

**AN INVESTIGATION OF AGRICULTURAL SYSTEMS
AND WAYS OF KNOWING IN SAMDRUP JONGKHAR,
BHUTAN:**

**Outcomes of research undertaken by the Samdrup Jongkhar
Initiative: 2011-15**

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This working paper should be considered a work in progress. It is based on evidence available to the researchers at the time of investigation, including field interviews with farmers. We warmly welcome any comments, corrections, modifications, and additional material that can improve and update this report over time. These may be sent at any time to samdrupjongkharinitiative@gmail.com.

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LIST OF ACRONYMS AND ABBRVIATIONS

AEO: Agriculture extension officer

DLO: Dzongkhag (district) livestock officer

FYP: Five year plan

GNHC: Gross National Happiness Commission

IDRC: International Development Research Centre

LEO: Livestock extension officer

MoAF: Ministry of Agriculture and Forests

MT: Metric Tonnes

NBC: National Biodiversity Centre

NOP: National Organic Programme

NPHC: National Post Harvest Centre

NSB: National Statistics Bureau

Nu: Bhutanese Ngultrum (currency)

NWFP: Non-wood forest products

RGoB: Royal Government of Bhutan

RNR: Renewable Natural Resources

RNR-RDC: Renewable Natural Resources Research and Development Centre

SJI: Samdrup Jongkhar Initiative

EXECUTIVE SUMMARY

The following working paper highlights four years of quantitative, qualitative, and Action-Based Research in Dewathang, Orong, Phuntshothang, and Pemathang gewogs of Samdrup Jongkhar, Bhutan. Baseline data were collected at the household level on farming systems and livelihoods to initially monitor the regional transition to organic agriculture and eventually to identify ecologically friendly development opportunities. Overall, the research attempted to document traditional agricultural knowledge, knowledge gained through organic agriculture trainings, and the perspectives of farmers in a total of 179 interviews.

Scientists from Navdanya conducted trainings in 2010, 2011, and 2012 in the region on improved organic farming methods that included: soil fertility and pest management, composting, seed storage, co-operatives, terracing, and rainwater harvesting. This suite of technologies was intended to substitute for the inorganic chemicals that were being actively phased out after the launch of the Samdrup Jongkhar Initiative (SJI). It was hoped that organic agriculture would help to enhance food security and secure lucrative markets allowing farmers to move beyond subsistence, giving the next generation of farmers an incentive to continue farming.

Interviews in 2011, 2012, and 2013 mainly focused on documenting general demographic data of the agricultural systems typically found in the study region as well as monitoring the adoption rates of the taught organic practices through a lengthy questionnaire that upon use in the field was found not to be very culturally sensitive. Agricultural data revealed that farmers in Dewathang and Orong were generally focused on dairy and vegetable production while rice was the main cash crop in Phuntshothang and Pemathang. For various reasons including labour and resource shortages, the interviewed farmers, to a large extent, had not adopted the organic agricultural trainings.

It also became clear that there was extreme agroecological diversity not only between gewogs, but also between and within chiwogs indicating that recommendations for the study region as a whole would be difficult based on current sample sizes. Nevertheless, data from 2011-2013 are presented from the interviews of sampled farmers from each gewog in the following themes: Cropping patterns of Dewathang, Orong,

Phuntshothang, and Pemathang gewogs; Challenges in Agriculture; Sources of Agricultural Information and Community Organizations; The Adoption of the Jersey and Jersey-cross Breed of Cattle; Agricultural Livelihoods; Monitoring the Transition to Organic; Influence of Religion and Traditional Knowledge; New Research Objective; New Research Methodology; and Seed Saving and Diversity.

Research in 2011, 2012, and 2013 also uncovered that Samdrup Jongkhar farmers were practicing traditional forms of organic agriculture already. Instead of trying to monitor the adoption rates of farmers and continue using the lengthy questionnaire, research methodology was altered in 2014 following Action-Based Research in order to better articulate with the region's oral culture, as well as to learn about the traditional practices and knowledge already being used by the farmers.

Interviews in 2014 focused more on the views that farmers wanted to share with researchers, including aspects of their traditional farming, what influences their agricultural decision making, and their views on modernization and change in the region. The research had less of an agenda and didn't worry about extracting specific information, letting the voices of farmers shape the direction of research and recommendations. Data from this year are presented on the following themes: Household Demographics; Life On The Farm; Training; Change in Cropping Systems Since Childhood; Seed Saving; Maintaining Soil Fertility; Pests and Disease; Religion and Decision-Making; Farmer Co-operatives; Modernization; and Dreams For The Future. A section summarizing a seed workshop in 2015 follows.

While the information gathered over the research period has provided a clearer picture of on-the-ground realities of the people of Samdrup Jongkhar, it has only provided a glimpse into the complex agroecological subjectivities of the local people. The SJI's organic agriculture programme must work to balance the introduction of outside information and trainings with cultivating the local knowledge and wisdom that already exist in agriculture in order to support sustainable socio-economic development that does not sacrifice the rich and diverse culture and environment that the people of Samdrup Jongkhar depend upon. Based on the complex intricacies uncovered through this research, the future responsibility of the SJI may be most effective and inclusive as a mediator or

facilitator between farmers and extension officers, paying particular attention to the role that religion plays in agricultural decision-making, building individual capacity, and forging collaborative relationships. Other recommendations based on the problems encountered in agriculture such as the problems with crop raiding by wild animals, seed saving, pests and disease, food storage, and labour shortages as well as potential future agricultural development activities (farmer promoter network, information dissemination, reintroducing traditional crops, biodiversity fairs, awareness building over the importance of local foods, and value added and small-scale processing of foods) are also given in the concluding section.

1.0 INTRODUCTION

Farmers in Samdrup Jongkhar Bhutan have been isolated until the recent past from outside knowledge, practices, and resources regarding agriculture and mostly reliant on their traditional ways of knowing. As farming systems evolved from *tseri* (shifting cultivation) and forest gathering to permanent agricultural land settlements, Samdrup Jongkhar farmers have developed unique and innovative ways of adapting their cropping practices to physical and sociocultural environments in order to maintain food security and provide livelihoods. These agricultural systems developed by farmers, specific to their local context (i.e., altitude, climate, natural resources, cultural values etc.), are increasingly coming under the influence of ecological, social, and economic pressures introduced from the international community.

Approximately 83% of the population of Samdrup Jongkhar practiced subsistence agriculture in 2008 (RNR, 2009). However, Samdrup Jongkhar is ranked as the 8th most vulnerable dzongkhag in food insecurity (RNR, Sector 10th FYP) and only 39% of the households were sufficient in home grain production for consumption in 2008 (Ministry of Agriculture and Forests [MoAF] 2010a). While a traditional agricultural livelihood was once a sufficient means to achieve household food security, it is becoming more difficult for farmers to continue a lifestyle that is unable to meet their economic needs in the midst of development pressures and the growth of a cash economy. Furthermore, rural-urban migration is a serious issue reducing the amount of available on-farm labour, because the youth are searching for better opportunities. In 2009, 37,300 people were migrants, or 6% of the population (United Nations Development Programme. 2009. *Human Development Report*; <http://www.undp.org/hdr2009.shtml>). This is the highest rate of rural-urban migration in South Asia and is projected to continue and even increase if there is not deliberate effort to find incentives for youth to stay in their villages (His Majesty the Fourth King in his 2000 National Day Address to the Nation from Trashigang). Therefore, the capacity of Samdrup Jongkhar farmers to effectively adapt beyond household self-sufficiency, with reduced labour inputs and in light of increasing ecological and socioeconomic pressures, is arising as a serious issue at the regional scale.

The research described in this report is in response to the emerging ecological and social pressures impacting farming systems in Dewathang, Orong, Phuntshothang, and

Pemathang gewogs of Samdrup Jongkhar dzongkhag, located in southeastern Bhutan. Through quantitative, qualitative, and Action-Based Research, this report presents four years of data collected at the household level on farming systems and livelihoods to identify the best ecologically friendly development opportunities in agriculture. The research attempted to document traditional agricultural knowledge utilized by farmers, the use of knowledge shared to farmers through organic agriculture trainings, and the perspectives of farmers about the farming successes and challenges they face in light of development at local and national scales. The goal is that future development projects in the area draw from this research so that projects reflect the voices of farmers, are rooted in their ground realities, and respond effectively to the new pressures faced by rural households.

The research was designed by a collaboration of people from the Samdrup Jongkhar Initiative (SJI; <http://www.sji.bt/>) in Bhutan and GPI Atlantic (<http://www.gpiatlantic.org/>) in Canada, with support from Navdanya (<http://www.navdanya.org/>) in India. Staff of the SJI implemented the research, a team that was multidisciplinary in nature, involving researchers with expertise in agroecology and farming systems, including organic agriculture, capacity development, anthropology, and sociology. The research process involved the participation of farmers, as well as people working closely with farmers, such as agricultural extension officers (AEOs), village-heads, and community members.

1.1 Background on the Samdrup Jongkhar Initiative's Organic Agriculture Programme

There is no panacea for what farmers face in Samdrup Jongkhar. The Samdrup Jongkhar Initiative (SJI), however, has taken an approach towards agricultural development that uses the tools and techniques of Action-Based Research (Reason and Bradbury, 2001) to identify the best ecologically friendly development opportunities in agriculture, thereby encouraging systemic resilience through farmer-to-farmer trainings and capacity building on methods and technologies of sustainable agriculture. The SJI hopes that by promoting economic opportunities that enhance food security and incomes

in the dzongkhag it will empower farmers with a greater capacity for innovation and adaptation in face of future change. In order to work towards this objective, the Organic Agriculture Programme at SJI includes three main components—each consisting of concrete, achievable goals:

- a) Action-Based Research;
- b) Capacity development through organic farming trainings; and
- c) Economic diversification through organic agriculture pilot impact areas.

By understanding the local agricultural context, through transferring appropriate technologies and techniques, and by establishing markets for high-value products, the SJI hopes to help bring about self-sufficiency, while fully protecting and enhancing the natural environment, strengthening communities, stemming the rural-urban migration tide, and fostering a co-operative, productive, entrepreneurial, and self-reliant spirit that will break the culture of dependence and endemic poverty that have characterized the region—the SJI’s primary goal.

This report highlights the quantitative, qualitative, and Action-Based Research component of the SJI organic agriculture programme that has been conducted since the project’s inception in 2010. Other SJI reports summarize the outcomes in Capacity Development (see Navdanya Trainings paper) and Economic Diversification components, such as the 5 pilot impact areas in Soil Conservation, Organic Rice Production (System of Rice Intensification), Fruit Tree Nursery, Asparagus as a Cash Crop, and Solar Drying Technology (see published case studies on each of these pilots). See the SJI website (<http://www.sji.bt/>) for background on the SJI and its programs.

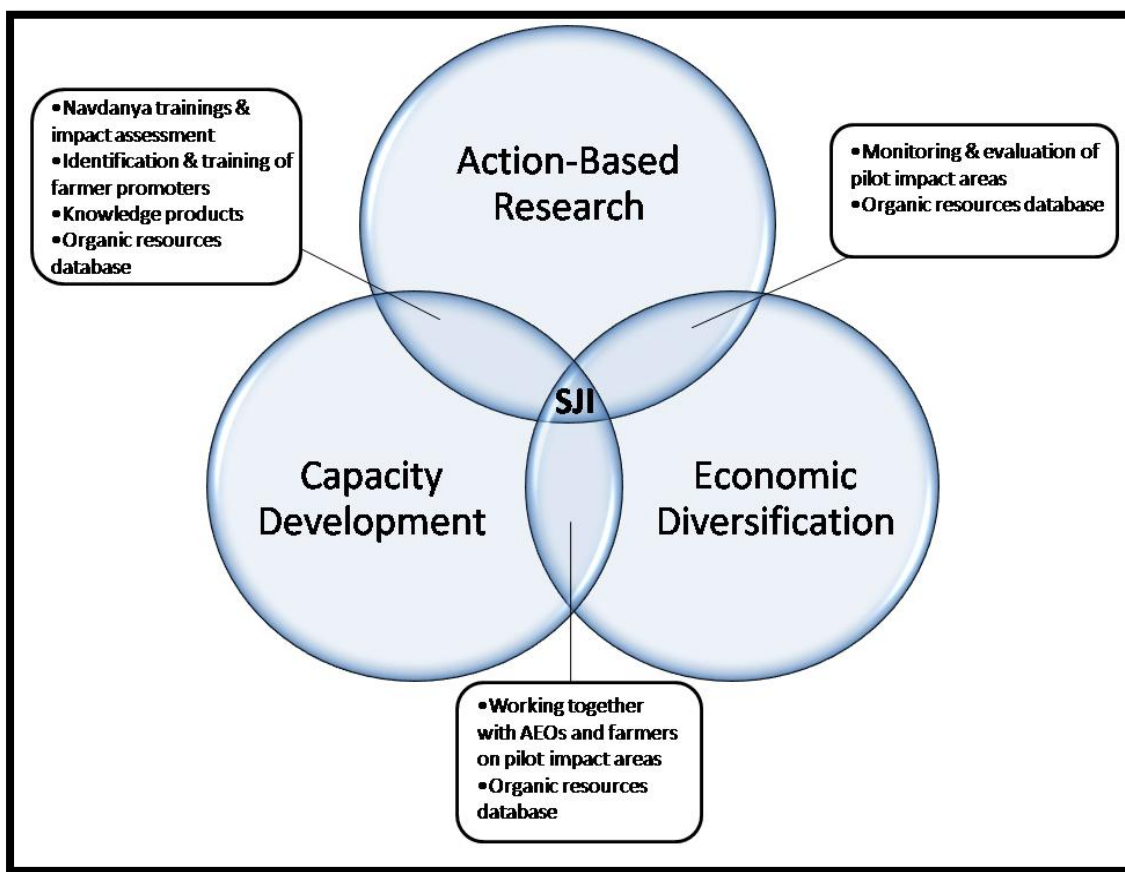


Figure 1: The interconnected focus areas of the organic agriculture programme at the SJI. Action-Based Research is the focus of this report.

1.2 Rationale for Using an Action-Based Organic Agriculture Research Approach

“A primary purpose of action research is to produce practical knowledge that is useful to people in the everyday conduct of their lives. A wider purpose of action research is to contribute through this practical knowledge to the increased wellbeing—economic, political, psychological, spiritual—of human persons and communities, and to a more equitable and sustainable relationship with the wider ecology of the planet of which we are an intrinsic part.”

-Reason & Bradbury, 2001

The nature of Action-Based Research as it relates to agroecological development is fundamentally very sensitive work. On the one hand, sustainable development organizations seek to enhance rural livelihood opportunities efficiently, and on the other, feel that any interventions in the process of research should be designed to account for the complex socio-cultural and ecological contexts within which they are inquiring. While empirically based knowledge certainly has its place within the more “traditional” development paradigm, the embodied or “tacit” knowledge which farmers have gained through a lived experience or through oral transmission must not be glossed over or dismissed (Sriskandarajah et al., 1991).

Rather than taking on the respective roles of “expert-researcher” and “farmer”—a relationship inherently biased towards the knowledge of the former—Action-Based Research in the SJI organic agriculture programme seeks to validate both ways of knowing the world; one that is rich in content, the other rich in context (Bawden, 1991). Through the process of collective inquiry and knowledge sharing between farmers and researchers, a more holistic perspective on the very real issues farmers are facing emerges, bringing with it a mutual trust and commitment from all parties involved. Furthermore, when farmers are empowered with greater agency and mobilized in the process, their respective capacity to innovate and adapt when faced with uncertainty should be enhanced in the future (Sol et al., 2012).

1.3 Rationale and Aims of the Research

The overall objectives and approach within the organic agriculture programme at SJI have followed a natural evolutionary process since the programme’s inception in 2010, based on what has been learned both directly through the research and by observing and

analysing what has worked and what has not. In the beginning, research felt like an “extractive” process (Rhoades and Nazarea, 2006), but as researchers became more aware of the influence of their work and presence in the field, they strove to make the research more participatory and culturally sensitive—thus, the Action-Based Research approach was born. Dr. Julian Gonsalves, external reviewer to the SJI, in 2013, provided materials and support to help the SJI make this change. The SJI believes that research and its objectives should be flexible and open to change in response to emerging research results as the research itself evolves over time.

1.3.1 Evolution of Research Objectives at the SJI

The primary objective during the first stages of the organic agriculture programme at SJI was to monitor and evaluate the dzongkhag’s transition to organic agriculture. During this phase the activities carried out consisted primarily of concurrent training sessions on “improved organic practices”, rooted in scientific and western understandings of the world, followed by field visits conducting in depth interviews that partly assessed the adoption rates by farmers. The trainings were carried out by expert agriculture agents from Navdanya (<http://www.navdanya.org/>), an organization started by Dr. Vandana Shiva in Dehradun, India, and in organic farming methods including soil fertility management, composting, seed storage, co-operatives, terracing, and rainwater harvesting. The in depth interviews that followed drew from detailed questionnaires, recording information on everything from household demographics, to field acreage and land type, to use or non-use of chemical fertilizers or organic practices, to soil electrical conductivity, soil organic matter, and macronutrient content derived from on-site soil samples.

It quickly became clear that while this methodology would yield valuable information over a longer period and larger and random sample population, it was not reasonable to expect a comprehensive set of data with which to inform immediate action. This was especially true considering that the very lengthy initial questionnaire was leading to research fatigue and irritation on the part of farmers. Also, very few of the farmers in 2011 had received training so monitoring was not possible in this year, and of

the interviewed farmers in 2012 that did receive training, only about half of them adopted the taught organic agriculture techniques. This led the research team to rethink the research goals, objectives, and methodology.

Additionally, from preliminary research and following the recommendation of an external evaluator, Dr. Julian Gonsalves (2013), it was uncovered that the objective to “monitor a transition to organic” was somewhat redundant, as the farmers in the region were already inadvertently practicing organic by tradition and default (with the notable exception of cash crops like mandarins), and hence the original intention to observe and monitor a “transition to organic” had to be considerably modified. For example, as noted in the first year’s research and in Dr. Gonsalves’s external review report, most farmers already “practice mixed farming, intercropping, mulching, crop rotation, all considered important aspects of organic farming.”

The unpacking of experiences and results and the inputs of the external reviewer led to the development of SJI’s research framework and strategy from a “top-down” approach to one rooted in farmer agency—now central to SJI’s identity. The pitfalls associated with “top-down” development have been cited elsewhere (Sabatier, 1986; Escobar, 1997; Jakimow, 2008). Thus, a new objective to highlight the contextually relevant skills and knowledge that farmers already have surpassed the old objective to inject “improved” practices and monitor their adoption rates. It was hoped that the new research objective would help elucidate the factors involved in farmers’ decision making and possibly inform with more detail as to why farmers adopt or reject introduced agricultural technologies. Thus, as of 2013, the **SJI’s primary research objective** became:

To collect baseline data to inform research about current local organic agriculture practices (traditional and introduced) and what can be improved within these practices, in order to identify the best ecologically friendly development opportunities in agriculture.

In basic ways this decided practical shift in focus remained very much in line with both original project objectives and the fundamental philosophy and understanding of

both the farmer trainers and of the Samdrup Jongkhar Initiative as a whole. Thus the first visit to Samdrup Jongkhar by Dr. Vandana Shiva, founder and head of Navdanya, for the launch of the SJI in December 2010 was marked by a meeting she had with about 250 local farmers, which she began by asking them to describe their existing traditional practices. After listening carefully, Dr. Shiva noted they were already effectively practising important core elements of organic agriculture.

Subsequent trainings led by senior Navdanya farmer trainers, beginning in December 2010, further built on existing practices by refining and improving existing methods for better results and higher productivity. Thus, they focussed on examining closely existing composting methods and working closely with farmers to improve the methods of preparation, storage, and application to use the compost to maximum advantage. Indeed farmers regularly expressed appreciation that, in sharp contrast to the more ‘modern’ advice to shift drastically from traditional methods to use of chemical fertilizers, pesticides, and so-called ‘high-yield’ seeds, the SJI/Navdanya trainings were acknowledging and building on, improving, and enhancing what was already familiar to them and traditionally practised for generations past. Similarly the SJI/Navdanya trainings taught farmers how to identify and use effectively natural and biological pest-control agents already available on their own land.

In line with this philosophy, the purpose of the newer approaches to SJI research was therefore to represent the myriad of voices and perspectives of farmers more effectively than is possible through a more quantitative questionnaire alone, in order to inform SJI’s work both to improve economic security and to support and enhance the existing ecologically sound agricultural practices of farmers. In order to do this, a more participatory methodology (Chambers, 1994), focused on the integration of local and global knowledge (Agrawal, 1995; Sillitoe, 2007), was developed to draw out the expertise of farmers so that the research could learn from them.

