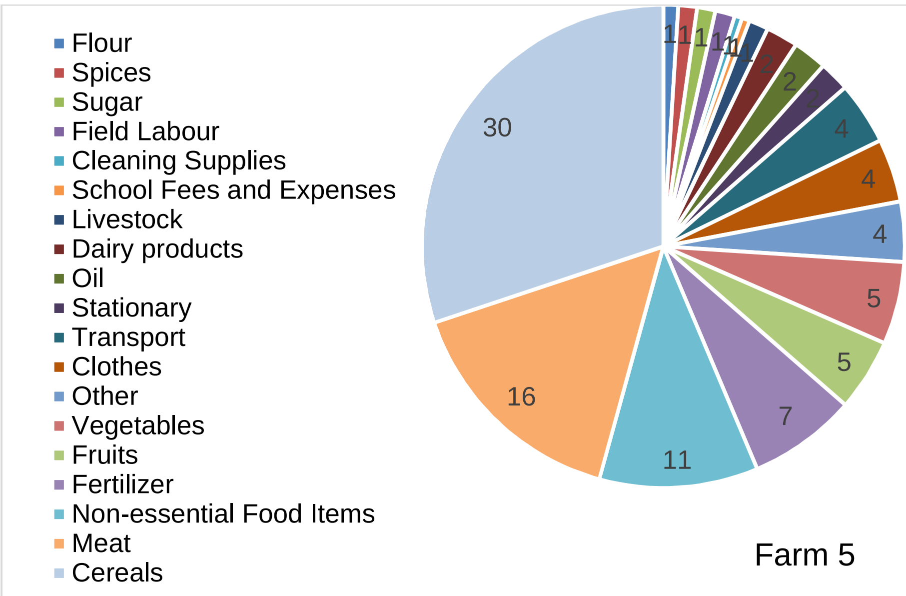
To understand the subject of expenses for households in Kaule, the following figure displays expenses in categories per farmer.

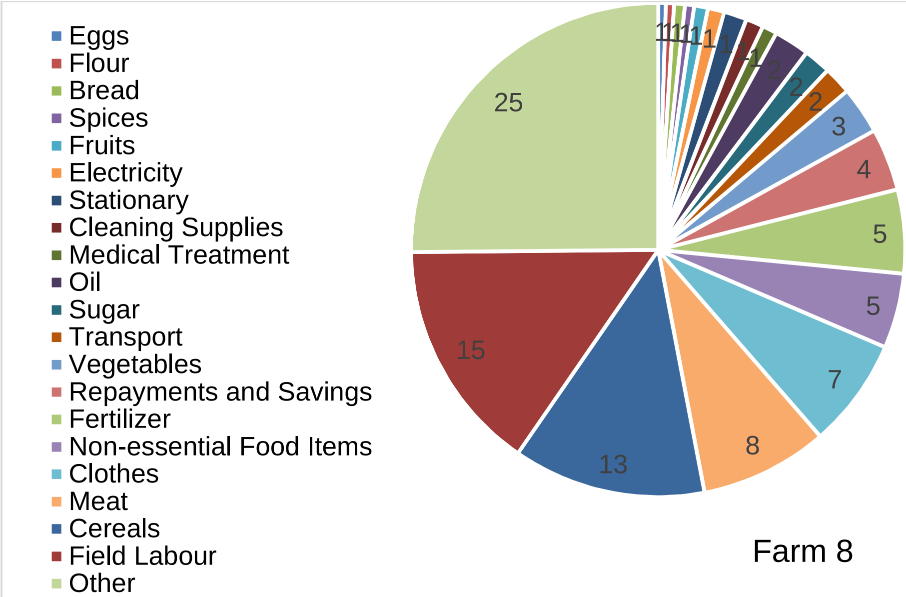
**Figure 27:** Percentage and different categories of expenses in 2010

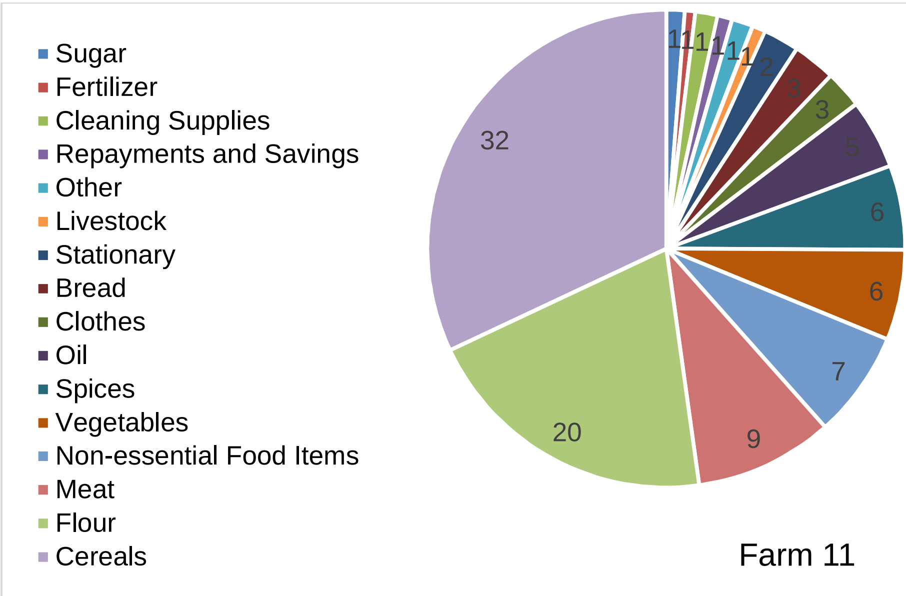


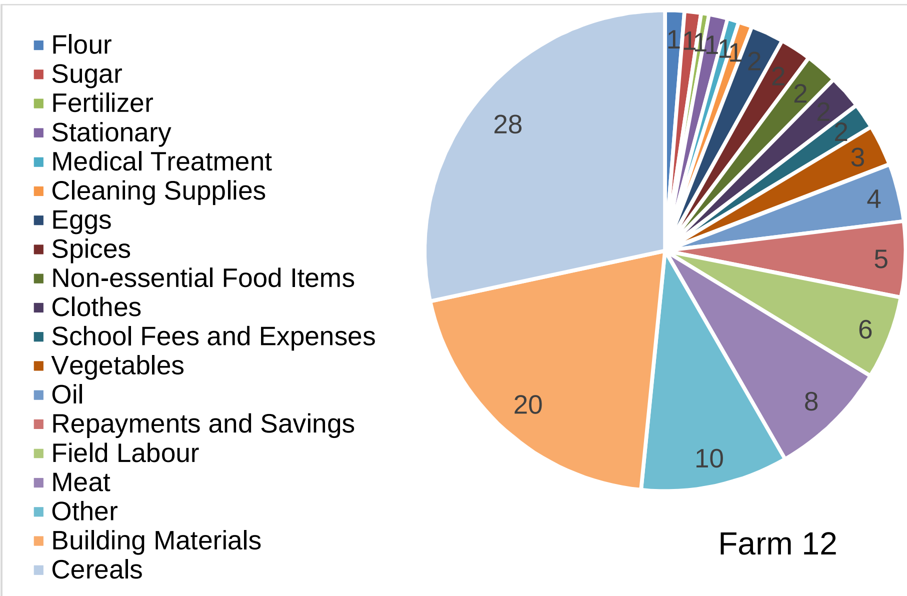

Eggs
Tea
Sugar
Fruits
Field Labour
Stationary
Clothes
School Fees and Expenses
Medical Treatment
Livestock
Loan Repayments and Savings
Cleaning Supplies
Vegetables
Building Materials
Oil
Spices
Transport
Other
Non-essential Food Items
Meat
Fertilizer
Cereals
24
13
12
10
7
6
5
5
4
3
2
Farm 2

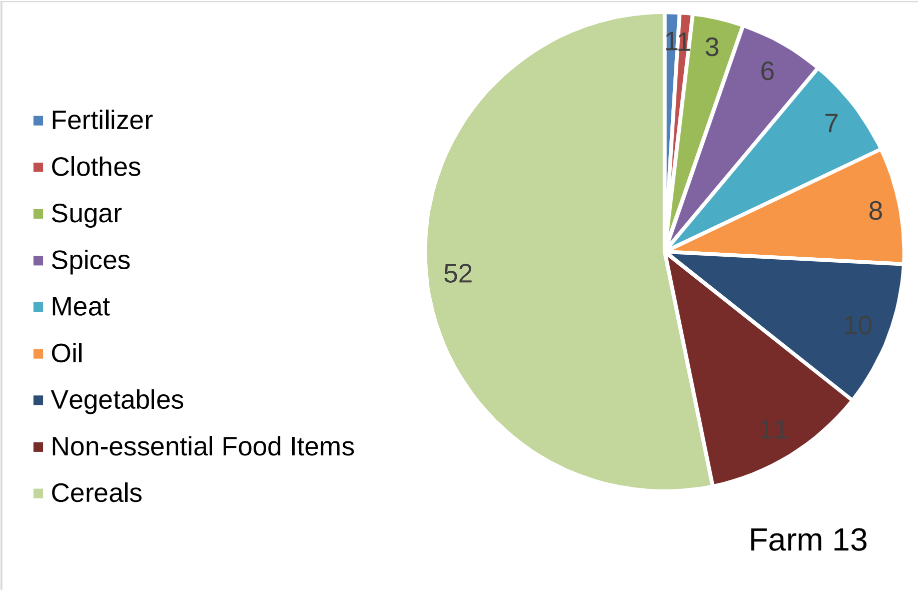

Electricity
Cleaning Supplies
Medical Treatment
Loan Repayments and Savings
Oil
Non-essential Food Items
Clothes
School Fees and Expenses
Spices
Fertilizer
Meat
Other
Flour
Field Labour
Cereals
1
1
1
2
3
3
3
3
4
5
7
11
12
21
23
Farm 3

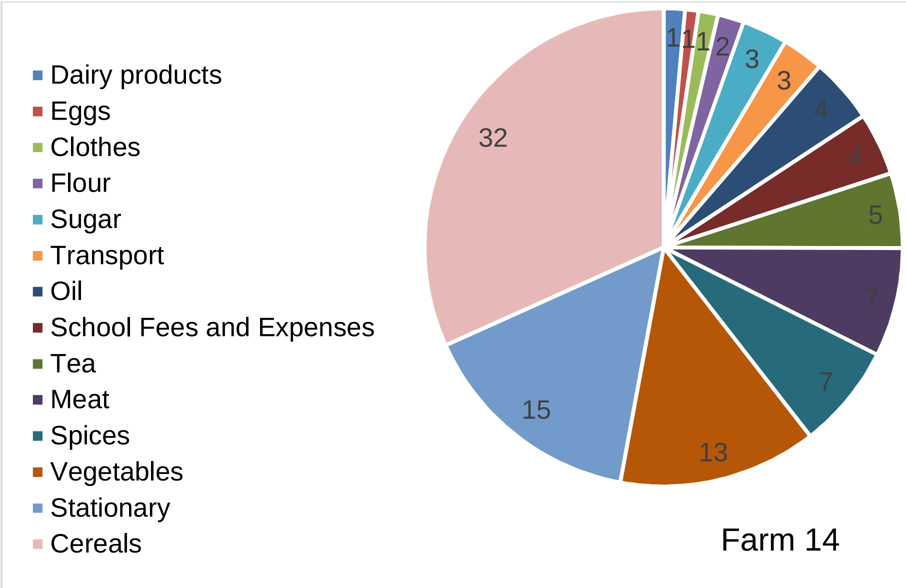

Flour
Spices
Sugar
Field Labour
Cleaning Supplies
School Fees and Expenses
Livestock
Dairy products
Oil
Stationary
Transport
Clothes
Other
Vegetables
Fruits
Fertilizer
Non-essential Food Items
Meat
Cereals
30
16
11
7
5
5
4
4
4
2
Farm 5


Eggs
Flour
Bread
Spices
Fruits
Electricity
Stationary
Cleaning Supplies
Medical Treatment
Oil
Sugar
Transport
Vegetables
Repayments and Savings
Fertilizer
Non-essential Food Items
Clothes
Meat
Cereals
Field Labour
Other
Farm 8


Sugar
Fertilizer
Cleaning Supplies
Repayments and Savings
Other
Livestock
Stationary
Bread
Clothes
Oil
Spices
Vegetables
Non-essential Food Items
Meat
Flour
Cereals
Farm 11


Flour
Sugar
Fertilizer
Stationary
Medical Treatment
Cleaning Supplies
Eggs
Spices
Non-essential Food Items
Clothes
School Fees and Expenses
Vegetables
Oil
Repayments and Savings
Field Labour
Meat
Other
Building Materials
Cereals
Farm 12



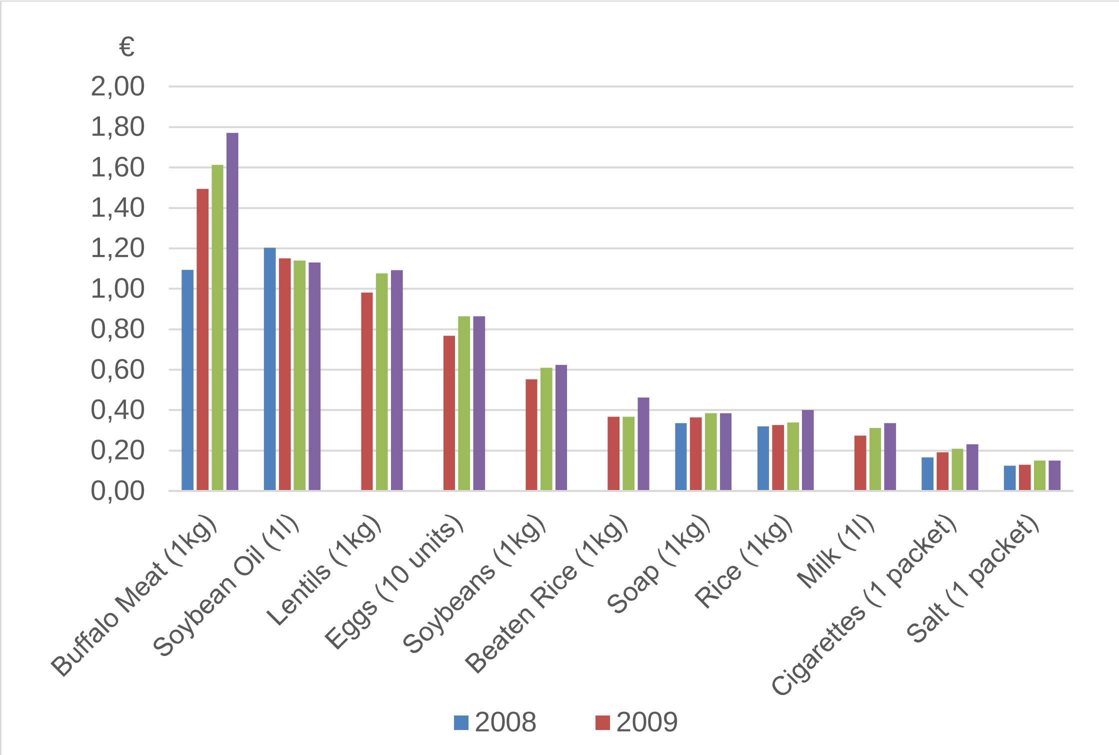

The category "other" includes undefined general expenses such as for festivals and shopping. In Farm 8, expenses "other" are the biggest category due to presents and goods for a marriage endowment. Non-essential food items include cigarettes, alcohol, sweets, and other snacks.

The number of defined categories of expenses per household range between 14 and 22.

Farm A spent most money on cereals (rice and beaten rice) followed by the category other, field labor, school fees, loan repayments or savings and livestock.

A look at the bigger categories of expenses for other farms show that cereals and field labour rank high on nearly every farm, followed by fertilizer, meat, none essential food items, and the category others. Flour and vegetables are also cost-intensive for some farms. Clothes and spices, building materials and stationary are mentioned by single farms as bigger expenses.

**Figure 28:** Price increases of selected goods between 2008 and 2011




Farmers reported that daily costs of living are rising every year so that living costs are increasing. Figure 28 illustrates the rising price of selected goods between 2008 (or in some cases 2009) and 2011.

Apart from soybean oil, all other goods have increasing prices over the years. This shows a trend that is in line with farmer perceptions.

In conclusion, the agroforestry farm has a better financial situation than other farms in 2010. The income and the expenses are higher. Expenses can be seen as everyday living costs but also as investment in the farm if used for building materials and further farm development. In the end, the household balance at the agroforestry farm is positive and the household does not get into debt. Income is balanced between farm work and external work.

The picture of other farms is more diverse. There are different strategies of income generation. In most cases, the focus is either on farm income or on income generation by external work. Apart from the agroforestry farm, only Farm 3 has a balanced income from both sources. The three farms with the highest income after the agroforestry farm generate income mostly by farm work. Strawberry production plays here the biggest role. However, it seems to be possible to survive from farm income if a valuable cash crop is included.

The household balances are in nearly all cases negative. This indicates that most likely not all data on income and expenses were provided. Perhaps farmers rather reported farm related income data than income from external sources, especially when external jobs were done in fulltime.

#### 5.2.2.2 TOT Training

In spring 2009, NAF was hired to give a three-week TOT training to project farmers. To understand the impact of the training on participant perceptions, an interview was conducted afterwards with eight farmers. The questions and corresponding answers are presented in Table 82.

**Table 82:** Feedback of farmers about the agroforestry training in 2009

| | | | |
|---|---|---|---|
| 1. | **Did you like the AF training in general?** | Farm A | very good |
| | | Farm 1 | good |
| | | Farm 5 | good |
| | | Farm 2 | good |
| | | Farm 12 | good |
| | | Farm 7 | very good |
| | | Farm 13 | very good |
| | | Farm 14 | very good |
| 2. | **What did you like most about the training?** | Farm A | grafting, trimming and cutting of trees, nursery establishment |
| | | Farm 1 | soil and seed treatment |
| | | Farm 5 | new types of plant species |
| | | Farm 2 | new types of plant species |
| | | Farm 12 | AF techniques, seed treatment, grafting and cutting of trees, use of bamboo |
| | | Farm 7 | new types of plants and planting time of species |
| | | Farm 13 | nursery establishment |
| | | Farm 14 | playing games, having fun with all participants |
| 3. | **What did you not like about the training?** | Farm A | some participants were disturbing |
| | | Farm 1 | liked everything |
| | | Farm 5 | liked everything |
| | | Farm 2 | participants did not follow the rules |
| | | Farm 12 | participants were not punctual, some participants were disturbing |
| | | Farm 7 | some participants were disturbing |
| | | Farm 13 | liked everything |
| | | Farm 14 | liked everything |

| | | | |
|---|---|---|---|
| 4. | How understandable were the lessons? | Farm A | 80 % was understandable, the rest was hard to understand because of the technical terms |
| | | Farm 1 | understandable, some were difficult to understand due to disturbances in the classroom |
| | | Farm 5 | understandable |
| | | Farm 2 | - |
| | | Farm 12 | difficult to understand because it was the first training the farmer got, new topics, too much information |
| | | Farm 7 | in general understandable, but some trainers were difficult to understand |
| | | Farm 13 | some difficult to understand due to disturbances in the classroom |
| | | Farm 14 | it was difficult in the first two days, then understandable |

| | | | |
|---|---|---|---|
| 5. | How was the speed of the training? | Farm A | good speed but some topics were very technical and speed should have been slower |
| | | Farm 1 | good |
| | | Farm 5 | good |
| | | Farm 2 | apart from Kumari's lesson it was good |
| | | Farm 12 | all trainers taught quite slowly |
| | | Farm 7 | good |
| | | Farm 13 | - |
| | | Farm 14 | good |

| | | | |
|---|---|---|---|
| 6. | Which of the topics were useful? | Farm A | soil lesson |
| | | Farm 1 | nursery establishment and seed treatment |
| | | Farm 5 | planting techniques |
| | | Farm 2 | grasses and livestock production |
| | | Farm 12 | seed treatment |
| | | Farm 7 | nursery establishment and seed treatment |
| | | Farm 13 | nursery establishment |
| | | Farm 14 | every topic |

| | | | |
|---|---|---|---|
| 7. | Which topics were not useful? | Farm A | all topics were useful |
| | | Farm 1 | all topics were useful |
| | | Farm 5 | all topics were useful |
| | | Farm 2 | all topics were useful |
| | | Farm 12 | all topics were useful |
| | | Farm 7 | all topics were useful |
| | | Farm 13 | all topics were useful |
| | | Farm 14 | all topics were useful |

| | | | |
|---|---|---|---|
| 8. | **Which other topics should be included in future lessons?** | Farm A | livestock management training, fish farming and overall management of agroforestry with all components, farm management, monthly planting and harvesting calendar |
| | | Farm 1 | strawberry cultivation, multipurpose trees, fish farming, pest control, greenhouse establishment, farm management |
| | | Farm 5 | plants that are ecologically suitable for this area |
| | | Farm 2 | none |
| | | Farm 12 | farm visits and visual examples |
| | | Farm 7 | none |
| | | Farm 13 | livestock management training |
| | | Farm 14 | none |

| | | | |
|---|---|---|---|
| 9. | **How was the structure of the lessons?** | Farm A | well structured |
| | | Farm 1 | well structured |
| | | Farm 5 | well structured |
| | | Farm 2 | well structured |
| | | Farm 12 | well structured |
| | | Farm 7 | well structured |
| | | Farm 13 | well structured |
| | | Farm 14 | well structured |

| | | | |
|---|---|---|---|
| 10. | **Suggestions for future lesson structures.** | Farm A | more practical lessons (immediately practice in field) |
| | | Farm 1 | less entertainment, more class and less topics |
| | | Farm 5 | none |
| | | Farm 2 | all participants should feel responsible |
| | | Farm 12 | more practical lessons (immediately practice in field) |
| | | Farm 7 | none |
| | | Farm 13 | none |
| | | Farm 14 | none |

| | | | |
|---|---|---|---|
| 11. | **How was the ratio between theoretical and practical lessons?** | Farm A | more practical lessons should be provided |
| | | Farm 1 | good balance |
| | | Farm 5 | good balance |
| | | Farm 2 | more practical lessons should be provided |
| | | Farm 12 | more practical lessons should be provided |
| | | Farm 7 | more practical lessons should be provided |
| | | Farm 13 | more practical lessons should be provided |
| | | Farm 14 | more practical lessons should be provided |

| | | | |
|---|---|---|---|
| 12. | **Did this training help to establish nurseries on your own farm?** | Farm A | yes |
| | | Farm 1 | yes |
| | | Farm 5 | yes |
| | | Farm 2 | yes |
| | | Farm 12 | yes |
| | | Farm 7 | yes |
| | | Farm 13 | - |
| | | Farm 14 | somehow |

| | | | |
|---|---|---|---|
| 13. | **What sort of further help do you need?** | Farm A | none |
| | | Farm 1 | - |
| | | Farm 5 | - |
| | | Farm 2 | - |
| | | Farm 12 | problem with spacing between seeds and plants |
| | | Farm 7 | material support like plastic |
| | | Farm 13 | - |
| | | Farm 14 | doesn’t feel perfect and need more training and help |

| | | | |
|---|---|---|---|
| 14. | **Were the provided seeds and plants satisfying?** | Farm A | 50 % satisfied, rest did not germinate yet |
| | | Farm 1 | yes |
| | | Farm 5 | yes |
| | | Farm 2 | yes |
| | | Farm 12 | yes |
| | | Farm 7 | yes |
| | | Farm 13 | yes |
| | | Farm 14 | yes |

| | | | |
|---|---|---|---|
| 15. | **Which other plants should be included?** | Farm A | all plants that are suitable for the area and climate |
| | | Farm 1 | offseason vegetables (cauliflower, cabbage and radish) and greenhouse cultivation plants |
| | | Farm 5 | all plants that are suitable for the area and climate |
| | | Farm 2 | multipurpose plants, plants that give the best results |
| | | Farm 12 | offseason vegetables (cauliflower, cabbage and radish) |
| | | Farm 7 | - |
| | | Farm 13 | offseason vegetables (cauliflower, cabbage and radish) |
| | | Farm 14 | all plants that are suitable for the area and climate |

| | | | |
|---|---|---|---|
| 16. | How can the teachers improve their lessons? | Farm A | individual teaching on the field (weekly to monthly basis), monitor the effects at the farms, topics should be practical and understandable |
| | | Farm 1 | lessons about local environment, marketing and already cultivated plants (strawberries) |
| | | Farm 5 | topics should be practical and understandable |
| | | Farm 2 | more practical lessons |
| | | Farm 12 | no suggestion |
| | | Farm 7 | individual teaching on the field (weekly to monthly basis) |
| | | Farm 13 | teach slowly and repeat |
| | | Farm 14 | teach slowly and repeat |

| | | | |
|---|---|---|---|
| 17. | How was the performance of the group (participants)? | Farm A | some were disturbing and making noise |
| | | Farm 1 | some were disturbing and making noise |
| | | Farm 5 | they were good |
| | | Farm 2 | some were disturbing and making noise |
| | | Farm 12 | good communication between participants and trainers, participants were late |
| | | Farm 7 | some were lazy some were interested |
| | | Farm 13 | good communication between participants and trainers, questions and repetitions |
| | | Farm 14 | noted down lessons in notebooks and repetition |

| | | | |
|---|---|---|---|
| 18. | Other suggestions, ideas or critiques? | Farm A | none |
| | | Farm 1 | none |
| | | Farm 5 | none |
| | | Farm 2 | refreshment training for interested people and more participants |
| | | Farm 12 | none |
| | | Farm 7 | refreshment training for interested people and more participants |
| | | Farm 13 | none |
| | | Farm 14 | parents should be first included and afterwards children |

In conclusion, farmers accepted the TOT agroforestry training very positively. This impression also occurred for farmers that did not participate in the interview during group meetings. The training was challenging and sometime too technical, still farmers got many new ideas and information. For the future, farmers would like lessons that are more practical, the inclusion of several other topics like livestock management, fish farming and farm management, as well as longer expert monitoring and attendance on the fields.