2.0 BACKGROUND TO THE STUDY

Samdrup Jongkhar dzongkhag (or province/district in Bhutan) is located in southeastern Bhutan, directly adjacent to the Indian states of Assam and Arunachal Pradesh (see Figure 2). The dzongkhag has eleven gewogs (or sub-districts): Martshalla, Pemathang, Phuntshothang, Samrang, Lauri, Serthi, Langchenphu, Gomdar, Wangphu, Orong, and Dewathang (see Figure 3). The dzongkhag has a population of 47,708 and a total of 5,191 households (<http://www.samdrupjongkhar.gov.bt/index.php/dzongkhag-profile>).



Figure 2. Bhutan. Centre: Map of Bhutan's 20 districts and major cities (<http://www.nsb.gov.bt/map/main/map.php#>).



Figure 3. Map of the 11 gewogs of Samdrup Jongkhar (<http://www.samdrupjongkhar.gov.bt/index.php/dzongkhag-map>).

With a total area of 1,878 km and an altitude range between 200-3,600 m, there is a variety of agroclimatic zones within a relatively short distance (GNHC, 2013). Samdrup Jongkhar dzongkhag is characterized by elevations that range 200 meters to 3600 meters above sea level (<http://www.samdrupjongkhar.gov.bt/index.php/dzongkhag-profile>). The dzongkhag is covered in broadleaf sub-tropical evergreen forests, mountains, and is scoured by a history of water erosion. The most level and fertile area suitable for large-scale agriculture is limited to areas along the southern border (<http://www.samdrupjongkhar.gov.bt/index.php/dzongkhag-profile>).

Samdrup Jongkhar is classified as part of Bhutan’s Wet Subtropical Zone, which has the lowest altitude, warmest weather, and most rainfall in the country (5,309.4 mm;

as recorded at Aerong), with an average annual humidity of 7%. The monsoon predominates from June to September whereas October to March is the dry season. The climate is subtropical with temperature ranges from a minimum of 14 degree centigrade to a maximum of 36 degree centigrade (<http://www.samdrupjongkhar.gov.bt/index.php/dzongkhag-profile>).

According to the Statistical Yearbook of Bhutan (NSB, 2012), only 4.3% of Samdrup Jongkhar's total land area is classified under agricultural land. The crop diversity grown on this land is relatively high due to the existence of microclimates and the range of agroclimatic variation within the dzongkhag. Cereals, primarily rice and maize, horticultural crops, and fruits predominate agriculture in the dzongkhag. While cereals such as maize and rice are grown on both irrigated and rain-fed fields, horticultural crops such as vegetables, pulses, oilseeds, spices, and fruits are grown almost exclusively on rain-fed upland lands.

Due to the warm climate and the potential for double cropping, maize is the most extensively grown and double-cropped cereal crop in Samdrup Jongkhar, followed by rice (NSB, 2009; 2012). According to the National Statistics Bureau (2012), 5,251.06 MT of maize was produced from on a total of 4,642.02 acres in 2012. For rice, a range of locally bred landraces and improved varieties provided by the government are cultivated from lowland (irrigated) paddy to uplands reaching 2,600 m. In 2012, farmers in Samdrup Jongkhar produced 3,031.91 MT of rice on 2,356.47 acres, contributing 6.7% of the total production in Bhutan (RNR, 2009).

In terms of horticultural crops, the diversity of agroecological zones in the dzongkhag provides a range of opportunity for vegetable and cash crop cultivation. The most widely cultivated vegetables continue to be potato, saag, radish, chilli, pumpkin, and onion, though brassicas such as cabbage, cauliflower, and broccoli, as well as solanaceous crops such as tomato and eggplant are increasing in popularity as they enter the palettes of the population (RNR, 2009).

As for cash crops and fruits, farms in Samdrup Jongkhar produce ginger, cardamom, areca nut, walnut, peach, plum, orange, mango, pears, and bananas, along

with lesser production of apple, passion fruit, star fruit, and persimmon (RNR, 2009). These high-value cash crops are an important source of livelihood generation for farmers in Samdrup Jongkhar, especially considering that Samdrup Jongkhar thromde serves as the economic hub for the five eastern-most dzongkhags of Bhutan, creating a potential for meeting market demands in both India and internationally.

Soils in Samdrup Jongkhar dzongkhag are generally shallow and often overlays gravel, making farming practiced on hillsides a considerable challenge due to soil erosion. The most common present method for increasing soil fertility is tying cattle in fields, letting manure incorporate into the soil itself, although some farmers are practicing various forms of pit and pile composting to maximize soil fertility. Both intercropping and mulching are traditional practices used by farmers to varying degrees.

Most of the farmers in the dzongkhag are organic by tradition or default, but they have also mentioned — especially in 2011 research — that they would use chemical inputs if they were available. This viewpoint has changed in recent years, however — see 2013 research findings section below — which might have something to do with the work of the SJI . Therefore, due to circumstance and the marginal location of farmers in Samdrup Jongkhar, they are unable to purchase the expensive inputs required for high-external input agriculture. Surrounding the urban areas, though, more farmers have the opportunities to use synthetic fertilizers or pesticides that were at one time supplied by the Bhutan government. In 2008, 5.6% of the households in Samdrup Jongkhar used pesticides, amounting to 6.3 MT. In the rest of the country, Paro had the highest percentage (68%) of households applying pesticides at nearly 450 MT followed by Punakha (48.5%), whereas in Gasa, there were no pesticides applied in 2008 (RNR Census, 2009). In Samdrup Jongkhar, census data indicate that pesticide use is highest in Orong (12.7%) followed by Gomdar (11.9), as both are large producers of mandarins (RNR Census, 2009).

Farmers using chemical inputs have noted that hard pans and nutrient imbalances within the soil have become commonplace. When fertilizer use is analyzed by gewog in Samdrup Jongkhar, it appears that Serthi has the lowest percentage of households using organic fertilizers (0%) followed by Martshala (1.9%), Langchenphu (3%), and

Dewathang (4%). Orong had the highest percentage of households applying organic (farmyard manure) fertilizers to their fields (64%) followed by Phuntshothang (60%), and Gomdar (54%; RNR Census, 2009). In terms of chemical fertilizers (i.e., urea) only 10% of households overall in Samdrup Jongkhar apply these to their fields. However, the highest using gewogs were Lauri (28%), Orong (15%), and Gomdar (14.7%) (RNR Census, 2009).

In addition to cereal and vegetable production, activities on the farm consist of raising livestock (dairy cattle, draft animals, and poultry), processing food, and producing wild crafted products. The national cattle population has declined from 345,000 in 1999 to 316,000 in 2005 (RGoB, Ministry of Agriculture and Forests, National Strategy For Community Forestry, 2010). This reduction is attributed to the transition from local cattle to the Jersey breed as well as the transition farmers made from an average between 30-40 free ranged to 6-12 stall fed animals during this same time frame with a concomitant reduction in forest grazing. Confinement of animals is currently recommended (GNHC, 2007—Samdrup Jongkhar 10th FYP, 2008-2013) for the introduced Jersey breed, which have replaced indigenous breeds adapted to forest grazing. Furthermore, milk-marketing groups have been institutionally established to help market dairy products regionally.

Almost 87% of the total land area of Samdrup Jongkhar is classified as forest (NSB, 2012). Through the creation of Community Forestry, in 2001, Bhutan has transferred forest management from a centralized to a decentralized paradigm. Community Forest Management Groups are comprised of local people who traditionally were the stewards of forest resources. Surprisingly, although Samdrup Jongkhar has a wide range of non-wood forest products (NWFP) and uses 94.73% of the community forest's 24,997 ha land base for that purpose, they are ranked as one the least important sources of income with 11.8% of the households benefiting (the national average is 5.58%). Chirata (*Swertia*), star-anise (*Illicium griffithii*), bamboo, cane, and mushroom are examples of NWFP in Samdrup Jongkhar (GNHC, 2007—Samdrup Jongkhar 10th FYP, 2008-2013). It is important to note that the number one mechanism to cope with food shortages in Samdrup Jongkhar is selling NWFP (78.95%).

Traditional practices of *Tsamdro* (grazing) livestock and *Sokshing* (collection of leaf litter and fire wood) in community forests do not come at a cost, but are allocated and considered as NWFP to households typically not in excess of 2.5 ha (Ministry of Agriculture and Forests, RGoB, National Strategy For Community Forestry, 2010). The goals of sustainable forestry and developing thriving rural economies will have to allow for compromises between commercialization/income generation and traditional wild crafting to support rural livelihoods.

Many issues remain for the forestry sector as it decentralizes decision-making and responsibilities to local communities. A balance between conservation, scientific silviculture regimes, and empowerment of the extensive local and site-specific knowledge of communities is still being established. As the transfer materializes, the forestry departments will continue to provide technical advice and facilitate participatory silvicultural technique implementation.

Farm products are primarily for household consumption, but excess is sold or bartered depending on market access. Some products, including rice grain, maize, vegetables, butter, farm cheese, milk, meat, eggs, and alcohol are directly marketed for cash. The preservation of vegetables is traditionally accomplished through pickling and sun drying. These practices remain as the primary methods to extend the harvest into all seasons; however, electric driers have recently expanded due to a government-sponsored program. Solar driers are relatively new to Bhutan and have been distributed to rural villages without electricity (see SJI's Solar Drying Case Study on the dissemination of solar driers to remote Lauri and Serthi gewogs). Wild harvested and cultivated straw mushrooms, as well as chillies can contribute significantly to a producer's income.

There are several challenges impacting farmers in Samdrup Jongkhar. According to the Renewable Natural Resources Census (RNR, 2009), the most significant challenges to farming were soil fertility and erosion (59%), increasing pest (including wild animals) and disease pressure (35%), insufficient irrigation (17%), unproductive land (12%), and monsoon rains (9%). Many of these issues are interrelated. Monsoon rainfall leads to soil erosion and leaching of soil nutrients, particular in the absence of terracing on much of the sloped land. The loss of organic matter increases the need for irrigation during the dry

season. Crops that are nutrient deficient and water stressed are more prone to pests and diseases. Eventually, continued abuse and neglect results in unproductive land.

From their research in 9 gewogs of Samdrup Jongkhar, PannoZZo et al. (2012) identified declining soil quality and pests, market access, and difficulty competing with Indian produce as primary agricultural challenges (Table 1). Although 79% of the population is engaged in agriculture, 51% of the rice, which is the national staple food, 50% of the pulses, and 75% of the edible oil are imported, mainly from India (Delek & Thimmaiah, 2007). Samdrup Jongkhar town is located near the border with Darranga, Assam and is a major border crossing for imported produce. For example, the shopkeepers in Dewathang buy vegetables from India because they are much cheaper, sometimes half the cost of the equivalent Bhutanese products. Most often, Indian produce looks more appealing to the customer, due to a much higher use of synthetic agricultural chemicals. This may explain why Samdrup Jongkhar villagers have often shared that they generally view produce from Bhutan as ‘clean’, but still purchase produce from India. Interestingly, Bhutan’s Auditor General, who is originally from Dewathang, noted that in the 1980s, Samdrup Jongkhar was practically self-sufficient in food production, with almost nothing bought or imported from across the border.

The availability of perishable produce and processed consumer goods from India may also explain the loss of crop biodiversity noted by PannoZZo et al. (2012). Traditional grain crops like *Yangra* (foxtail millet; *Setaria italica*), *Cherra* (little millet; *Panicum sumatrense*), *Kongphu* (finger millet; *Eleusine coracana*), *Brayma* (bitter buckwheat; *Fagopyron tataricum*), *Breymo* (sweet buckwheat; *Fagopyron cymosum*), and *Mo* (amaranth; *Amaranthus spp*). have mostly disappeared, but are still grown in some pockets of Samdrup Jongkhar, including Lauri gewog. Corn, rice, and wheat flour have largely displaced the use of these labour intensive and difficult to grow crops in the diets of local Bhutanese. Diminishing livestock diversity can be attributed to government initiatives to introduce foreign breeds like the Jersey to increase milk production.

Table 1. Major challenges related to agriculture in Samdrup Jongkhar.

Problem	Causes
Low food self-sufficiency	Lack of water Difficult to store during monsoon season Crop damage by wild animals Insufficient labour Soil erosion and low soil fertility Pest and diseases Insufficient land
Biodiversity losses	Growing cash economy and urbanization Increasing chemical fertilizers and pesticides (insecticide and herbicide) use Low availability of seeds Increasing improved breed of livestock
Lack of marketing channels	Cheap vegetables imported from India Lack of infrastructure (roads and storage)

Source: Summarized from PannoZZo et al., (2012).

Ethnically, Bhutan is extremely diverse with many language groups and communities with dialects that belong to Tibetan-Bhutanese origin (Delek & Thimmaiah, 2007). Samdrup Jongkhar has a mixed population of Sharchops and Lhotshampas. While the Sharchops are of Buddhist faith, the Lhotshampas are Hindus. The official language is Dzongkha, however English is quite common in Samdrup Jongkhar, especially among educated youth whose higher secondary school education is largely in English. In Samdrup Jongkhar, the primary language is Tshangla, or Sharchop followed by Lhotshamkha, Nepali.

3.0 RESEARCH METHODS

3.1 Study Area and Population

This research focused on four gewogs (Dewathang, Orong, Phuntshothang, and Pemathang; Figure 4.), out of 11 in the dzongkhag, based on their accessibility. The researchers focused on understanding farmers' realities in these particular areas in more depth, rather than stretch their capacities too thinly over a larger research area with minimal outcomes. Dewathang and Orong are located at relatively higher altitudes than Phuntshothang and Pemathang, with maize, vegetables, and citrus planted as the major crops. In the lowlands of Phuntshothang and Pemathang gewogs (also know as Bangtar) more tropical fruits, paddy rice, areca nuts, and ginger are grown. General information and cropping patterns of these four gewogs are shown in Table 2. and Figure 5.



Figure 4. Research study area in Samdrup Jongkhar: Orong, Dewathang, Phuntshothang, and Pemathang gewogs. Adapted from RNR, 2009.

Table 2. Profile of four gewogs selected for study. (Adapted from RNR, 2009 and Tsering Om, 2010).

Gewog	Dewathang	Orong	Phuntshothang	Pemathang
Altitude (m)	800-1,000	1,200-1,500	200-300	600-1200
Population	3,091	4,626	2,751	2,515
Area (km²)	358.1	179.0	137.2	66.1
Dryland (acre)	901.5	1843.9	745.0	478.0
Paddy (acre)	77.9	66.1	657.3	657.3
Fallow (%)	34.8	ND	15.9	11.3
Distance to Dewathang (km)	18	62.5	68	77
Poverty ratio (%)	30	42	46	56
Irrigation channel (km)	5	16.6	11.7	11.0
Main products	Maize, Mandarin, dairy	Maize, Mandarin, vegetables	Rice, areca nuts, ginger, fish, goat products	Rice, areca nuts, ginger, goat products
Co-operatives	Milk	Cheese/ Butter, Tengma, Vegetables	Rice, Fish, Bee keeping	Goat
Organic fertilizer application (%)	4.0	ND	59.5	33.1
Chemical fertilizer application (%)	10.6	ND	2.3	6.5
Pesticides (%)	4.8	ND	4.9	2.4

ND: No data.

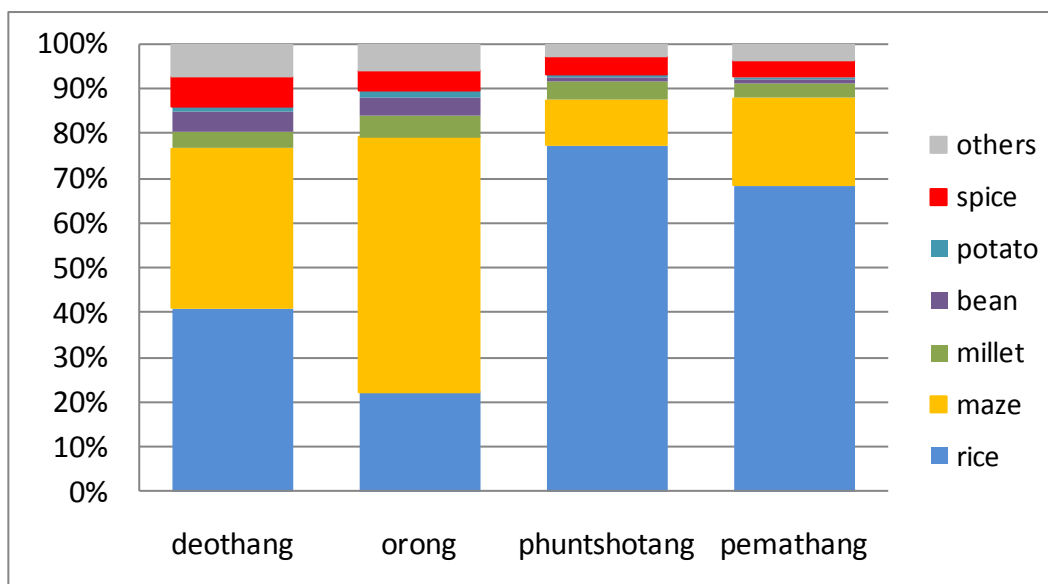


Figure 5. Cropping pattern for Dewathang, Orong, Phuntshothang, and Pemathang gewogs, MoAF (2010) Agricultural Statistics.

The population of Dewathang and Orong is predominantly Sharchop, while that of Phuntshothang and Pemathang are Lhotsampa. The primary language spoken in Dewathang and Orong is Sharchokpa and most people follow Vajrayana Buddhism, originally from Tibet. In Phuntshothang and Pemathang, while there are some Sharchop residents, the majority of the population is of Nepalese origin and Hindu religion.

3.2. Quantitative, Qualitative, and Action-Based Research Approaches

All research was based on ethnographic methods (participant observation, interviews, and field notes; Bernard, 2006). Since 2011, foreign and local researchers conducted 179 (quantitative and qualitative) in-depth and extensive sets of field interviews with farmers from Orong, Dewathang, Pemathang, and Phuntshothang. Specifically in 2011, two sets of interviews occurred with four foreign researchers. The first set was with two researchers and included 60 interviews. The second set, with another two researchers, included 40 interviews. In 2012, two researchers, one foreign and one local, conducted 11 extensive interviews. In 2013, 18 extensive interviews were conducted by entirely local staff as they gained proficiency in research methods—a part of the capacity building

initiative of the organization. In the final year, 2014, three local staff conducted 50 more interviews. Across the geowgs, since 2011, a total of 61 interviews were conducted in Dewathang, 47 in Orong, 34 in Phuntshothang, and 37 in Pemathang.

The method of sampling farmers varied each year, as research methods evolved, and as findings were carefully examined with a view to learn from experience and improve both SJI practice and the research itself. In 2011, because the research objective was to monitor the transition to organic agriculture, AEOs took a ‘purposive sample’ (Bernard, 2006) of farmers based on their interest in learning and practicing organic agriculture. This also followed several training visits made by Navdanya scientists and trainers who taught farmers about organic and sustainable agriculture including soil fertility management, composting, seed storage, co-operatives, terracing, and rainwater harvesting. The goals of these trainings were that farmers would adopt the taught organic practices and be monitored in subsequent years. In 2012, farmers in Dewathang were chosen by SJI Farmer Liaisons (staff of the SJI who liaise between the organization and farmers), based on their previous trainings and to follow up on the interviews conducted in 2011. There were also farmers selected for interviews who hadn’t received prior training and who were interested in contributing to the study. In 2013 and 2014, farmers from diverse socioeconomic backgrounds were chosen at random by SJI Farmer Liaisons, based on their recruitment by the local *Tshogpa* (village head).

In 2011, 2012, and 2013, quantitative and qualitative interview questions were derived from the *SJI Agricultural Composite* and *Qualitative Questionnaire* (see APPENDIX A and APPENDIX B), spanning the themes of technology adoption, local farming practices, farming challenges, traditional knowledge, and economic livelihoods, etc. In 2014, quantitative and qualitative interview questions were derived from the *Farmer Questionnaire* (see APPENDIX C) and attempted to learn about farmers’ perceptions of traditional and contemporary farming and decision-making and to document the local stories and perspectives of farmers as they wished to share. It was also hoped that by better understanding the subjectivities of farmers, researchers could better understand the reasons for technology adoption and rejection. The work in 2014 attempted to have less of a research agenda and was designed to learn from farmers about the issues important to them, an approach no less reliable or valid from a larger research

perspective. Farm-site evaluations and participant observation were also used to gather data on social, environmental, and household economic conditions in all four years.

Various interpreters helped translate interviews from Sharchokpa—the non-written, Sino-Tibetan language of eastern and southeastern Bhutan—and Nepali to English when held with foreign researchers, while the local SJI research team conducted other interviews only in Sharchokpa and Nepali. All interviews were audio recorded and transcribed to English for analyses. Interviews took between 1-3 hours to complete not including transcription.

Quantitative data analyses in the study were done using Microsoft Excel and SPSS. Qualitative analyses were based on open-coding of the observational notes and interview transcripts. Transcripts were inductively open-coded to detect themes (Opler, 1945). Techniques used to draw out themes included: looking for repetitions, identifying indigenous typologies, metaphors, and analogies, as well as similarities and differences between interviews. Processing the data used the basic “cut and sort” technique to organize the findings thematically.

4.0 RESEARCH FINDINGS

The findings reported in this section are organized by year, as sampling methodology and the different research questionnaires used did not allow for year-to-year data to be combined. Again, from the long-term perspective of the researchers, the possible loss in capacity to produce time series results in the first four years of operation is far compensated by the essential evolution of research methods and practices to suit local conditions and needs. The researchers were literally learning from each cycle of research and adapting both research and practice accordingly.

Results below are presented and discussed in various themes: In 2011: Cropping patterns of Dewathang, Orong, Phuntshothang, and Pemathang gewogs; Challenges in Agriculture; Sources of Agricultural Information and Community Organizations; The Adoption of the Jersey and Jersey-cross Breed of Cattle; and Agricultural Livelihoods. In 2012: Monitoring the Transition to Organic; Influence of Religion and Traditional Knowledge; New Research Objective; New Research Methodology. In 2013: Seed Saving and Diversity; Traditional Agricultural Knowledge; and Challenges to Farming. In 2014: Household Demographics; Life On The Farm; Training; Change in Cropping Systems Since Childhood; Seed Saving; Maintaining Soil Fertility; Pests and Disease; Religion and Decision-Making; Farmer Co-operatives; Modernization; and Dreams For The Future.

4.1 Findings from 2011

The primary goal of 2011 research was to collect baseline data from April through August in the four gewogs — Dewathang, Orong, Phuntshothang, and Pemathang — and from September to December to begin and monitor the transition to organic agriculture. Two sets of foreign researchers underwent the research in 2011 when a majority of the work was completed. From April to September, 60 interviews were conducted with farmers, and from September to December, 40 were conducted. Weather was unusually favourable during the monsoon season that year, making travel easy without any restrictions.

4.1.1 Monitoring the Transition to Organic

It was realized, by the time the research was underway that insufficient numbers of farmers had been trained in organic agriculture to be able to monitor their adoption rates. In April 2011, 15 farmers had been chosen to attend the Navdanya trainings in Dehradun, India and it wasn't until July 2011 when Navdanya's top trainer Negi-ji visited Samdrup Jongkhar to continue the trainings. Of the 15 farmers who had received organic agriculture trainings, only a few had adopted them. Farmers mentioned time and other resource limitations for the lack of adoption; however, for many farming was not their primary profession and may have also contributed to the lack of interest.

4.1.2 Cropping Patterns of Dewathang, Orong, Phuntshothang, and Pemathang Gewogs

There are two seasons for crop production; one planting in the winter (September – January/February) and one planting in the summer (February – July/August). Summer is characteristically very hot and humid with frequent rains and landslides. Maize and vegetables are planted in February and harvested in June with a gap until August. Winter is cold and dry with very little rain and frequent water shortages. Crops are planted in August for harvest at the end of November and then there is a break in the cycle until February.

Crop production varies within each of the gewogs, because of different elevations, climatic differences, availability of markets, and perhaps, farmer decision-making priorities. Pemathang and Phuntshothang both reported a higher number of fruit trees and nuts as cash crops than Dewathang and Orong. This diversification could explain the need to diversify agricultural income in Pemathang and Phuntshothang, as livestock/dairy does not provide a reliable source of income as it does in Dewathang and Orong.

Rice and buckwheat are grown in Pemathang and Phuntshothang, where wetland predominates, the land is flat enough, and there is enough water for irrigation during the summer months. Here, paddy land is often leased and is paid for by giving 50% of the cultivated rice to the landowner in return. Commonly planted rice varieties include: Khamthi, Moshino, IR-06, IR-08, IR-64, Sarkali, and Bdr. Farmers mix three to four varieties together during cultivation to avoid pest and diseases, and to differentiate

commercial rice and that for self-consumption. As of 2011, in winter, paddy fields remain fallow, whereas by 2014, daincha (*Sesbania bispinosa*) plants are planted in the winter as a green manure.

Dewathang and Orong have frequent water shortages and grow only dryland maize typically on steep slopes during the monsoon. Some lowland paddy does exist outside of Dewathang in Rikhey village, but it is estimated to be at ~5%. Most cultivated land in Orong and Dewathang occurs on land owned entirely by the farmers and around their households. Table 3 highlights a summary of household data collected at the farm-level in the four gewogs.

Table 3. Averages of household data collected from selected farmers in four gewogs.

Gewog	Dewathang	Orong	Phuntshothang	Pemathang
Family members per household	5.57	3.93	4.40	5.07
Farmers per household	2.81	2.71	3.07	3.41
Leased in (acre)	0.19	0.00	2.03	2.32
Leased out (acre)	0.00	0.00	1.20	1.00
Dryland (acre)	2.97	3.05	1.26	1.39
Paddy (acre)	0.18	0.00	3.20	2.86
Fallow (acre)	1.47	0.18	0.40	2.50
Access to farm from house (min)	9.33	1.43	13.33	6.38
Access to the nearest road (min)	15.00	1.43	0.42	22.86

Grassland and fallow land account for 29% of the total land use in Dewathang, and 36% in Pemathang (see Figure 6). Other prominent crops are mandarins, which account for 13% of agricultural land use in Dewathang. Commonly grown commercial vegetables include chillies, beans, ginger, garlic, and spinach.

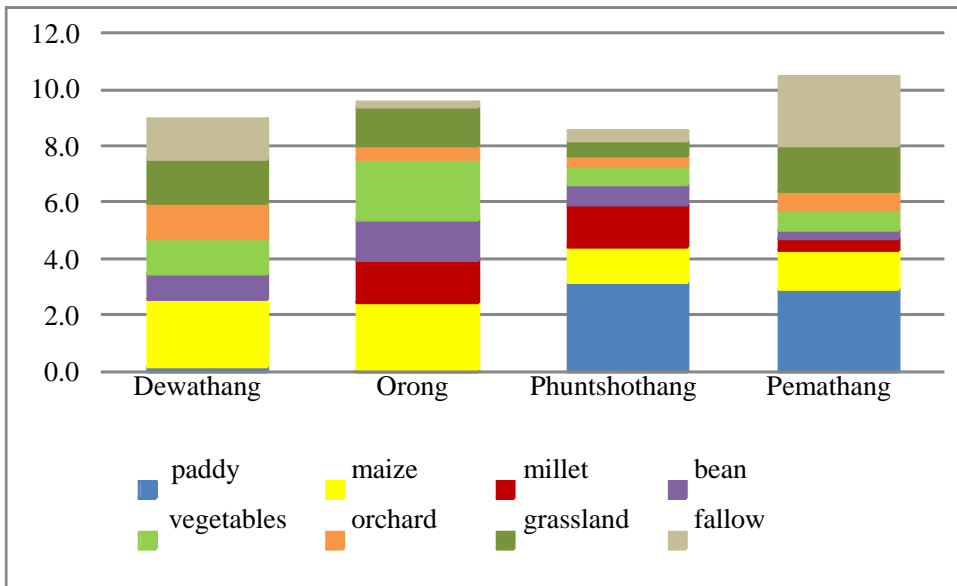


Figure 6. Total or average crop area (acre) of selected households form four gewogs.

The crops listed in Tables 4, 5, 6, and 7 are what the sample of farmers (n) said they produced, and do not necessarily reflect agricultural statistics from the MoAF. It is also important to note that farmers did not list off everything that they produced when asked, but needed direct questions, so the following tables are only a general indication of the crops grown in the gewogs.

Table 4. Dewathang Crop Production (n=7)		
Kitchen Garden	Field	Other
Radish	Maize	Banana
Cabbage		Mango
Chilli		Okra
Beans		Guava
Spinach		Areca Nut
Cauliflower		
Potato		
Pumpkin		
Forest Potato		
Ginger		
Garlic		
Onion		
Broccoli		
Saag		

Table 5. Orong Crop Production (n=8)		
Kitchen Garden	Field	Other
Radish	Maize	Banana
Cabbage	Dhal	Oranges
Chilli		Tapioca
Pumpkin		Mango
Beans		Peaches
Spinach		
Ginger		
Cucumber		
Stick Potato		
Cauliflower		

Table 6. Phuntshothang Crop Production (n=7)		
Kitchen Garden	Field	Other
Radish	Maize	Banana
Cabbage	Buckwheat	Mango
Chilli		Okra
Beans		Coconut
Spinach		Guava
Cauliflower		Banana
Potato		Litchi
Pumpkin		Papaya
Forest Potato		Sugarcane
Ginger		Pomegranate
Garlic		Areca Nut
Onion		
Broccoli		
Sac		

Table 7. Pemathang Crop Production (n=6)		
Kitchen Garden	Field	Other
Radish	Maize	Banana
Cabbage	Rice	Tapioca
Chilli	Paddy	Mango
Beans	Buckwheat	Okra
Spinach	Dhal	Coconut
Cauliflower		Guava
		Areca Nut

Crop rotation, intercropping, and mulching are traditionally well known and commonly used techniques (Table 8). A total of 75.4% of interviewed farmers (n=60) are practicing intercropping with mainly maize and beans. Some farmers are also sowing pumpkin below the maize crop to better utilize the land and to suppress weeds. On the ridge of paddy fields, farmers in Phuntshothang and Pemathang commonly grow lentils or peas to provide nutrients, as well as to prevent soil erosion and to preserve water. Although 80% of interviewed farmers (n=60) had knowledge of composting, only half of them made compost. Only 56% of interviewed farmers know how to control pest and diseases without using pesticides (herbicides, insecticides, and fungicides). The role of beneficial insects is not widely known (18.4%; n=60). A more detailed description pertaining to farmers' knowledge and practices is provided in Table 8.

Table 8. The percentage of farmers knowing about specific agricultural practices and whether they practice them.

Practice	Number of farmers sampled	Knowledge (%)	Practice (%)
Composting	57	80.7	53.6
Tethering	31	ND	41.9
Crop rotation	54	81.5	83.0
Intercropping	58	79.3	75.4
Mulching	54	83.3	77.8
Soil conservation	56	73.2	55.4
IPM	57	56.1	42.1
Beneficial insects	49	18.4	8.2
Traditional medicine	48	37.5	ND

ND: No data.

Very few farmers save their seeds other than a few maize and rice varieties. Vegetable seeds used to be available free of cost, but the government (via AEOs) are now charging for these. It is uncertain if farmers lack experience saving seeds or if there is no interest due to availability from AEOs. Several farmers mentioned the reason they buy seeds is that vegetable varieties are difficult to save and that there are seed quality issues. Some farmers reported that traditional seed knowledge is disappearing as paddy and maize replace the need for old crops. Only a few farmers are saving traditional crops such as kongphu, yangra, cherra, khala, and breymo. There was specific interest by Pemathang farmers to start a seed storage facility in their gewog to preserve old, locally adapted varieties.

The application of chemical fertilizers, mainly urea, is very low in all gewogs. Following the launch of the SJI, traders and AEOs in Samdrup Jongkhar agreed to no longer supply urea to local markets. As of 2011, only 7.5% of interviewed farmers (n=60) in Samdrup Jongkhar were still using urea. Many farmers stopped using urea after experiencing that it hardens their soil. However, some farmers buy urea in India or are using leftover stocks from past years. Farmers have accepted the discontinuation of chemical fertilizers in the area, largely as a result of SJI and Navdanya influence; however, farmers felt more reluctant to abandon the use of pesticides. Thirty seven percent of interviewed farmers (n=60) used pesticides in 2011. In Orong and Pemathang, almost half of the farmers used insecticides and herbicides—insecticides are commonly utilized in paddy and herbicide usage is the highest in Pemathang. These are provided by the AEOs and often for free. According to AEOs, there seems to be an increasing demand for pesticides from farmers. It is interesting to note that most farmers who used insecticides and herbicides considered themselves as practicing ‘natural’ and ‘organic’ farming.

Dewathang and Orong appear to focus mainly on livestock and maize as sources of income and supplement their income with vegetables produced from kitchen gardens. Improved breeds of cattle represent 64.6% of the cattle in Dewathang and 82% in Orong, whereas in Phuntshothang they represent 32.9% and 46.1% in Pemathang (n=60; Table 9). There are milk co-operatives in Dewathang and Orong, and Orong’s milk co-operative

also focuses on cheese and butter making, however milk is most profitable. None of the selected farmers in Dewathang and Orong reared goats or sheep, while most farmers in Phuntshothang and Pemathang did. Farmers in Pemathang have initiated a goat-keeping group to be able to provide credit to farmers interested in buying goats.

The focus on maize and livestock in Dewathang may be due to poor growing conditions and the inability to produce enough vegetables on marginal soils to satisfy both self-consumption and market production. In contrast, Orong did report having a vegetable group, the Morong Vegetable Group Co-operative, that markets vegetables to the local school and government officials, but this was only reported by a few farmers and apparently was not a major source of income.

Table 9. Livestock profile from selected households in four gewogs. Average values have been transformed.

Average livestock per farm	Dewathang	Orong	Phuntshothang	Pemathang
Local cow	1.70	0.67	2.33	2.33
Improved breed cow	3.10	3.07	1.14	2.00
Ox	1.40	0.67	1.86	2.82
Mithun	0.00	0.00	0.07	0.00
Horse	0.00	0.00	0.07	0.08
Goat	0.00	0.00	1.14	1.23
Sheep	0.00	0.00	0.36	0.62
Chicken	3.00	0.53	126.79	3.54
Livestock unit per acre	2.24	0.74	0.65	0.56
Milk production (liter/year)	270.00	210.00	64.50	56.59
Egg	299.00	15.00	568.18	50.00

Across Samdrup Jongkhar, maize has multiple uses; however, its primary use is to produce alcohol. *Bangchhang*—a local wine made by fermenting maize is also distilled into *Ara*. A secondary use of maize is for food consumption. It is often ground into a coarse powder and eaten with rice, called *Kharang*, or pressed into flakes to make *Tengma*. Maize is also an important source of cattle feed. Many farmers grow two varieties of maize: *Yangtsipa*, which is an improved variety for self-consumption, and *Zerpa* is a local variety used for feeding cattle.

In Orong and Phuntshothang, 13% and 16% of interviewed farmers grew millet, respectively. Foxtail millet, little millet, finger millet, and amaranth are traditionally grown for making *bangchhang*, *ara*, and for ceremonial purposes during pujas (religious rituals). Buckwheat (*Fagopyrum spp.*) is grown for *Putang* (traditional noodle), or *Kyaptang* (traditional bread).

4.1.2 Challenges in Agriculture

Pests

The main pests and diseases are caseworm (*Paraponyx stagnalis*) in paddy and citrus fruit fly and Huanlongbing (HLB; citrus greening) diseases in mandarin orchards, in addition to various soil-borne diseases in potato and ginger. Commonly observed biological control methods taught in SJI/Navdanya trainings include spraying organic pesticides such as solutions extracted from Neem (*Azadirachta indica*), Vakain (*Melia Azadirachta L.*), Lantana (*Lantana Camera*), and Artemisia (*Artemisia annua L.*; see Table 10). Other organic pesticide solutions include the use of chilli, ginger, and turmeric that are mixed with soap, ash, or oil. Cultural control methods practiced by farmers include crop rotation, especially for potato and ginger, burning residues to avoid diseases in peppers, and collecting dropped oranges to avoid transmission of diseases in oranges. Some farmers mentioned the importance of planting on auspicious days to prevent diseases. Some farmers use panchagavya (“*Five Products*” from the cow: cow dung, cow urine, milk, curd, and butter (ghee), providing a powerful organic fertilizer and pest repellent) and vermiwash (a method of collection of the sticky substance on the earthworms, rich in nutrients and also acting as an insect repellent), introduced by Navdanya earlier in 2011.

Table 10. Inventory of existing farmers' knowledge and management practices.

Management	Knowledge	Practice
Nutrient management	Composting (CPP, panchagavya, pile compost, vermicompost)	Tethering and Pile compost are largely applied (Panchagavya and green manure are new techniques being promoted)
Crop protection	Tethering Intercropping Green manure Hand picking Burning residue Garlic/Chilli /Ash/Soap Mulching Crop rotation Seed treatment Timing of planting Guarding	Hand picking and using ash/garlic/chilli/soap for pest control is commonly practiced. Siren and guarding/noise making is practiced for wild animals
Soil and water conservation	Stone bunds Contour planting <i>Tantshe</i> (slope plants) Cover crops Terracing Mulching	Stone bunds are used in paddy fields. <i>Tangtshé</i> is grass planted on ridges or slopes. Pumpkins are grown under maize as a cover crop.
Post harvest (storage)	Hanging maize on roofs Sun drying vegetables Pickling Burying underground	Sun drying vegetables is common. Maize is mainly stored hanging over smoky fires, or is crushed and processed (<i>Kharang</i> and <i>Tengma</i>).
Farm equipment	Ox-plough Hand spade Milling machine Maize grinding tool	Farm mechanics are hardly seen in the district. Traditional tools such as ox-plough, wooden miller, and stone grinders are largely used.
Non Timber Forest Products (NTFP)	Mushroom/Banana Honey Fodder production Wild vegetables (Yam, Fern, Asparagus) Medicinal plants Soap seeds Bamboo/Rattan	Community forest groups maintain NTFP. Income generation from medicinal plants and crafts is a newly developed program.

Soil and Water Conservation

Soil erosion, land degradation, and availability of water are serious problems in Samdrup Jongkhar. According to the Dewathang AEO, hillside slopes are getting steeper and steeper, with less topsoil due to soil erosion. Interviews revealed that as many as 73.2%

of farmers (n=60) know about soil conservation methods to some extent but few go as far as building terraces. Most interviewed farmers (77.8 %) use some form of mulching to protect soil from heavy rainfall and to keep moisture during the dry season (Table 10), however corn fields are often located on steep slopes with little soil cover. The main soil and water conservation practices used by farmers include: preparing stone bunds for paddy terraces, growing cover crops such as pumpkin underneath the maize canopy, and contouring the ridges of terraced fields with lentils and other legumes. *Tangtshe*, or slope plants, introduced free of cost by the livestock department, are commonly known to protect the soil, and are planted on the ridges of terraces or slopes. Fodder grasses, such as Napier grass, Ruzi, and Para grasses, are also being used and promoted as types of tangtshe. The forestry department also supplies bamboo free of cost to farmers.

The limited implementation of terracing and other soil conservation practices prompted the Soil Conservation Case Study in Serthi gewog (see published study at www.sji.bt/). One of the main limitations to up-scaling terracing appeared to be the labour needed to establish them, but once informed of the benefits of soil conservation, farmers were more willing to invest the labour needed to see future gains in soil health. Specifically, terracing appeared to be used by only a few farmers in Dewathang, Orong, Phuntshothang, and Pemathang, and only after SJI/Navdanya trainings informed farmers of the benefits. Interestingly, during a field visit to Gomdar, a gewog adjacent to Orong, in 2015, over 50% of the land was observed to be in terraces with tangtshe of Napier grass. Why terracing is not widely practiced in these four gewogs of study, but commonly in Gomdar, is uncertain. This difference could be attributable to trainings by local AEOs and/or traditional practices specific to these areas.

Farmers used to double-crop their paddy in Phuntshothang and Pemathang but have now abandoned this tradition due to a diminished water supply during the winter months. Instead, farmers leave fields fallow and allow cattle to graze. Some farmers reported water shortages in winter, some in summer, and some not at all. It appears that access to water is dependent on the location of the water source, which varies across villages and gewogs. In Pemathang, farmers are looking for support to improve irrigation

channels and water access. Some farmers expressed that this was the biggest hurdle to becoming food self-sufficient.

Destruction of Crops by Wildlife

The human-wildlife conflict in Bhutan is especially troubling for farmers. It is speculated that wildlife interference in farming is the result of several factors including the diminishing habitat in neighbouring Assam, as well as the wildlife corridors and protected areas abounding in Bhutan. In particular, respondents in Dewathang (n=10) reported the trouble they were having with wild elephants when discussing what types of crops they grow. When asked about any concerns they may have, they also mentioned the issues with animals. Many people were exasperated by the trouble that wild animals were causing and unsure what to do. Dewathang and Phuntshothang (n=10) had the highest reported incidence of human-wildlife conflicts (Table 11). Elephants were not mentioned as being an issue in Phuntshothang, but it was stressed that these animals do a lot of damage to crops in Dewathang. No one in Orong (n=10) brought it up, even when asked about major incidents. During field visits to Phunshothang, the hosting farmers took turns getting up throughout the night to try to ward off wild boars (Table 10). Their technique was to take a flashlight and sit up in a tree stand looking out over the paddy and sing at the top of their lungs.