## 5.3 Framework: Data Linkages

The interviews and indicators provided different datasets for this research. So far, they have been used to describe single farmer households in the form of case studies and certain aspects of farmers' lives. The intention of the following chapter is to detect linkages between household livelihood strategies and project performance and to gain a more generalised level of observation at the group level. A survey of interview questions and answers was created in Table 83. This survey enables the comparison of the agroforestry farm to the average value of 15 farms in transition as far as information was provided.

**Table 83:** Compilation of selected case study and interview data (2009 / 2011)

| | Total land area (ha) | % of assigned land for agroforestry | Total no. of household members | Total no. of children | Total no. of work categories on farm | No. of work categories on farm for women | No. work categories on farm for men | No. same categories on farm men / women | No. work categories for children | No. of household members with external work | Household members who work outside Nepal | Total No. of cultivated plants 2009 | Total No. of cultivated plants 2011 | No. of plants for own consumption 2009 / 2011 | No. of plants for selling 2009 / 2011 | Interest in cultivating new plants |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Farm A (Agroforestry)** | 0.69 | 100 | 7 | 3 | 15 | 12 | 9 | 7 | 4 | 2 | 0 | 20 | 25 | 26 | 26 | yes |
| **Average (Farm 1- 15)** | 0.77 | 18 | 7 | 2 | 14 | 10 | 7 | 4 | 2 | 2 | 0 | 11 | 10 | 13 | 6 | yes |
| **Farm 1** | 0.40 | 42 | 6 | 1 | 16 | 11 | 8 | 3 | 3 | 0 | 0 | 21 | 13 | 17 | 13 | yes |
| **Farm 2** | 1.11 | 6 | 11 | 2 | 12 | 9 | 8 | 5 | 0 | 3 | India | 12 | 10 | 18 | 4 | ? |
| **Farm 3** | 0.60 | 5 | 14 | 7 | 16 | 11 | 10 | 6 | 2 | 3 | 0 | 7 | 12 | 22 | 6 | yes |
| **Farm 4** | 0.34 | 23 | 5 | 1 | 15 | 13 | 4 | 4 | 5 | 3 | 0 | * | 6 | 10 | 4 | yes |
| **Farm 5** | 1.16 | 9 | 13 | 3 | 14 | 9 | 8 | 4 | 2 | 4 | 0 | 11 | 22 | 24 | 10 | yes |
| **Farm 6** | 0.40 | 57 | 4 | 2 | 13 | 7 | 5 | 0 | 3 | 1 | Dubai | 12 | 14 | 13 | 6 | yes |
| **Farm 7** | 1.76 | 24 | 11 | 4 | 13 | 10 | 5 | 3 | 2 | 0 | 0 | 12 | ** | 10 | 4 | yes |
| **Farm 8** | 0.76 | 22 | 5 | 2 | 17 | 11 | 10 | 5 | 1 | 1 | yes | 8 | 12 | 16 | 9 | yes |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Farm 9 ***** | 1.51 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Farm 10** | 0.60 | 5 | 4 | 1 | 15 | 11 | 7 | 4 | 2 | 1 | yes | 5 | 5 | 8 | 3 | yes |
| **Farm 11** | 0.76 | 5 | 8 | 4 | 15 | 12 | 12 | 10 | 3 | 1 | 0 | * | 9 | 6 | 4 | ? |
| **Farm 12** | 0.55 | 15 | 6 | 3 | 15 | 11 | 4 | 2 | 1 | 2 | 0 | 10 | 6 | 8 | 6 | yes |
| **Farm 13** | 0.38 | 34 | 4 | 2 | 13 | 7 | 9 | 4 | 1 | 1 | 0 | 8 | 6 | 7 | 5 | yes |
| **Farm 14** | 0.60 | 13 | 5 | 2 | 11 | 6 | 5 | 0 | 1 | 1 | 0 | 13 | 10 | 13 | 6 | yes |
| **Farm 15** | 0.65 | 7 | 2 | 0 | 11 | 8 | 5 | 2 | 0 | 1 | 0 | 10 | 4 | 9 | 1 | yes |

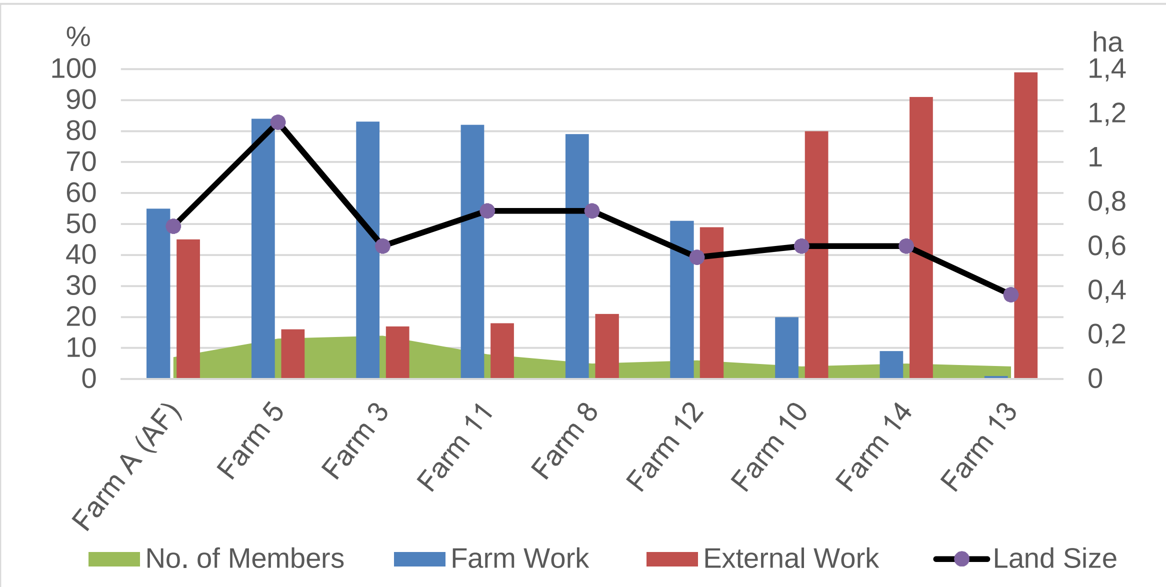
*Only Interviewed in 2011, ** Only Interviewed in 2009, *** No participation in personal interviews.

## 5.3.1 Land Size, Family Size and Income Strategy

The total land average of the 15 farms in transition is 0.77 ha, with four farms above average, and 11 farms with smaller than average land areas. The smallest farm has a size of only 0.34 ha and the biggest one a size of 1.76 ha according to reported land sizes. Farm A, with a land size of 0.69 ha is smaller than the average. The land sizes per family are thus quite diverse. More land can be seen as a kind of life insurance for families because land prices are rising constantly.

Still, it is not possible to generalise that a family with more land is also financially better off than a family with a smaller land size. That would be too simple as more factors play a role in the family's financial budget and situation. Figure 29 compares the linkage between land sizes, family size and income generation strategies to better understand the background of a household's livelihood.

**Figure 29:** Overview of income source, number of family members, and land size.



In most cases, bigger family sizes are connected to bigger land sizes and to farm work as the income strategy. Eventually, bigger families that often include several adults were created through family unions (parents, uncles and aunts, children and grandchildren) in order to combine more land thus creating more farmland. More land for farming also allows intersecting farm strategies. For example, the integration of strawberries or other cash crops that need, in many cases, extended land areas for cultivation.

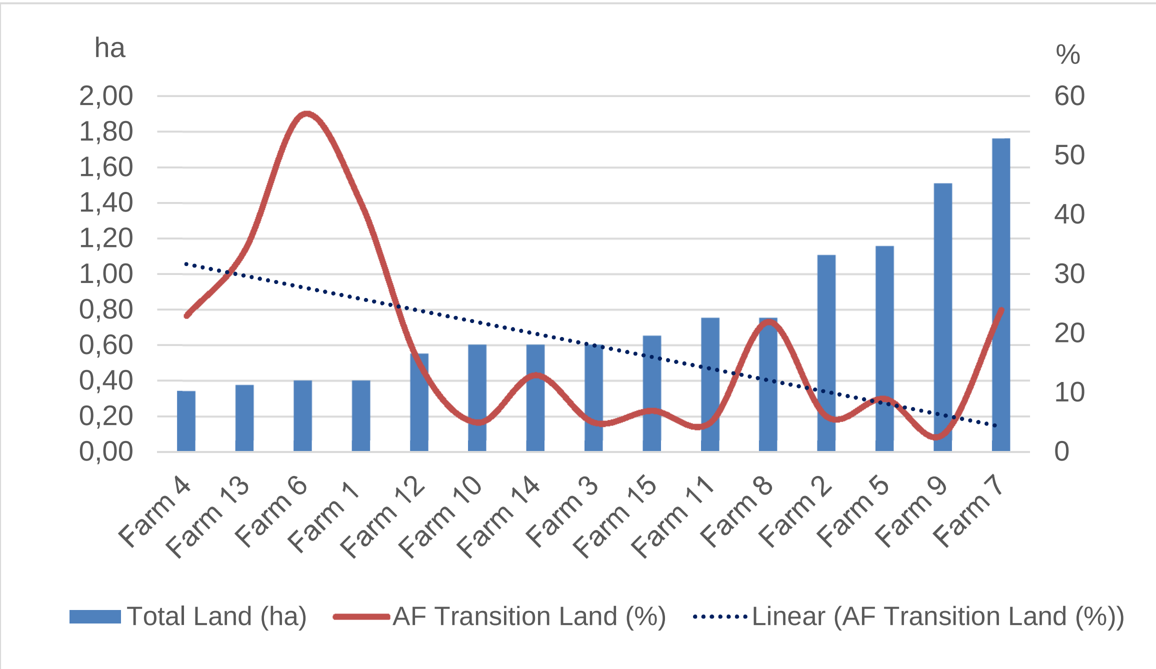
Only Farm 3 is exceptional in the illustrated trend because he has a big household but a comparably small land size and farming as the main income source. In this case, the reported land size was probably not correct, especially because the household cultivates strawberries as a main income source (compare Figure 25).

Apart from farm A, only farm 12 has a balanced income strategy between farm work and external work and in addition a rather small land portion. Farm 12 has the lowest income reported of all compared households (see Figure 25). If the reported income is correct and includes both income sources (farm work and external work), then at a first glance, farms with a clear focus on one income source, either farm work or external work, seem to perform better in terms of financial balance. However, personal conditions need to be considered. Work distribution, plant cultivation, illness and other factors might influence the result. However, it appears likely that an equal income split between farm work and external work should provide financial security because the household's income is then based on two pillars. If one source temporarily decreases, then the other can reduce the pressure.

On average, 18 % of all transition farmland was provided for transformation into agroforestry farming within the project. The smallest percentage of transformation land was 3 % and the biggest percentage of transformation was 57 % of total land. The huge difference in provided land for transformation is remarkable.

Figure 30 illustrates that households with smaller land sizes often provided higher percentages of their total land for transition.

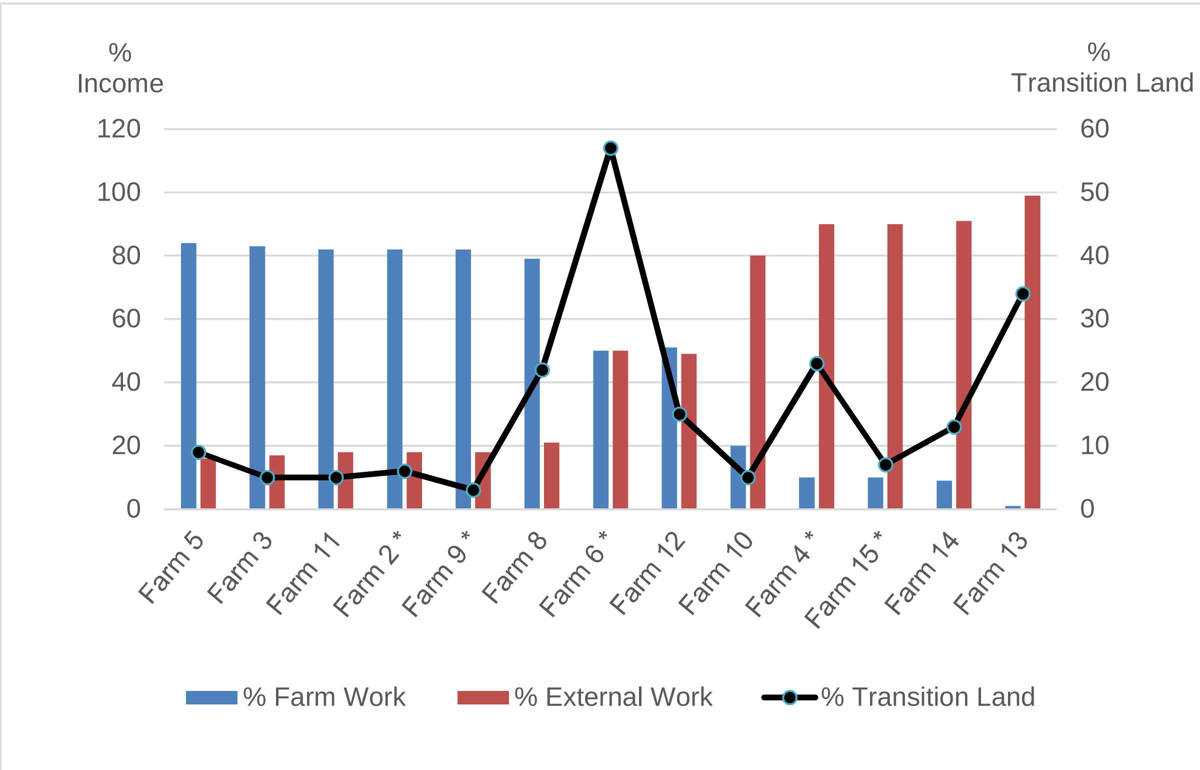
**Figure 30:** Total land in hectares and percentage of transition land per household



Still, there is an individual variance in the proportion of provided transition land. This individual decision could be based on different factors. These include personal trust in the project, available marginal land (or other land) that is available for transformation, or even a change of income strategy of the household. An income strategy change was for example given in the case when a household decided to open a shop. It also makes a difference if a household reported all its land or just part of it. If not all land was reported then the percentage of transition land would seem bigger than it really is.

The fact that farms with smaller land size wanted to transform larger land portions might also be connected to income generating strategies. Figure 31 shows the income strategy of 13 households and the percentage of their provided land for transition to agroforestry. As is shown in Figure 29, originally only eight farms in transition provided information on finances and thus on their income source strategy. For five more households the strategy was estimated based on personal observation and on verbal communication. These estimated farms are labelled with an asterisk. The two farms that left the project at an early stage were not estimated and included because of insufficient observation and communication.

**Figure 31:** Income strategy and percentage of transition land per household




* Estimated values by data of personal interviews.

Figure 31 shows that those farms with farming as the income strategy gave very small portions of land for transition, which is probably related to the fact that they use their land for more intensive farming. Households that rely on external income probably have more spare land they can provide.

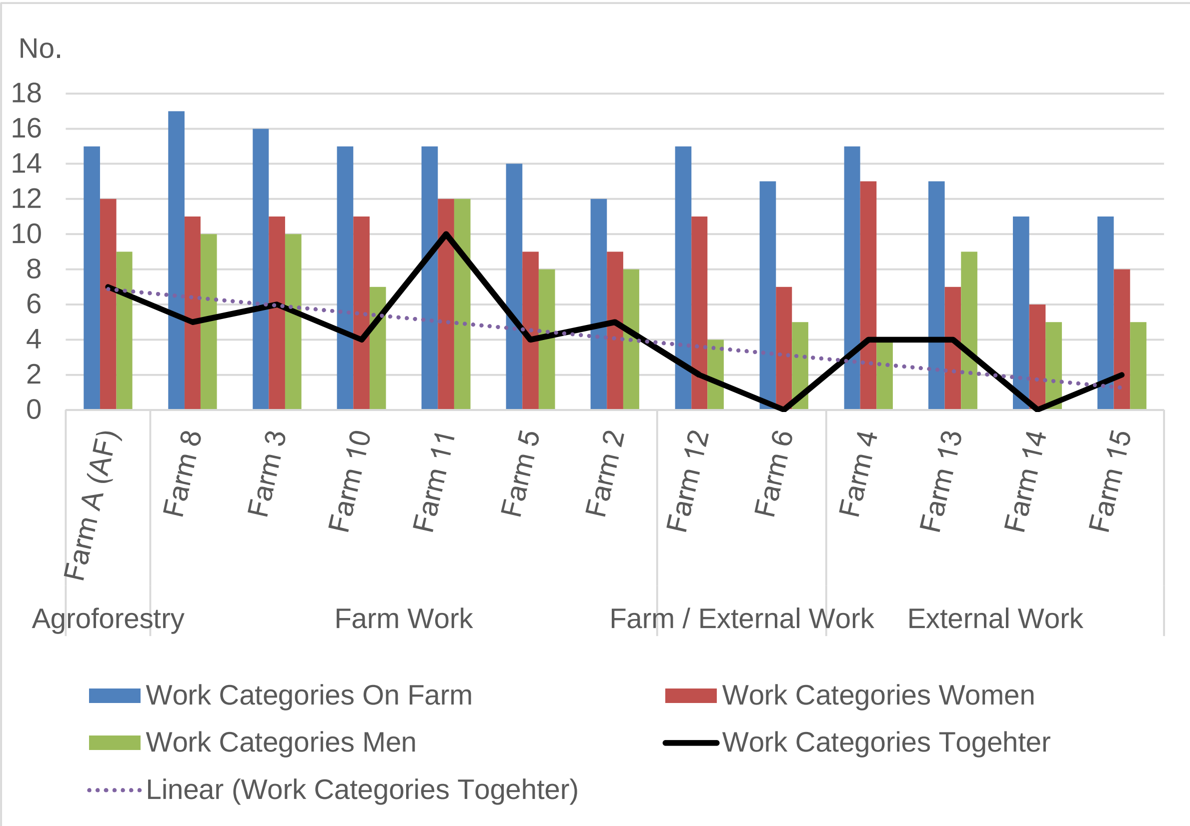
In conclusion, farmland size, size of a household and income strategies as well as size of provided transition land should not be regarded separately but as being connected. Bigger families have in most cases more land and survive on farming. Small families or families with small land sizes are more dependent on external work. Even though bigger households need to feed more individuals, they still have the advantage that they can generate income from both farming as well as external work due to the number of available manpower.

Even so, surely all participants have a farming background and knowledge about farming practices. It also might be true that farms with mainly farm income are more competent at farming or at least for the integration of new farming methods. If this is true then they might be better at estimating the amount of work that is connected to transitioning a farm into agroforestry while external source income farms misjudged the amount of necessary work.

### 5.3.2 Work Categories and Work Distribution

Project households were asked to define all work categories on their farms. This was an open-ended question without suggested categories. The stated categories are not the same in every family. The rationale for this question was to obtain information about the range of farm work.

**Figure 32:** Number of work categories in regards to income strategies per farm




On average, 14 households specified 14 different categories in farm work (compare Table 83). Naturally, families with a focus on external work income generation have in most cases fewer work categories on the farm than farms with a focus on farm work.

In addition, it was interesting to see how families divided the work between family members. The breakdown of work categories showed that in average 10 categories were carried out by women, in comparison to seven categories carried out by men.

In cases where women were mostly responsible for the farm work, like on Farm 4 and Farm 12, a relatively high number of categories were stated. This had has a psychological component because the women felt that the farm work was a very big burden as they were not being supported by their families.

According to the data collected, women do most of the work on the farm. Men also work on the farm but are in addition more often involved in external work. On average, two members per household work off the farm. Certainly, the number of persons per family that work in external work needs to be seen in relation to the total family size. Children are commonly only sparsely involved in farm work.

The extent to which categories are divided between men and women, or carried out to together, seems to be an individual choice per household, still in the farm work income strategy more work is done together.

Out of the 14 households, four had one or more family members that worked outside of Nepal. Named countries for external work were India and Dubai. Farmers stated in open interviews that the ratio of family members that worked outside the country was rising. A family member abroad, that supports its family in Nepal, is beneficial to the household's financial situation. A statement made by farmers was that in comparison to what one could earn in external work in Nepal, jobs abroad were well paid. Considering the living situation of farmers, it was asked how work abroad is organised. Farmers explained that specialised agencies in Kathmandu offer to organise work abroad. Those agencies deal with the difficult arrangement for necessary passports and visa, as well as flight tickets and work placement in the target country.

In conclusion, men, women and children work on their farms to different extents. Children focus mostly on education and are only sparsely involved. Because men often work partly or even fulltime outside the farm in external work, the women need to look after the farm work to a higher extent.

### 5.3.3 Plant Cultivation

In 2009 and 2011, the total number of cultivated plants for harvest per household was recorded. This was done with the intention of ascertaining if the number of cultivated plants that added to nutrition or income of farm households changed during the project course. In addition, it was possible to compare the plant diversity on transition farms and on the agroforestry farm.

In 2009, an average of 11 plants were cultivated per transition farm, compared to an average of 10 in 2011. On Farm A (agroforestry) 19 plants were cultivated in 2009 and 24 plants in 2011. This shows that on the agroforestry Farm A, more than double the number of different plant species were cultivated compared to the other evaluated farms in Kaule.

A slight decline of cultivated plants in 2011 compared to 2009 can be seen for transition farms. This is most likely just a variability of cultivation that changes from year to year. Several farmers stated that they are practicing crop rotation. Although there is no increase of plant diversity on farms in transition if one regards the group as a whole, on the individual level, as described in the case studies, there are differences. However, distributed perennial plants within the project did not count in this data set because farmers only reported plants that already produced a harvest, and the distributed perennial plants did not produce a harvest in 2011. Fodder plants were also not recorded. This explains in a certain extent the higher plant diversity of the agroforestry Farm because there the perennials were already part of the farming system at the project start and thus producing harvest.

The reason for the increase in plant diversity at the agroforestry farm between 2009 and 2011 is also not directly connected to the distributed plants of the agroforestry project. Next to perennials, additional vegetables like beans, potatoes and tomatoes were cultivated in 2011. A lower number of crops in 2009 at Farm A was due to participation in the training and other project activities.

In agroforestry, due to the inclusion of fruit trees and other perennials, there is soil coverage all year round, while on other farms often the land lies relatively or absolutely bare during several months of the year. Figure 33 illustrates farming terraces with no or little coverage in May 2010, and compares them in closer detail to a strawberry plantation field and an agroforestry field.

**Figure 33:** Comparison of terrace fields in Kaule

a) Terrace fields in Kaule in May 2010

b) Strawberry field in May 2010

c) Agroforestry field in May 2010

In May the monsoon season already starts. Thus, water is available and the fields are not absolutely bare like in the dry months. Still, the coverage of the agroforestry land is much denser than on conventional fields. The field coverage on Farm A keeps moisture in the soil. In addition, it enriches organic material in the soil and prevents soil depletion as shown in Table 74. This is reflected in the higher crop cultivation rate of agroforestry land compared to conventional farming (compare Table 83).

In conclusion, Farm A cultivates a much higher diversity of crops partly due to perennials. The favourable attributes of agroforestry farming are also a supposed part of the successful crop cultivation on Farm A. However, between 2009 and 2011, the project had no directly measurable effects in regards to harvested yield, neither on Farm A nor on the transition farms if regarded as a group average.

### 5.3.4 Project Trend Lines

The original intention of the indicator data collection was to describe the project development and influence on the participating farms and households. As described earlier, it was unexpectedly difficult to collect continuous data sets. Interruptions and limited divulgement of information by participants (at least at the project start) made it in most cases impossible to create a comprehensive picture of the process by comparing indicator data over time. Table 84 shows the selected indicators in order to make project trend lines visible.

**Table 84:** Overview of selected indicators

| | Soils | | | Plants | | Income / Expenses | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Soil Organic Material (%) | $N_{tot}$% | $P_{avail}$ (mg kg -1) | Survival % of total plant species (2009 - 2011) | Survival % of total plant quantity (2009 - 2011) | % Income from farm work (2010) | % Income from external work (2010) | % Expenses food (2010) | % Expenses construction materials (2010) |
| Farm A (AF) | 3.17 | 0.063 | 101 | 88 | 67 | 55 | 45 | 35 | 5 |
| Average Transition | 1.60 | 0.018 | 53 | 54 | 12 | 48 | 49 | 65 | 3 |
| Farm 1 | - | - | - | 0 | 0 | - | - | - | - |
| Farm 2 | 2.79 | 0.014 | 56 | 74 | 25 | - | - | 62 | 4 |
| Farm 3 | 1.74 | 0.028 | 59 | 88 | 25 | 81* | 17 | 38 | 0 |
| Farm 4 | 1.60 | 0.007 | 41 | 65 | 7 | - | - | - | - |
| Farm 5 | 1.41 | 0.021 | 41 | 70 | 15 | 84 | 16 | 74 | 0 |
| Farm 6 | - | - | - | 43 | 12 | - | - | - | - |
| Farm 7 | - | - | - | 0 | 0 | - | - | - | - |
| Farm 8 | 0.98 | 0.014 | 53 | 45 | 8 | 55* | 21 | 36 | 0 |
| Farm 9 | 2.27 | 0.035 | 72 | 26 | 2 | - | - | - | - |
| Farm 10 | 1.48 | 0.014 | 73 | 83 | 14 | 20 | 80 | 73 | 0 |
| Farm 11 | 1.70 | 0.007 | 47 | 74 | 17 | 82 | 18 | 89 | 0 |
| Farm 12 | 0.75 | 0.018 | 25 | 52 | 7 | 51 | 49 | 51 | 20 |
| Farm 13 | 2.29 | 0.035 | 58 | 50 | 12 | 1 | 99 | 85 | 0 |
| Farm 14 | 0.59 | 0.014 | 85 | 64 | 10 | 9 | 91 | 76 | 0 |
| Farm 15 | 1.61 | 0.014 | 21 | 75 | 30 | - | - | - | - |

* The household took out a loan.

From all the collected indicators, the data row of plant or plant species survival from 2009 to 2012 is the most complete data set available. Thus, plant species survival was selected as a basis for formation of groups due to performance in plant cultivation and an attempt was made to correlate it with other fields like farm income strategies.

In Table 80, the percentage of plant and plant species survival of 31 different distributed species of agroforestry plants, seedlings and seeds is shown. Because the germination rate of seeds helped determine the number of plants which every single farm started with in 2009, comparison was difficult due to the diverse starting conditions. It was therefore decided to compare species survival of 13 distributed perennial species (see Figure 22) between the households. In total, every household received about 100 single plants within these 13 species. In this way, the number of plants and plant species that all farms started with in 2009 was the same.

**Table 85:** Group classification related to plant species survival until spring 2012

| Group | Participant | No. of species that survived | Average % of distributed plants that survived |
|---|---|---|---|
| **Agroforestry** | Farm A | 12 | 73 |
| **A (10 – 13 species)** | | | |
| **≈ 80 - 100 %** | Farm 3 | 13 | 63 |
| | Farm 10 | 13 | 59 |
| | Farm 2 | 10 | 48 |
| | Farm 11 | 10 | 34 |
| **B (6 - 9 species)** | | | |
| **≈ 50 – 70 %** | Farm 15 | 8 | 43 |
| | Farm 13 | 8 | 32 |
| | Farm 12 | 8 | 30 |
| | Farm 14 | 8 | 29 |
| | Farm 6 | 7 | 32 |
| | Farm 5 | 7 | 30 |
| | Farm 4 | 7 | 22 |
| **C (1 - 5 species)** | | | |
| **≈ 10 – 40 %** | Farm 8 | 5 | 23 |
| | Farm 9 | 5 | 23 |
| **Broke off from project (0 species)** | | | |
| **0 %** | Farm 1 | 0 | 0 |
| | Farm 7 | 0 | 0 |

Table 85 shows the number of plant species that survived, and the percentage of plant survival within the 100 single plants and 13 different species for 15 households and Farm A. In the table below, the farms are subdivided into groups based on the number of species that survived.

Group A is defined as participants on which 10 to 13 species survived on the farm; Group B on which 6 to 9 species survived; and Group C on which 1 to 5 species survived. All numbers are until 2012. Two participants left the project in autumn 2009 because they did not plant the distributed plants on their own land.

**Table 86:** Selected interview values assigned to group A, B and C

| | | Total Land Area (ha) | % of Total Land for Agroforestry Project | Total Nr. of Household Members | Total No. of Work Categories * | No. of Work Categories for Woman | No. of Work Categories for Man | No. Work Categories Children * | No of Household Members who work outside Farm | Work outside Nepal | Total No. of Cultivated Plants 2009 | Total No. of Cultivated Plants 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Group A** | | | | | | | | | | | | |
| 1. | Farm 3 | 0.6 | 5 | 14 | 16 | 11 | 10 | 2 | 3 | no | 7 | 12 |
| 2. | Farm 10 | 0.6 | 5 | 4 | 15 | 11 | 7 | 2 | 1 | yes | 5 | 5 |
| 3. | Farm 2 | 1.11 | 6 | 11 | 12 | 9 | 8 | 0 | 3 | India | 12 | 10 |
| 4. | Farm 11 | 0.76 | 5 | 8 | 15 | 12 | 12 | 3 | 0 | no | * | 10 |
| | Average | 0.77 | 5 | 9 | 15 | 11 | 9 | 2 | 2 | - | 8 | 9 |
| **Group B** | | | | | | | | | | | | |
| 1. | Farm 15 | 0.65 | 7 | 2 | 11 | 8 | 5 | 0 | 1 | no | 10 | 4 |
| 2. | Farm 12 | 0.55 | 15 | 6 | 15 | 11 | 4 | 2 | 2 | no | 10 | 6 |
| 3. | Farm 13 | 0.38 | 34 | 4 | 13 | 7 | 9 | 1 | 1 | no | 8 | 6 |
| 4. | Farm 5 | 1.16 | 9 | 14 | 14 | 9 | 8 | 2 | 4 | no | 11 | 22 |
| 5. | Farm 6 | 0.4 | 57 | 4 | 13 | 7 | 5 | 3 | 1 | Dubai | 12 | 14 |
| 6. | Farm 14 | 0.6 | 13 | 5 | 11 | 6 | 5 | 1 | 1 | no | 13 | 10 |
| 7. | Farm 4 | 0.34 | 23 | 5 | 15 | 13 | 4 | 5 | 3 | no | * | 6 |
| | Average | 0.58 | 23 | 6 | 13 | 9 | 6 | 2 | 2 | - | 11 | 10 |
| **Group C** | | | | | | | | | | | | |
| 1. | Farm 8 | 0.76 | 22 | 5 | 17 | 11 | 10 | 1 | 0 | yes | 8 | 12 |
| 2. | Farm 9 ** | 1.51 | 3 | - | | - | - | - | - | - | - | - |

* No data provided. **Movement to another land during the project.

To compare the group members in order to find similarities, the interview survey is arranged according to the group order in Table 86.

Comparing the values of these three groups seems at first quite disconnected. However, in Group A one can notice that all group participants only assigned small portions of their total land for transition.

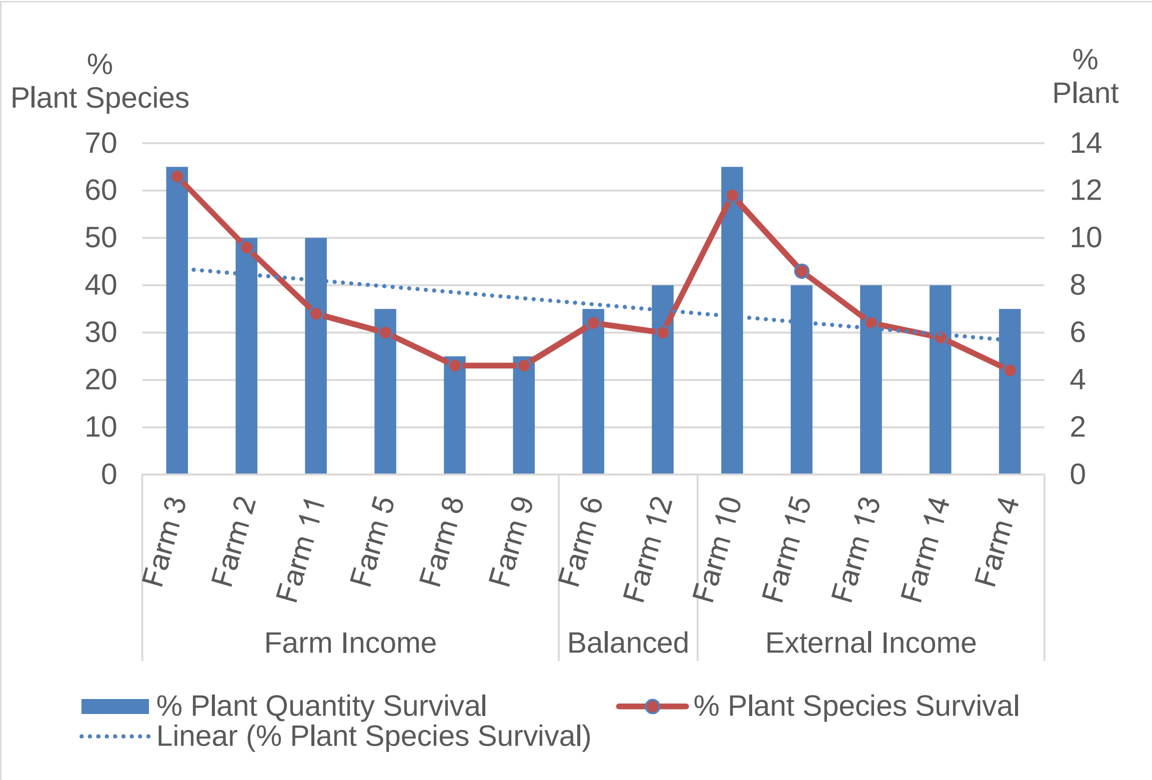
On average, Group B farmland sizes are smaller than those in Group A. The percentage of assigned land for transition is, at 23 %, nearby five times higher than the average of Group A.

Work categories for Group B are on average also less than in Group A. This is probably connected to the focus on external work. Interestingly, the average of cultivated plants for harvest in 2009 and in 2010 are in Group B higher than Group A. Especially in 2011, this is connected to farm 5's high cultivation rate, being the only group member focusing their income on farm work.

Group C consists of two members, whereof one changed farm during the project and was thus only partly included in the evaluation. The reason why Farm 8 performed quite poor in plant survival is not understood and rather surprising due to his project participation and interest. It is assumed that there were unknown personal family matters that required time and drew attention away from plant maintenance.

Most of Group A members focused on farm income and the majority of Group B members focussed on external work. Both farms with balanced income strategy are part of Group B. Group C includes two households focused on farm income. The previous chapter showed that the farm income strategy is one underlying and connecting link between different elements of household constructions and performances. In the next step in Figure 34, farm income strategies and plant survival are compared.

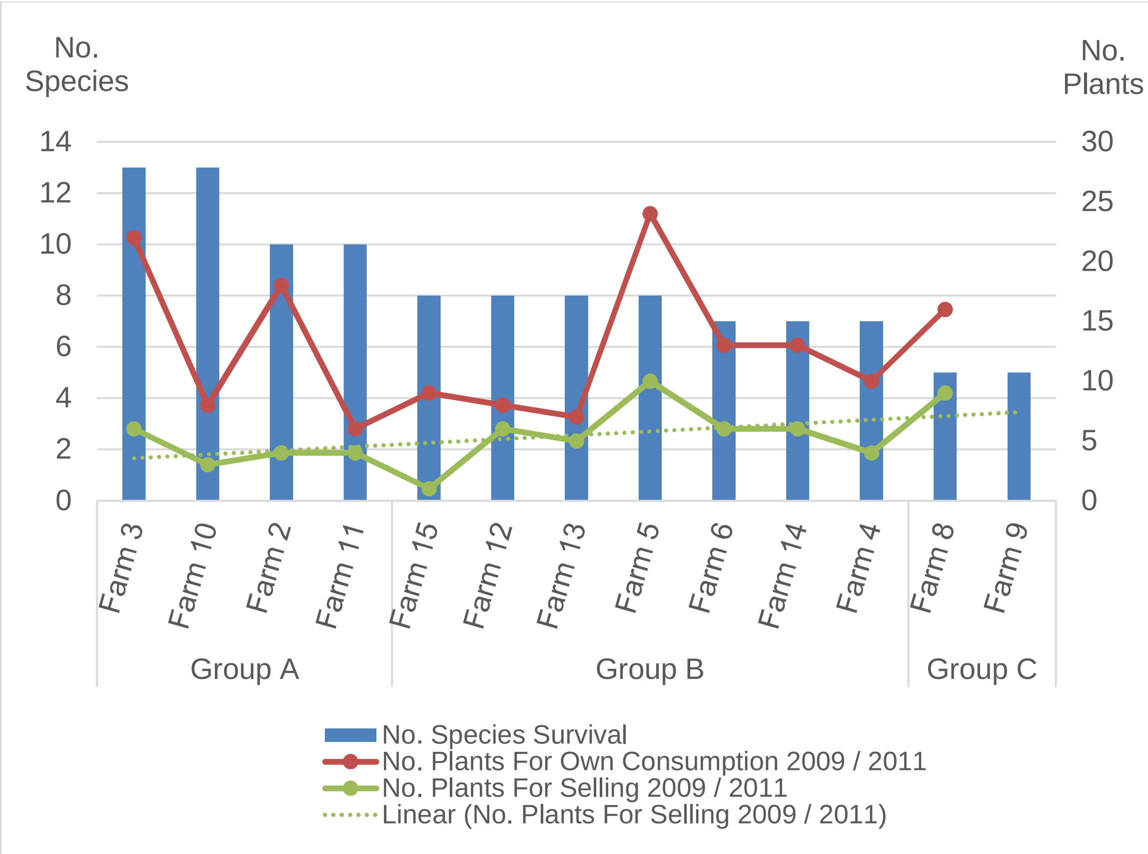
**Figure 34:** Farm income strategies and plant survival from 2009 to 2012



The only group member, Farm 10 that is external work focused in Group A Farmer 10 is a cousin of Farmer 3. Both households are located directly next to each other. The families worked together and achieved a comparably good result in plant cultivation.

The trend line in Figure 34 also shows that in general more plants survived on farms that focused on farming for livelihood sustenance. Exceptional to this are Farm 5, Farm 8 and Farm 9. Farm 9 and Farm 8 had assumed underlying personal reasons why plants diminished, as described above. Farm 5's household was during the whole project very focused and engaged. The result in this case was probably the most surprising one. In Figure 35, species survival is compared to harvest use either for own consumption or selling in 2009 and 2011. Here it becomes obvious that Farm 5 cultivates a particularly high number of plants for both own consumption as well as selling. Eventually he just concentrated on plants other than the 13 evaluated species.

**Figure 35:** Comparison of species survival and use of harvest




The trend line of cultivated plants for selling is ascending in Group B compared to Group A. This shows that farm income focused households cultivate fewer plant species but most likely more quantity of cash crops.

Finally, this data was compared to soil data to see if they were correlated. Surprisingly, no trend was found.

In conclusion, farms that focused on farm income generation assigned less land for transition to agroforestry in most cases. These farms were more successful in the plant cultivation of 13 provided agroforestry perennial species than other farms. Both farms that focused on external and farm work income production or only on external income production assigned on average a bigger portion of their land to transition. They were, however, less successful in plant cultivation.

Farm income production is often focused on cash crops like strawberries or radish. For this, bigger plain areas are needed to be able to cultivate a sufficient quantity. Even so, farms with external income production also cultivate plants for selling; these are often more diverse and cultivated in smaller amounts.

Farmers that are used to cultivating cash crops are better at evaluating the income that can be produced by such plants. Perennials that were distributed were mostly fruit trees. Fruit are expensive and can generate income. It was noted that successful farmers cared better for their plants because they assessed their value.

In some exceptional cases to above described trends, personal family matters influenced the results. Apart from plant cultivation, income source strategy and size of transition land, no connections were found to other indicators.

# 6 Discussion, Conclusion and Outlook

## 6.1 Discussion and Conclusion

The goal of the agroforestry project is to introduce agroforestry as a farming system in Kaule, starting with 15 farms that transformed part of their land to agroforestry, and one existing agroforestry farm. The existence of an already well established agroforestry farm was the reason why Kaule was considered an adequate location to start such a development project. The establishment of an agroforestry system takes time, as trees and other plants need time to grow into their full potential. The presence of an existing agroforestry farm provided an example of what can be achieved after the long initial time of establishment. Without this example, it would have been hard for farmers to understand or estimate the possible yield of the project and motivation would most likely have faded away before the project finalisation. This already happened several years before when another organisation tried to establish agroforestry in Kaule. At that time, farmers left the project because they were not able to imagine the projects outcome. The combination of the existing agroforestry farm, an intensive theoretical and practical training on agroforestry, and extended project monitoring, was the basic concept of the project.

The agroforestry training was designed as a training of trainers (TOT) provided by the Nepal Agroforestry Foundation (NAF). It was important that a local organisation was hired for the training because one needs to consider the cultural and social background of all participants. A foreigner would not be able to understand and empathize in such a way as a native person could.

The monitoring was made up of two parts: the first part was the attendance in the field regarding planting of agroforestry plants and nursery establishment. The second part was monthly meetings that allowed discussion within the group in order to understand problems, needs and to plan additional workshops together. The monitoring in the field is displayed in the results and the monthly meetings gave insights and allowed an understanding with which to link observations and to explain the situation of farmers, and the development of the project.

In 2009, only the agroforestry Farm A practiced agroforestry in Kaule, but many other farmers expressed their interest to learn agroforestry at this time. Initial open interviews (see Tables 7 to 13) were carried out before the project start to understand the general situation of farmers in Kaule, including their basic problems. The biggest problem was mainly a lack of income, and related problems like the livelihood of families including food supply, insufficient health care and low levels of education, which reduces other opportunities for their children when farming cannot supply livelihood to families any more.

To minimise risk and to handle the project with the given project resources, it was limited in participation to 15 families. The idea was that those 15 participants as a focal group received TOT training and later could share their knowledge with other interested farmers.

With the goal of understanding the influence of agroforestry on farmers' living situations, different indicators and interviews were employed. Participant observation helped to understand living in Kaule on a deeper level.

### 6.1.1 Determined Problems in Kaule

Interviews revealed that to live as a farmer in Kaule involves certain problems, whereof some are increasing over time.

The size of farming land per family is decreasing in many cases, due to estate distribution between sons. Nowadays, the farmland that is owned by a family is often not large enough to sustain the livelihood of that family. As a result, an increasing rate of farmers work additionally outside their farms for extra income. More people are also working abroad to sustain their family's income. As described in the introduction, the final development is that families need to leave their land and move to Kathmandu. If relatives cannot bolster them, this could end in homelessness. The acquirement of new land is very costly and not affordable for most farmers. Selling of their own land would allow a greater revenue for families but leave them without a basis and with the above-described dangers over the long run. As land prices are constantly rising, it would appear a better investment to keep the land. Future prognosis by members of NAF was that farmers with land situated directly next to the main road would probably sell it in the future because the offers will be too tempting. In their opinion, it would be better not to include such farms in the project, as the land will be cleared anyway. Still it was decided by the project not to exclude them, with the hope that agroforestry activities could ease the situation of farmers and prevent them selling their land.

Besides, smaller land sizes, a depletion of soils additionally results in lower harvests. Soil testing in Kaule showed that in general soils are in such a bad state that it makes one wonder how the actual yields can be achieved.

Wild and domestic animals hinder farming. Because fencing of land is not common, some households let goats graze on neighbouring fields. This is also the reason why natural resources like leaf litter in community forests are quite decimated. Often farmers reported that their neighbours cut young agroforestry plants because they were not aware of them when they were collecting fodder for their buffalos. Summarised it can be said that especially during dry months the source of nutrition for the livestock is very limited. Than pressure on and competition for fodder raises and plants are in higher danger. Next to domestic livestock, wild animals are also a serious problem for farmers. Monkeys, for example, destroy the harvest or even the whole plants when they wander in groups over the fields. Because monkeys resemble Hanuman, the monkey god, it is against the law to harm them, so all a farmer can do is try to chase them off his land.

Next to land and farming issues, farmers also have to deal with rising living costs. Living is already costly if additional goods and services for nutrition, healthcare or education need to be purchased. Especially food and essential commodities are slowly but constantly becoming more expensive over time. Payments for harvests, on the other hand, are not satisfying according to farmer statements. Increasingly, loans are needed to fill temporary financial deficits that might occur due to a poor harvest or a pest attack.

Farmers do not have the spare time to increase efforts on the farm or on external work.

During the participatory study phase between 2009 and 2011, at least three persons committed suicide in Kaule. Villagers explained that this is not unusual as living circumstances are sometimes too hard for people. Reasons were not evaluated in deeper detail but the above described circumstances might be part of it.

Project participants explained that they would invest in more land, bigger houses, better animal shelter and child education if they would earn more money. This seems to be the most evident required needs of farmers if they would like to go on living of farming.

### 6.1.2 Family strategies to address livelihood pressures

Farmers in Kaule developed different strategies to face the above problems. The strategies they use depend on several factors like land size, family size, level of education, employment and others.

While evaluating project data it became clear that the income strategy of households seemed to be the underlying issue in the sense of household and project performance. It needs to be distinguished between a family focusing on farm income generation, or on external work income.

When family and land sizes were compared, it became clear that bigger families usually have bigger land sizes. Households with bigger land sizes are usually producing their main household income from farm work. Small families or families with smaller land sizes are more dependent on external work.

As described earlier, land sizes are getting smaller. It is assumed that families with numerous members build family units including parents, their sons and wives. In this way, land is not divided but stays combined. The usual way would be that only the oldest son stays with his wife in the farmhouse, while other sons receive part of the family land and move out.

The spatial coherence allows the cultivation of bigger crops. Often farms that focus on farm income cultivate fewer different plant species for selling than other farms. They concentrate on fewer cash crops like strawberries, radish or rice and produce bigger quantities in this way.

Even if a household has a clear focus on farm work income, some family members may still work off the farm. More workforce is available due to the family size. This adds to the income thus helping to support the household.

Farms that focus on external work need to be subdivided into two categories: Households that survive on more secured long-term jobs, and households that work in occasional part time work. Employees of the first category usually work as a teacher, tailor, carpenter or secretary and have in most cases a higher education, in some rare cases even a university degree.

Households that survive on occasional jobs have little or no specialised education. These work categories are jobs on construction sites, as a bus driver or as a housekeeper. In occasional jobs, times with no employment might occur if there is no demand.

A third but minor group were households that have a balanced focus on both farm work and external work. The agroforestry farm follows this strategy. It has the advantage that both income sources lessen the threat of either a loss of harvest or job.

In several of the evaluated fields, a connection between income strategy and performance was found.

Farm work is distributed between household members. Some work categories are done by women, and some by men. This is again due to diverse factors. A traditional example is given in the planting of potatoes. Only men are allowed do this. None of the project's participating farmers could explain the underlying reason for this tradition. However, their ancestors passed it on and farmers keep to this tradition like to many others. This is a good example of how farmers' lives are connected to traditions and religious aspects. These influences are the most difficult to understand by foreigners as even natives often cannot explain them in deeper detail and only priests may know the background. There are many (more or less noticeable) rules based on traditions. Following these traditions is an important source of social identification, especially in a caste system like in Nepal. Foreigners need to be attentive in respecting them. This is an important factor for developing respectful relations with the project members and the whole village as a basis for a mutual project development and performance.

Men mostly carry out work categories that include very hard physical labour like ploughing or terrace construction.

In some households, work is relatively equally distributed between men and woman. This is mainly the case on farms that concentrate on farm income production.

In households with a focus on external income, the women are mainly responsible for farm work while the men earn money in external work. However, there are exceptions to this trend. Especially in the younger generation, some women have a higher education. In such cases, they are responsible for the total or a significant part of external income. This is also the case for balanced income source farms.

Children generally focus on school and education, and are only very sparsely involved in farm work. When children did not go to school, which was the exception, they were only involved to a very low extent. Reasons for not going to school were either mental or physical constraints, or the fact that parents also have a low education and do not see the importance of education. If children have mental or physical constraints then there is no external help for the parents. In these cases, handicapped children seem to be hidden and do not take part in official events.