Table 11. Wild animal problems for four Gewogs (n=10).

Gewog	Pests Reported	Frequency reported %
Orong	No major issue	.
Pemathang	Wild Boar, Deer, Porcupine, Birds, Monkey	30
Phuntshothang	Wild Boar, Elephants	50
Dewathang	Wild Boar, Elephants, Deer	30

One reason given to explain the diminishing crop diversity in the region, particularly buckwheat and foxtail millet, is that they are more susceptible to wildlife attacks. In Pemathang, many of the Lhotshampa speaking participants (n=10) said that until recently they did grow millet, however they began having problems with crows to

the extent that their crops were almost completely decimated forcing them to stop growing the crop and switch to rice. It is uncertain as to why traditional crops are more susceptible to predation, but it was a common reason given.

Although they do have a siren to ward off animals in the village—as is mentioned in Pannozzo et al., 2012, as an emerging local technology to address the issue—it is not working anymore due to the animals growing accustomed to the noise. There have been other proposed technologies to ward off wild animals such as electric fencing and using bees, but these were not addressed in this study. There were a few lucky farmers that stated they did not have any troubles with animals, compared to others, because they were located in town. This problem is a relevant and even serious issue that deserves some consideration in future development projects of the region.

Post Harvest

Post-harvest loss is also a serious issue, where moisture and temperature are especially high during the monsoon season. Up to 43.2% (n=20) of farmers experienced post harvest losses across the gewogs. Maize is the most susceptible, as it is dried with the cob intact, hanging from rooftops (Table 10). One farmer mentioned that modern roofs made of aluminum sheets worsened the amount lost in storage compared to traditional housing made of bamboo or straw roofs, which control temperature and moisture better. Ear rot caused by *Fusarium spp.*, is one of the major causes of storage loss of maize. Air-drying storage units for maize kernels were supplied by the National Post Harvest Centre (NPHC) to overcome this constraint, but were not well adopted in the gewogs due to the preferred method of roof drying. Generally, the post-harvest losses for vegetables are not as high, as farmers tend to sundry and pickle them for preservation. In Orong, the MoAF has provided drying sheds.

4.1.3 Sources of Agricultural Information and Community Organizations

Findings suggest that the most common form of receiving information regarding agriculture was from either the livestock (LEO) or the agricultural extension officers

(AEO; see Table 12). This is an important research finding that helped shape the SJI's new objective and action for training AEOs in organic farming methods, rather than the farmers themselves. Fifty-five percent of participants watch agricultural programs on television and 24% listen to the agricultural radio programs. Programs on the television or radio were also popular sources of entertainment and knowledge. One farmer reported learning how to make compost from a radio special. Although, more often than not, the content on television focuses on mechanization, many farmers said they were also aware of organic methods from the same source. It was very rare for someone to say that they learned about agricultural techniques from their neighbours. There were some reports that respondents first heard about the Jersey from neighbours, or were interested because they saw what others in their community or other communities were doing and wanted to adopt Jersey cows as well.

Table 12. Sources of agricultural information (n=31).

Media or Distribution Channel	Participants Reported Utilized
Newspaper	3%
TV Agricultural Programs	55%
Radio Agricultural Programs	24%
Agricultural Extension Officer (AEO)	58%
Neighbours or Friends	0%
Self or Family	6%
No One	3%

The main co-operative groups in the four gewogs are the milk marketing (or livestock), vegetable, and community forest groups (see Table 13). The vegetable group is responsible for collecting produce, marketing, and selling it in Samdrup Jongkhar town. The milk groups have been the most successful in Dewathang and Orong, selling milk each day both locally in Samdrup Jongkhar town, and across the border in India as a widely acclaimed and popular export item. The community forest group was only recently formed and some people were not entirely sure of the benefit of participation, but were members nonetheless. The community forestry group was responsible for maintaining the health of the forest for future generations by restricting access at certain times of the year.

Table 13. Community Group Participation by Gewog.

Gewog	Groups Available	% Member	% Female/Male Members
Orong (n=10)	Milk Marketing, Vegetable, Forestry	100%	50/50
Phuntshothang (n=4)	Forestry, Fishery	20%	50/50
Pemathang (n=6)	Forestry, Goat	66%	50/50
Dewathang (n=4)	Milk Marketing	50%	40/60

Farmers who were members of a community organization spoke of the benefits in terms of financial assistance, ease of market access and discounted milk products (milk marketing group), access to forest products and protection of the forest (community forest group), and a sense of pride and happiness in being apart of a group. It was noted that there was a difference between farmers who participated in the groups and farmers who did not. One participant noted that farmers not part of a group had less confidence socially than those that did participate. Commonly, participants who were not in a group would say that they were uneducated, and thus not able to participate, or they had too many responsibilities with children and family members.

4.1.4 The Adoption of the Jersey and Jersey-cross Breed of Cattle

Samdrup Jongkhar dzongkhag has a strong history of dairy production and reverence for the cow. As one farmer in Dewathang said,

“Even the cow dung can be used in the field as manure, so there is a whole advantage having the cow. Even a bunch of spinach needs cow manure to grow well... if there are no cows, [there is] no meaning for the farmer. One can become rich due to cows”.

Orong has the strongest presence of Jersey cows of all the gewogs, possibly because the MoAF provides cowsheds, pasture seeds, and training, but not pasture land itself (Table 14). Farmers across all the gewogs noted the troubles with Jersey as compared to the local breeds. Much of the difference comes down to taste and quality of milk and ease of care in the local breeds versus the higher milk production in the Jersey

or Jersey-cross. One farmer discussing the differences between the Jersey and the local breeds said, that the Jersey have more diseases and eat more; whereas the local breeds live longer, are healthier, and have better, richer milk. However, this farmer continued to explain that the calf mortality rate is the same and their temperament is similar, but the output with the Jersey is higher and provides a very good source of income. Therefore, the focus of this farmer’s operation is completely on milk yield. Other farmers referred to this particular farmer as an exemplar for the community and an expert in livestock.

Table 14. Livestock and Adoption by Gewog.

Gewog	Breeds Reported	Span of time from adoption	Farms with Jersey or cross (%)
Orong (n=7)	Inore (local) – Jersey Cross Pure Jersey	2 -20 years ago	100%
Phuntshothang (n=9)	Jatsum (local) - Jersey Cross	4 years ago	33% (cross only)
Pemathang (n=9)	Unknown local breed Jersey Cross Pure Jersey	2-15 years ago	77%
Dewathang (n=9)	Jatsum (local) Jersey Cross Pure Jersey	6-10 years ago	50.0%

The reason for adoption can be connected to the strong presence of the Livestock Extension services’ commitment to introducing the Jersey breed. They promote the new breed through government-sponsored meetings that focus on the higher milk production of the Jersey. Participants also reported that their neighbours started transitioning and so they decided to follow suit after seeing the benefits. Furthermore, one participant noted that her husband went on a study tour sponsored by the government through neighbouring dzongkhags (districts) Mongar and Bumthang to see the impact of Jersey. From direct observation, it was noted that Orong and Nagzor chiwog (or village), in Wooling, were particularly well off based on proxy indicators such as beautiful wood and brick houses and well-dressed people.

Of the six farmers interviewed in Dewathang with cattle, only one farmer reported having a local cow while the remaining five had either all Jersey or local x Jersey cross herds. Although it was reported that having a Jersey was good overall, there was some concern regarding the increasing cost of feed and their high mortality from falling off cliffs, as Jerseys are more prone to accidents. Also, whereas local cows can forage from the forests, Jerseys require grain to supplement their forage feed. Thus, the inputs into Jersey cow production can also be higher than the requirements needed for local breeds.

Three farmers who did not have any cows said that they were too old, did not have the labour required for the additional work that cows needed, or were too poor to afford the investment and upkeep of cows. The low adoption rates for Dewathang may have been an artefact of purposeful sampling rather than representative of the farming population as a whole. However, it does provide insight into the role income, age, and family relations may have on adoption of a new breed of cow.

Phuntshothang had the lowest adoption rate, as 33% of interviewed farmers had crossbreeds. No one interviewed had a pure Jersey. One participant who commented on the Jersey said that they were too much work, just to get sick and die for little gain in milk yield. Another farmer mentioned that Jerseys are less intelligent than the local breeds in that they defecate right where they are standing compared to local cows that step backwards to do so. There may be less of a push from the government to introduce Jersey in this area due to limited pastured land. According to the District Livestock Officer (DLO) the first step in improving production would be to distribute cross bred cows, and second, for the government to increase the availability of pasture land. The DLO continued to say that, people would not be interested in pasture feeding unless they are convinced of the benefits. The DLO suspected that if there were a demonstrated need, the government would provide more land.

The DLO noted that there are differences between now and 10 years ago, one being the management of cows—10 years ago farmers were doing this as they did in their grandparents' time. Stall-feeding in the cowshed is an improvement and pasture feeding is new too. The DLO explained that Phuntshothang farmers are 80% dependent on one crop of paddy per year, whereas in Orong and Dewathang it is more common for income

to be evenly distributed throughout the year due to daily milk sales. The DLO believes that Phuntshothang farmers will eventually transition to the system adopted by farmers in Dewathang, and that they expect this development to happen in time. “Lots of changes can be good for livestock, but we need some new technology. We need to introduce good farming systems here” (District Livestock Officer notes from Phuntshothang).

Pemathang, although similar to Phuntshothang in terms of population demographics and agroecological factors, had a much higher rate of the Jersey-cross and pure Jersey adoption. Although only one farmer out of nine reported having three pure Jersey, four farmers reported having a crossbreed.

The reason for the positive view of the Jersey breed in Pemathang may be attributed to government promotion through a particular community held meeting. As one participant discussed, the meeting was well attended by community members of both men and women, and 50% of those that attended adopted the new breed. The other 50% had more than 20 cattle in their herd and did not want to transition. One farmer said that for the same amount of work as a local breed and with fewer cows, she would get more production and that was what persuaded her to adopt. It is not known if there were additional government incentives, as participants did not discuss this aspect.

4.1.5 Agricultural Livelihoods

Ninety percent of the participants in Orong reported that they were self-sufficient (see Table 15). Although the average percentage of food that people had to purchase from the market amounted to 60% of their needs, 90% of interviewed farmers reported being able to make those purchases. Agricultural incomes were supplemented through construction work or crafts such as weaving. The one respondent who reported that his household did not have sufficient income, described the very wet weather conditions in summer as a contributing factor, making travelling to the market or for work in construction very difficult, resulting in fewer purchases. However, many people described how neighbours, friends, and family would help each other either by providing loans or food. The most common purchases that people needed to make at the market were for rice, salt, oil, milk powder, and vegetables (see Table 16). There was likely a relationship between

participation in the milk-marketing group and self-sufficiency, as 100% of farmers belonging to the milk-marketing group reported that they had Jersey or Jersey-cross cows, and 90% of these farmers were self-sufficient.

Table 15. Self-sufficiency and Purchases by Gewog.

Gewog	Claim Self-Sufficiency	Purchase vs. Produce (avg).
Orong (n=7)	90%	40% produce
Phuntshothang (n=9)	80%	60% produce
Pemathang (n=10)	40%	65% produce
Dewathang (n=4)	NA	NA

Table 16. Most Reported Purchases at the Market by Gewog.

Gewog	Goods
Orong (n=7)	salt, oil, rice, vegetables
Phuntshothang (n=9)	salt, oil, sugar, powdered milk, chilli, vegetables, tea
Pemathang (n=10)	salt, oil, sugar, powdered milk, chilli, masala, tea
Dewathang (n=4)	salt, oil, rice, vegetables

Phuntshothang was perceived as being the least wealthy of the four gewogs and people from other villages and also from within the district also casually mentioned this. The population is ethnically quite mixed. Many of the people who live there were resettled from other areas. Even though they are of lower socioeconomic status, 80% reported that they were self-sufficient and able to purchase or produce everything that they need. Two participants said that they were very poor because they either did not own land, or lacked many of the things that other people had. Purchases that farmers made from the market included milk powder, sugar, salt, chilli, and oil. No one reported purchasing rice from the market because they all had rice paddy that they grow for self-consumption with the excess sold at the market, or in the case of one farmer, half of it to his landlord.

Pemathang participants had the most concern for not being able to purchase what they need from the market. A coping strategy used by some was to borrow money from neighbours who were able to help out and then pay them back when they sold a cash crop such as *Doma* (areca nut). Salt was reported as often not being available now that it is imported, whereas it used to come from the highlands. Other purchases included oil,

sugar, powdered milk, tealeaf, masala, and chilli. The Lhotshampa participants included spices as an important purchase that is imported.

Dewathang was the most difficult gewog to assess in terms of self-sufficiency vs. reliance on market purchases, as none of the interviewed farmers reported the percentage of what they had to buy versus what they were able to produce on their own, as they did in the other gewogs. This may be attributed to the considerably greater market access and proximity to markets in Dewathang compared to the other three gewogs. However, Dewathang farmers did respond with concern over not being able to produce what they need in the summer months due to the poor soil and rainy conditions. The winter was said to be better for producing enough for local consumption. One participant described her situation as being difficult and needing to purchase her household's needs on credit. Often, she ate poor quality food so that her children could eat better. She described the difference between rice and maize as being a status symbol, in that maize was nutritionally better but often viewed as a poor man's food. There was a lot of concern expressed for vegetables not growing well in Dewathang due to poor soil conditions. However, one of the SJI model farmers has been able to improve the quality of his vegetables greatly through adoption of the Navdanya-taught composting methods that have significantly enhanced the quality of his soil.

4.2 Findings from 2012

The goals for 2012 research were to follow up with the 100 farmers interviewed from the four gewogs in 2011, as well as to continue to expand the collection of baseline data. These goals were ambitious, however, considering the short time the foreign researcher leading the research had in the field (2 months) and the extremely heavy monsoon rains from June–July that made travel by vehicle—and often by foot—nearly impossible. It was decided that the research would be confined to Dewathang, as it was easier to reach compared to Orong, Phuntshothang, and Pemathang. In actuality, only 11 interviews were conducted in Dewathang—where the researchers (one foreign and one local) were stationed—because of the difficulty with transportation. The heavy monsoon rains, though they disrupted travel plans and intended interviews actually provided a

tremendous opportunity to build local research capacity, which became the primary goal for 2012.

It was also found that farmers were more hesitant to talk with the research team, because in several cases they had already been interviewed in 2011. Farmers were becoming frustrated by the presence of researchers and requests of them to participate in the work. Because of this, the responses received were often very brief and several interviews went uncompleted. Therefore, the quality of the research in 2012 was severely compromised. Despite this, the lack of responses from farmers in the structured interview actually led to several very important research findings, which are discussed in more detail in the sections below (Monitoring the Transition to Organic, Influence of Religion and Traditional Knowledge, New Research Objective, and New Research Methodology).

In fact, as indicated below, the research team learned the hard way in 2012 that the frustrations and difficulties encountered in research can actually be the most important teaching, and can lead to the most significant and productive shifts in direction both for the research itself and for the action and practice agenda. Again, it was decided that a major goal of 2012 work would be to build the capacity of the local researcher to ensure the sustainability of the research program so that interviews would be able to be scheduled more freely and conveniently with farmers (and in Sharchop without the need to translate to English) without the need for foreign researchers.

The researchers also learned from 50% (n=6) of the interviewed farmers and by word of mouth from several other farmers that most had not implemented the techniques taught in the SJI farmer trainings of previous years. As a result of this, the researchers decided to conduct informal interviews with farmers (n=5) living within a 10 km radius of Dewathang (to facilitate transportation). The goal for these informal interviews was to begin to understand farmers' agroecological subjectivities to be able to understand the agricultural decision-making and how this may influence the adoption and rejection of agricultural technologies. Questions in these informal interviews addressed specific traditional farming practices, agricultural decision-making, the influence of religion, and knowledge sharing across the generations.

4.2.1 Monitoring the Transition to Organic

About half (n=6) of the farmers who had participated in some or several of the SJI organic agriculture trainings had not adopted these improved organic practices. Most farmers said this was because they had no time, they had less available help on their farms, they didn't think the practices were necessary, or because they were not interested.

While it is certain that farmers lead busy lives and completing farm-related tasks is more difficult these days than in the past due to rural to urban migration, it was difficult to understand why farmers wouldn't be interested, or felt the taught practices were unnecessary, since many farmers reported struggling to earn enough money and provide enough food for their families. It is possible that perhaps farmers were satisfied with their present techniques and not enough research was conducted prior to the trainings to understand the local challenges faced by farmers. Perhaps it could have been the result of trainings that were not culturally sensitive enough or that facilitators did not acknowledge traditional perspectives prior to or during the trainings. Quite possibly it could also have been attributed to the way in which knowledge is understood and transmitted in oral vs. written cultures, the latter responsible for teaching the scientific, western knowledge of organic agriculture to the former.

In oral cultures like in Dewathang and Orong, people tend to communicate through narrative presentations, storytelling, and other traditional art forms, which operate differently from written cultures (Ong, 2002). Although Nepali is a written language, many of the farmers in Phuntshothang and Pemathang are illiterate, so it is suspected that their information and knowledge transmission operates similarly to oral cultures of Dewathang and Orong, although this was not ascertained in this study. Dewathang and Orong farmers (and possibly farmers in Phuntshothang and Pemathang) use the oral tradition through active participation in and passive observation of both formal and customary socio-religious, cultural, and political institutions and events to express ideas, values, norms, beliefs, superstition, and culture to other farmers, villagers, and children (Penjore, 2003). This is not to suggest that Samdrup Jongkhar farmers are unscientific; rather, that there are important elements to consider when studying their subjectivities.

For example, a farmer from Lauri gewog was interviewed in 2011 and shared that he used urea once 5 years ago on the advice of the AEO who told him that he'd get higher yields. He did get higher yields the following year, but while weeding the year after that found that the weeds came out in clumps rather than individually as they always had in the past, and that the soil felt drier to his touch than previously, explaining why the weeds were now clumped when he pulled them out. Observing this, the farmer said he never used urea again. This can be considered very scientific reasoning. He used the power of observation to study the soil quality and characteristics and to draw conclusions about the impact of the new inputs, on the basis of which he made a highly scientific decision.

Meyer (2003), outlines the main attributes of information handling among people used to the oral tradition, which can help to understand why agricultural trainings were not widely adopted in Dewathang:

- In an oral culture, information is stored in people's memories only. Therefore, people with good memories play a vital role in storing and transferring information, and so the death of a knowledgeable person may lead to valuable information being lost.
- The manner in which information is communicated will largely determine whether the community will react to it or not. For example if outside information is not offered in metaphorical speech or demonstrated in a way people are used to, they will not be able to understand it and it will not make any impression on them.
- Phrasing and repetition are used to ensure that critical expressions are stored in the memory. Phrasing provides the basis for consensually agreed upon interpretation, which may go beyond what was actually said.
- A particular form of language delivered in a special way is employed in specialised contexts for particular purposes.
- Authority structures play a vital role in storing and transferring information, the implication being that if authorities are not familiar with a particular type of outside information, the information will not easily be sanctioned, and thus will not easily be accepted by the group.
- In cultures with an oral tradition, information is exchanged face to face. Information cannot be transmitted over long distances. Often, information remains within the borders of a particular community. Unless people of different communities interact, information created in other communities will remain inaccessible.
- As said above, in an oral culture, the only place to store information in, is people's memories. Stories and myths tend to be experiential (i.e., based on events familiar to the listener or storyteller).

- Mnemonic aids such as rhymes are widely used to make the oral transfer of information more reliable.
- Recipe-like patterns or stereotypical methods of expression are also very common. Unnecessary repetition may be used to ensure that information is conveyed correctly, and in detail.

Meyer (2003) argues that certain information attributes of written cultures may render information less useful as a development resource when used in oral cultures. Outside information has such a small chance of successfully crossing the boundaries between modern and traditional societies when care is not given to understand the communication mechanisms and information attributes of a particular culture. Perhaps more attention can be placed on future agricultural trainings to present information in ways that are more tangible in oral cultures, like in Samdrup Jongkhar.