### 6.1.3 The Black Box Influence on Project Implementation

During the project period in 2009 to 2011, many unforeseen incidents happened. These incidents influenced the data collection and sometimes even the project design. The surrounding influences on a field study make every study unique and unrepeatable. When a project is planned and set up, results are usually anticipated. During the project time, there will naturally occur unforeseen influences. This is like a black box that makes it impossible to forecast a project's success. The black box contains conditions in the social and environmental fields. The processing of a project also depends on the black box content. This means that a project with the same set up could be successful the first time, but unsuccessful the second time due to external influences.

During the project's course, Nepal went through a strong political transformation. The kingdom was discharged and a newly built democracy needed time to develop, and unforeseen social and political disturbances occurred. General strikes and uncertainties about political developments were part of farmers' everyday life. Sometimes, members of political parties tried to threaten farmers into participating in demonstrations in Kathmandu. General strikes stopped traffic and the external supply or export of goods for variable periods several times. No one could work during this time and everyone stayed in or near their house. Political party members sometimes wandered around and tried to intimidate individuals with other opinions.

Sometimes weather conditions like strong rainfalls or hail during the monsoon time made it impossible to farm the fields and kept participants at their houses.

Another underestimated fact was the number and duration of festivals in Nepal. These altered the daily routine repeatedly during the project time. This is a good example of how a foreigner may not be well enough informed or familiar with local conditions. This needs to be considered in project planning and implementation.

Other factors like the cognition or assessment of general social values or rules are also a key to successful or unsuccessful collaboration and project implementation. It was explained by locals that in Nepal, a person is perceived to be bright and clever in a positive way if he or she tells lies in a way that brings personal advantages, either in a financial or in a practical way. In Germany, lying for one's own advantage is also not uncommon, but regarded socially as negative. Another example is the perception and value of time. In Nepal, people will arrive when they have finished their previous activity (i.e. not always on time), while in Germany one tries to keep on time no matter what. Being late in Germany is regarded as disrespectful. In Nepal, it is not regarded in this way, or at least not to the same extent. More likely, someone who is late is a very busy person and thus important. As a foreigner, it takes a time to notice such different social values, and can be the source of disappointment and misunderstanding while working together.

These examples and a multiplicity of other factors play an important role in the success or failure of a project.

### 6.1.4 Comparing Agroforestry and Farms in Transition

Finally, the original plan to compare data on project development was altered because it was not possible to collect continual data sets. With the collected data, it was still possible to compare agroforestry to farms in transition, which gives a deeper insight into the farmers' situations and makes it possible to evaluate whether agroforestry can be a helpful tool to improve farmer livelihoods. This collected data can also be compared later to ongoing project development.

#### 6.1.4.1 Soil

Collection of soil data on certain selected attributes was chosen as an indicator to compare the soil of the agroforestry farm to soils of farms in transition and to look into the project's effects on soil quality. Altogether, in comparison to other farmers' soil, the agroforestry farm is clearly in better condition for all measured parameters. Still, the soils of all farms in Kaule are in a poor state, especially in terms of total available nitrogen. Enhancement of nitrogen content should enhance directly the harvest yield. Arrangements to lower the acidity of soils could also further enhance soil quality. A high concentration of phosphorus might be connected to the acidic soils but usually does not harm plants.

Considering that soils are the essence for good farming, it was interesting that farmers believed that under the soil is more soil and that they have an endless source. There was little awareness of soil degradation. During the training, it became clear that farmers heard for the first time about nitrogen, phosphorus, soil organic matter and other soil quality factors. A trial with green manure was not very successful because it was hard for farmers to understand why the plants should stay on the field rather than to be used for feeding their livestock. As agroforestry is obviously favourable for soil quality, it could theoretically be a good way to improve the soil situation in Kaule. However, soil betterment would take a long time. To help in this tradition, training on liming and mineral fertilisation could help to smooth the difficult starting conditions.

#### 6.1.4.2 Biodiversity

Poor soil quality, plant cultivation and floral as well as faunal biodiversity enhancement are closely linked to each other. To evaluate the biodiversity status, soil living insects were chosen as an indicator. The idea was to investigate if denser plant cultivation (as was assumed to occur with agroforestry) might influence the appearance of coleopteran species. Kaule seemed to be suitable for such investigations, as the national park is very near. This provides a resource of insects for recolonization. This indicator was the most work-intensive and maybe the most ineffective of all. Coleopteran life cycles follow a very narrow time line and surrounding disturbances affect traps to a high degree. Insufficient data sets thus did not allow for a meaningful analysis. However, the darkling beetle *Gonocephalum* is described to be an indicator for ecosystem status as it appears in higher numbers in disturbed systems. Due to its lower numbers, the ecosystem status of the agroforestry farm seemed to be in a better status than other tested farms, which goes hand in hand with the other indicators like soil quality and plant diversity.

#### 6.1.4.3 Plant cultivation

Plant cultivation was chosen as an indicator, because it is directly connected to the agroforestry project and one of its focuses. The agroforestry farm had a much higher diversity of cultivated plants than the other farms. This is on the one hand connected to the integration of perennials, and, on the other hand, to the three-dimensional layer structure of agroforestry that allows trees, shrubs and vegetables all to grow on the same land. In addition, plant survival is favoured by better soil and ecosystem status of the agroforestry farm in comparison to the other farms. These factors provide a better starting position for seedlings. Finally, the agroforestry farmer was more experienced in diverse plant cultivation. Although all participants have a farming background and knowledge about farm practices, it might be that farms with a focus on farm income are more competent than farms with a focus on external income sources.

Many plants were distributed within the project and in light of the plant and plant species survival rate, one gets the impression that distributing fewer plant species with more attention on their cultivation would have been more effective. Plants were distributed without charging any fees at the project start in 2009. Later on, it became clear that free plants do not have the same value as a plant that has a price. From 2010 onwards, farmers had to participate with some rupees (a few euro cents) when new plants were purchased. If these plants survive to a higher extent will be seen over time.

All in all, between 2009 and 2011 the project had no direct measurable effect in regards to harvest yield, neither on the agroforestry farm nor on transition farms if evaluated as a group and not on the individual farm level.

A later visit of the farms in 2014 showed that farmers did have new income sources through crops that were introduced. Farmers harvested lemon grass, kiwi, asparagus and other distributed plants. The amount of harvest for certain crops was too small for selling and was therefore consumed by the household. Other crops like lemon grass that was mixed with tee generated some income. In autumn 2014, it was foreseeable that, from the following year on, also kiwi would likely be harvested in sufficient amounts for selling.

#### 6.1.4.4 Income/ Expenses

Data on income and expenses helped to understand the income generation strategies and sources of expenditures for the different farms.

The agroforestry farm had a better financial situation than other farms in 2010. The income and as well the expenses of the household were higher than the others. Expenses were on everyday living costs but also on farm investments. In the end, the household balance of the agroforestry farm was positive and the household did not need to obtain any loan. Income was balanced by farm work and external work. This was possible even though the farm is smaller than the average of the other farms. 2010 is a representative year for the periodical income surplus of the agroforestry farm, which occurs due to timber sales.

The picture of other farms is more diverse. Only one other farm had balanced income sources from both farm work and external work. The financial situation in this case was one of the worst. However, in this household it is most likely related to personal family matters and not necessarily to the income strategy. This is an example demonstrating how project performance might also be related to personal circumstances.

The farms of highest income after the agroforestry farm were those that generate income by a clear focus on farm work. The sale of cash crops played a big role. If sufficient land is available, farming focused on cash crops seems convenient to sustain the family's livelihood, even if the family has many members. The question is how long it can continue if the family size expands further. Finally, either the land needs to be split again to build more households, or more family members need to work in external work.

After the balanced combination of agroforestry farming and external income sources, a focus on farm income seems to be the better livelihood strategy for the moment. However, it is not always possible to combine the land of several family members under one household in order to create sufficient land for cultivation.

If the land is small and a better education is given to family members, external work can be a good alternative to assure a good livelihood. Nevertheless, job offers are limited in the small infrastructure of the village.

The worst financial cases occur if a family is reliant on external work and that work is on an occasional basis. In this case, the income source is insecure and poor livelihood conditions easily occur. Often this goes hand in hand with a low educational level that is in some cases also passed on to the children. This seems to be a downward spiral and often does not give much hope for improvement.

The best long-term strategy seems to be the association of different land parts between households for cultivation. However, this is most likely only possible within families because otherwise arguing might be pre-programmed. If this is not an option, then a balanced income source on a higher educated level as well as farming seems to create a more stable and secured situation. Agroforestry, if successfully implemented, could be very helpful for livelihood security because it allows gaining reasonable income by farming even if cultivated on limited land. A combination of agroforestry and higher educated external work could help families to gain a better livelihood.

The fact that household balances were in nearly all cases negative could indicate that not all data on income and expenses were reported. A general level of mistrust and the wish to avoid deeper insights into private matters is a comprehensive explanation why only half of the farmers provided data on financial matters. Another reason for incomplete datasets might be that some farmers are illiterate and thus not able to document data by themselves.

#### 6.1.4.5 TOT

Farmers accepted the TOT agroforestry training very positively, even though the training was challenging and too technical in some cases. Still, farmers got many new ideas and information. For the future, farmers would like lessons that are more practical, and the additional inclusion of several other topics as well as longer expert monitoring and attendance on the fields. In 2013, several farmers shared their lessons and experiences to other interested farmers in the surrounding villages. The training was a one-day information workshop in which the basis of agroforestry was explained. In addition, every participant of the new group received some tree seedlings.

The event made clear that the TOT training received by the focal group in 2009 was most likely not sufficient to provide the self-confidence needed to train others. This was because most farmers did not want to do so and felt shy. More training in how to train others would be needed to install a regular person to give agroforestry training. In addition, trainers could be more motivated if they could earn some income in this way.

### 6.1.5 Project Trend Lines

When indicator and interview data were compiled in a grouping framework based on plant species survival rates, two clear trends crystallised:

a) Farms that focus on farm income generation were more successful than those farms that focused on external work income.

b) Farms that performed better in plant survival rates assigned less land for transition to agroforestry, and farms that performed worse assigned more land for transition to agroforestry.

Farms that focused mainly on farming, rather than on external work, performed better in plant cultivation than others did, perhaps because their attention is targeted on plant cultivation anyway. In this case, several family members work together on plant cultivation, while on farms focussing on external work, often only the women (sometimes only one woman) are responsible for all household and farm work. In addition, farms that cultivate cash crops for income generation might be better in evaluating the value of such plants. Eventually, successful farmers cared better for their plants because they better assessed the income potential.

Farm income is often focused on a few cash crops like strawberries or radish. Bigger flat areas are needed to cultivate a sufficient quantity of those crops. Even so, farms with external income generation also cultivate plants for selling; in these cases, often more diverse species are cultivated in smaller amounts. In this way, external work focused farms might have more spare land.

As most households with an external work income strategy were in a poor financial situation, bigger land sizes might have been assigned for transition to agroforestry out of some kind of desperation or hope for a betterment of their livelihood by the project. Especially if they have Farm A as an example in mind that has a positive livelihood situation, even so its land is rather small sized and income is partly earned external.

### 6.1.6 Hypothesis Assessment

At the start of this thesis, hypotheses were phrased to describe expected project outcomes and to finally evaluate whether project expectations were met. In the following section, the hypotheses are considered one by one against the project findings.

*Changes in the socioeconomic basis of farmers through implementing agroforestry in comparison to remaining in subsistence farming.*

- Agroforestry enhances a farmer's market for selling goods due to a higher plant diversity.

In Kaule, agroforestry increases the goods available for the market due to higher crop diversity. The amount of crop production for the market was on the agroforestry farm four times higher in 2009 and 2011 than the average of the other farms. In addition, new plants like herbs and fruits that are not cultivated by other farmers added to the general market offer. Additionally, the plant survival rate of newly introduced plants and plant species was the highest on the agroforestry farm. Whether or not agroforestry enhances plant diversity depends on the applied agroforestry system. However, in Kaule, the agroforestry system of Farm A clearly achieved this criterion.

- Conversion of conventional farming to agroforestry increases income and decreases expenses for farmers.

An increase in income can be expected if agroforestry is successfully established in a way that resembles Farm A. An increase in income would especially be the case for households that have an income focus on external work or on a balanced mixture of external and farm work. Because they generally have a lower income, the enhancement would be even clearer.

Anyway, even if it would have been possible to collect sufficient data for a time line of income development, a decline of income data would have been found in the beginning. This is because at the start, unforeseen difficulties might occur that influence income and expenses. The establishment of an agroforestry farm needs a longer time for being evaluated because the system needs a long time for its establishment.

The agroforestry farm not only had a higher income but also higher expenses. Expenses included everyday living costs for several areas but they also include higher investments in the farm in order to further its development. Because of this, the second part of the hypothesis can be disapproved. It was assumed that expenses decline because plant cultivation for own nutrition is included in agroforestry and could lower expenses if less items need to be bought at the market. The data showed that if higher income was generated, more likely also the expenses would increase. Farmers stated that they would invest in bigger houses, more land and children's education.

- Working hours on the farm and the necessity of external employment will be reduced.

The study showed that a mixed income by farming and external employment is probably the most favourable livelihood strategy for families without big farms. Whether external work is necessary is rather a question of land size than of the farming system. However, agroforestry can help to generate income by farming even on small pieces land and, in this way, less external work is required than if no farm income is produced.

Farmers save time if they do not need to collect livestock fodder outside their land because it is included in agroforestry cultivation. The cultivation of many diverse species, on the other hand, is most likely more time consuming than cultivating one or two cash crops. In this sense, the working time directly on the farm is probably the same. It was not perceived that family members of the agroforestry farm had more spare time than of the other farming families.

*The impact of agroforestry on the ecological system in comparison to conventional subsistence farming with lower plant diversity.*

- System change towards agroforestry enhances biota diversity in the project area.
- Agroforestry enhances organic material in soils and helps to improve soil quality.

This study showed that agroforestry has a much higher plant diversity than other evaluated none agroforestry farms in Kaule. Even though the beetle indicator was not very strong, a tendency could be found that also the faunal ecosystem is in better conditions than on other farms. Soil data also revealed a better soil status of the agroforestry farm compared to the other farms. As soil quality, plant growth and ecosystem status are closely linked, agroforestry as carried out at Farm A is clearly favourable for soil and diversity.

*Sustainability and dissemination of introduced methods by agroforestry training.*

- TOT (Training of Trainers) training empowers and motivates farmers to circulate information.

In 2012, after the time of the here presented work, two farmers of the original group gave an agroforestry introduction lesson to other interested farmers of neighbouring villages. In the scope of this lesson, they explained the principle of agroforestry and they distributed tree seedlings to other farmers. It needed some encouragement by the group for them to give the training, because everyone of the original group felt shy. Even if the TOT training was designed in a way that participants should be able to train others, a three-week course is probably not enough. This is especially the case if one considers that farmers are not used to teaching and some of them did not attend school. It is probable that without external help, the training or information diffusion to others will not become an autonomous process. However, the practical aspects of the TOT was convenient and training was in the end given on to others. The quality of this training, however, was not evaluated.

- Group formation and registration facilitates motivation and activity of project participants.

The group formation was the basis of all later project performances. Without monthly group meetings, intensive discussions, and group activities the project would not have been possible. The registration of “Kaule ev Nepal” was originally done for legal reasons but over the time it proved to be very important for the group perception. When they built their own board, opened their own account and later even designed group membership cards and collected member fees, it became clear that the group identity is important for the members. In this way they are visible to other villagers and not just dependent on foreigners. After this project phase was finished in 2011, the next project phase started in 2012 and it concentrated on the development and fostering of group activities of “Kaule ev Nepal”. The local organisation finally applied successfully for funding from the German embassy for the construction of toilets. At this point in time, the activities are still not total autonomous but with attendance of Kaule e.V. in Germany. However, the local organisation is constantly growing. If the organisation can survive with no foreigner involvement only time can show. The registration of an organisation is in Nepal even more complex than in Germany. For farmers it is often very hard to fulfil all the bureaucratic requirements. Nevertheless, the formation of a local group seems to be a way in which over time the project eventually could become independent. At least it is supportive of this process.

The reason why individuals are participating in the group are manifold. The project produced several visible outcomes like fishponds, a new water system, toilets, burning facilities for trash and several others. The focal farmers are most likely proud to be members of an organisation that until today has existed for 5 years. Other newer members might be curious. Of course, the wish to get rewards of the project will be a strong motivation for all members. Foreigners are in their eyes a financial protection.

The group formation was one of the underlying activities that helped to give a structure and that offered a stage for project development. In this way, it clearly added to the motivation and activity of the project members.

### 6.1.7 Hohenheim Concept

In the context of the Hohenheim Concept, the introduction of agroforestry would be called an innovation, and Farm A, being the first one to introduce and practice agroforestry, is the innovator.

The beginning of the diffusion process is seen when others adopt the innovation and was initialized by the project when training and material were provided. Whether or not the process of diffusion continues over time can only be seen over a longer time period. Until the end of 2012, the diffusion process has not yet overcome the so-called critical phase. This is because it has not been reported that other farmers outside the project have adopted the agroforestry system and this means that a self-supporting phase has until this point not yet been reached.

The force field of the political situation also influenced farmer behaviour. Members of political parties threatened project members that they would be registered on a “black list” if they did not perform in a certain way. If this party would get into power, farmers on black lists would be at a disadvantage. The influence of the caste system is another example for a force field. The rules of the cast system assign a certain role to its members. It seems very hard, if not impossible, in many cases to act outside those rules. However, farming is a subject that went in accordance with farmers’ everyday lives. In this way, it would in general have a chance of being implemented.

What we overlooked at the project start was the problem with demonstration or model farms. People come and see, and it is an advantage to have procedures or results visible. In this way, the pressure on the agroforestry farm increased over time when more people got interested. However, Farm A started to ask what their advantage would be as a demonstration farm, because they did not get any additional financial or material support so as not to create jealousy and suspicion by other project members. Over time, the rejections to being a demonstration farm by members of Farm A increased. But the visible example, the existence of a demonstration farm is not sufficient, if people believe that the demonstration farmer has better resources or is not really comparable to themselves and their situation.

The question is, what are the driving or inhibiting forces for the diffusion of agroforestry as a system that can help to generate income.

Table 1 (compare chapter 1.1.3) displays certain factors that can affect the diffusion process. The following section considers the analysed and described situation of project members in Kaule against those suggested factors in order to try to predict project development.

**Comprehensibility:** Do project participants understand why the innovation is a solution? Do they understand the possible outcomes? Farm A is a visible example of agroforestry working. In this way, other farmers are able to imagine the outcome of the project and the advantages of agroforestry. Additional monthly meetings and trainings offer the possibility to talk and discuss about all aspects that concern the newly introduced system. Demonstrations and meetings are also open for other interested individuals. Over time, a change in perception of project participants and villagers was observed. At the project start, certain facts were not clear or understood and this resulted in suspicions. However, later on, project participants would share certain factors they had at first been careful with and then represented them, as they were their own ideas. The process of assimilation and understanding of newly introduced ideas was then advancing.

**Complexity:** How many stages does the innovation involve? The agroforestry system, as Farmer A is practicing it, includes many plants, plant species, and techniques, is extremely complex, and needs a long time for establishment. The complexity is on several levels. First of all, the training on agroforestry was for some farmers too technical. There was too much information in too short a time. Farmers were most likely over saturated. The transfer of knowledge gained by the training into practical results on the field was hindered by the complexity of the system.

Another level of complexity was the amount of distributed plants and other practical materials. As farmers need to go on with their everyday life and income generation, they cannot concentrate only on the project. For this reason, it was probably hard for them to care for their normal lives and build up the new system on their farm at the same time.

**Divisibility:** Is partial adoption possible? It is hard to determine whether agroforestry will be established on all or just some farms in the future but surely one mayor role for project development was played by the ongoing communication during meetings. In this way, the project stayed alive, but it was also noticed that the constant repetition of agroforestry related trainings and lessons, over time, changed farmer perceptions of the project. Even though many plants and plant species died on the farms, and not all farms are flourishing agroforestry farms at the end of 2012, changes might have occurred in ways of thinking and for sure new ideas and techniques were introduced. Maybe later, some farmers will start by themselves to include more species on their farm that are favourable for income and the soil. This is already slowly happening. After asparagus plants were more or less lost by most farmers, a few farmers started again to harvest and sell them. Asparagus is expensive and there is a demand for it in Kathmandu. Farmers then started to find out where they could get seeds to cultivate plants again. In this way, also with other plants like kiwi or lemongrass, single farmers started to operate by themselves. As soon as one can derive some income through a newly introduced plant, naturally others also get interested.

These examples show that it is not important that all farmers adopt all plants and suggested techniques at once. Each single introduction can be applied separately and more can be added over time. Most likely, the combination of many components will bring a better outcome as the data of Farmer A implies.

**Risk:** What are the consequences of failure? Because all participants only provided part of their land for transition to agroforestry, the risk that a participant would lose their total livelihood subsistence was minimized. In addition, the participation was limited to a few families so that in case of unforeseen threats or disadvantageous development financial aid could have been organised and provided by the project responsible organisation in Germany. Of course, this was not communicated to project members to avoid creating expectations or listlessness.

In the case that the agroforestry techniques will not be adopted, there is the possibility of a loss of face and a loss of credibility for the agroforestry system as well as for the project.

**Observability:** Are activities and results observable to others? The results of the project were visible to others because they saw plants growing and the formation of the local organisation was notable through activities like monthly group meetings and trainings that took place in the democentre located in the centre of Kaule village. The democentre was renovated and used and many international volunteers participated. In this way, a lot of activity in general was detectable. On the other hand, in the start, many plants died and for villagers that did not participate in meetings and trainings it was not comprehensible why so many fodder plants were distributed and cultivated. Results were best visible on Farm A. But the farm processes, meaning the farming activities and the reasoning of Farmer A who visited many additional trainings and made his constant experimentation, may not be visible at al.

**Observability of Success:** How and when can success first be observed? How long are the stages between input and output? The given example of the agroforestry farm showed the long time span that is necessary to implement agroforestry. Farmer A is nowadays, after at least 10 years of input, a successful and respected person in the village. Other farmers follow him as a good example. All interviewed farmers stated that they would like to have an agroforestry farm like Farm A. This farm has a good and regular income and has ongoing development of modern techniques like biogas, stone stables and new toilets. In addition, Farmer A has a respected job as secretary of the village officer.

First stages of success can already be seen in planting and growing plants on the fields. In addition, the formation of the local organisation including certain activities like monthly group meetings are detectable to others. The growth of the local organisation and the widening of included land into the agroforestry farming are visible long-term developments. Finally, the improvement of farms by investment that was gained by selling agroforestry goods would be the last observable stage of success.

**Observability of Failure:** How is failure visible? Some project participants decided to leave the project. Villagers that could not participate in the project were in some cases jealous and prejudiced the project by giving negative future prognoses for the project development. Farmers reported, for example, that other villagers asked project participants if they would from now on consume grass after livestock fodder plants were distributed. This is one of the reasons why two participants left the project quite early after behaving in a contradictory fashion towards the project's goals. When it was discovered that other villagers were putting certain pressure on participants, it was discussed in the monthly meetings resulting in the group better understanding the situation and finding ways to overcome this inconvenience.

Some introduced plants were unknown to farmers and they did not know how to use or cook them. In addition, they could not estimate the value of such plants. This was an impeding fact and these plants died shortly after being introduced on the fields.

**Comparability of motivation:** Is the motivation of innovator and early adopters the same? Finally yet importantly, personal ability had a very strong influence on the success or failure of the introduction of agroforestry as it is practiced on Farm A. Farmer A has a strong personality. He is a pioneer. Other villagers' opinion did not make him give up, and he went through the years of destitution until the agroforestry system eventually began to work successfully. Even so, others told him to leave his land and move to Kathmandu. During this time, he would have had a low social status in Kaule. That he continued, even though his wife was angry with him, as he reported, shows his strong character. This is most likely a requirement in installing a complex system like an agroforestry system. If other farmers are able to reach the level of Farmer A only time will show.

The general income generating strategy is an important factor. For families earning most income from work outside their farm, the establishment of agroforestry as a long term investment does not make sense, perennial cash crops and some subsistence crops fit better in this case.

Another reason why many villagers wanted to participate in this project as early adopters might be the hope of receiving financial aid from foreigners. The support and possibility for getting materials was also motivating. In general, a project generates multiple advantages for people to be in contact.

**Compatibility:** Does the innovation match existing cultural practices and norms? The farming system seemed to be compatible with cultural and traditional practices. One hindering point was the occurrence of wild animals like monkeys that resemble the monkey good Hanuman (compare chapter 6.1.1). However, this effects farming in general and not agroforestry per se.

Agroforestry is not compatible with all kinds of strategies of livelihood development. It only makes sense, if the farm is important for the family income and farming will be a main source of income for the next 20 – 40 years.

**Labour Input:** What implications has the innovation on labour inputs? To install agroforestry is time consuming. Once it is running, labour input can be seen as being reduced in terms of time input because farmers can produce everything or many things they need on their own farm and do not need to collect wood, fodder or food outside their farm, or at least to a smaller extent. But the high number of elements in the system does not allow for scale effects as in mono cropping. Therefore the savings in work load might be lesser than expected.

**Costs:** What are the short-term and long-term costs? From project start onwards, there was a focus on keeping costs for adopters as low as possible. Plants or seeds were distributed and nurseries established. The idea was that project members would later on pass knowledge and material to other interested individuals. That this is not working as expected became clear when it was discovered that farmers valued plants and building materials, they got free less than when they had to pay a small amount. In addition, they did not understand why they should share plants and materials with other newcomers.

Still, even when no external financial support is provided, the costs for plants and seeds are not very high. Farmers can cover such costs theoretical with loans that they can get from a farming cooperative in Kaule.

Of course, if adopters want to include practices like fishpond establishment or beekeeping, the costs are higher. The local organisation “Kaule ev – Nepal” applies within Nepal for funding from governmental or non-governmental organisations to facilitate its members with trainings and materials.

Once the cash crops of the agroforestry project start to generate income, adopters can reinvest in other techniques.

**Returns:** What are the benefits of the innovation? Agroforestry offers a wide range of different cultivations and additional supporting practices. These can be carried out separately, but as more details are included, the more effective the system can be as the existing agroforestry farm demonstrates. The most important benefits are extra income generation through cash crops and other techniques like beekeeping or fish farming. These activities have additional positive effects on environmental services. The diversity of plant cultivation has a positive effect on soil conditions, bees add to higher pollination rates and fishponds create water resources on the farmland. The harvest of agroforestry and affiliated practices add either to a more diverse diet of adopters or to higher income rates over the long run.

## 6.2 Conclusion and Outlook

No innovation is suitable and advantageous for everybody. This is again confirmed by the analysis of this study. If it had been known for whom, and under which conditions, agroforestry is most compatible and promising in Kaule, the project participants could have been selected more accordingly. Favourable factors would have been income orientation on a longer run through farming or a balanced strategy between farming and off-farm work, sufficient labour force, smaller sized farm, no immediate financial pressure or debts, and a personality keen to learn and to try out new things.

However, the aim in itself to convert all farms to agroforestry turned out to be questionable. There are many ways to improve livelihoods, and surely, transformation from conventional farming to agroforestry is not the easiest one, and certainly not for everybody.

In conclusion, the research questions of this study are answered.

1. Which impact brought about through agroforestry practice has or could have a system change towards improving social, economic and ecological conditions in Kaule?

2. To what extent are the applied methods the right ones needed for achieving sustainability of the project?

Agroforestry can be a system that allows farmers to produce considerable income even on smaller land areas. The ecological enhancement by agroforestry, especially by the enhancement of soil quality allows cultivating more plants in a more successful way. This became clear when the project was revisited in 2014 and the project was found in a surprisingly good condition. Trees and other plants had grown by then and agroforestry was actually visible on all farms that were participating in the project. At this time, four participants had left the project, resulting in a continuation and participation of 12 farms.

Some project members reported earning agroforestry income by selling lemon grass as a tea substitute, others by selling vegetables, bee honey and fish production. In 2014, Farm 1 started to harvest kiwis. The engagement of participants that started the project in 2009 and that were still in the project seemed very motivated and very positive.

Better plant production can enhance the nutrition of families on the one side, and helps to generate income on the other. Still a combination of both farm work as well as external work seems to be the most secure livelihood strategy. This is especially true if higher education is involved which can help to get a safer long-term occupation.

Of course, the problems of land division and the decrease of available land per family cannot be avoided. In addition, in a village like Kaule there will not be endless demands for higher educated job seekers. If no jobs are available in the village for higher educated family members, eventually they need to work in Kathmandu over the long run. Nevertheless, a good education will also prevent pauperisation and it opens new perspectives. However, the enhancement of soil quality that is obviously connected with agroforestry improves the farming value of the land and allows again higher production. Although a farm's land can only feed a certain amount of people, the farmland in Kaule and in surrounding areas is not being used to its optimum. In this way, there is still some room for agricultural enhancement if the underlying problems, like poor soil quality or poor irrigation systems are resolved.

Although agroforestry could be a solution because it provides the necessary services for soil quality enhancement and income generation, it is still not necessarily the right system for everyone in the village because of its complexity. Still, step-by-step techniques can be adopted over time. This type of adoption can be compared to what happens in nature. An oak tree produces hundreds of thousands of acorns, though only a few hundred will germinate. Some will die later by being eaten but are still serving as fodder. Finally, some will grow to full height and produce new acorns. The circle starts again. Of course, the analogy cannot be taken 1:1 but still some little pieces of comparability might be there. At least a system like agroforestry that offers a wider range of components can be applied in several ways, which suit the personal preferences of possible adopters. If the seed finally germinates will be dependent on many factors whereof some are not predictable.

Recommendations for the future of agroforestry in Kaule are those that offer better starting conditions for plant cultivation. First, soil preparing conditions like liming and fertilisation should be carried out to create a basis were plants can grow and establish themselves in a strong and healthy way. Then training could be given again on single selected plants, especially cash crops, one by one over time. When one is established, the next one can follow. At the same time, it is important that the harvest can be sold because then farmers see and estimate the value of the plant. A market for selling ecologically grown crops is provided by the nearby-situated capital Kathmandu.

Maybe work groups could be formed in the local organisation that focus on certain activities, for example, the “water group”. Farmers in this group would get support and material only on establishing irrigation on farms that belong to the village. This cluster approach would prevent overburden. Still different groups with several members could focus on different subjects so that results are visible to other farmers and might be inspiring to engage in farm or village development. The same system could also be done for the promotion of certain cash crops. For example, a group could be formed that cultivate and disseminate kiwi plants. Additional periodical training on cultivation, harvesting and marketing could contribute to success. Nevertheless, it would be important to propagate not only one but also several plants to enhance biodiversity in the sense of agroforestry.

For some problems, no solutions could be found. For example, the threat monkeys pose for farming. As long as the wildlife department or other responsible authority does not evolve an action plan on how to handle the monkey populations that destroy crops and harvest, farmers are exposed to that threat.

In addition, livestock of neighbours that graze on farmland is a tricky issue. Fencing is expensive because it needs materials that will not rot during the monsoon rain. Electrical fencing is difficult because electricity is often not available. The best solution seems to be house gardens so one can have an eye on the crops, but that is of course not always possible.

Good examples of agroforestry enhance the diffusion process. As pressure increased on the existing agroforestry farm due to its popularity, the project recommended establishing a new demonstration farm that belongs to all members of the local organisation and would be financed through income generation by fundraising and by membership fees.

The visit in 2014 has shown, that Agroforestry has developed to be only one component in the basket of options of the project. The selection of further options is increasingly handed over to Kaule ev – Nepal, bringing more local participation into the development process and attracting external help only to support self-help.

When the project was revisited at the end of 2014, the local organisation had grown and included many new members. New adopters started to implement certain components of the project on their land. Higher-ranking individuals of the village also participated. It was reported that the organisation and the project have a very good reputation in the village and in neighbouring villages.

Finally, in 2014 the project participants wrote a letter to Kaule e.V. in Germany and asked to provide again a project manager for three more years to accompany the project further. Because the participants asked for further support, it was decided to send someone again for three years. This time the focus of the work will be on water issues.

# 7 Summaries

## 7.1 Summary

### Introduction

In the Midhills of Nepal, agriculture is practiced mostly as subsistence farming on often small-sized terraces. Nowadays there are often only a few trees left in cultivated areas, which leaves the soil bare for several months of the year, mostly in winter. Degeneration processes by environmental influences on bare terraces, and a deficiency of organic material lead to poor soils and consequently to a reduced harvest.

### Problem Statement and Objectives

A rising population leads to a fragmentation of farms by spreading estates, thus leading to ever smaller-sized cultivated land areas. These often and increasingly do not produce enough food to feed farmers and their families. The possibilities of work in other income sectors are limited. Consequently, some farmers leave their land and move to Kathmandu, while others send family members abroad to earn money in India, the United Arab Emirates or Bahrain where they often work under unsafe conditions.

To break this chain it is necessary to develop new survival strategies. One solution is to ensure that existing farms can produce enough food to feed themselves and sell to make a living. This can theoretically be achieved by alternative farming methods and the introduction of new techniques. Agroforestry with its mixed farming styles and aspects of permaculture can eventually help to ameliorate the soils and provide extra nutrition and income through a perennially mixed plant production system that also includes several cash crops.

The objective of the present study is to evaluate the actual situation of farmers in the region of Kaule, Nepal, and to assess the system change from subsistence farming to agroforestry. An existing agroforestry farm established in Kaule about 15 years ago will serve as a reference.

### Methodology

For the system change to agroforestry several hypotheses were put forward on the assumption of the stated problems. These hypotheses have been tested by several methods such as socioeconomic and ecological field surveys, in combination with qualitative social research methods like interviews, questionnaires, protocols and direct observations. The results were then ordered in case studies per household and later accumulated into comparative group observations. The system change was then contextualised to a situation-based functional theory of adoption and diffusion of innovations in social systems.

This study report is the written monitoring result of the three initial project years from 2009 to 2011 in Kaule, and in some cases supplemented by additional data from earlier and later years. Data on income and expenses, work distribution within the families, soil quality and biodiversity have been selected. General descriptions of farming methods and reports on several training sessions are also included, as well as the assessment of terrace sizes and meteorological data.

## Results

The monitoring of income and expenses data of project participants, including income sources and living costs, allowed for a better understanding of the actual financial situation of farm households. Farms could thereby be distinguished into full-time farming for income and own nutrition, part-time farming, doing farming and external work for income and own nutrition, and part-time farming based on external income sources that only have income by external work and just have some few plants for own nutrition. This result was interesting because beforehand all farms were assumed to be and defined as subsistence farms.

The documentation of work categories in households and their distribution showed, on the one hand, the everyday work routine of families, and on the other hand, the work distribution between the family members, that was in dependency to the main income sources of the households. In full-time farms the work was rather equally distributed between men and women, while in other farming categories mainly the women were responsible for farm work.

Data on soil testing showed that soils are generally in a bad condition in Kaule. The soil of the agroforestry farm is in a distinctively better condition than at the other farms.

The documentation on cultivated plants revealed that the long-term established agroforestry farm cultivates more than double the number of plant species compared to the average of the other project farmers.

Due to external disturbances, no significant results could be achieved for soil-living coleopteran. The capability of soil-living coleopteran as biodiversity indicator was finally regarded as doubtful.

The survival rate of newly introduced plants by project participants was finally used to build three groups. Other indicators and results were then assigned to those groups. This revealed intersections of performance and farms livelihood situations and strategies. Full-time farming households performed better than other categories. However, the established agroforestry farm performed best even though it is a part-time farm.

After comparing single household situations in the case studies with those of accumulative group observations, two different livelihood strategies were found that seemed to be sustainable for the current situation in Kaule. One strategy is where several parts of families merge together to create bigger social structures and combine their land in bigger scales to produce their livelihood. Alternatively, like the case of the agroforestry farm, the other strategy is part-time farming with enhanced cultivation methods for nutrition and income production, in addition to external work based on higher education.

When agroforestry was compared to a situation-based functional approach to describe its potential for adaption and diffusion, it was found that agroforestry in its complexity is difficult to establish and places high expectations on adopters. For households that cultivate only a few plants for personal consumption, agroforestry is not suitable, although they can adopt single elements of the package. The introduction of new plants and methods into farming systems needs to be preferentially planned by marketing prospects. The potential of diffusion of the innovation depends on the necessary support.

**Conclusion**

Even though agroforestry, in the form it has been promoted by the project, is relatively complex, it allows farmers to choose out of its multitude of elements which ones to adopt. The adoption of further farming methods and plants and also additional components like composting or beekeeping can be further developed over time. The potential of agroforestry to enhance soil quality and to contribute to better crop production became apparent when it was compared to other project farms.

For the future selection of project participants it is recommended to pay attention to the income strategies of households. Full-time and part-time farms have a better potential for adoption than households that base their income on external work.

The potential of diffusion of agroforestry to other farms in the area is possible, as long as suitable local structures like demonstration farms and locally organised project structures are established and continual trainings are organised. A mixture of self-help and external support is therefore favourable.

## 7.2 Zusammenfassung

**Einleitung**

In den Midhills von Nepal wird Landwirtschaft meist auf kleinen Terrassenfeldern in Form von Subsistenzlandwirtschaft praktiziert. Heutzutage sind auf landwirtschaftlich genutzten Flächen nur noch wenige Bäume vorhanden und die Felder liegen vor allem während der Wintermonate brach und unbedeckt. Umwelteinflüsse sowie ein Mangel an zugeführtem organischem Material tragen zu Degenerationsprozessen und einer Verarmung der Böden bei. Dies resultiert wiederum in reduzierten Ernteerträgen.

**Problemstellung und Zielsetzung**

Erbteilung trägt in den Midhills fortwährend zur Landfragmentierung bei, und führt in Kombination mit einer zunehmenden Bevölkerungsdichte zu immer kleineren landwirtschaftlichen Nutzflächen pro Haushalt. Diese Flächen produzieren häufig nicht mehr genügend Ernteerträge um die Familien zu ernähren. Die Möglichkeiten auf andere Arbeitsfelder, als alternative Einnahmequelle zur Lebenserhaltung auszuweichen, sind begrenzt. Daraus resultiert, dass einige Familien ihr Land verlassen und nach Kathmandu ziehen. Andere Familien senden Familienmitglieder ins Ausland, üblicherweise nach Indien, in die Vereinigten Arabischen Emirate oder nach Bahrain, wo sie zu unsicheren Konditionen arbeiten.

Um dieser Entwicklung entgegen zu wirken, müssen Familien neue Überlebensstrategien entwickeln. Eine Lösung könnte zunächst eine erhöhte Nahrungsproduktion auf den vorhandenen Landflächen sein. Dies kann theoretisch durch alternative Anbau-, und Kultivierungs- Methoden erreicht werden. Agroforstwirtschaft, mit ihren Misch-, und Dauerkulturen, kann zu einer Verbesserung der Böden und so langfristig zu einer gesteigerten Bodenproduktivität beitragen, und mit „Cash Crops“ zusätzliche finanzielle Einnahmen erzielen.

Die hier vorgelegte Studie evaluiert die grundlegende Situation von Landwirten in Kaule und beschreibt die Projektbemühungen zur Verbreitung der Agroforstwirtschaft. Ein bereits seit über 15 Jahre bestehender Agroforstbetrieb in Kaule dient dabei als Vergleich.

**Methoden**

Für die Systemumstellung zur Agroforstwirtschaft wurden durch die Annahme von Problemstellungen verschiedene Hypothesen formuliert. Diese Hypothesen wurden mit Daten von unterschiedlichen Indikatoren, aus dem sozial-ökonomischen und ökologischen Bereich, durch Messungen und mit qualitativen sozialwissenschaftlichen Methoden wie Befragungen, Gesprächs-Protokollen und persönlichen Beobachtungen geprüft. Dazu wurden diese Daten zunächst in Fallstudien pro Haushalt zusammengeführt und dann zu einer vergleichenden Gruppenbetrachtung der Projektteilnehmer verwendet. Die Systemumstellung wurde anschließend im Rahmen einer situationsfunktionalen Theorie der Übernahme und Verbreitung von Neuerrungen in sozialen Systemen betrachtet.

Die hier vorgelegte Studie bezieht sich im Kern auf die ersten drei Projektjahre von 2009 bis 2011. In manchen Fällen sind, zum besseren Verständnis, zusätzlich Daten von früheren oder späteren Jahren beigefügt. Daten zu Einnahmen und Ausgaben der Betriebe, zur Arbeitsverteilung innerhalb der Familien, zu Bodenbeschaffenheit und zur Biodiversität wurden erhoben. Daneben wurden generelle Beschreibungen des Pflanzenanbaus, sowie verschiedenen Schulungsberichte erstellt und die Vermessung der Terrassenflächen sowie meteorologische Daten ausgewertet.

**Ergebnisse**

Die Datenaufnahme zu Betriebseinnahmen und Ausgaben der am Projekt teilnehmenden Landwirte, ermöglichte einen tieferen Einblick in die wirtschaftliche Situation der Haushalte. Mögliche Einnahmequellen und die Lebenshaltungskosten wurden erfasst. Damit ließen sich die teilnehmenden Betriebe überraschender Weise in Haupt- Neben- und Zuerwerbsbetriebe einteilen, auch wenn sie zuvor alle per Definition der Subsistenzwirtschaft zugeordnet wurden.

Durch das Erfassen der unterschiedlichen Arbeitskategorien in den Betrieben und der Zuordnung derer Zuständigkeiten wurde zum einen der Arbeitsalltag der Projektteilnehmer dokumentiert, zum anderen wurde deutlich, dass die Verteilung der Arbeit innerhalb der Betrieb abhängig von der Haupteinnahmequelle der Familie ist. In Haupterwerbsbetrieben ist die Arbeitsverteilung eher gleichmäßig zwischen Frauen und Männern aufgeteilt. In den anderen Fällen sind häufig die Frauen stärker in der Landwirtschaft aktiv.

Bodenanalysen bestätigten den generell schlechten Zustand der landwirtschaftlich genutzten Böden in Kaule. Deutlich wurde dabei der im Vergleich wesentlich bessere Zustand des Bodens im bestehenden Agroforstbetrieb.

Die Erfassung der Anbaupflanzen veranschaulichte, dass der bestehende Agroforstbetrieb teils mehr als doppelt so viele Pflanzenarten anbaut, als der Durschnitt der anderen am Projekt teilnehmenden Landwirte.

Bodenlebende Coleopteren wurden analysiert. Aufgrund wiederholt auftretender externer Störungen, konnten jedoch keine aussagekräftigen Ergebnisse erzielt werden. Die generelle

Tauglichkeit von bodenlebenden Coleopteren als Biodiversitätsindikatoren wird letztendlich angezweifelt.

Anhand des Projekterfolgs der teilnehmenden Landwirte, bezogen auf die Überlebensrate von im Rahmen des Projekts verteilten Pflanzen, wurden drei Gruppen gebildet. Die Ergebnisse aus den Indikatoren und Befragungen wurden anschließend diesen Gruppen zugeordnet. Dies verdeutlichte den Zusammenhang von Erwerbsstrategie und Erfolgsrate. Familien, mit landwirtschaftlichem Haupterwerb erzielten höhere Erfolge als andere Landwirte. Auch auf dem existierenden Agroforstbetrieb überlebten die meisten Pflanzen, auch wenn dieser als Nebenerwerbsbetrieb fungiert.

Nach der fallweisen Beschreibung der Betriebe und der darauffolgenden Eingruppierung wurden letztendlich zwei Strategien identifiziert, die für eine nachhaltige Entwicklung von Familie und Betrieb in Kaule vielversprechend erscheinen. Entweder schließen sich Familien zu größeren Einheiten zusammen und erwirtschaften ihren Lebensunterhalt auf den vereinigten größeren Landflächen. Alternativ, wie im Beispiel des bestehenden Agroforstbetriebs, kann die Nebenerwerbslösung bei verbessertem Anbau  für die Produktion von Nahrung und Einkommen, und mit zusätzlicher möglichst qualifizierter außerbetrieblicher Arbeit zum Erfolg führen.

Die Betrachtung des Agroforstprojekts, im Rahmen eines situationsfunktionalen Ansatzes, zur Bewertung des Adoptions-, und Verbreitungspotentials, zeigte, dass Agroforstwirtschaft eine sehr komplexe Neuerung ist, die hohe Anforderungen an die Übernehmer stellt. Für Zuerwerbsbetriebe oder solche mit auslaufender Landwirtschaft ist sie ungeeignet, jedoch können diese einzelne Elemente des Pakets übernehmen. Die Einführung der neuen Pflanzenarten und Methoden in das Betriebssystem muss vorrangig von der Vermarktung her geplant werden. Nur bei geeigneter Unterstützung gibt es ein Potential für die Verbreitung dieser Neuerung.

**Schlussfolgerung**

Auch wenn die Agroforstwirtschaft, in der Form wie sie durch das Projekt vermittelt wurde, relativ kompliziert ist, ermöglicht sie durch eine Vielzahl von Elementen letztendlich den Landwirten die Wahl, welche davon angenommen werden und welche nicht. Die Annahme von weiteren Anbautechniken und Pflanzen aber auch von zusätzlichen Komponenten wie z.B. Kompost oder Bienenzucht kann mit der Zeit ausgebaut werden. Deutlich wurde auch, dass durch das Potential der Agroforstwirtschaft, die verarmten Böden anzureichern, auf längere Sicht eine Erhöhung der Ernteerträge zu erwarten ist.

Zukünftig empfiehlt es sich, bei der Auswahl von Projekt-Teilnehmern, verstärkt auf die Haupterwerbsstrategie der Familien zu achten. Familien die fast ausschließlich von der Landwirtschaft leben, oder Familien die ihr Einkommen zu ungefähr gleichen Teilen aus der Landwirtschaft und einer externen Erwerbstätigkeit beziehen, haben ein höheres Adoptionspotential als Zuerwerbsbetriebe.

Ein Ausbreitungspotential der Agroforstwirtschaft zu anderen Landwirten der Gegend ist möglich, wenn geeignete lokale Strukturen in Form von Demonstrationsbetrieben und lokalen Projektstrukturen etabliert und wenn weiterführende Lehrgänge organisiert werden. Eine Mischung aus Selbsthilfe und externer Unterstützung ist dafür günstig.

# 8 References

ACHARYA, K.P. 2006: Linking trees on farms with biodiversity conservation in subsistence farming systems in Nepal. In: *Biodiversity and Conservation* 15: 631–646.

ADHIKARI, B.; WILLIAMS, F.; LOVETT, J.C. 2007: Local benefits from community forests in the middle hills of Nepal. In: *Forest Policy and Economics* 9(5): 464-478.

ALBRECHT, H. 1964: Die Bedeutung von Demonstartionsbetrieben als eine Form der landwirtschfatlichen Entwicklungshilfe. In: *Zeitschrift Für Ausländische Landwirtschaft*, Heft 2: 1-24.

ALBRECHT, H. 1974: Die Verbreitung von Neuerungen – Der Diffusionsprozeß. In: *Der Förderungsdienst*, Sonderheft 2: 33-40.

BAHADUR, K.C. 2011: Linking physical, economic and institutional constraints of land use change and forest conservation in the hills of Nepal. In: *Forest Policy and Economics* 13: 603–613.

BAREISS, G.; HRUSCHKA, E.; RHEINWALD, H. 1962: Probleme des Beispielsbetriebes. Eugen Ulmer Verlag, Stuttgart: 122-128.

BAUL, T. K., ULLAH, K. M. A., TIWARI K. R., MCDONNALD, M. A. 2013: People's local knowledge of climate change in the Middle-Hills of Nepal. In: *Indian Journal of Traditional Knowledge (IJTK)* 12(4): 585–595.

BBC 2014: BBC NEWS - Nepal Profile - Timeline. www.bbc.com/news/world-south-asia-12499391.

BENNETT, B.; COOPER, J.; DOBSON, H. 2010: We know where the shoe pinches: a case study based analysis of the social benefits of pesticides. In: *Outlook on Agruculture* 39(2): 79-97.

BIGGS, E.M.; TOMPKINS, E.L.; ALLEN, J.; MOON, C.; ALLEN, R. 2013: Agricultural adaptation to climate change: Observations from the Mid-Hills of Nepal. In: *Climate and Development* 5: 165–173.

BREMNER, J.M. 1965: Total nitrogen: macro-Kjeldahl method to include nitrate. P. 1164. In C.A. Black *et al*. (ed.) Methods of soil Analysis. Part 2. Chemical and Microbiological properties. In: *Agron. Monogr.* 9. ASA. Madison. WI.

BHATTARAIA, K.; CONWAYB, D.; YOUSEF, M. 2009: Determinants of deforestation in Nepal's Central Development Region. In: *Journal of Environmental Management* 91(2): 471-488.

BHUJU, U. R., SHAKYA, P. R., BASNET, T. B., SHRESTHA, S. 2007: Nepal Biodiversity Resource Book. United Nations ENVIRONMENT Programme (UNEP); Ministry of Environment, Science and Technology, Government of Nepal (MoEST), ISBN 978-92-9115-033-5.

BISTA, P.; GHIMIRE, R.; SHAH, S.C.; PANDE, K.R.2010: Assessment of Soil Fertility Management Practices and their Constraints in Different Geographic Locations of Nepal. In: *Forum geographic; Studii și cercetări de geografie și protecția mediului,* Year 9, No. 9/ 2010, pp. 41-48.