It was also suspected that the lengthy questionnaire used to monitor the adoption rates of farmers was too quantitative and dependent on detailed data measuring linear inputs and outputs at the farm level. In light of the realization about the different ways of operationalizing information in oral cultures, it was suspected that the original data collection tool was too rigid, expecting ‘hard’ data and numbers to bolster the organic training initiative. It was believed that this did not resonate well with the agroecological subjectivities in Samdrup Jongkhar. For example, if a farmer was repeatedly asked a particular question about a quantitative aspect on the farm it would often yield a diversity of results and required extensive probing to ascertain an accurate and encompassing response. This is one of the primary reasons researchers began to redesign the research methodology.

Of the farmers who had participated in the SJI organic agriculture trainings and had adopted one or several of the taught organic agricultural practices, about half (n=6) said that they needed more help from the SJI and/or AEOs to follow up and monitor their implemented practices, to make recommendations, and to stay organic once transitioned. Several farmers expressed an interest in developing farmer co-operatives but felt they needed greater support from the SJI to help establish these, to organize interested farmers, and to coordinate the marketing of produce. These findings are not surprising given that

trainings were given with little follow-up on the part of the SJI, mostly due to staffing shortages, and that the Dewathang AEO was pressed to complete the government's mandate for agriculture training and monitoring in the area, and was, thus, unavailable to fully monitor the SJI's transition to organic.

There is also a culture of dependency in the region, with farmers heavily reliant on the regular support of AEOs and government to provide solutions to common farming problems, trainings, and farm inputs, like seeds, fertilizer, and pesticides, often at little to no cost. For example, one farmer expressed, "wild animals come in the night and eat our crops and we haven't been able to tackle this problem. This problem should be solved by the government" (Pemathang farmer, 2014). While it is probably not entirely the case, and more a result of how research approached the subject in interviews, few farmers expressed being innovative and explained that they were unable to implement experimentation with new methods on-farm because they were occupied with other work.

Farmers interviewed for the first time mentioned that the primary reasons why they had not adopted organic farming techniques were because they had no time, they did not know about the technique(s), or that they were not interested in them because they preferred the methods already used. One particular farmer expressed that, "extension agents come to us to teach us new farm techniques, but never to know or to work with the knowledge that we already have" (Dewathang farmer, 2012). Other farmers mentioned that they knew about particular organic agricultural techniques, or variations of them from their ancestors' traditional knowledge, and that they consider using them when they need to. There is a considerable opportunity here, for researchers and the SJI to learn about the traditional knowledge and practices that already exist and to build off those in future trainings. An attempt to make the trainings more grassroots, participatory, and perhaps even farmer-led may work to combat the issues of ignorance on the part of the trainers/facilitators, expressed by some of the farmers.

4.2.2 Influence of Religion and Traditional Knowledge

One of the most interesting findings that may indicate a reason for why farmers are not implementing the taught organic practices is that several farmers regard their direct physical interaction with their agricultural environment as separate from agricultural outcomes. In other words, religion, ecological spirituality, and cosmology are believed to play a large role in decision-making and farming outcomes, including yield loss to wild animals and other pests.

Since ancient times Sharchop villagers have cultivated and applied place-based systems of knowledge in stewardship of their local agroecosystems. The religious tradition in this region has formed from an amalgamation of Buddhism and pre-existing Bon practices that significantly influence local agroecological subjectivities. For example, many Sharchop villagers believe that all life on Earth is connected through a shared energy, and therefore, offer great respect to all species and local deities that are thought to reside in rocks, rivers, trees, and other natural and spiritual elements (Tashi, 2008; Ura, 2004).

Specifically in terms of agriculture, astrology is a guiding force and helps farmers make decisions about what days to plough their fields, plant their crops, and when to harvest. Farmers in Dewathang will consult with the local astrologer, or *Tseepa*, to find out the auspicious days of the year, as well as “good” days and “bad” days. “Good” days are usually the 8th, 10th, 15th, and the 25th of each month of the Bhutanese calendar and when people perform pujas or celebrate these auspicious days. “Bad” days tend to fall on the 3rd, 13th, and 23rd of the month. There are also “bad” days to sow seeds (often on Fridays) that are called “insect” or “pest” days. If farmers so much as sow their seeds on a “insect” or “pest” day, many attacks by insects or wild animals will prevail. If they sow on a “heat” day (Saturdays or Mondays), the heat will consume their crops. If they place ashes from a puja around the perimeter of their field or on particular crops, farmers believe pest attacks by insects and wild animals will be averted. Even the act of performing a puja can help “feed” the animal spirits and other deities so they will not be hungry for farmers’ crops (Dewathang *Chospa*—a type of Monk that knows about religion and is often consulted for agriculture purposes, 2012). Farmers also shared the belief that if crops grow well one year and not the next, it is because the crops are “taking

a rest” (Dewathang farmer 2012). These viewpoints suggest that farming outcomes are due to more than one’s hard work on the farm. They are also the result of the rimdros (or religious rituals) and other pujas, offering to deities and altars, and the blessings of Rinpoches that ensure the good fortune and merit of the farmers.

While Pema Lingpa is credited for spreading the dharma (in its Tibetan Buddhist manifestation) throughout Bhutan in the 14th century, one farmer shared that approximately 50 years ago the dharma was again taught in her region. She explained that before that time, religion existed but people didn’t have masters or teachers to teach them the correct way to practice. She continued to share that people were practicing shifting cultivation, cutting the forest, and rearing and killing pigs, cattle, and other animals—still, despite the abundance of food, it is believed that people were unable to feed themselves because of the sins they were committing. Since the Rinpoches and other masters reintroduced the dharma in the region, this farmer explained that people heard that cutting the forest, burning, ploughing the land, and killing animals and insects during farming are all forms of sin, bringing bad merit and karma to those performing them (Royal Society for Protection of Nature, 2006). The new teachings freed farmers of their sins, but they were also encouraged to abandon any of the farming practices that lead to intentional killing. This is not to imply that the knowledge of present day farmers is greater than their grandparents, as cutting and burning the forest is still practiced in several cases. However, this one farmer and a few others, including one *Tsampa* (a type of lama) did emphasize a collective shift in thinking about harming the natural environment and other species once hearing the great teachings. This begs the question of whether the government’s move to resettle those practicing shifting cultivation to permanent land settlements was partly influenced by the dharma, as some farmers have noted the first attempt to ban people from the forest came during Bhutan’s First FYP in the early 1960s. Although the government’s campaign and possibly the re-teaching of the dharma lead to the slow phase out of shifting cultivation practices, this particular farmer assured that the dharma did little to change traditional forms of agriculture, as people still look to when the birds first sing or when the cypress puts out new branches to know when to plant summer crops, and to the nine sister stars to know when to plant winter crops (Dewathang farmer 2012).

There is an important opportunity to learn more about the agroecological subjectivities of farmers in Samdrup Jongkhar and the impacts of religion on their agricultural decision-making. Special attention in the future should be made to look at the connections between Hinduism and agriculture to be more representative of the Lhotsampa population. Further insight into these areas may shed light on how and why farmers adopt and reject certain agricultural technologies and practices, feeding directly into the SJI agricultural training program.

4.2.3. New Research Objective

While the long-term project objectives had been outlined in full, the research objectives required further definitional clarity. One of SJI's original stated goals (before 2013) was to see farmers adopt organic farming methods in Samdrup Jongkhar as a potential prototype for Bhutan's national goal of shifting to 100% organic food production. However, because the SJI had this very explicit stated goal of transitioning to organic methods, it needed to ask whether its own agenda of what forward movement constituted subtly biased the interview questions and the implementation of the questionnaire by not adequately taking into consideration existing conditions and circumstances or local and traditional knowledge and understanding.

In other words, an important realization made in 2012 was that the SJI had, somewhat inadvertently, mixed the training agenda (which teaches and promotes organic farming practices) with the research agenda (designed to assess progress towards those training goals). This joining of training and research goals had proved somewhat problematic in light of the discovery from the first two years of research results that many farmers are not implementing much of what they have been trained on. Especially, it was speculated that the SJI's training goals and the pursuit of organic agriculture influenced the research in ways that may have obscured issues of direct importance to the farmers themselves and influenced the trainings that may have limited learning (oral vs. written culture) and the adoption of organic technologies.

In sum, a key stated goal of the SJI was to transfer knowledge on organic farming practices. However, based especially on multiple interviews and research results from the

first two years of research, it was determined that a key goal of the SJI agricultural research should be to learn from the myriad of voices of Samdrup Jongkhar farmers themselves, without the filter of SJI's development agenda. It was thought that this shift in research focus would enable the SJI to more effectively represent farmer voices and interests both in the research results themselves and also to local and regional agriculture authorities, especially the MoAF.

Therefore, it was determined that the SJI make special efforts to ensure that the research remained unbiased, (account for farmers' wishes, inputs, and traditional knowledge) separate from training initiatives, and reflective of the responses (adoption/rejection) of farmers to the trainings. It was also decided that such a shift in research objectives would require modification of the existing interview tool that had been honed, improved, and shortened since the project's inception but had still remained fundamentally within the framework of SJI agricultural development and training objectives (to transition to western, scientific organic agricultural practices), rather than from the perspective of what matters to the farmers themselves.

It was the hope that with clearer research objectives, that they would in turn influence what data needed to be collected in future years and determine what would be done with the findings. For example, researchers asked: if findings are needed to convince the Ministry that the organic transition is working, how could this be presented in ways that actually serve the farmers rather than just the policy audience? It was thought that such clarification of research objectives would directly help the SJI identify what interview tools (e.g., quantitative or qualitative interviews) best captured the data needed, how many (and what groups of) farmers should be sampled, and how the data would be analysed.

It was recognised that a shift in research objectives may well require the SJI to extend the agriculture research beyond the 3-year IDRC project period. However, researchers believed that a key function of research integrity, and of honest analysis of initial results and of informal conversations and interviews with farmers since the launch of the SJI, was to examine and question the research framework itself and to make the required changes in research objectives indicated by the data.

In too many cases, the framework of development research reflects the biases of both the researchers and of development specialists, which can bias results, analyses, and recommendations. The final recommendations are often, therefore, out of touch with and not in accord with the actual needs and priorities of the research subjects (in this case local farmers). The research had reached the stage—particularly through examination of research data on non-implementation of what had been taught in trainings—where it had to acknowledge honestly this burgeoning problem.

Rather than a fundamental research “flaw”, this finding was regarded as a vitally important result and outcome of the research of the first two years that had been extraordinarily useful in helping the research identify the path correction needed.

4.2.4 New Research Methodology

Over the course of the 2011 and 2012 years of research in Samdrup Jongkhar, the researchers had experienced farmers’ frustration with largely quantitative questionnaire and decided to experiment with a narrative interview approach that engaged more directly and personally in conversation with farmers. It was determined that using a shortened questionnaire alongside narrative interview questions that focused more directly on farmers’ perspectives with the objective of learning from and representing the farmers more effectively than would be possible with the original questionnaire alone would be the best path forward.

The ongoing dilemma of what research method to use developed not only from the overarching issue of clarifying the research objectives, as described above, but also from an understanding that Sharchokpa culture is especially unique in that it utilizes oral rather than written methods for transmitting knowledge and information across generations. By using a written, quantitative questionnaire that articulated well with Western culture and ways of understanding, the researchers learned that it was important to ask whether they were missing out on understanding some of the key local perspectives, contextualized knowledge, and the ways of knowing they were interested in documenting and preserving. Even if researchers asked farmers of their perspectives and

insights during interviews, farmers might have been reluctant to share their valuable knowledge if researchers had already irritated them with an irrelevant, lengthy, and culturally insensitive survey. The goal for the ensuing few months was to redesign and field-test the questionnaire to be shorter, more encompassing of the issues that mattered to farmers, and flexible in its structure.

4.3 Findings from 2013

The aim for the 2013 research was similar to past years—to continue collecting baseline data to monitor the transition to organic agriculture. Although researchers began to question the research objectives and approaches in 2012, there was some reluctance to change the research strategy in the final year of the 3-year funded IDRC project without sufficient approval and support from the IDRC and other project stakeholders. Since the SJI was to have an external reviewer to visit later in 2013 before seeking a project extension, it was decided to keep the research objectives and framework used in previous years until the project could be reviewed and the requested project extension hopefully granted. The researchers decided to focus the work in two (Dewathang and Orong), rather than in all four gewogs included in previous years, in order to avoid spreading the research efforts too thinly, and to also generate more meaningful findings, locally, that would eventually serve as a model for future research efforts in other Samdrup Jongkhar gewogs. This was the first year the local research team conducted interviews without the help of foreign researchers – a mark of the enhanced local research capacity trained and generated the prior year. The researchers were able to accomplish 18 interviews —11 from Dewathang (Rikhey village) and 7 from Orong. All Dewathang interviews were collected in Rikhey village, a unique agricultural community that cultivates upland paddy and still follows several traditional farming practices from their ancestor’s time. It is safe to say that Rikhey does not sufficiently represent the entire Dewathang gewog.

Despite the urge to adjust the research strategy, the researchers recognized the need for ongoing baseline data collection and to inform the SJI of the interested farmers keen to participate in future agricultural trainings and related activities (seed saving, co-operative forming, farmer liaison work, etc.). Research in 2013 was also justified based

on the interest of ensuring the research be valid and representative of Samdrup Jongkhar farmers, in general.

One very important research finding that was found in both Rikhey and Orong gewog is that all interviewed farmers reported to not have used any chemical fertilizers or pesticides in their farming during the previous year. This is a considerable change from 2011 when researchers found very high insecticide use rates in Orong. Although only 7.5% of all interviewed farmers in Samdrup Jongkhar used chemical fertilizers in 2011, as of 2013, none of the interviewed farmers mentioned using chemical fertilizers. This is probably partly the result of the work of the SJI, working with local AEOs to ban the distribution and use of these chemicals. It could, however, also be the result of farmers knowing about the SJI's mission and looking to satisfy researchers connected to the SJI with the "correct" response. It is also possible that the farmers targeted in these interviews just so happen to be organic by tradition, especially in Rikhey. If it is the case that these farmers, and a majority of other farmers not yet interviewed, are not using chemicals (urea/synthetic fertilizers, herbicides, and/or insecticides) then a redefinition of the problem the SJI is targeting in research and training is needed. As many farmers appear to be organic by tradition, understanding those practices will be just as valuable to work needed to transition other farmers that are using chemicals to organic agriculture (traditional or SJI organic).

The following sections will summarize the major findings found in Rikhey and Orong gewogs in 2013: Seed Saving and Diversity; Traditional Agricultural Knowledge; and Challenges to Farming.

4.3.1 Seed Saving and Diversity

Seed saving is not very widely practiced in both the gewogs. Seed is saved mostly from maize and paddy in Dewathang (Rikhey chiwog), and maize, beans, and chillies in Orong. All interviewed farmers in Rikhey shared that they only save one variety of each maize and paddy, whereas in Orong only 14% of interviewed farmers save more than one variety of their crops. In both gewogs, almost all other seeds, especially vegetable seeds are acquired from the government through the AEO. The problem of getting seeds from

the AEO is that they are not locally adapted to the microclimates of the villages where they are planted. Furthermore, since most are hybrid seeds, seed saving is a challenge. The seeds are most often non-organic, as they are covered in fungicide and other chemical seed treatments. They are also procured from one source—Druk Seed—a Bhutan seed company taken over by the MoAF in 2010 that contracts seed growing out to farms in India (Sonam Peldon, Bhutan Observer 2010, http://bhutanobserver.bt/2494-bo-news-about-ailing_druk_seed_loses_corporate_entity.aspx). AEOs used to supply these seeds free of cost to farmers, but as of 2013 hybrid seeds (10 g) now cost, approximately 120 Nu (close to USD \$2), a considerable expense for some farmers. Local seeds (non-hybrids) are some times available for around 15-20 Nu.

The conservation of genetic biodiversity *in situ*—in farmers’ fields—is commonly cited as an alternative to *ex situ* conservation—in seed banks—for reducing genetic erosion experienced in agricultural varieties over the past 100 years (Witcombe et al., 1996). Also, biodiversity conservation, *in-situ*, by planting a variety of crops (especially landraces), helps to reduce cropping system vulnerability while increasing harvest security and resiliency in the event of environmental stresses brought by pests, disease, and drought, as well as climate change (Ceccarelli, 1994; Thurston, 1991). However, it appears farmers have become reliant on ‘improved’ seeds distributed by the government leaving little biodiversity to be conserved for crops of economic importance. While it is difficult to say for certain how many landraces of rice and maize exist, the research suggests there are very few, if none at all, in Orong or Dewathang. This is quite surprising since neighbouring Assam, India has an estimated 8000 landraces of rice (Singh and Singh, 2000). Therefore, there is and will be a reliance on Bhutan’s national gene bank (*ex-situ* conservation) to maintain any collected germplasm. Assessment of landrace diversity for all agricultural crop species and methods to conserve it still needs to be addressed across Samdrup Jongkhar.

An issue of increasing importance is the cost of seeds as full subsidization has been curtailed in the last year and a cost-sharing program has been implemented to prevent wastage seen when seeds were distributed freely. Informal conversations with a few farmers indicated that they have already identified seed saving and distribution as

potentially lucrative. The pre-emptive establishment and strengthening of these local seed networks should become a primary focus in regard to *in-situ* conservation of crop genetic resources and future development work.

4.3.2 Traditional Agricultural Knowledge

Past research was limited in uncovering farmers' sentiments that they were practicing a form of organic, *Rangzhin* (natural), farming already. All farmers interviewed in Rikhey and Orong expressed knowing about and practicing variations of organic agriculture as their grandparents practiced it (Table 17). Similarly, all interviewed farmers mentioned knowing about and practicing traditional forms of mulching using tree leaves, uprooted weeds, and crop residues. In Rikhey, 82% of interviewed farmers expressed possessing traditional knowledge of and practicing intercropping. In Rikhey, farmers practice a traditional method of intercropping/cover cropping rice-bean with maize to ensure good soil fertility. In fact, this method is so much depended on and produces such good maize yields that no other methods to promote soil fertility are used. In Orong, surprisingly fewer farmers, 29%, of interviewed farmers knew about or practiced intercropping; however, 71% of those farmers were applying cow dung directly to their crops. In Rikhey, 82% of interviewed farmers did not know about or practice crop rotation, while in Orong this was true for 86% of interviewed farmers, who also didn't practice any types of composting. In Rikhey, 36% of interviewed farmers were practicing composting to varying degrees (pit/heap composting, panchagavya, or ganamurt).

Table 17. The average number of farmers who know about and practice organic farming, mulching, intercropping, crop rotation, composting, and the influence of religion on agricultural decision making.

	Knowing about and practicing organic farming	Knowing about and practicing mulching	Knowing about and practicing intercropping	Knowing about and practicing crop rotation	Knowing about and practicing composting	Influence of religion on agricultural decision-making
Dewathang	100%	100%	82%	18%	24%	55%
Orong	100%	100%	29%	14%	36%	71%

In Rikhey, 55% of interviewed farmers acknowledged a connection between religious elements and agricultural decision-making, while 71% of interviewed farmers acknowledged this in Orong. Farmers in both gewogs reported consulting local astrologers (*Tseepas*) to find out the dates to avoid farming and the good days to plant their crops. It was often said that if agricultural work was conducted on one of the auspicious dates that crops wouldn't grow well or bare fruit. Auspicious dates noted were the full-moon days, the 10th, 29th, and 30th of each month of the Bhutanese calendar. Farmers in both gewogs mentioned the sins associated with killing insects during farming and felt they were better off avoiding the auspicious days when many more insects are killed as a result of their presence in the field. One particular farmer in Orong when discussing the changes observed in shifting cultivation compared to contemporary farming on permanent land settlements mentioned the good merit farmers have now accumulated because they are killing fewer insects as they are no longer burning their fields. This accumulated merit is thought to bring higher crop yields. Farmers in Rikhey (Dewathang) and Orong noted offering pujas to local deities to ensure timely rainfall for their maize crops.

Several farmers mentioned not even knowing of the practices their grandparents used that they are no longer using. In Rikhey, most farmers shared that ploughing with

oxen, exchanging labour, sharing equipment, and mulching were traditional agricultural practices still used from their grandparents' days. Farmers in both Rikhey and Orong mentioned that crops such as millet, mustard, finger millet, amaranth, soybean, bitter buckwheat, and sweet buckwheat were “lost”, whereas maize, beans, paddy, rice bean, and gasha saie (a traditional fruit translated as deer fruit, with a bitter outer flesh and tasty seed, similar to walnut) have been brought forward from their ancestors' time. Often the “lost” crops were mentioned to be more susceptible to wild animal and pest attacks due to the morphology of the plants, as compared with maize. It was also said that there was no seed left of these “lost” crops even if farmers wanted to preserve them.

4.3.3 Challenges to Farming

In Orong, 57% of interviewed farmers thought labour shortage was a serious problem in their village compared to 27% in Rikhey (Dewathang). This is likely the result of the labour exchange practice commonly used in Rikhey where a group of farmers go farm to farm cultivating, sowing, weeding, and harvesting together. Twenty nine percent vs. 27% of interviewed farmers in Orong and Rikhey, respectively, thought the labour shortage was attributed to rural-urban migration.

Many farmers discussed the challenges they observed with increasing pest problems with both insects and wild animals as well as post harvest losses. In Rikhey, almost all (89%) interviewed farmers commented that pest problems (insects and disease) were worse than in the past, especially in maize and paddy, but were unsure why. As noted in previous surveys, wild elephants, boars, deer, rats, and monkeys often attack crops, which result in large losses—sometimes as high as 100%. Farmers tend to respond to this by guarding their fields at night and making noise to keep animals away. Furthermore, food storage losses due to insects remain a major problem where about 20% to 100% of the crop is lost each year. For maize many farmers in Rikhey manage storage loss by processing it into *karang* (a coarse corn meal) before weevils can cause damage. It is interesting to note that despite losses to insects, diseases, and wild animals, almost all farmers mentioned that crop yields are higher than 10 years ago, most likely due to the “improved” varieties that they receive from AEOs.

Farmers also mentioned irrigation water being a major constraining issue. In Rikhey, it's not available in the winter, preventing double cropping of paddy, and in summer excess rainfall causes flooding. It was also mentioned that the rain patterns were changing with untimely rains arriving in the summer and drier winters than in years back. In the summer, the heavy monsoon is responsible for bringing increased pests and diseases and for washing away valuable topsoil. Despite this observation made by several farmers in both Rikhey and Orong, farmers typically said their soils had improved over the last 10 years. This may be explained by the observation of a few farmers that there is less summer rainfall than 10 years back.

In terms of finding solutions to their farming problems, 91% of interviewed farmers in Rikhey noted that when they need information on farming they go ask their AEO. In Orong, the same was true for all the farmers interviewed. In Orong, all farmers interviewed thought that having better tools would improve their farming. The same was true for 73% of interviewed farmers in Rikhey.

Almost all farmers in both Rikhey and Orong said they felt that their farms were large enough to support their families and that they felt more financially secure than in years past (Table 18). They almost all reported having good health and never had to do without at anytime during the season. The message is optimistic on the surface, but highlights the inadequacies of the present questionnaire and potential for proposing skewed recommendations on the part of the researchers. For example, the majority of farmers were more food secure and financially secure compared to years back, but most had experienced crop failure at some point in the last year. This is an example of the type of responses received warranting further follow-up during interviews. The inability of the current questionnaire—without substantial follow-up after questions—is limited in understanding the problems farmers face on their farms and in their households. Time limitations during interviews are the main reason for not sufficiently probing after uncovering contradicting information. Therefore, the researchers felt a strong case was made in this year's research to reinforce the previous year's intention to overhaul the questionnaire.

Table 18. Percentage of farmers reporting their farm is large enough to support their family, they are more financially secure than in years back, they have good health, and they do not have to do without in any season.

	Farm is large enough to support family	More financially secure than in years back	Good health	Not having to do without
Dewathang	36%	91%	91%	82%
Orong	29%	71%	43%	71%

4.4 Findings from 2014

The research strategy formally changed in 2014, from a framework largely interested in quantitative findings to one more focused on the voices of farmers. After receiving the support of the external reviewer and based on his recommendations (see Gonsalves’ report), it was decided that Action-Based Research would become the new research strategy. SJI’s donor, the IDRC, had also approved the new strategy, as this change was included in the proposal for the project’s extension. This year an important emphasis was placed on training local researchers in this new research methodology and about the importance of note taking and probing during “conversation-style” interviews. A foreign agriculture researcher, Ben Hunsdorfer, joined the team for five months and, under the supervision of the agriculture research coordinator and lead author of this report, was responsible for redesigning the research questionnaire (see APPENDIX C) and the capacity building of local researchers in research methods. Two primary books by H. Russell Bernard (Research Methods in Anthropology: Qualitative and Quantitative Approaches [2006] and Handbook of Methods in Cultural Anthropology [2000]) were used, among other resources, to discuss with the local researchers how to conduct detailed interviews. In turn, the local researchers were responsible for building the capacity of the foreign researcher in the local contextualized knowledge uncovered in the field.

Fifty interviews were conducted in the four gewogs studied at the start of the project—Dewathang (14), Orong (15), Phuntshothang (9), and Pemathang (12). Research happened from February to May 2014 and tried to target farmers randomly. The village

heads (*Tshogpas*) of the villages visited helped gather the support of farmers, but the farmers interviewed were randomly sampled from the population.

Despite intensive work and the best of intentions, the new research questionnaire was not finalized prior to its implementation in the field. Only after data collection began, the questionnaire was revised and adjusted by the research coordinator (and lead author of this report, who was working from abroad). It was too late to revamp the questionnaire according to a style that would allow for detailed narrative responses to be collected, as data had already been collected in two out of the four gewogs. To allow for greater comparisons to be made in the field it was decided, in the end, to keep the new narrative-style questionnaire as was originally designed (with few additions made; see APPENDIX C). The problem discovered with this questionnaire during the initial interviews was that it didn't sufficiently allow for follow-up questions and probing on the part of the researchers. Although researchers were investigating how best to do this during interviews, the questions themselves didn't have enough built-in follow-up questions and in some cases the follow-up questions were skipped altogether. As a result, while the Action-Based Research was successful in minimizing farmer fatigue and allowed for the farmers to share more openly what they wished to contribute along the theme of the questions, it didn't allow for slight nuances to be detected, deeper introspection into the responses, and full comparisons to be made across the gewogs. More will be discussed on this in the study limitations section.

The following sections will discuss the research findings for 2014: Household Demographics; Life On The Farm; Training; Change in Cropping Systems Since Childhood; Seed Saving; Maintaining Soil Fertility; Pests and Disease; Religion and Decision-Making; Farmer Co-operatives; Modernization; and Dreams For The Future.

4.4.1 Household Demographics

The researchers tried to interview an even number of men and women in each gewog. In Dewathang, however, it was difficult to find women available to participate and 77% of the interviews happened with men. This is likely due to chance, but also the fact that the researchers did not insist on having a representative sample when interviews happened in

Dewathang—the first gewog where research occurred. Later, when researchers visited Orong, Phuntshothang, and Pemathang they knew the importance of seeking a representative sample of the population, comprised of almost equal numbers of men and women. In Orong, Phuntshothang, and Pemathang 54%, 57%, and 57% of respondents were men, respectively.

Looking at age of respondents, the average age of respondents was 48 in Dewathang (n=14), 49.9 in Orong (n=15), 38.4 in Phuntshothang (n=9), and 46.1 in Pemathang (n=12; see Table 19). Across the gewogs, this may be indicative of a trend towards an aging farmer population, especially if the next generation leaves the farm as is already happening in large and growing numbers. Over the years many farmers have shared about their labour shortages as young people move away from the villages to the cities. The fact that there are fewer numbers of young farmers engaging with farming causes alarm for the future of agriculture in the region. More children are going to school and becoming educated, and choose to work off farm after school. The result is that land is sold or goes fallow with no one to tend to it. Farm size is also less than it was in 2004 (10 years back), partly due to labour shortages, but also due to the fact that land holdings often get divided amongst children. SJI founder, Dzongsar Khyentse Rinpoche has recently addressed this emerging issue during village visits in Samdrup Jongkhar, strongly advising villagers not to sell but to hold onto their land.

Aging farmers are quite experienced, having 18-29 years of experience as principle farmers. They probably, however, have more experience, as the majority of the older generation is illiterate, not having attended school as children, and likely learned about farming from their parents throughout childhood. Interestingly, the average age when farmers considered themselves to have become farmers was 21 and this may have been when parents formally transferred the farming responsibilities to the children. It is certain that the future of subsistence farming will change over the next generation, as fewer young farmers are learning the skills of their parents. This point is also evident when looking at the number of family members in the household with the number involved in livelihood generation on the farm. An average of 4-6 people live per household, whereas only 2-3 of them help generate earnings from the farm.

For the moment, 73-100% of interviewed farmers across the gewogs (n=50) are meeting their needs from farm and other income (see Table 20). In Dewathang, there is a new and thriving Sunday Vegetable Market where farmers sell their local produce, explaining the greater diversity in income generating crops as compared to the other gewogs. Orong also has a high diversity of income generating crops, but is further away from the Dewathang and Samdrup Jongkhar markets. The One-Stop-Shop and Vegetable Co-operative in Orong helps to market their produce. There are also successful Milk Marketing Co-operatives in Dewathang and Orong where farmers earn a substantial portion of their income from milk sales in addition to crop sales. In Phuntshothang there is a thriving local market where local goods are procured, however, in both Phuntshothang and Pemathang a majority of the farm sales comes from rice. Even though there is no local market in Pemathang perishable crops are still sold. In all gewogs farm gate sales via word of mouth contribute substantially to income generation. Farmers' generated income across the gewogs is used to buy anywhere between 32% and 38% of their dietary requirements that cannot be produced on farm (n=50; Table 19).

Table 19. Household data summarizing the average age of farmers, the number of people in their families, the number of years spent farming, the acreage, the acreage in 2004 (10 years back), the number of people contributing to livelihood generation, the number who are meeting their needs through farm income, and the percent of food items purchased from the market.

	Age	No. of yrs. Farming	2014 (ac)	2004 (ac)	No. in family	No. contributing to livelihood	Meeting needs from farm income	% Buy
Dewathang	48	27.4	1.42	1.78	4.69	2	100%	38%
Orong	49.9	25.4	1.45	2.08	4.2	2.46	85%	32%
Phuntshothang	38.4	18.1	3.55	3.78	6.6	3	88.8%	35%
Pemathang	46.1	28.6	2.8	5.15	4.75	2.58	72.7%	33%

Table 20. Type of income generating crops and work by gewog.

	Type of income generating crops	Type of income generating work
Dewathang	Millet, maize, rice, barley, cabbage, small chilli, big chilli, Orongpa chilli, radish coloured beans, local beans, long beans, peas, broccoli, cauliflower, spring garlic, garlic, bunch onion, onion, mustard greens, saag, turnip, squash, local tomato (cherry), potato, pumpkin, carrot, coriander, ginger, oranges, mango, banana, guava, and milk.	Agriculture Office
Orong	Ginger, peanuts, maize, cardamom, cabbage, broccoli, cauliflower, spinach, radish, turnip, coriander, chill, saag, ginger, garlic, potato, carrot, cucumber, beans, fiddleheads, oranges, cheese, butter, and milk.	Agriculture Livestock Construction Carpentry Lumberjack, Custodial Shop-keeping
Phuntshothang	Paddy, wheat, betel nut, potato, saag, chilli, radish, ginger, poultry, honey, banana, jack fruit, guava, and orange.	Agriculture, Contract work Road work Construction
Pemathang	Paddy, betel nut, mushroom, ginger, onions, cabbage, chilli, saag, dhal, cheese, and butter.	Agriculture Contract work Carpentry Construction Porter worker Weaving

4.4.2 Life On The Farm

Farmers in Orong, Phuntshothang, and Pemathang were asked, “Can you please tell me about your life here on the farm?”. The question wasn’t asked in Dewathang as the questionnaire was implemented prior to finalization.

Several farmers mentioned the feeling of being free and being able to work independently, yet with their families. One Orong farmer shared that, “I feel so free being farmer. I have full power in my life to decide what to do or not do. When I was working in a government job I had a tough time and had to go to duty on time and never had time for family. Now, I get all the time to spend with my wife and work together on farm. I

finally feel like it's my life"! Another farmer said, "working here on farm since 2007, I feel I am free man because I can work whenever I want. If I am tired I can take rest and there is no one to order me around. I am able to eat fresh organic vegetables, which are produced myself. So I am proud to be a farmer!" (Orong farmer, 2014).

Happiness was another factor farmers mentioned when discussing about their life on the farm. Fifty four percent of Orong (n=15), 44% of Phuntshothang (n=9), and 50% of Pemathang (n=12) farmers interviewed mentioned they were happy farming. "I am happy working here on my own field. Till now I didn't work under anyone, I have always been an independent farmer. Whatever I produce on my field is enough for my livelihood. I am happy here with my family and I value happiness more than money" (Orong farmer, 2014). Another Orong farmer said, "I feel happy as a farmer because I am getting to eat fresh vegetables". In fact, this was a sentiment expressed by several farmers in all three gewogs. Getting to eat fresh, organic vegetables seems to be highly valued by farmers. Self-sufficiency was also discussed. As one Pemathang farmer put it, "As a farmer I feel happy, because I don't have to depend on others and I get whatever I need from my farm". Farmers in Orong and Phuntshothang also mentioned earning enough from vegetable sales to make their lives more comfortable than in the past.

No interviewed farmers in Orong (n=15) mentioned the hard work associated with farming, but it was mentioned by 44% (n=9) of interviewed Phuntshothang farmers. One farmer shared that, "I have spent my life here as a simple farmer. Till today I have earned just enough cash for my family, but most of the time it's hand to mouth". No interviewed farmers in Pemathang (n=12) directly said that farming work was challenging. However, one farmer shared about the labour exchange process and the gratification received from working hard during farming. "During transplanting paddy, we do it together with friends. We do it in someone's field one day and go to another person the next time. We work together as a team amongst friends. If you produce and sell 10 kilograms of dhal this year and you are successful in surpassing the production the following year, then it is gratifying" (Pemathang farmer, 2014).

4.4.3 Training

Fewer farmers have received government training in Dewathang compared to the other gewogs (Table 21). This could be partly due to the fact that Dewathang has been without an AEO since 2012, but also partly due to the presence of the SJI in the gewog that has held nine trainings by experts from Navdanya with farmers, mostly in Dewathang, since 2010, on organic farming techniques, including soil fertility management, composting, seed storage, co-operatives, terracing, and rainwater harvesting. The trainings have been carried out both at the Navdanya model farm in Dehradun, Uttrakhhand, India, and on site in Samdrup Jongkhar, with farmers of Dewathang and Orong (and to some extent Gomdar) gewogs. Nine percent of the interviewed farmers in Dewathang (n=14) attended the Navdanya trainings in India that were organized by SJI and funded by IDRC, whereas farmers from other gewogs who also attended these trainings were not interviewed in this year's study. Twenty seven percent of Dewathang (n=14) and 73% of Orong (n=15) farmers interviewed attended the Navdanya trainings hosted by the SJI in Samdrup Jongkhar itself.

The adoption rate of Navdanya trainings was not recorded in Dewathang gewog because the questionnaire without this question was implemented in the field and later updated. In Orong, however, 27% of the interviewed farmers (n=15) did not adopt the techniques taught by Navdanya because they felt they were too time-consuming. On the other hand, 55% of Orong farmers interviewed felt the trainings were useful, particularly in the area of compost making (colleting dung and mixing with dried leaves). For more information on the successes and challenges of the Navdanya trainings, see the SJI's Navdanya Focus Group paper.

Table 21. The trainings received by farmers by gewog.

	Government	Attended Navdanya training in India	Navdanya training in Samdrup Jongkhar
Dewathang	18%	9%	27%
Orong	46%	.	73%
Phuntshothang	77.70%	.	.
Pemathang	66.70%	.	.

The greatest numbers of interviewed farmers who received government trainings came from Phuntshothang (77.7%; n=9) and Pemathang (66.7%; n=12). While farmers mentioned they had previously received government training in vegetable production, particularly onion, in addition to tree fruit crops such as oranges, teak plantation, betel nut cultivation, and dairy, farmers also said they wanted trainings in: seed and vegetable production and improved materials/tools in Dewathang; vegetable production, livestock, irrigation, and machinery in Orong; new methods of cultivating crops in Phuntshothang; and irrigation canals, high-yielding varieties, vegetable production, and fertilizer in Pemathang (see Table 22).

Table 22. Farmers wanting training in the following areas by gewog.

Dewathang	Seeds, vegetable production and monitoring, materials/tools
Orong	Vegetable production, livestock, irrigation, machinery
Phuntshothang	New methods for cultivating crops
Pemathang	Irrigation canals, high-yielding varieties, vegetable production, fertilizer

4.4.4 Change In Cropping Systems Since Childhood

Farmers were asked: Have you noticed a change in farming practices in your village since you were a child? (Shifting cultivation, permanent settlement, change in crops or techniques, etc.). The prompts in parentheses were given when farmers didn't provide initial feedback.

Many farmers mentioned that shifting cultivation practices have mostly been abandoned, although direct observation by researchers confirmed it is still practiced in several cases, especially in Dewathang and Orong. One Pemathang farmer shared that, “They used to practice shifting cultivation. The ash from the burnt wood (the whitish ash) used to give good harvest. That practice is no longer used. This practice used to yield better results than the present one. But after two years, the field had to be laid fallow and new ones tilled. We do practice the old ways taught and given to us by our grandparents. But old ways are changing”. Farmers who have left shifting cultivation said the main reason for this was because of its impact on the environment, plants, wild animals, and insects.

The abandoned crops that were mentioned to be previously grown in Samdrup Jongkhar included millet, cotton, buckwheat, and barley. In Orong, farmers mentioned that compared to the past, they now know how to properly grow vegetables and to manage soil fertility with composted manure. One particular farmer in Orong said that in the past, intercropping was widely practiced, whereas now people know how to plant single crops in well-prepared garden beds.

The labour exchange system has changed in some of the gewogs while remaining the same in the others. Interviewed farmers in both Dewathang and Orong explained that now they don’t exchange labour anymore with their neighbours (recall with the exception of Rikhey village; see 2013 findings), but actually pay wages for labour. Some farmers have explained abandoning this practice because now there are not so many people available to work on the farm. In Phuntshothang and Pemathang, however, labour exchange is still a commonly relied upon practice. Farmers go farm to farm to see that crops are (trans)planted and that weeding and harvesting are accomplished for everyone. One Pemathang farmer explained, “We especially exchange labour during [paddy] transplantation. It is called *Parma*. This is because there is no money to purchase the labour. And the program has to be fixed on how much to do at whose house...”. Also, traditionally, there have been bigger families in Phuntshothang and Pemathang, and possibly more available labour to partake in the exchanges (see Table 19).

A common response from farmers across the gewogs was that in the past people were cultivating more land, but it was yielding less. Farmers have speculated that this is due to improved seeds, good quality manure, and training in improved methods of farming. In Phuntshothang and Pemathang, farmers explained that while they are still using draft-powered animals to cultivate their fields, tractors and tillers have already come to their area and might slowly start to displace the oxen. Rice threshing machines have replaced stone grinders, which were standard in the past.

Most farmers explained that farming today is better than in the past because they now grow enough diversity of vegetables in sufficient quantity that they are not only able to provide for their families, they also now have surplus available to sell. In Phuntshothang one farmer said that, “in the past there were hardly any vegetables—onions, cabbage and broccoli weren’t there. Everything was gathered from the forest, but now we sell vegetables commercially”. As a result of the improvement in vegetable growing, farmers have largely stopped foraging in the forest, especially for firewood and water, which are now available on their own land and from public water sources. Farmers attribute the improvement in vegetable growing to improved seeds (modern varieties), and proper training. What they cannot produce is available in the market for a reasonable price. It was said that the newly created Dewathang Sunday Market has been a great place for farmers to sell their local produce without facing the competition of the town market that sells mostly Indian produce at very cheap prices. One farmer explained that people from town are becoming more knowledgeable about the benefits of shopping and eating locally.

Despite these changes, several farmers across the gewogs said that they are continuing the practices used by their parents, such as ploughing with oxen, weeding with spades, broadcasting seeds at the time of sowing, and harvesting and storing harvested grains in bamboo baskets. One Pemathang farmer, when talking about traditional methods of crop storage shared, “We store paddy in a *gothra*, which is a bamboo woven basket. When that gets filled, we top it with rice husk and then finally we seal with a coating of cow dung mixture”.

When asked if farmers thought modern practices are replacing the traditional ones, and how, farmers had various responses. Several farmers in Orong (n=15) explained that in the olden days [they] used to work on the farm just for self-consumption but now [they] do it for money—that farm work has become a business. One Orong farmer said, “changes brought by modern[ization] are good because before, our parents had good fertile soil but they didn’t know how to maintain it. Now we are getting advice from [the] government [about] how to deal with our soil by making compost and using natural resources [that] work in harmony with nature”. Another Orong farmer said, “before we used to plant vegetable, maize, rice, beans, and pumpkin in one field but now we make different beds for the different vegetables. Now we use seeds and value added natural manure”. Actually several farmers from across the gewogs mentioned that one noticeable change is that they used to plant vegetables all together and now they plant them in rows in separate beds.