BISHT, I.S., PANDRAVADA, S.R., RANA, J.C., MALIK, S.K., SINGH, A., SINGH, P.B., AHMED, F., BANSAL, K.C., 2014: Subsistence Farming, Agrobiodiversity, and Sustainable Agriculture: A Case Study. In: *Agroecology and Sustainable Food Systems* 38, 890–912.

BYG, A., HERSLUND, L., 2014: Socio-economic changes, social capital and implications for climate change in a changing rural Nepal - Springer, n.d.

CAMPANHA, M.M.; SILVA SANTOS, R.H.; DE FREITAS, G.B.; MARTINEZ, H.E.P.; GARCIA, S.L.R.; FINGER, F.L. 2004. Growth and yield of coffee plants in agroforestry and monoculture systems in Minas Gerais, Bureau OF STATISTICS NEPAL 200): Population Census 2001, www.digitalhimalaya.com/collections/nepalcensus.

CHAUDHARY, R.P. 2000: Forest conservation and environmental management in Nepal: a review. In: *Biodiversity and Conservation* 9: 1235–1260.

CIFOR, 2014: About us. www.cifor.org/about-us/science-for-forests-and-people.html, 8th of April 2014.

COLLINS, R.; JENKINS, A. 1996: The impact of agricultural land use on stream chemistry in the MiddleHills of the Himalayas, Nepal. In: *Journal of Hydrology* 185 (1-4): 71-86.

DARR, D. 2008: Effektive Even When Neglected: Farmer Groups and the Diffusion of Agroforestry Innovations in Rual Communiteies of Eastern Africa. In: Kommunikation und Beratung. In: *Sozialwissenschaftliche Schriften zur Landnutzung und ländlichen Entwicklung.* Margraf Publishers GmbH Science books, ISBN 978-3-8236-1554-5.

DAY, P.R. 1965: Particle fraction and particle size analysis. Chap. 43 in Methods of Soil Analysis, Part 1. C.A. Black, ed. American Society of Agronomy, Madison. Pp. 545-567.

DEPARTMENT OF HYDROLOGY AND METEOROLOGY (DHM) NEPAL 2012: www.dhm.gov.np

DEPARTMENT OF NATIONAL PARK AND WILDLIFE CONSERVATION 2012: www.dnpwc.gov.np

STEFFAN-DEWENTER, I., KESSLER, M., BARKMANN, J., BOS, M.M., BUCHORI, D., ERASMI, S., FAUST, H., GEROLD, G., GLENK, K., GRADSTEIN, S.R., GUHARDJA, E., HARTEVELD, M., HERTEL, D., HÖHN, P., KAPPAS, M., KÖHLER, S., LEUSCHNER, C., MAERTENS, M., MARGGRAF, R., MIGGE-KLEIAN, S., MOGEA, J., PITOPANG, R., SCHAEFER, M., SCHWARZE, S., SPORN, S.G., STEINGREBE, A., TJITROSOEDIRDJO, S.S., TJITROSOEMITO, S., TWELE, A., WEBER, R., WOLTMANN, L., ZELLER, M., TSCHARNTKE, T. 2007: Tradeoffs between income, biodiversity, and ecosystem functioning during tropical rainforest conversion and agroforestry intensification. In: *PNAS,* 104(12): 4973-4978.

DHAKAL, D.; GRABOWSKI, R.; BELBASE, K. 1987: The Effect of Education in Nepal's Traditional Agriculture. In: *Economics of Education Review* 6 (1): 27-34.

DHITAL, Y. P.; RIJAN B. K.; JIANCHENG S. 2013: Soil Bioengineering Application and Practices in Nepal. In: *Environmental Management* 51 (2): 354–64.

DHITAL, N. 2009: Reducing Emissions from Deforestation and ForestDegradation (REDD) in Nepal: Exploring the Possibilities. In: *Journal of Forest and Livelihood* 8(1): 56-62.

DONNER, W. 2007: Menschen, Kulturen und Staat zwischen Monsunwald und Bergwüste. Bergisch Gladbach [u.a.] : Ed. Kathmandu, ISBN 978-3-939834-01-4.

DOPPLER, W. 1991: Landwirtschaftliche Betriebssysteme in den Tropen und Subtropen. Verlag Eugen Ulmer Stuttgart 1991, ISBN3-8001-4084-5.

DOBREMEZ, J. F. 1972: Les grandes divisions phytogéographiques du Népal et de l'Himalaya. In: *Bull. Soc. Bot. France* 119: 111-120.

ELEVITCH, C.R.; WILKINSON, K.M. 2000: Information Resources for Pacific Island Agroforestry. Per-manent Agriculture Resources, Holualoa, http://www.agroforestry.net.

ERTUR, O.1994: The need for a national urbanisation policy in Nepal. In: *Asia-Pacific Population Journal / United Nations*, 9:19-36.

FAO 1999: Annotated bibliography forest cover change: Nepal. In: *Forest Resources Assessment Working Paper* - 012 2001.

FAO 2006: Compendium on Food and Agricultural Indicators – 2006 http://www.fao.org/es/ess/compendium_2006/pdf/NEP_ESS_E.pdf

FAO 2008: Climate Information Tool. http://www.fao.org/nr/water/aquastat/gis/index3.stm

GENTLE, P.; MARASENI, T.N. 2012: Climate change, poverty and livelihoods: adaptation practices by rural mountain communities in Nepal. In: *Environmental Science & Policy* 21: 24-34.

GERLITZ, L. 2011: Implementierung und Evaluierung eines WRF-basierten dynamisch-statistischen Downscaling-Ansatzes für die Region Langtang / Nepal. Diplomarbeit am geographischen Institut der Universität Hamburg.

GERLITZ, L., CONRAD, O., THOMAS, A. & BÖHNER, J. (2014): Warming patterns over the Tibetan Plateau and adjacent lowlands derived from elevation- and bias-corrected ERA-Interim data. In: *Climate Research*, Vol. 58: 235–246.

GERRARD, A.J.; GARDENER, R.A.M. 2002: Relationships between Landsliding and Land Use in the Likhu Khola Drainage Basin, Middle Hills, Nepal. In: *Mountain Research and Development,* 22(1):48-55.

GERRARD, A.J.; GARDENER, R.A.M. 2003: Runoff and soil erosion on cultivated rainfed terraces in the Middle Hills of Nepal. In: *Applied Geography* 23: 23-45.

GIRI, A.; KATZENSTEINER, K. 2013: Carbon and Nitrogen Flow in the Traditional Land Use System of the Himalaya Region, Nepal. In: *Mountain Research and Development* 33: 381–390.

GOOGLE EARTH 2010: "Kaule Nuwakot District" 27°48´38.60´´N and 85°14´55.98´´O. release January 23, 2010; application July 02, 2011.

GRAHAM, E.R. 1948: Determination of soil organic matter by means of photoelectric colorimeter. In: *Soil Science* 65: 181-183.

HAFFNER, W. 1984: Potentials and Limits of Agricultural Production in Nepal as seen from an Ecological-Geographical Standpoint. In: *Erdwissenschaftliche Forschung* XVIII: 115-126.

HÉGÉSIPPE, CORMIER 2007: Open Source Wikipedia. http://commons.wikimedia.org/wiki/File:Subdivisions_of_Nepal_DE.png

HOFFMANN, V.; GERSTER-BENTAYA, M.; CHRISTNICK, A.; LEMMA, M. 2009: Rural Extension Volume 1: Basic Issues and Concepts. Margraf Publishers ISBN 978-3-8236-1571-2: 94-105.

HOFFMANN, V. 2007: Book Review: Five editions (1962-2003) of Everett ROGERS: Diffusion of Innovations. In: *Journal of Agricultural Education and Extension*, Vol.13, No.2, 147-158.

HOFFMANN, V. 1992: Beratung als Lebenshilfe. Humane Konzepte für eine ländliche Entwicklung. Verlag Josef Margraf: 104-105.

HOLLINGER, D. 2006: Agroforestry Development: Traditional Mountain Farming in Nepal. Presented at the United Nations 14th Commission on Sustainable Development May 11.

ICHIYANAGI, K.; YAMANAKA, M.D.; MURAJI, Y.; VAIDYA, B.K. 2007: Precipitation in Nepal between 1987 and 1996. In: *International Journal of Climatology* 27: 1753-1762.

ICRAF, 2014: About us. www.worldagroforestry.org/about_us, 8th of April 2014.

JANETSCHECK, H. 1982: Ökologische Feldmethoden. Verlag Eugen Ulmer Stuttgart 1982, ISBN 3-8001-3049-1.

KHATRI-CCHETRI, T. B. 1991: Introduction to soil and soil fertility. IAAS, Rampur, Nepal, 232 p.

KOLLMAIR, M. 1999: Futterbäume in Nepal. Kultur Gesellschaft, Umwelt, Schriften zur Südasien- und Südostasien-Forschung, Band 3.

KREMER, V. 2010: Comparative evaluation of green manure legumes for reclamation of degraded terraces in the mid-hills of Nepal. Diploma Thesis, submitted to University of Bonn, Germany.

KRISHAN, R. 1965: Agricultural Demonstartion And Extension Communication. Asia Publishing House, London: 83-101.

KROMP, B. 1999: Carabid beetles in sustainable agriculture: a review on pest control efficacy, cultivation impacts and enhancement. In: *Agriculture, Ecosystems & Environment*, 74, Issues 1–3: 187–228.

KUMAR, B.M. 2006: Agroforestry: the new old paradigm for Asian food security. In: *Journal of Tropical Agriculture* 44: 1-14.

LAMICHHANE, K., 2013: Effectiveness of sloping agricultural land technology on soil fertility status of mid-hills in Nepal. In: *Journal of Forestry Research* 24, 767–775.

LEMMA, M.; HOFFMANN, V. 2007: The Agricultural Knowledge System in Ethiopia - Insights from a study in the Tigray region. In: *Rural Development News*, 34: 38.

LILLESØ, J.P. B.; SHRESTHA, T.B.; DHAKAL, L.P.; NAYAJU, R.P.; SHRESTHA, R. 2005: The Map of Potential Vegetation of Nepal- a forestry/agro-ecological/biodiversity classification system. Forest & Landscape Denmark, Development and Environment Series no. 2, ISBN 87-7903-210-9.

LÖßNER, M.; SCHMELZ, C. 2006: Naturgefahren bei Ghandruk – Ursachen, Auswirkungen und Risikomanagement. In: *Werkstattpapiere* 12, Institut für Geographie Justus-Liebig-Universität Gießen.

MAHAT, T.B.S.; GRIFFIN, D.M., & SHEPHERD, K.R. 1987: Human impact of some forest of the Middle Hills of Nepal; Forests in the subsistence economy of Sindhupalchowk and Kanhrepalanchowk. In: *Mountain Research and Development* 7 (1): 53-70.

MAJUPURIA, T. C., MAJUPURIA, R. K. 1999: Nepal Nature's Paradise. Hillside Press Ltd., ISBN – 974-8614-94-8.76

MANANDHAR, N.P.; MANANDHAR, S. 2002: Plants and people of Nepal. Timber Press, Inc. USA, ISBN 0-88192-527-6.

MARTIN, K.; SAUERBORN J. 2006: Agrarökologie. Verlag Eugen Ulmer Stuttgart 2006, 43-44, ISBN-13:978-3-8252-2793-7

MCCLINTOCK, N.C. 2003: Agroforestry and Sustainable Resource Conservation in Haiti: A Case Study. Working paper, North Carolina State University, Raleigh, NC http://www.ncsu.edu/project/cnrint/Agro/resource_home.htm

MCNEELY, J.A.; SCHROTH, G. 2006: Agroforestry and biodiversity conservation – traditional practic-es, present dynamics, and lessons for the future. In: *Biodiversity and Conservation* 15:549–554.

MICHAELS, K.F. 2007: Using staphylinid and tenebrionid beetles as indicators of sustainable landscape management in Australia: a review. In: *Aust. J. Exp. Agric.* 47: 435–449.

MIEHE, G.; MIEHE, S.; SCHLÜTZ, F.; SCHMIDT, J.2003: Sind Igelheiden die zonale natürliche Vegetation altweltlicher Hochgebiergshalbwüsten? Vegetationskundlich zoogeographische und palynologische Befunde aus dem tibetischen Nepal – Himalaya. IN: *HARTMANN, M. & H. BAUMBACH (Hrsg.): Biodiversität und Naturausstattung im Himalaya.- Naturkundemuseum Erfurt*: 7-22.

MINISTRY OF LOCAL DEVELOPMENT GOVERNMENT OF NEPAL 2012, Homepage: www.mld.gov.np/vdc.htm

MORTON J.F. 2007: The impact of climate change on smallholder and subsistence agriculture. In*: PNAS* 104:19680-19685.

NAIR, P.K.R. 1985: Classification of agroforestry systems. In: *Agroforestry Systems* 3: 97-128.

NAIR, P.K.R. 2011: Agroforestry systems and environmental quality: Introduction. In: *Journal of Environment Quality* 40: 784.

NATH, T. K. AND INOUE, M. 2008: How Does Local Governance Affect Projects' Outcomes? Experience from a Participatory Forestry Project of Bangladesh. In: *International Journal of Agricultural Resources, Governance and Ecology* 7: 491–506.

NATIONAL ASSOCIATION OF VILLAGE DEVELOPMENT COMMITTEES IN NEPAL (NAVIN) 2011: Homepage www.navin.org.np

NEUPANE, R.P. 1999: Prospects of Agroforestry intervention in the Hills of Nepal. Paper presented at the workshop entitled: Image Processing and Spatial Statistics in Forestry, November 2nd, KVL, Copenhagen Denmark.

NEUPANE, R.P., THAPA, G.B. 2001: Impact of agroforestry intervention on soil fertility and farm income under the subsistence farming system of the Middle Hills, Nepal. In: *Agriculture, Ecosystems and Environment* 84: 157-167.

NIGHTINGALE, A.J. 2010: Bounding difference: Intersectionality and the material production of gender, caste, class and environment in Nepal. In: *Geoforum* 42: 153-162.

NIJHOFF, M.; JUNK W. 1983: A global inventory of agroforestry systems: A project announcement. In: *Agroforestry Systems* 1:269-273.

PANDEY, K.K. 1982: The livestock-fodder situation and potential fodder resources. In: *Mountain Development and Environment*, 47-60.

PAUDEL, K.C. 1992: Implication of Forage and Livestock Production on Soil Fertility. In: *FAO Animal Production and Health Papers* 105: 177 pg T0706/E.

PEDLEY, D.N., HEARN, G.J., HART, A., ROSSER, N.J., DUNNING, S.A., OVEN, K., MITCHELL, W. A. 2007: Trends in landslide occurrence in Nepal. In: *Nat Hazards* 43: 23–44.

PILBEAM, C.J., TRIPATHI, B.P., SHERCHAN, D.P., GREGORY, P.J., GAUNT, J., 2000: Nitrogen balances for households in the mid-hills of Nepal. In: *Agriculture, Ecosystems & Environment* 79, 61–72.

PROBST, K., HOFFMANN, V., CHRISTNICK, A. 2005: Research and experimentation done by farmers and scientists. “Setting Breeding Objectives and Developing Seed Systems with Farmers“ Verlag Margraf, Weikersheim,15:24.

RAI, K.K. 2006: Society for Wetland Biodiversity Conservation-Nepal. Personal interview. 4 October 2006, Kathmandu.

RARELIBRA, 2006: Open Source Wikipedia. http://commons.wikimedia.org/wiki/File:Bagmati_districts.png

RATNADASS, A.; FERNANDES, P.; AVELINO, J.; HABIB, R. 2012: Plant species diversity for sustainable management of crop pests and diseases in agroecosystems: A review. In: *Agron. Sustain. Dev.,* 32:273-303.

RAY, M.L.; WILSON, M.M.; WANDERSMAN, A.; MEYERS, D.C.; KATZ, J. 2012: Using a Training-of-Trainers Approach and Proactive Technical Assistance to Bring Evidence Based Programs to Scale: An Operationalization of the Interactive Systems Framework’s Support System. Published online, Springer Verlag. DOI 10.1007/s10464-012-9526-6.

REGMI, B.N. 2003: Contribution of agroforestry for rural livelihoods: A case of Dhading District, Nepal. Paper presented at The International Conference on Rural Livelihoods, Forests and Biodiversity, 19-23 May 2003, Bonn, Germany.

ROGERS, E. M. 2003: Diffusion of Innovations. The Free Press of Glencoe, New York.

ROS-TONENA, M.A.F.; INSAIDOOB, T.F.G.; ACHEAMPONGC E. 2013: Promising start, bleak outlook: The role of Ghana's modified taungya system as a social safeguard in timber legality processes. In: *Forest Policy and Economics*, 32: 57–67.

ROTH, K. 2012: Evaluation und Erschließung von Absatzmärkten für Bio-Cash-Crops kleinbäuerlicher Haushalte in Kaule / Nepal. Master Thesis, University of Erlangen-Nürnberg, Germany.

SAFA, M.S. 2005: Socio-Economic Factors Affecting the Income of Small-scale Agroforestry Farms in Hill Country Areas in Yemen: A Comparison of OLS and WLS Determinants. In: *Small-scale Forest Economics, Management and Policy*, 4(1): 117-134.

SCHAWALLER, W. 2005: New species and records of Agyrtidae (Coleoptera) from the Nepal Himalayas. In: *Dtsch. Entomol. Z.* 52: 115–123.

SCHRÖDER, J. M.; HEUVELDOP, J. 2002: Agroforestry systems and their importance for biological diversity. In: *Angewandte Wissenschaft* 494: 153-159.

SCHWAB, N. 2012: Agroforstwirtschaft - Ein Weg zur nachhaltigen Landnutzung im Mittelland Nepals? Boden- und vegetationsgeographische Vergleiche mit konventionellem Terrassenfeldbau. Diploma Thesis submitted to University of Hamburg.

SCHWEINFURTH, U. 1957: Die horizontale und vertikale Verbreitung der Vegetation im Himalaya. Bonn, Ferd. Dümmlers Verlag, Bonner geographische Abhandlungen, ISSN 0373-0468; 20.

SCHWEINFURTH, U. 1992: Mapping Mountains: Vegetation in the Himalaya. In: *GeoJournal* 27 (1): 73-83.

SHARMA, N.K. 2010: District and VDC profile of Nepal. Published by: Intensive Study and Research Centre, ISBN: 978-9937-2-2459-8.

SHARMA, R. 2006: Traditional agroforestry and a safer mountain habitat. In: *Sustainable Mountain Development* 50: 63-38.

SHIBU, J. 2012: Agroforestry for conserving and enhancing biodiversity. In: *Agroforestr System* 85:1-8.

SHRESTA, K. 1998: Dictionary Of Nepalese Plant Names. Mandala Book Point, Kantipath Kathmandu. Nepal.

SHRESTHA, L., 2013: Geriatric health in Nepal: concerns and experience. In: *Nepal Medical College Journal : NMCJ* 15, 148–152.

SHRESTHA, R.K. 1992: Agroecosystem of the Mid-Hills. In: *FAO Animal Production and Health Papers* 105, 177 pg T0706/E.

SHRESTHA, S. 2014: Maoist defeat in Nepal: The price of a missed opportunity. In: *Economic and Political Weekly* 49: 13–16.

SHRESTHA, S.H. 1991: Simple Geography of Nepal. Educational Enterprise, Kathmandu, 2nd Edi-tion: 20-21.

STAINTON, J. D. A. 1972: Forests of Nepal. John Murray, London: ISBN 0719526590.

TIWARI, K.R.; SITAULA, B.K.; BAJRACHARAY R. M.; BØRRESON,T. 2009: Effects of soil and crop management practices on yields, income and nutrient losses from upland farming systems in the Middle Mountains region of Nepal. In: *Nutrient Cycling in Agroecosystems* 86: 241-253.

TORQUEBIAU, E. 2000: A renewed perspective on agroforestry concepts and classification. In: *Life Sciences* 323: 1009 – 1017.

TROEH F. R. THOMPSON L.M. 2005: Soils and Soil Fertility. 6th ed. Ames, Iowa: Blackwell Pub.

WEISS, W.1999: Nepal Information 84: 184.

WESTBROOK, L. 1994: Qualitative Research methods: A Review of Major Stages, Data Analysis Techniques and Quality Controls. In: *LISR* 16: 241-254.

WHATNABLE, F.S.; OLSEN, S.R. 1965: Test of ascorbic acid method for determining phosphorus in water and sodium bicarbonate extracts of soil. In: *Soil Science Proceeding* 29: 677-678.

WIENERS, E. 2015: Adaptability of Backcasting for Sustainable Development – A case study from Nepal. n.p.

WRIGHT, C.H. 1939: Soil analysis. A Handbook of Physical and Chemical Methods. Thomas Murthy and Co. London.

# 9 Appendices

## 9.1 Annex 1

### 9.1.1 Questionnaires

#### 9.1.1.1 Questionnaire No. 1 Background of Farmers Situation in Kaule

**1. School/Education**

How many years do the children spend in school?

How often do the children go to school?

What are the costs of sending the children to school?

What is the distance to the local school?

What is the location of the local school?

How long does it take the children to get there?

What are the costs associated with the transport to school?

Do the children need to take a bus to get to school?

Do farmers consider education important?

Do the farmers think that going to school will help the children on the farm in the long run?

What do children like learning about the most?

Are the children sent to higher education/university?

Is the ratio between boys and girls the same?

**2. Medical Care**

Where are the closest medical facilities for the family?

How long does it take to get there?

How often does the family visit the medical centre?

What are the costs associated with getting medical attention?

- How much money does it cost to see the doctor?
- What are the costs of transportation to the medical centre?

- What is the possibility for health insurance and, if so, how much does it cost?

If the costs or distances were less would they go to the doctor more often?

Do farmers think that it would be better for them to see the doctor more often?

What is the most common illness?

## 3. Social Structure

What is the social network of the family?

Do the brothers/sisters, aunts/uncles, grandparents share the same farm?

If a parent falls ill, how does the family adapt/help each other?

At what age do most men/women get married?

Are marriages most commonly arranged marriages?

Do couples live on the parent's farm after marriage?

What recreational activities do farmers spend their time doing?

What is the women/wives' breakdown of the day?

What is the children's breakdown of the day?

## 4. Acquirements

How does one acquire land?

How much does it cost to purchase land?

How much does it cost to purchase a cow, goat, ox, buffalo, rabbit, chicken, and seeds?

What is the breakdown of expenses including food, medicine, education, and other?

## 5. Nutrition, Medical And Cultural Plants

What is the typical meal for a Nepali farming family?

How often do they eat meat? (Chicken, rabbit, cow, buffalo, etc.)

How much food do they purchase from the market?

How much food do they consume from their farm?

What is the difference between agroforestry farming and monoculture farming?

Do they plant any medical plants on their farms? Which ones?

What do these medical plants do?

Would farmers like to plant more medical plants?

Do farmers sell these plants? How much?

Which other cultural (religious)/medical plants would they use/plant?

## 6. Farm Income And Infrastructure

How far is the market to sell the crops?

How long does it take to get there?

Which transportation systems are used?

Do farmers feel that they receive enough money for their crops?

Does the price they receive for crops change? By how much?

Currently what additions (equipment) to farm/house would most help farmers (workload)?

What equipment (future) would help mostly and in what way?

If farmers had a greater income, what would they spend money on?

## 7. Agroforestry Versus Monoculture Farming

What do farmers like most about the agroforestry system?

What do they like least about the agroforestry system?

What do farmers like most about monoculture farming?

What do they like least about monoculture farming?

What are the comparisons between the workload of agroforestry systems and monoculture farming systems?

### 9.1.1.2 Questionnaire No. 2: Division of work per household

#### a) Family composition

How many people currently life in the household?

How many adults?

How many children?

Do the brothers/sisters, aunts/uncles, grandparents share the same household?

If a parent falls ill, how does the family adapt/help each other?

Do children live after marriage on the parent’s farm?

### b) Performed working hours on farm

What is the woman/wives' breakdown of the day?

What is the man/ husband's breakdown of the day?

What is the children's breakdown of the day?

What recreational activities do farmers spend their time doing?

### c) Performed working hours out of farm

Is time spent on work outside of the farm?

Where?

By who?

How much time on average?

Does anyone in the family work outside of Nepal?

### d) Distribution of workload between family members

What are the usual tasks of women on the farm?

What are the usual tasks of men on the farm?

What are the usual tasks of children on the farm?

Are persons outside the family structure hired for work on the farm?

For what kinds of work?

How often and when?

How does the workload change over the year? What are the busy months and less busy months?

## 9.1.1.3 Questionnaire No 3: Cultivated plant use by farmers

### a) Use of plants for farmers' own nutrition

What kinds of plants for nutrition are cultivated other than for sale at the market?

What is the size of harvest?

When is the harvesting time?

What does the family eat when it is not harvesting time?

### b) Use of plants for sale at the market

What kinds of plants are grown for sale at the market?

Size of harvest?

Market prize?

Market location and access?

### c) Cultivation of religious plants

What kinds of religious plants are grown on the farm?