Phuntshothang and Pemathang farmers particularly discussed the changes seen with motorized machines. One farmer said, “the tradition is being affected by the forces of modernity in small ways. Modern ways are easier on you. Working with hands, manual labour is now on the wane. Machines have come. Old methods are slowly making way for the new”. Another farmer said, “Machinery is replacing our traditional technology; especially oxen are replaced by power tillers, horses by motor cars”. As mentioned by this farmer the introduction of machinery is seen to make things easier for the farmer and can possibly address some of the labour shortages seen on the farm. One Pemathang farmer shared his belief that modern machinery has evolved with climate change “Now people are using tractors. Even the harvesting is done by machines. It is faster. The traditional way takes time. The use of the tractor is due to compulsion created by the climate change. The rains do not come and when they do come, you have to do it quickly. If you plough an acre of land using oxen, you will require a lot of time. A tractor does it in a day. Two days after rain, you can do the ploughing. Now you have to wait for the rain to come. In the past, you didn’t have to, so you could do the ploughing at ease. The weather change is hampering a lot”. One Orong farmer mentioned that they no longer churn milk on the farm, instead they sell to the milk group where milk is churned by machines.

Several farmers said that they no longer plant “ordinary seeds”, that they now get hybrid varieties from the government. In fact many of the modern practices were said to involve government interventions, such as providing improved seeds, mechanization, irrigation channels and sources, and trainings on compost and vegetable bed making—all initiatives to help farmers generate more income. Despite these government-led interventions, 80% of Orong (n=15), 63% of Phuntshothang (n=9), and 92% of Pemathang (n=12) farmers interviewed felt that AEOs listen to local/traditional perspectives on agriculture.

In addition to these changes, several farmers across the gewogs felt that the traditional practices were still continuing, or that this change was the result of a natural evolution, “some of the practices of our grandparents may not be to our liking and likewise, the way we work may not be liked by our children, change is inevitable” (Pemathang farmer, 2014).

4.4.5 Seed Saving

Sixty-four percent of interviewed farmers in Dewathang (n=14) are saving seeds compared to 40% in Orong (n=15), 33% in Phuntshothang (n=9), and 67% in Pemathang (n=12). Most of the seeds saved in Dewathang are from maize, millet (2 farmers), paddy, and a few vegetables. The vegetable seeds farmers reported saving in Dewathang include saag, garlic, pumpkin, chilli, beans, cucumber, rice-bean, and bunching onions. In Orong, pumpkin, chilli, saag, maize were the only reported varieties saved. Farmers in Phuntshothang save rice, beans, spinach, dhal, ginger, eggplant, and chilli and in Phuntshothang they reported saving rice, black dhal, and beans. Sixty-six percent of interviewed farmers in Dewathang, 80% of farmers in Orong, 89% in Phuntshothang, and 92% in Pemathang rely on the AEO for cabbage, broccoli, cauliflower, onion, turnip, potato, beans, and saag seeds in addition to “improved” rice varieties (Burkam Ja 1&2 and KamJa 1&2), maize, and barley seeds. Seeds are sometimes distributed for free, especially when tied to government granted agriculture projects, but most of the time they cost ~120 Nu per packet (for 10 g of hybrid seed). Farmers in Dewathang sometimes also buy seeds from India, or locally in Bhutan (1 pack costs ~15-20 Nu.) and exchange with

other farmers, but exchanging was only mentioned by one farmer in Dewathang (n=12), one farmer in Phuntshothang (n=9), and one farmer in Pemathang (n=12). Interestingly in Orong, 26.6% of farmers mentioned that they exchange seeds with their neighbours. It was also mentioned by Orong farmers that the local vegetable group is trying to save more of its own seeds. One Orong farmer mentioned being reliant on the AEO for cauliflower, broccoli, radish, and pumpkin seeds in the past, but he has since learned how to save those seeds. Dewathang farmers also mentioned buying potato seeds from Wamrong (about five hours drive distant in neighbouring Trashigang dzongkhag), which has a good climate for producing seed.

4.4.6 Maintaining Soil Fertility

Farmers mentioned several factors when discussing soil fertility, such as rotating crops, mulching, making compost, incorporating green manure, tethering cattle in their fields, and intercropping. It is clear that farmers have vast knowledge on the subject. One farmer in Pemathang shared, “We use cow dung as manure primarily. It has to be looked after properly. We also grow daincha (*Sesbania bispinosa*), which is good for the soil. We grow beans to make the soil fertile. I also make compost by collecting cow dung, urine and adding the leftover biomass from the fodder”. One Dewathang farmer (n=10) talked about rotating crops, such as spinach, beans, and pumpkins, while another Orong farmer discussed his plan for making hedgerows on his farm since he had just learned about this practice from the AEO. One Phuntshothang farmer mentioned it was common to leave paddy stocks in the field to rot and be incorporated into the soil before the next crop. Almost all the farmers across the gewogs said they mulch their weeds after they are uprooted.

One Dewathang farmer mentioned the trouble of having dung piles on steep slopes because they wash away during the monsoon. Another two farmers talked about protecting their cow dung piles from sunlight and water. Typically, interviewed farmers in Dewathang (60%; n=14), Orong (73%; n=15), Phuntshothang (100%; n=9), and Pemathang (93%; n=12) spread and incorporate cow dung in their fields at the time of planting, or just let cows graze the field prior to planting season. Five farmers in

Dewathang (n=10) talked about composting cow dung to increase soil fertility. In Orong, eight farmers (n=15) mentioned composting, while one (n=9) did this in Phutshothang, and four (n=12) in Pemathang. One Orong farmer shared, “Yes, I collect dry biomass, green biomass, cow dung and urine and dig a pit deep 2.5 feet and length 6 feet and add materials that I collect step by step, dry, green, dung and urine, three times same and after 1 month and after 2 month ready to use. This was taught by trainer came from India, and it is effective”. Another two farmers in Dewathang mentioned using cow urine directly on their soil for fertility and for keeping pests away from their crops. These methods were taught to farmers in the SJI/Navdanya trainings.

Two farmers in Orong (n=15) mentioned previously using urea but abandoning the practice since it “spoils” and “damages” soil. Two farmers in Phuntshothang talked about adding cow dung and cut branches to their fields before burning to increase soil fertility. The farmers interviewed in Dewathang and Orong mentioned that burning is an old practice, although the researchers have noted that burning fields prior to cultivation is quite a common practice in Dewathang. Burning is said to also occur in Orong, especially prior to chilli cultivation.

On the subject of intercropping, there seemed to also be a deep knowledge and understanding of this practice although a few farmers mentioned they weren’t intercropping due to labour shortages. In Dewathang, 75% of interviewed farmers practiced intercropping in some capacity, while in Orong only 53% practiced it. In Phuntshothang 44% of interviewed farmers used intercropping while 67% of interviewed farmers were doing so in Pemathang.

Farmers discussed intercropping maize, soybean, and rice-bean, or maize, saag, and radish, or beans, radish, chilli, and maize, or paddy and dhal (especially in Phuntshothang and Pemathang), among many other combinations. While many farmers reported not intercropping their vegetables, they mentioned the importance of planting legumes with cereals, like rice-bean with maize, in that they provide nitrogen-fixing bacteria to improve soil fertility and make soil “loose”. “I do intercrop maize with rice beans because it makes the soil loose and moreover it takes less effort and I don’t have to look for a separate field for two different crops. For vegetables I do plant all in one field

but in different beds because it is easy to weed and harvest them (Orong farmer, 2014). Some farmers mentioned that weeding is easier with intercropping, while others thought vegetables in single beds was an easier method of weeding compared to intercropping. Several farmers across the gewogs said that intercropping is a more efficient use of space compared to row planting in different beds. One Pemathang farmer mentioned intercropping because they had insufficient land to do otherwise. Farmers also explained the benefits intercropping has on reducing pest pressures. One Dewathang farmer shared, “I do intercropping of garlic, onion, carrot, and radish because it helps to reduce pest problems. I believe that all pests don’t eat all type of plants. So when we intercrop the smell of one plant kills the pests that don’t eat it”. Other farmers in Orong also mentioned that intercropping helps repel pests that are specialists.

4.4.7 Pests and Disease

Dewathang was the only gewog where specific questions about pests and disease were asked, for example: “Have you noticed an increase in diseases? Which ones?” And, “have you noticed an increase in pests? Which ones?” In terms of disease, the responses by farmers were difficult to assess, since often the names of the diseases were omitted because they were not known and only the symptoms were given. Farmers mentioned the yellow colour and drying of saag leaves, rotten saag roots, the yellow base of maize and its sudden lodging, and drying leaves and rotting stems and roots of maize.

In terms of pests, an overwhelming majority of interviewed farmers mentioned cabbage worm and cut worm (called *Zeeboo* in Sharchop) that affect vegetables. Another ash-coloured insect (no one shared this name), ants, aphids, and caterpillars all eat away at vegetables. Pests with the local name *Buthmo*, which is red in color, and *Youtsheme*, with a black head and long body, transmit diseases that make farmers’ crops look like they’ve been “burned by fire” (Dewathang farmer 2014). Wild animals like elephants, deer, porcupine, boar, and squirrels were all mentioned as serious problems.

Farmers in all gewogs were asked how they deal with pests. Farmers described using ash, urine, natural pesticides, synthetic pesticides, and picking and throwing insects. Fifty percent of Dewathang farmers (n=14) mentioned sprinkling ash on the

leaves of crops to target cabbage and cut worms. Thirty-three percent of farmers in Orong (n=15) used ash, whereas this was practiced by 13% of farmers in Pemathang (n=12). Twenty percent of Dewathang farmers use cow urine on their crops to deter pests. One farmer from Orong (n=15) mentioned also using cow urine. Another Orong farmer said he prepared a natural pesticide from the leaves of a tree called *Nengshing*, chopped and soaked in water for two to three days and sprinkled with water in the garden. He even said he planted marigold flowers that act as pest repellent. Some farmers also reported using synthetic chemicals to control pests, although this was rare. One farmer in Phuntshothang (n=9) and another in Pemathang (n=12) said they used insecticides. One Pemathang farmer said he was looking for insecticides but couldn't get any. Other farmers (40% in Dewathang) just mentioned picking and throwing the insects at the time of weeding.

In Phuntshothang one common method for managing pests in paddy is altering the water administered during flooding. Farmers find that weed pests are less common with paddy flooding, but also when they see "white" insect pests they know to cut off the water supply. When farmers see "red" pests they know to add more water.

In Orong 53% of interviewed farmers said there was nothing they could do about pests and diseases. While it wasn't detected in these specific pest/disease questions, past research has revealed that farmers have a difficult time deliberately killing insects, since it is considered a sin in Buddhist religion. Many farmers also have mentioned their intentions to minimize killing whenever possible, preferring to use the pick and throw method and natural pest repellents/deterrents, such as ash and plant derived solutions, instead of methods that kill insects, such as insecticides. Farmers also noted the benefits of performing pujas to reduce pest attacks.

In terms of wild animals, this is still a major problem faced by farmers. One Pemathang farmer described, "the problem of the wild animals attacking our crops is the biggest problem of all. The squirrel can bring down ten bunches of areca nut in a day. When you look at it, it is a small animal. We haven't found any solution to this menace. Then wild boars. And deer. And Elephants. We keep vigil in the night to ward off the elephants and wild boars. But they have become smart and do a lot of damage". Going to the field and guarding their crops at night is still the most widely practiced method of

farmers for keeping wild animals, like boar, deer, porcupine away from crops—except with elephants, as one Orong farmer shared, “in the case of elephants, I am helpless”.

Other popular methods include tying tin containers in fields that have iron or bamboo rods attached to them and a rope that feeds into the bedroom of the house, called *Pang Pang Ma*. That way when someone pulls the rope, the sound on the tin scares away animals. Scarecrows are also commonly used in fields. One farmer in Phuntshothang said they rub rotten cheese on their scarecrow to deter pests and animals, which works for about 2-3 days. In Phuntshothang, however, the problem with wild boars is really severe. Because of the heavy rainfall and the mosquitos that carry malaria in the summer months, farmers are unable to guard their fields at night. They lose almost all of their maize crop to animals, so that they’ve actually stopped growing maize, one farmer mentioned. Other Phuntshothang farmers take the chance of potentially getting malaria and they guard their fields anyway.

4.4.8 Religion and Decision Making

In Dewathang, farmers were asked: “How important are traditional practices and religious/spiritual beliefs to your current farming practices?” In Orong, Phuntshothang, and Pemathang, the question was changed to: “Does religion play a role in how you farm? (like in what dates you plant, what crops you grow, what methods you use, what/when you harvest, etc.?)”—prompts in parenthesis were given if farmers had no initial response. A follow-up question was: “How important is this to helping you make decisions about when and what to grow, what management decisions to make, and/or what to harvest?” Out of the 10 farmers who responded in Dewathang (n=10), 30% said they look to the auspicious dates for planting, 80% pray to the local deities, 20% make offerings to the local deities, and 40% make offerings to the local monastery. In Orong, 67% of interviewed farmers said that they consult the local astrologer to know the good days to plant. In Phuntshothang and Pemathang 56% and 67% of interviewed farmers mentioned this practice, respectively. As one farmer put it, “farmers in our community do believe in religion and spiritual practice like when to sow and when to harvest and offer first yield to deity and monastery. Because of [these] belief[s] and trust it keeps away

obstacles and brings happ[iness] in our life and peace in our society” (Dewathang farmer, 2014).

Over the years, research has begun to investigate the influence that religion and beliefs play on agricultural decision-making. One of the primary practices farmers have mentioned is consulting with the local astrologer (Tseepas) to determine the “good” and “bad” dates for planting and harvesting. One Orong farmer shared, “there are so many who believe that if we plant on pest or insect day there will be more harm by pest and insect and if we plant on a water day then rain will destroy our crops. I also heard from the astrologer that if we sow our seeds on earth day then it will be good because earth is matched with all elements. When we harvest I heard that we should harvest on fire day because fire will burn all elements so nothing will affect or harm us. We do these things and because of our beliefs or keeping faith on this, until now we don’t have problem in agriculture work”.

There is evidence, however, that this traditional practice is changing due to modernization, as farmers no longer have to consult tseepas. Rather, farmers can find out the “good” and “bad” dates from the radio, newspaper, and even from certain ‘Apps’ on their phones. Twenty percent of interviewed farmers in Orong (n=15) said that they learn the auspicious dates from the radio. Nevertheless, many farmers still meet with the local tseepas each year. In Dewathang, 20% of interviewed farmers mentioned that if they were unable to meet with the tseepas, then good times for planting generally are on Fridays or Sundays. Sunday was also mentioned as a good day to practice agriculture in Orong. “We go to the astrologer to look for the date when to harvest and when to plant, if they are not there we plant on Sunday — it is a good day for agriculture activities” (Orong farmer, 2014).

Farmers in Pemathang, who mostly follow Hindu religion, mentioned not working on “bad” days that are also determined by the tseepa. “On certain specified days like the full moon day and no moon day, and holy days, we don’t work. We don’t plough. But during the harvesting time we work because the work doesn’t entail digging and ploughing. Religion does play a role in our farming” (Pemathang farmer, 2014). Another farmer in Pemathang had a similar response: “On full moon and no moon day, we don’t

practice farming. We don't dig, plough, transplant. As per our custom, we coat the walls of our house with red soil. We offer incense to our Gods. We don't eat meat on these days. When it comes to harvest, we [also] rely on our customs because of the damage that wild animals can cause". In Phuntshothang similar customs were mentioned: "During *Ausi* and *Poornima*, (holy days like full moon day) we don't plough. When it comes to sowing, we do have a book, which tells which days are good for sowing. Not all follow these but being a spiritual practitioner myself, I tell my wife that today is a good day and let us plant some seeds and rice. The system of harvesting paddy on auspicious days is there in our community. It is practiced by all. I do get calls from people asking me when would be a good day for harvesting the paddy crop. Then there is the auspicious day to consume the first rice harvested from the field. On that day, we light some incense and offer it to the Gods. And only then do we consume the rice".

Another strong factor influencing agriculture is praying and making offerings to local deities. "Praying to local deities and making offerings to them [reduces] the pest and wild animals problems" (Dewathang farmer, 2014). This particular farmer also mentioned the importance of facing north while harvesting maize as a way to appease the local deity. Another farmer shared, "I do rituals to local deities because they protect our crops from wild animals and pests. It happened to me once when I didn't do rituals to local deities where half of my crops were destroyed by wild boar. Even leftover crops were bad quality. Thereafter, I do believe in rituals" (Dewathang farmer, 2014). Another farmer also mentioned the issue of reduced yield: "If I miss rituals once that year I feel there is decline in my product" (Dewathang farmer, 2014). One farmer even mentioned that rituals were performed to seek permission for using the land of the deities for farming, "I do ritual to local deities because I am using their land. If I don't do this ritual then I might face decline in crop productivity, increase in disease & pests, and wild animals might destroy my field".

The Lhotshampa farmers also make offerings to God in Pemathang and Phuntshothang. As one Pemathang farmer said, "we offer new crops to God. It is called *Nowagi*. Before we consume, we offer to God. We believe that God plays a role in our agriculture. Even if we work really hard, without God's blessings, it will not work".

Three farmers from Phuntshothang (n=9) also said they offer their first crops to their Gods.

Making offerings to the Monastery is another way farmers try to influence the outcome of their farming. Farmers often discussed the ways in which they accumulated good merit (to bring luck and good fortune to this and subsequent lives). Offering their first harvest to the Monastery is one way to accumulate merit. “I offer my first crop production of the year to monastery. I do these because I believe that if god is happy with my offerings nothing can disturb my crop” (Dewathang farmer, 2014). Another farmer said: “The first yield I offer to the monastery. Offering to the monastery makes me feel better and I believe that my yield increased and was harmed less by wild animals due to my strong belief in the Three Jewels and respect for nature”. This particular farmer also mentioned the belief that during shifting cultivation times, farmers were sinful as they were cutting and burning the forest as well as killing a lot of insects and wildlife. They also explained that was the reason for food shortages during those times. Despite the vast lands planted, because farmers were sinful, they had food shortages and had to supplement by foraging in the forest. This response has come up elsewhere in this year’s and past year’s research.

Most farmers (67% in Orong, 71% in Phuntshothang, and 50% Pemathang; n=36) across the gewogs (minus Dewathang where the question wasn’t asked) mentioned that if they didn’t get the “good” days for plantings, make offerings to local deities, gods, or the monastery that bad things would happen like losses to pests, or poor crop growth and lower yields. One Orong farmer said, “[these rituals are] important because if I don’t do them there is lot of harm to crops from diseases, pests, and wild animals”.

A follow-up question to the religious questions was asked: Do you believe that you, as a farmer, have the power to influence the outcome of your crops? This question was designed as a specific follow-up to research conducted in 2012 that suggested that agriculture was influenced by more than hard work alone. In Dewathang, one farmer said, “I believe that all things together bring good outcome of crops, such as hard work, good seeds, good soil, good care, good manure, and having faith on god and deities. My wife and I do practice all and that’s why we are having good income with agriculture”. This

perspective on the influence of Buddhism on farming was also shared by SJI founder Dzongsar Khyentse Rinpoche, who emphasized the importance of hard work and religious beliefs and practices in contributing to farming outcomes. In Orong, 5 farmers (n=11) said their outcomes were in part to do with the blessings from the “Three Jewels”. “I think it’s all because of our hard work and blessing from the Three Jewels that I can produce good yield of product” (Orong farmer, 2014). Another Orong farmer described, “as a follower of one great yogi I believe that it’s because of good seeds, good soil, hard work and together by blessing of lamas and Rinpoches. So whatever we do in our life we should have good merit. If we don’t have that, then nothing is possible in our life”. In Phuntshothang only 44% of farmers believed the outcomes of their farming were the result of their faith in God. Another 44% believed outcomes were due to hard work alone. In Phuntshothang, 67% of farmers attributed the outcomes of their farming to both hard work and God. One Phuntshothang farmer even mentioned results are attributable to the blessings from Rinpoches.

4.4.9 Farmer Co-operatives

Farmers were asked what community groups were in their gewogs and which ones they participated in. Table 23 shows the number of farmers belonging to particular community groups.

Table 23. The numbers of farmers belonging to the listed community groups, by gewog.

	Milk/ Livestock	Community Forestry	Vegetable	Khamty (paddy)	Mechanics	Goat
Dewathang	9 (n=10)	1 (n=10)	n/a	n/a	n/a	n/a
Orong	9 (n=15)	10 (n=15)	13 (n=15)	n/a	n/a	n/a
Phuntshothang	n/a	n/a	2 (n=2)	.	.	n/a
Pemathang	1 (n=8)	1 (n=8)	4 (n=8)	2 (n=8)	n/a	n/a

In Dewathang, of the two farmers asked: Would you be interested to participate in an organized farmer co-operative in your region? Both of them said yes. In Orong only

one farmer was asked this question, but they were also interested. In Phuntshothang, three farmers were asked this question and two said they are already in the newly formed vegetable group and one mentioned interest in the paddy group. No farmers were asked about interest in participating in farmer co-operatives in Pemathang.