What is their use?

What other religious plants are known?

Would they like to grow more plants for religious purposes?

### d) Cultivation of medical plants

What kind of medical plants are grown on the farm?

What is their use?

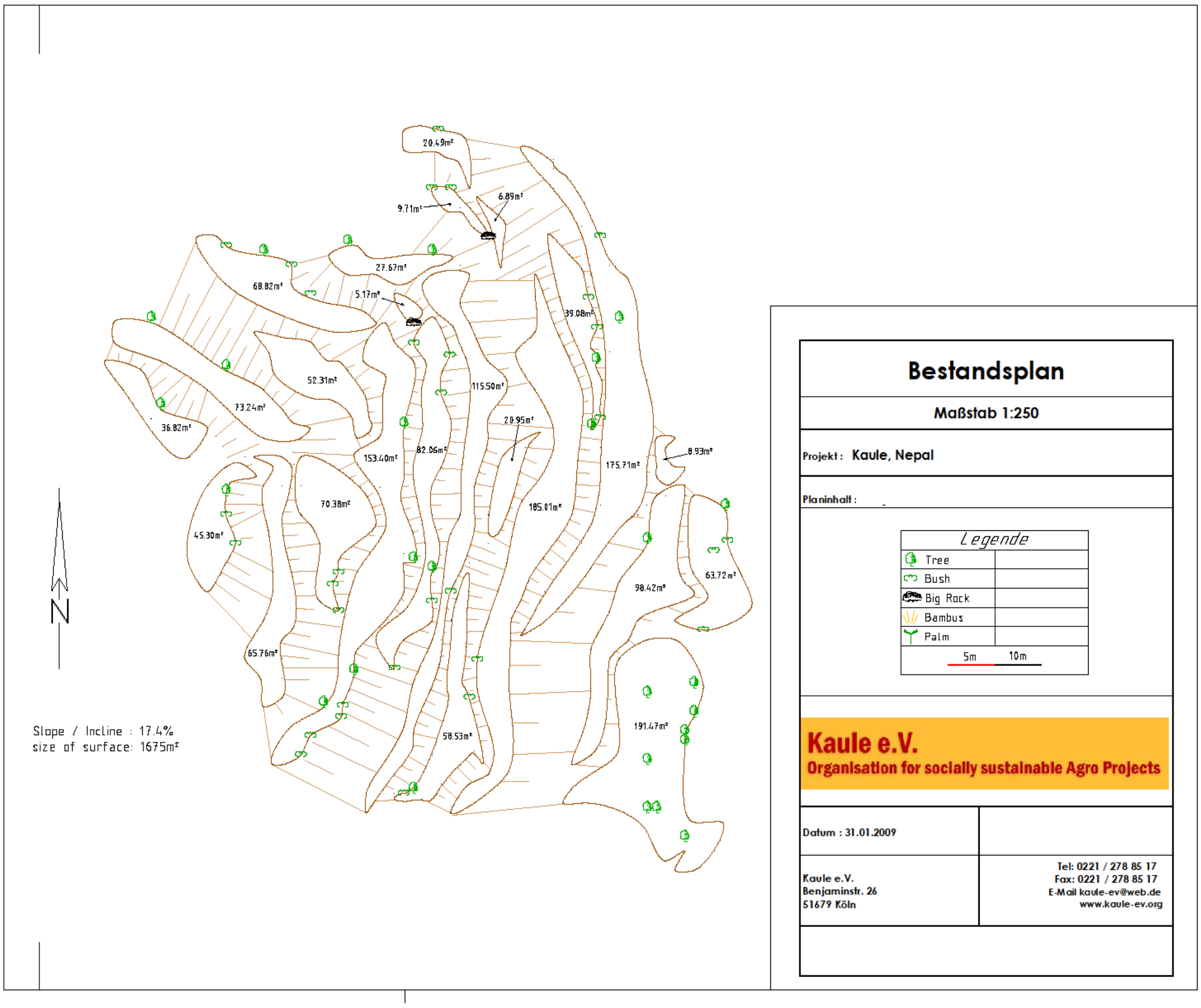
What other medical plants are known to farmers?

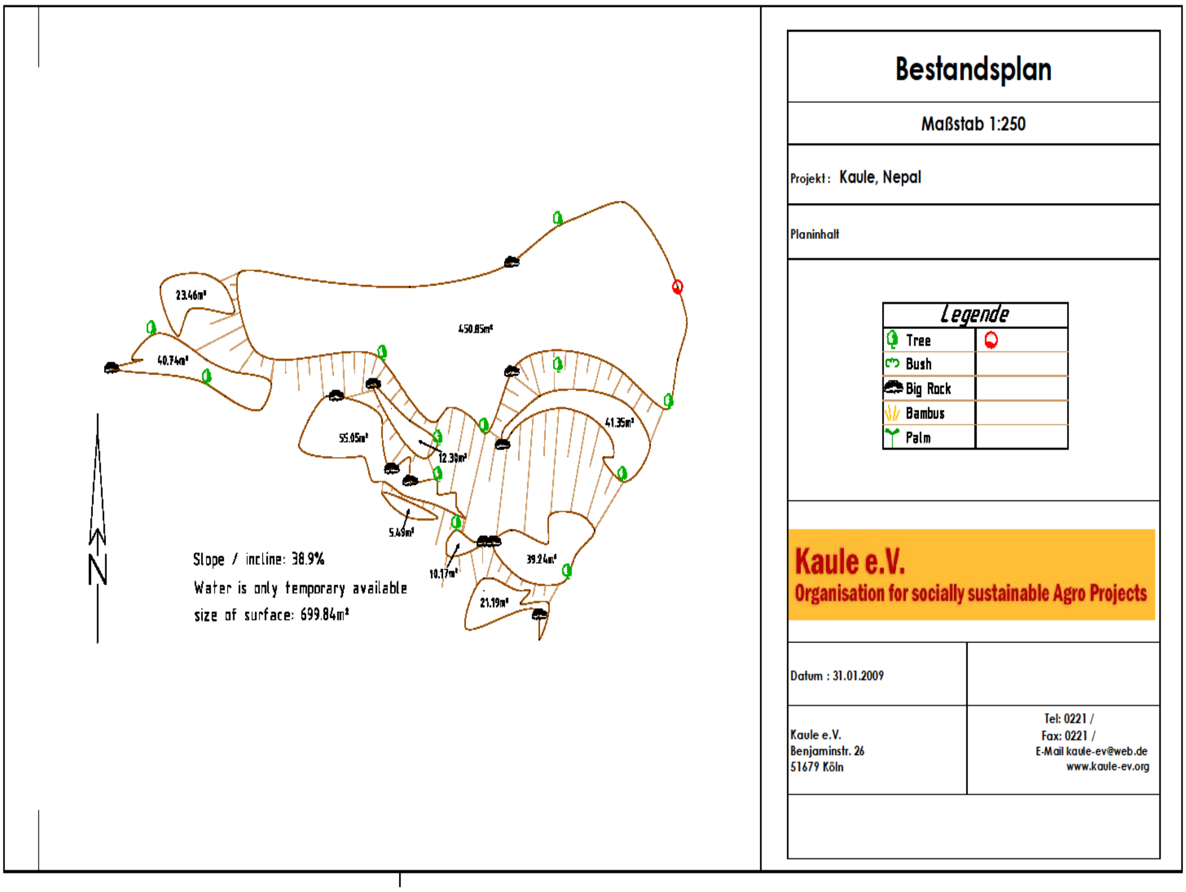
Would they like to plant more medical plants?

# 9.2 Annex 2

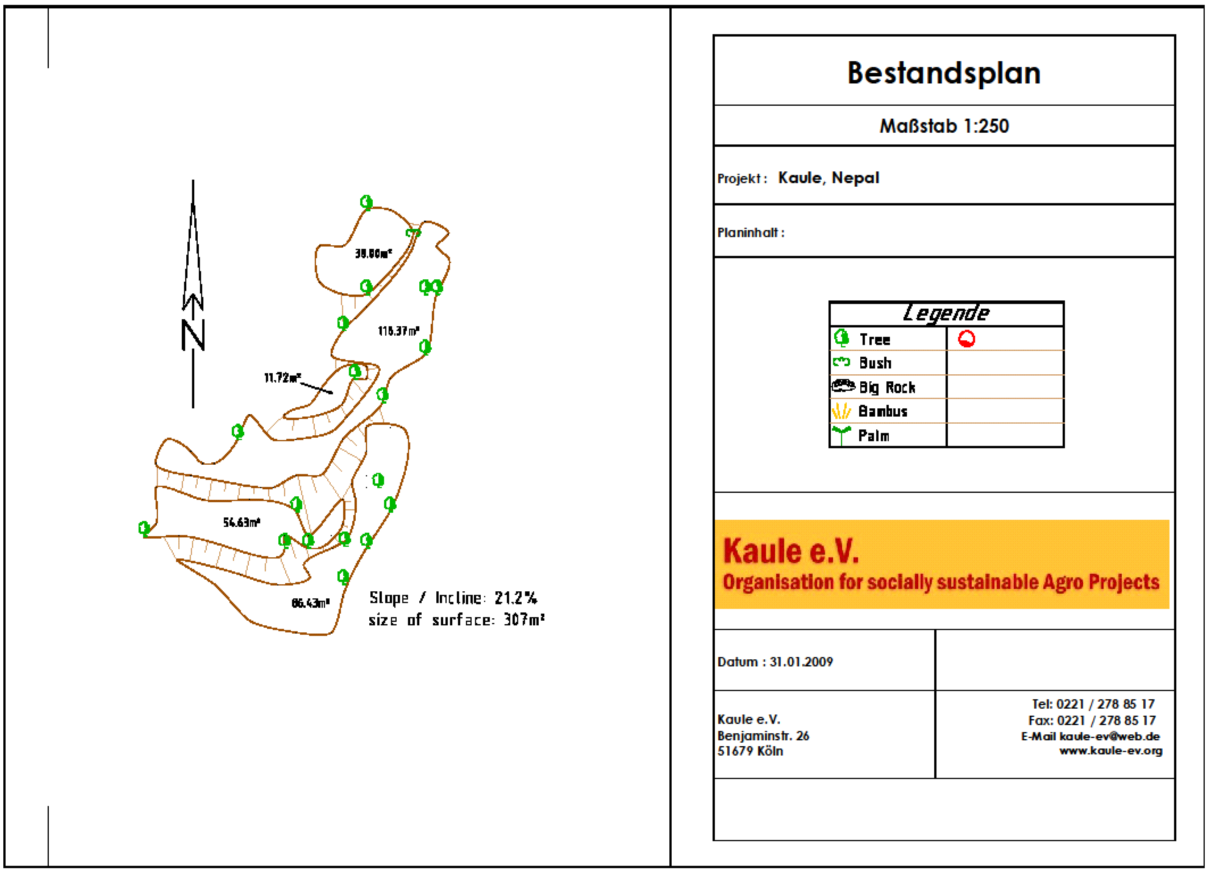
## 9.2.1 Maps

### 9.2.1.1 Farm 1: Fields (2009) assigned for conversion to agroforestry




23.46m²
450.85m²
40.74m²
55.05m²
12.30m²
41.35m²
5.49m²
39.24m²
10.17m²
21.19m²
N
Slope / incline: 38.9%
Water is only temporary available
size of surface: 699.84m²
Bestandsplan
Maßstab 1:250
Projekt: Kaule, Nepal
Planinhalt
Legende
Tree
Bush
Big Rock
Bambus
Palm
Kaule e.V.
Organisation for socially sustainable Agro Projects
Datum : 31.01.2009
Kaule e.V.
Benjaminstr. 26
51679 Köln
Tel: 0221 /
Fax: 0221 /
E-Mail kaule-ev@web.de
www.kaule-ev.org

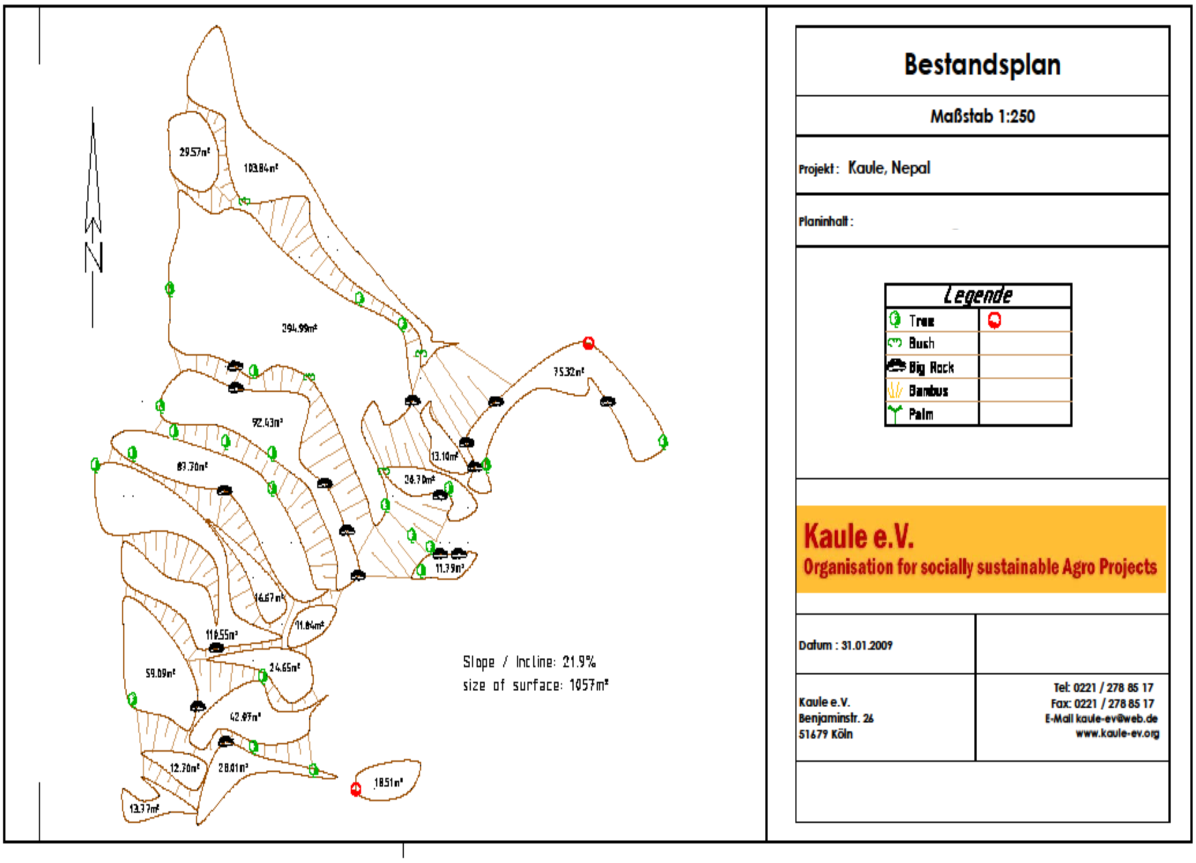
### 9.2.1.3 Farm 3: Fields (2009) assigned for conversion to agroforestry




### 9.2.1.4 Farm 4: Fields (2009) assigned for conversion to agroforestry

Damaged data file, no map available.

### 9.2.1.5 Farm 5: Fields (2009) assigned for conversion to agroforestry




### 9.2.1.6 Farm 6: Fields (2009) assigned for conversion to agroforestry

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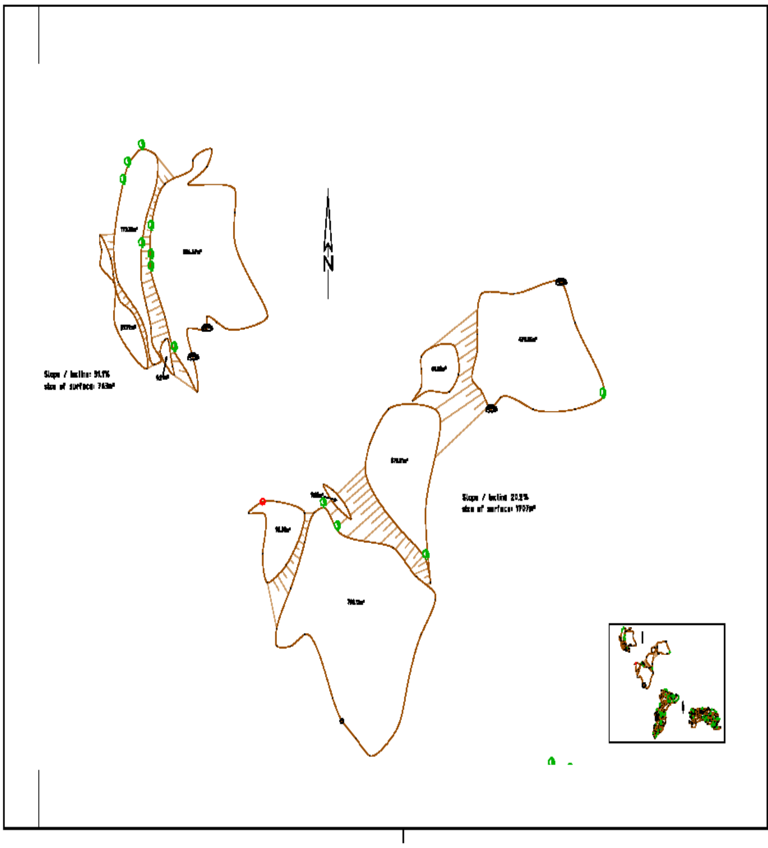


# Bestandsplan

Maßstab 1:500

Projekt: Kaule, Nepal

Planinhalt:

| Legende | |
| --- | --- |
| Tree | |
| Bush | |
| Big Rock | |
| Bambus | |
| Palm | |

**Kaule e.V.**
**Organisation for socially sustainable Agro Projects**

Datum : 31.01.2009

Kaule e.V.
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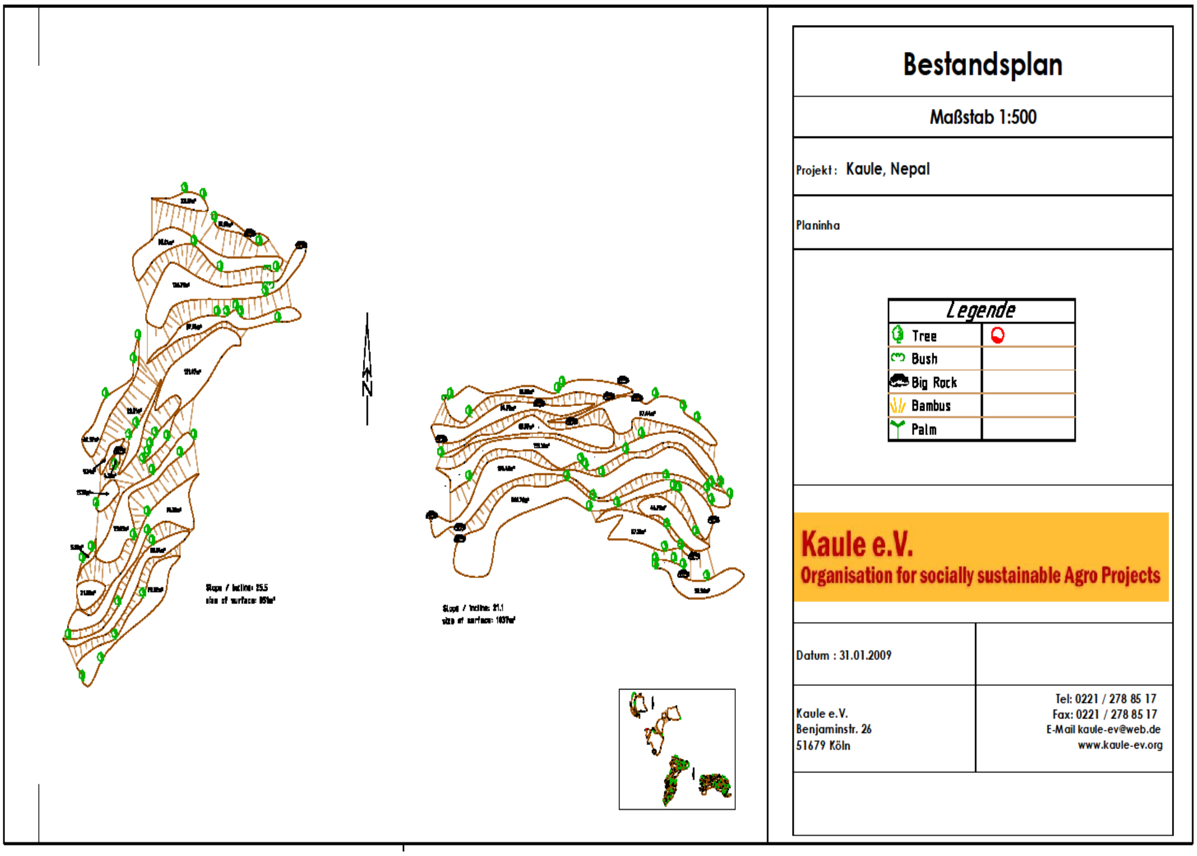
Land b)


Slope / Incline: 25.5
Slope / Incline: 21.1
N
Bestandsplan
Maßstab 1:500
Projekt: Kaule, Nepal
Planinha
Legende
Tree
Bush
Big Rock
Bambus
Palm
Kaule e.V.
Organisation for socially sustainable Agro Projects
Datum : 31.01.2009
Kaule e.V.
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51679 Köln
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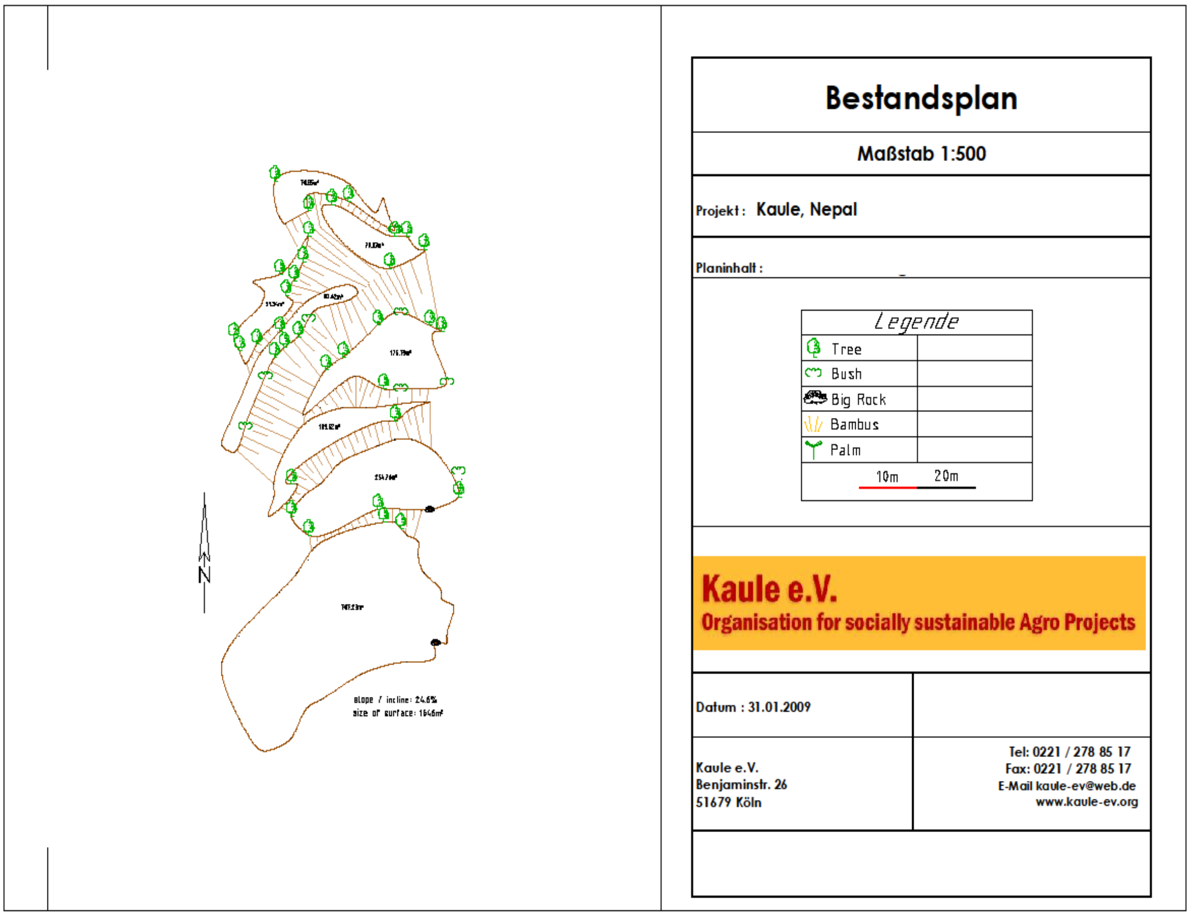
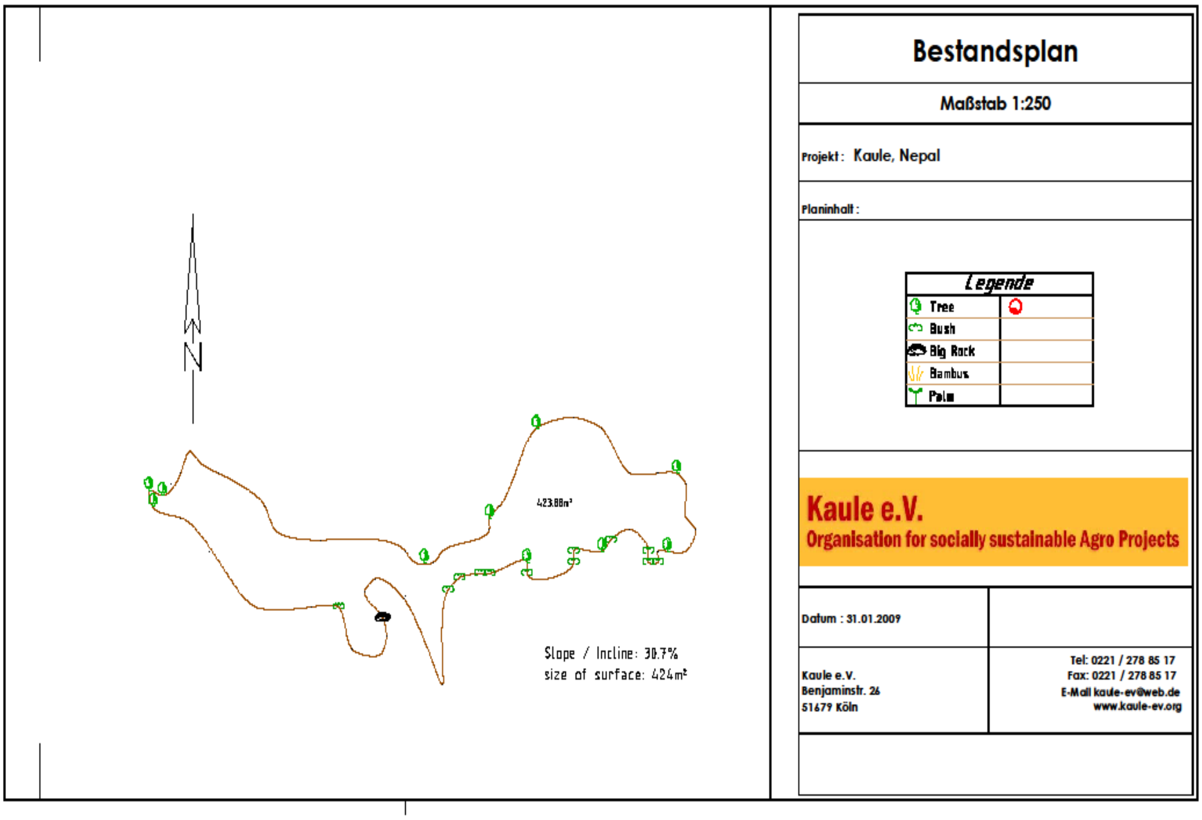
Fax: 0221 / 278 85 17
E-Mail kaule-ev@web.de
www.kaule-ev.org

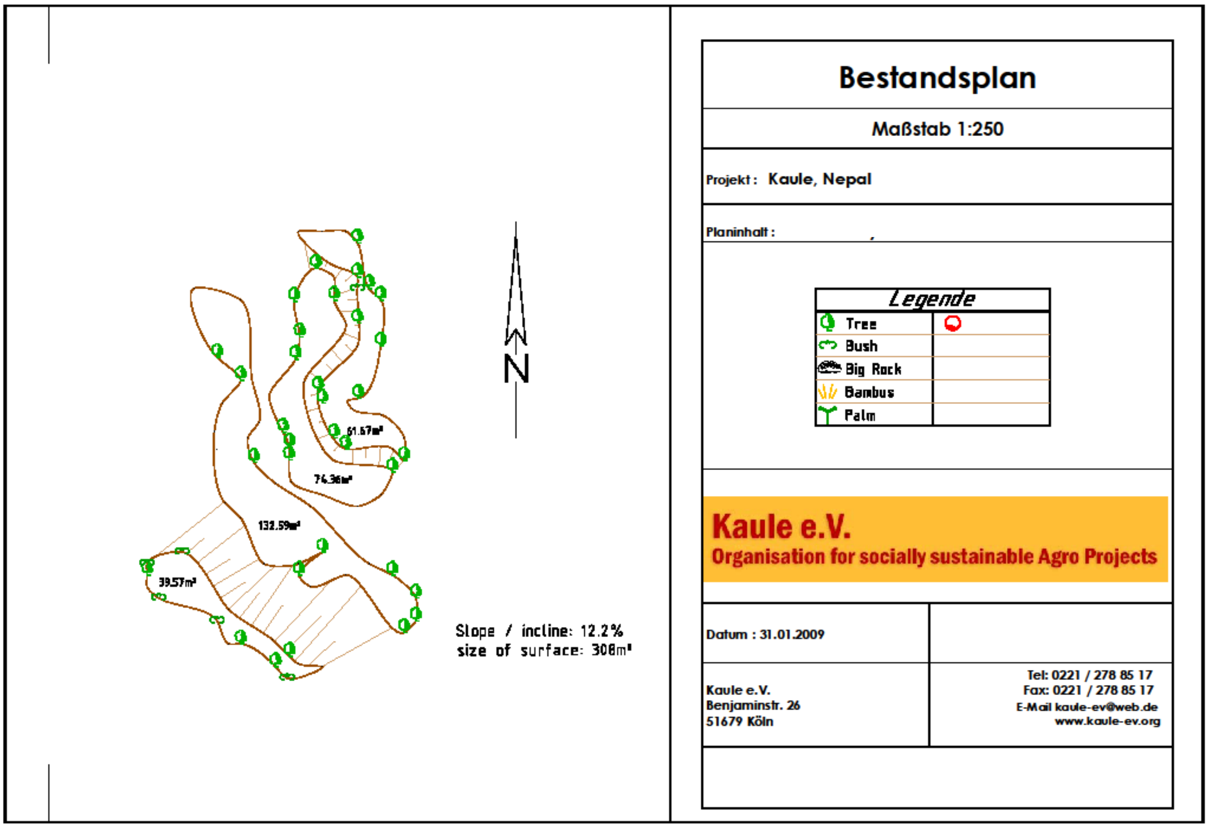
## 9.2.1.8 Farm 8: Fields (2009) assigned for conversion to agroforestry



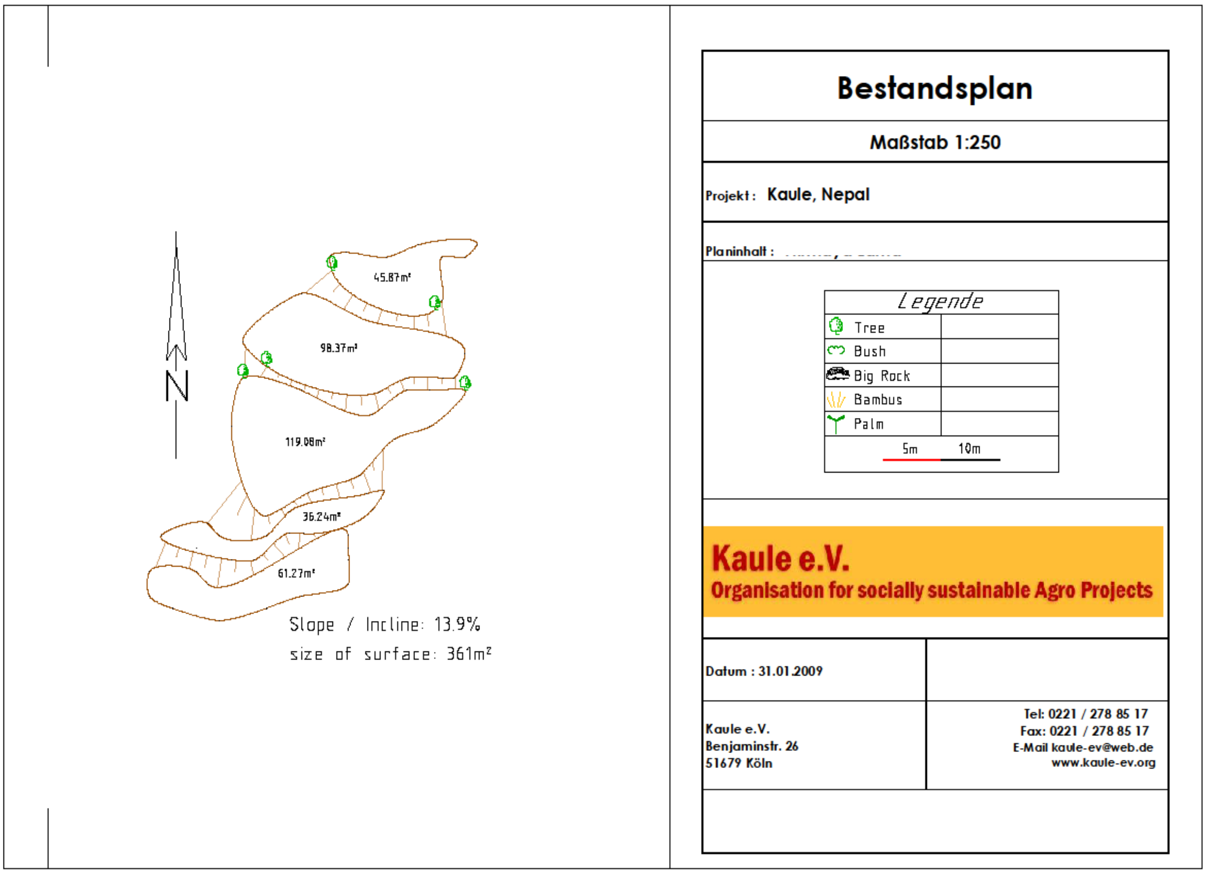
### 9.2.1.9 Farm 9: Fields (2009) assigned for conversion to agroforestry



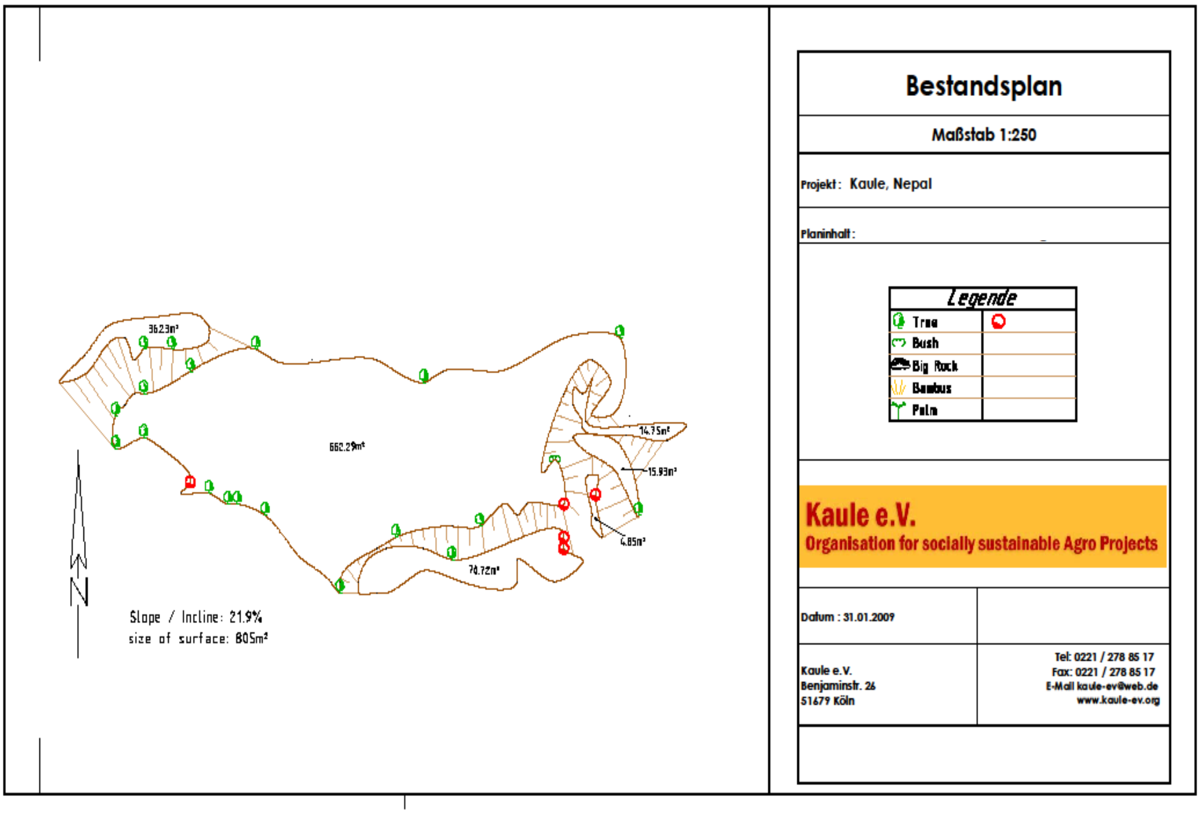
## 9.2.1.10 Farm 10: Fields (2009) assigned for conversion to agroforestry



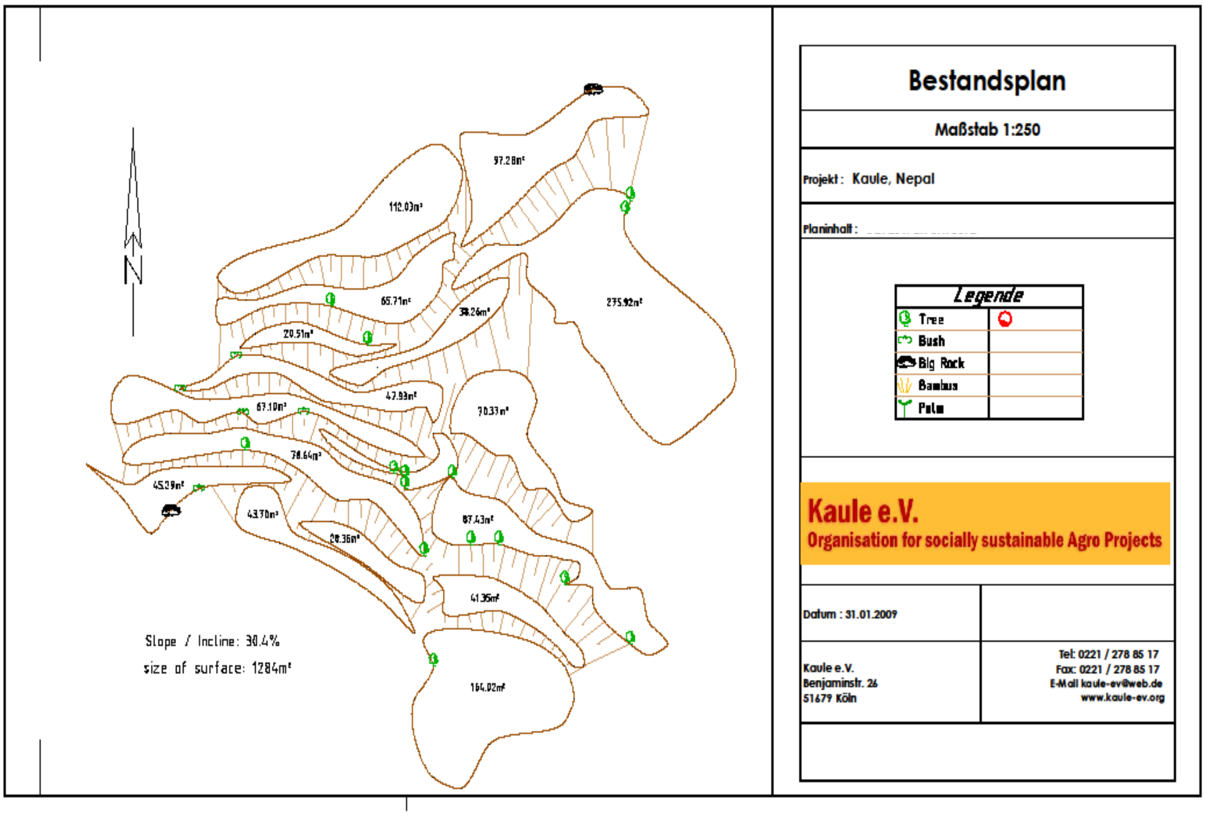
### 9.2.1.11 Farm 11: Fields (2009) assigned for conversion to agroforestry



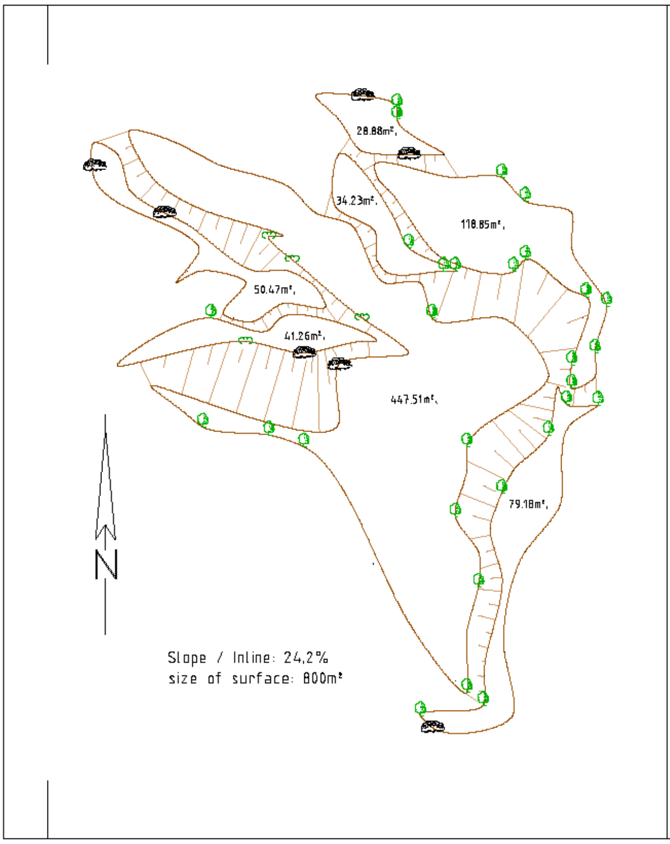
### 9.2.1.12 Farm 12: Fields (2009) assigned for conversion to agroforestry



## 9.2.1.13 Farm 13: Fields (2009) assigned for conversion to agroforestry



### 9.2.1.14 Farm 14: Fields (2009) assigned for conversion to agroforestry



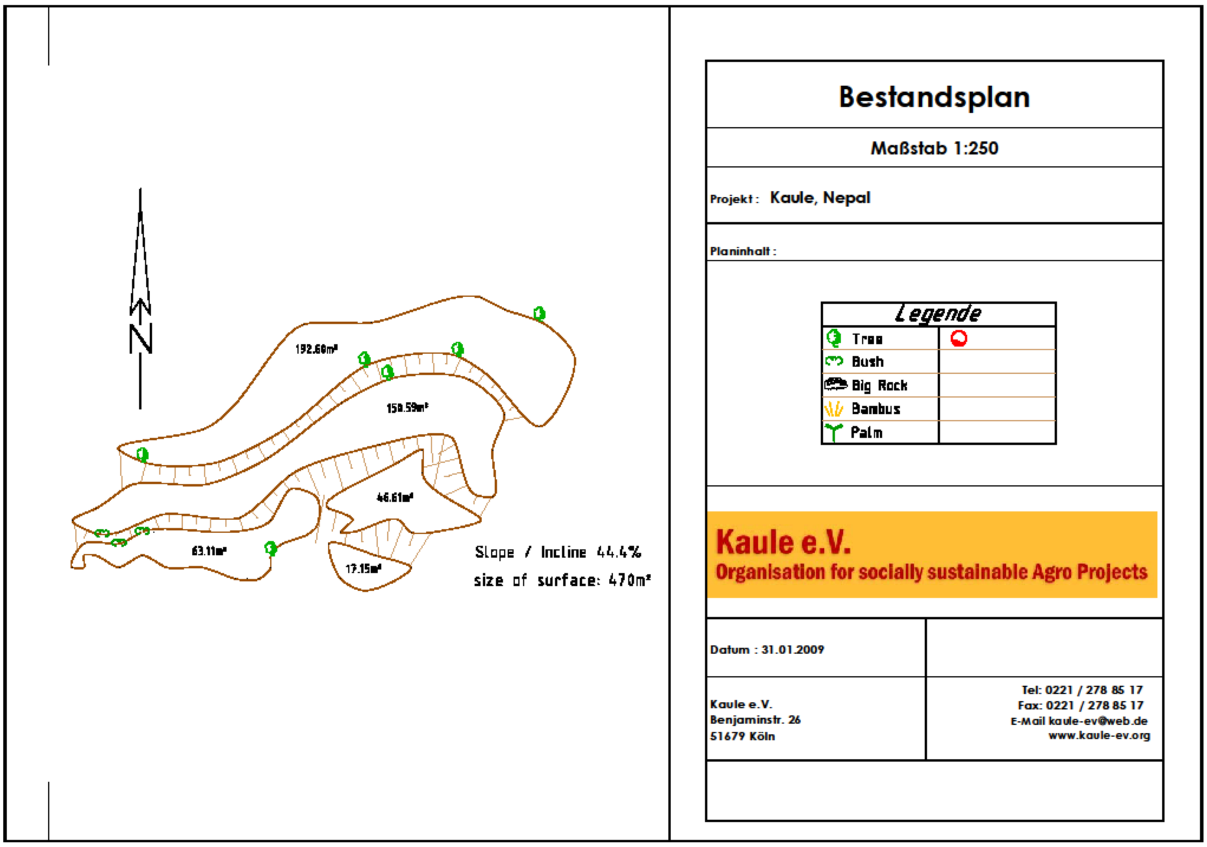

| Bestandsplan | |
|---|---|
| Maßstab 1:250 | |
| Projekt : Kaule, Nepal | |
| Planinhalt : | |

| Legende | |
|---|---|
| Tree | |
| Bush | |
| Big Rock | |
| Bambus | |
| Palm | |
| 5m 10m | |

**Kaule e.V.**
**Organisation for socially sustainable Agro Projects**

| | |
|---|---|
| Datum : 31.01.2009 | |
| Kaule e.V.<br>Benjaminstr. 26<br>51679 Köln | Tel: 0221 / 278 85 17<br>Fax: 0221 / 278 85 17<br>E-Mail kaule-ev@web.de<br>www.kaule-ev.org |

### 9.2.1.15 Farm 15: Fields (2009) assigned for conversion to agroforestry



## 9.3 Curriculum Vitae

| | |
|---|---|
| Name | **Alina Schick** |
| Date and place of birth | **1976, 2nd of July in Bonn, Germany** |
| Primary and secondary education | **1983 - 1987 Primary School, Oberpleis**<br>**1987 - 1993 Secondary School, Oberpleis**<br>**1994 - 1996 Technical College, Cologne**<br>**1996 - 1998 Evening Grammar School, Siegburg** |
| Social Work | **2007 Volunteer in Nepal**, Kaule at an Agroforestry Farm (3 months)<br>**2007 - 2013 Kaule e.V. "Organisation for Socially Sustainable Agro-Projects", Cologne**<br>Executive board member (2007 – 2014), project installation and conduction in Nepal (2009 – 2011) |
| Academic studies | **1998 – 2001** and<br>**2003 – 2004 Dipl. Biology, University of Bonn**<br>Major: Cellular and Molecular Botany<br>**2002 Graduate Certificate of Marine Science, University of Queensland, Australia**<br>Major: Marine Studies and Coastal Ecosystems |
| Work Experience | **2004 – 2006 OECD, Paris**<br>First Trainee then Consultant for Environmental Indicators in the Section of Agriculture and Fishery<br>**2006 – 2008 Nostra gGmbH**<br>Project Manager, Integration of Socially Disadvantaged Citizens at the First Working Market<br>**2012 – 2014 Geo BauPlan UG& Co. KG**<br>Office Management<br>**2012 – Today GraviPlant Project**<br>Research on Environment - Plant Interactions |
| Since 2008 | **Institute of Social Sciences in Agriculture, Department of Rural Sociology (430a), University of Hohenheim**<br>Ph.D. Candidate<br>**2012 and 2014**, Data Analysis in Hohenheim, Thesis Writing<br>**2013** Break for the Establishment of the GraviPlant Project |

Stuttgart - Hohenheim12.03.2015 Alina Schick

**Affidavit**

Herewith I certify that I have completed this dissertation independently, have used only the indicated sources and resources, marked citations as literal or regarding to content, and have not been supported by a commercial agent or advisor.

Stuttgart-Hohenheim, 12.03.2015 Alina Schick