4.4.10 Modernization

Farmers were asked: How has the modernization of Bhutan influenced you, your family, and your village? Most of the farmers in Orong, Phuntshothang, and Pemathang (Dewathang farmers weren't asked this question) talked about the modern conveniences modernization has brought, such as electricity, mobile phones, rice cookers, curry cookers, water boilers, water sources, education, hospitals, transportation, and road connectivity. One Phuntshothang farmer shared, “Much has changed. Earlier we used to carry axes and go to the forest to get firewood and carry it on our back. Now the young don’t have to do that. Even if they have to, they can load the firewood and bring it on a bicycle or a car. So much has changed. Earlier we had to go to the spring and get water by carrying it on our back in a bamboo basket and now that has also changed. Now there is water in every household. We used to light kerosene lamps but now electricity has come. The country has developed and with it villages are becoming different too.”

Several farmers discussed the influence modernization has on the youth, “Yes modernization had influenced our young people and villagers, as most of our youths are thinking that after study they have to get a government job. Even villagers are thinking that after study they have to work under government only. This thing is in their heads because of modernization, I think” (Orong farmer, 2014). One Phuntshothang farmer said, “We have been farming but our own children don’t want to do farming. They can’t do manual work and therefore do not look at farming. [We ask], how do we bring them to work in the fields (or how to attract them to farming)? They do go to school and even those who are not in school they don’t want to work in the farm. Instead [they] opt for off-farm work and do contract work and earn some money and the land is becoming fallow. Maybe with machinery, there will be farming”. One Orong farmer mentioned dealing with the labour shortage by not sending their children to school, “I will never

send my daughter and son to the school since we are getting old and there is nobody is take care of my land. Thus, due to modernization [educated youth] have influenced my family and village”. Another Orong farmer said, “Yes modernization has brought changes in my family and village, our kids are educated and get to see lots of new things. Before we were just like jungle people with no exposure and always in the forest, but now there is road access everywhere and vegetables dealers, vendors, and shopkeepers come to our door to collect as much as we can grow” (Orong farmer, 2014).

Other changes that were mentioned were the benefits of selling vegetables due to road connectivity. One Orong farmer shared, that “now [they] can sell vegetables to other parts of the country due to road connectivity. We can compare the price in different dzongkhags through the television and sell them wherever the price is higher”. Another Orong farmer mentioned the changing traditions with clothing: “Before our grandparents were wearing beautiful and flower full gho and kira, nowadays its rare to see these things”. One Pemathang farmer explained, “We have come up economically. In the past, we used to see people wearing patched clothes. There were no shoes, people wore slippers/flip flops. The living standard has come up”. Sanitation was also mentioned as being a new thing brought by modernization. In terms of agriculture, one Orong farmer said, “I feel our agriculture has become a business. Now we compete with each other in agriculture work so that we can earn more cash”.

4.4.11 Dreams For The Future

Farmers from all four gewogs were asked: What is your dream for the future? Some of the responses included wanting to expand organic production systems, growing for markets to be able to earn more, and to look after family, as well as to inspire family to continue farming.

One very motivated Dewathang farmer mentioned their ultimate goal, “to make my farm a pure organic and model farm for this country and a place where young people can come and work and learn about farming free of cost”. Several farmers in Orong said they want to expand their production to be able to sell more vegetables in local markets, as well as to other dzongkhags. Earning more was also a dream of farmers. One Orong farmer shared, “I feel like extending my vegetable field so that I can earn more money

then I get today. I want to become famous in agriculture farming work”. Other Orong farmers mentioned extending their vegetable production, orange cultivation, and increasing the number of cattle. Phuntshothang farmers mentioned investing in getting a selling shed. Phuntshothang and Pemathang farmers dreamt of producing enough rice to be able to export to Thimphu, and another wanted to export internationally. Expanding into poultry production was also a goal of some Phuntshothang farmers.

Other dreams mentioned were to see that family members were well taken care of and that successive family members were inspired to continue farming. One Pemathang farmer expressed: “May our children not have to toil like us. May they eat better than us. May they fare better than us”. In terms of inspiring the next generation one Orong farmer said, “I am thinking to continue my work in this farm till my son/daughter take it over from me. I want to promote my vegetable farming work and make it systematic one so when my heirs continue my work, they will be proud of me.” Another Orong farmer mentioned, “I want to take care of my lands and continue my farm work, so that one day my kids can be proud of me and follow in my steps”. Education was also mentioned as an important factor and one farmer from Orong said: “I am planning to send my son to study in agriculture sector so that he can join us and do better work and have better production in the future”.

Some distinctive responses that go beyond the farm level include what one Pemathang farmer said about Bhutan: “My future dreams are to live life well, brighten the nation, push the nation forward and if one progresses, so does the nation.” Another Pemathang farmer shared his dreams for peace: “Let there be peace in the country. Let the economy be good. May our children not go towards drugs. Just a peaceful life. You don’t need really big things. The first thing is peace. My priority is peace”.

4.5 Findings From a Seed Workshop in 2015

The outcome of a recent SJI seed saving workshop (February 27, 2015) in Pazoor, Dewathang was that seed saving is not a lost art, but thriving in the chiwogs of Dewathang and Orong. All 23-farmer participants save seeds in some capacity (Table 24) and were interested to learn more about how to improve their techniques and crop diversity saved. Fewer farmers exchanged their seeds or only shared some with others. Why this was the case was not addressed, but when asked if anyone wanted to make money from selling their seeds everyone said yes. The majority of farmers buy vegetable seeds like onion, cabbage, broccoli, and cauliflower, which are the main food and cash crops during the winter. Since these seeds come at a cost, the participants unanimously wanted to know how to save the seed from these crops and reduce the cost of purchasing annually. The SJI technical advisor on seed saving suggested that a portion of the farmers with sufficient land holding and extra time could specialize in one variety and then make these available to other farmers. The reason for this is to provide adequate isolation distances to limit cross-pollination between varieties. Cabbage, broccoli, and cauliflower, for example, all belong to the same species (*Brassica oleracea*) and can intercross producing unmarketable plants if grown in proximity.

One Orong farmer is saving and selling broccoli seeds and received training in seed production from RNR-Wengkhar. Another, farmer from Morong is selling many kinds of seeds, among them peas, beans, broccoli, and cauliflower. One farmer in Dewathang has also emerged as a seed distributor for his local area. These recent developments are likely the result of both Bhutan's policy of subsidizing rather than distributing free seed and farmers seeing the benefits of locally produced seed, associated social alliances, and economic return. Through interactions directly with individual farmers and through workshops there exists a capacity and plasticity of some progressive farmers to meet the continually evolving demands of society. Seed saving will be a part of this into the future, but to what extent will be determined by appropriate policy and an informed populace. Participatory varietal selection rather than participatory plant breeding or broad introduction of improved varieties (Witcombe et al., 1996) should be encouraged in Samdrup Jongkhar. Inclusion of farmers in selection and decision-making

will help align the goal of local self-sufficiency and the national goal of Gross National Happiness.

Table 24. Outcomes of a seed workshop held in 2015.

Farmer	Chiwog	Seeds Produced	Seeds Purchased	Seeds Exchanged
1	Rikhey	Maize, Paddy, Soya beans, lentils, rice bean	----	----
2	Rikhey	Maize, Paddy, Coriander	Vegetables	Rice bean
3	Domphu	Maize, Beans, Rice beans, Orongpa chillies, Spinach seeds, Coriander, Garlic, Ginger, Peas	Vegetables	Maize
4	Domphu	Maize, Coriander, Beans, Garlic	Vegetables (Cabbage, Onions)	-----
5	Rikhey	Yangtsipa Maize, Paddy, Rice bean, Garlic, Onions	Vegetables (Onions)	----
6	Martang	Maize, Beans, Coriander, Garlic, Rice beans, Ginger	Vegetables	Beans
7	Rikhey	Maize, Paddy, Garlic, Coriander, Onion, Black Dal	Vegetables (Saag, Cabbage)	----
8	Bangtsho	Beans, Sag, Garlic, Ginger, Maize	Vegetables (Radish, Turnip)	----
9	Rikhey	Broccoli, Beans, Peas, Brokchi Beans, Chema Beans, Maize	Raddish, Saag	----
10	Bengzor	Maize, Coriander, Garlic, Ginger, Beans, Cucumber, Pumpkin	Onions, Cabbage, Broccoli	Maize

11	Morong	Beans, Peas, Sag, Radish, Rice beans, Cucumber, Cabbage, Naam, Lasomo, Onions, Soya beans, Maize, Coriander	Cabbage, Broccoli, Cauliflower, Tomato	Garlic
12	Layrong	Maize, Millet, Peas, Finger Millet, Cauliflower, Cabbage, Broccoli, Carrot, Sag, Radish, Beans	Cabbage, Carrot, Bean, Pea, Radish	
13	Morong	Pumpkin, Round Chillies, Maize, Millet, Sweet Buckwheat, Spinach, Beans (Local, Serbu, Pole), Naam, Onions, Cucumber	Cauliflower	Beans, Peas, Spinach, Radish
14	Cheynari	Beans, Pumpkin, Spinach, Maize, Lettuce	Chilli, Radish	----
15	Khesangtiri	Beans, Lettuce, Coriander, Maize	Carrot, Garlic, Beans, Radish	Beans, Cabbage, Chilli
16	Khesangtiri	Maize, Spinach, Coriander, Beans	Cabbage, Onions, Broccoli, Cauliflower, Tomato, Radish	Beans, Chillies
17	Pazoor	Coriander, Beans, Pumpkin	Cabbage, Broccoli	Beans
18	Pazoor	Beans , Coriander	Spinach, Garlic, Onions	-----
19	Pazoor	Maize, Beans, Peas	Cabbage, Onion, Garlic	Chilli, Spinach
20	Khesangtiri	Maize, Beans, Coriander, Garlic, Ginger, Peas	Onions, Cabbage	Spinach, Chilli
21	Pazoor	Maize, Beans	Cabbage, Broccoli, Carrot, Radish,	Spinach, Chilli

22	Pazoor	Beans, Coriander, Peas, Bringle	Chilli, Cabbage, Cauliflower	Chilli, Spinach
23	Pazoor	Tomato, Bringle, Chilli, Beans, Lettuce, Banana	Vegetables	Chilli, Bringle, Cucumber, Pumpkin, Spinach

5.0 STUDY LIMITATIONS

As explained earlier in this report, Action-Based Research was chosen as the new method for 2014 research after research in 2011-2013 was conducted with a long questionnaire that was inflexible and irritated farmers. The results from 2011-2013, while useful, did little to acknowledge the voices and existing knowledge of farmers. A change in thinking and research strategy allowed the research to shift towards putting farmers in charge of the research direction and shape, as their views should be at the heart of future development projects and strategies in the region. The Action-Based Research method really allowed the perspectives of farmers to be reflected in the research findings.

Although the change in research method to Action-based research was seen as positive overall, as it focused on what was important to farmers, capturing their stories and perspectives without worrying about extracting specific data, it was somewhat limited in its ability to capture detailed information, as the questionnaire didn't build into it specific probes and follow-up questions. Even though the local research team learned about the importance of probing and following up with questions to elicit more detailed findings, for reasons unknown, but possibly due to the difficulties in conducting research and time limitations, the researchers didn't always do this. Research often lacked detail and meaning and was difficult to interpret. While Action-Based Research was seen as an improvement to previous year's research that can be argued was "extractive", it could have generated even greater results, had a more detailed questionnaire been implemented in the field (see APPENDIX D for a suggestion on an improved questionnaire for future Action-Based Research).

With regard to the sampling method, while the 2013 and 2014 research attempted to solicit the participation of farmers in a random way, achieving a true random sample of farmers in all the years was not possible. This is partly due to the proper channels the researchers had to go through to get permission from the gups and village heads to conduct research — they, along with AEOs often suggested farmers to the research team to interview — as well, the researchers were happy to talk to anyone interested in participating. The research findings were therefore generated from a 'purposive' sample. According to Bernard (2006) in purposive sampling you "decide the purpose you want informants (or communities) to serve and you go out to find some" (189). These samples

are used “widely in 1) pilot studies (studies done before running a larger study); 2) intensive case studies (objective is to identify and describe a cultural phenomenon); 3) critical case studies (communities that meet the criterion for specific research); 4) studies of hard-to-find populations” (Bernard, 2006, pp. 189-191).

It was also suspected that the research targeted ‘leading’ farmers, as in earlier year’s research the goal was to monitor the adoption rates of organic agricultural practices, and often the persons recommending the farmers wanted to be sure to leave a good impression on researchers. The research was also unable to draw conclusions about the larger population, because of the small, purposive sample of interviewed farmers in each gewog, each year. For example, in one year, research might have shown that a majority of farmers practice crop rotation, while the next year, because a different subsample of the population was chosen the majority of farmers might not have practiced this. Therefore, year-to-year findings couldn’t make conclusions about the larger farming population. The research team doesn’t see this is a problem, however, as the research gained a lot from conducting in-depth interviews with fewer farmers than more interviews with less content. In reporting, researchers were careful only to make conclusions about the sampled population.

One of the biggest challenges was that the same person did not always conduct research. In 2011 there were four foreign researchers, in 2012 there was one foreign and one local researcher, in 2013 there was one local researcher, and in 2014 there was one foreign and three local researchers. During the interviews, some researchers missed questions either by accident or intentionally, as interviews often have to be flexible enough to account for the particular situations encountered by participants during interview work. However, missed questions generated missing values and lowered the sample number of farmers asked each question. It is suspected that having more than one interviewer — there were eight local and foreign researchers over the years — as well as more than one translator when foreign researchers held interviews, generated a lot of variation in the way questions were asked and translated to generate definitive findings that were consistent year to year.

Not only did the variability in researchers generate variability in research findings, in the end, all research was sent to the research coordinator to write-up and interpret, who at the time was working abroad and was absent from the field from 2013-2014. While the research coordinator was always in contact with the local team and returned to Bhutan in 2015 to help with the writing of this final report, any errors in reporting or interpretation are a consequence of interpretation of the authors, as well as of the way research and writing were divided.

6.0 BEST ECOLOGICALLY FRIENDLY DEVELOPMENT OPPORTUNITIES IN AGRICULTURE: RECOMMENDATIONS

Recommendation 1: First and foremost, any future development activities in the area should include the voices and perspectives of local people. For example, it was uncovered early on in the research that farmers were largely practicing organic agriculture already, as has been practiced for generations by their ancestors. The original goal for introducing (western scientific) organic practices could have included attempting to learn about the local knowledge and practices that already existed and were providing successes to farmers in the region. There is a trove of local knowledge and wisdom that should be incorporated into future development activities that attempt to improve on the livelihoods of farmers/local people. Letting local people be the primary agents in activities that propose change will serve to empower people to have control over the things that most influence their lives. Not only will the development activities be more appropriate as they will draw from the local knowledge and wisdom that already exists, they will speak to greater numbers of people, since bottom-up initiatives tend to be more relevant and consider important aspects that are often glossed over or missed all together by foreigners and development ‘experts’. The SJI has started to focus on the local knowledge that already exists in agriculture through the Organic Resources Database that has been created, but future initiatives that work to introduce new knowledge or techniques can be more successful if a participatory approach to knowledge sharing is initiated. This should allow for a greater dialogue about local perspectives that need consideration prior to implementing a particular project and how the impending change will influence people in the process.

Recommendation 2: Almost all farmers across the years reported that their AEO is the person they go to for agricultural information and when they have questions about their farming. AEOs have already received training in organic farming techniques at Navdanya. It is uncertain, however, if AEOs teach and relay these trainings to their farmer constituents. If it is decided to pursue organic agriculture trainings or to introduce new

information and technologies, working closely with AEOs will be most necessary for the successful adoption of these techniques by farmers.

Recommendation 3: Build capacity of the emerging Farmer Promoter Network. With the help of the SJI, leading farmers have stepped forward as Farmer Promoters in each gewog. Farmer Promoters are experienced local farmers who are willing and able to monitor agricultural experimentation and fieldwork of other farmers. These Farmer Promoters will be essential in any future agricultural training initiatives, as they can help to see that local skills, knowledge, and perspectives are included in development programs. Moreover, having the Farmer Promoters lead the training could help facilitate a farmer-to-farmer approach to training (Holt-Giménez, 2006).

Recommendation 4: Farmers need support regarding crop raiding by wild animals. They have substantial local knowledge and many practices to deal with this, such as growing different crops, keeping watch all night, scarecrows, or supplementing income lost with off-farm work. The SJI and JNP Centre for Appropriate Technology could link with the World Wildlife Fund that has an extensive division dedicated to dealing with Human-Wildlife Conduct in Nepal, to share information resources and best practices. The capacities of both young organizations are not currently situated to handle a problem of this size. However, briefly there are many organic methods that the SJI could encourage to protect crops and farmers. Hedgerows, thorny bushes, trees and other natural barriers could be planted around the perimeter of crops to deter certain animals. This would also have the added benefit of preventing erosion. Trenches could also be dug, but pose other issues such as drawing on already overburdened and scarce labour. Other examples include: smoke bombs treated with chilli (proved effective in Africa), as well as farming menthe around the perimeter, and planting crops elephants dislike (worked to an extent in Nepal; World Wildlife Fund, 2008).

Recommendation 5: Fifty-five percent of participants in 2011 research watched agricultural programs on television and 24% listened to agricultural radio programs. Programs on the television or radio were also popular sources of entertainment and knowledge. One farmer reported learning how to make compost from a radio special. Although, more often than not, the content on television focuses on mechanization, many farmers said they were also aware of organic methods from the same source. The SJI, local government, and partners in the agricultural community are encouraged to strengthen the communication of information with local farmers. The development of local radio and television content focusing on sustainable/organic farming could facilitate what some farmers have already learned and developed interest in. The content of the show could be used to promote geographically broader farmer-to-farmer communication through “farm talk” radio and television shows that promote the exchange of information between peers. Agricultural radio or television could stimulate interest in the youth, draw attention to the goals of the SJI, support an alternative approach to the movement, and draw on the existing strengths of the agricultural information dissemination system. This would require technical training and capacity development in media production that other, non-agricultural people within the community may already be interested in learning but need the encouragement or opportunity to do so.

Recommendation 6: To facilitate the exchange of information between peers through co-operative development. As outlined in several SJI publications, there is an intention to support co-operative development. The Dewathang Milk Marketing Co-operative is a good example of a co-op that benefits its members. Many farmers reported that there was a difference between those who participated in the milk co-op and those who did not in terms of position within society, income, education, and well-being. Co-operatives helped in gaining access to capital, such as machinery, livestock, and timber, via the government. Farmers were told that if they could gather support, the government would provide them with a rototiller, in Pemathang, and Jersey cows in Phuntshothang. As this structure already exists, and if championed by the government, co-ops could be places where sustainable farming is promoted and where farmers get practical advice and tools.

As well, it could provide a platform for sharing ideas and best practices while forming community networks and connections that could possibly address other social issues (such as high rates of migration to the urban centres). Moreover, organic co-operatives act as conduits of agricultural information (between extension, on farm researchers, and farmers) and could involve farmers in all kinds of collaborative on-farm research, such as trialing specific practices. Incentives for this could include receiving organic seeds, access to a market (the co-op could act as a distribution channel for produce), and a potential source of income. Such activities could have seasonal adjustments such as, in the off -season farmers could develop new skills, trade seeds, plan for next year, organize cultural events like a festival, make and sell organic products, or anything else that the members decide. There may also be a space to discuss other issues and possible solutions to such issues as human-wildlife conflict.

Recommendation 7: In future organic agricultural related research and development in the region, the role of livestock within the local farming system should be understood and integrated into supported activities. As mentioned both by farmers, “if there is no cow, there is no meaning for the farmer,” and in the literature, “livestock make it possible for people to prosper in a relatively infertile mountain environment” (Roder et al., 2002, pg. 367). Livestock provide both stable income and valuable inputs for the fields, regardless of breed. However, combining dairying with intensifying vegetable production (the focus of organic trainings to date) could prove to be a strain on the already severe labour shortages, but may also prove to be synergistic. If organic certification becomes a goal, livestock need to be considered in the organic certification process, as feed, concentrates, and medicine, although not specifically organic (or local for that matter), will need to be included in the assessment. Complicating this is the possible assumption that farmers with Jersey or Jersey-cross are not going to revert back to local breeds, due to the positive impact and success that the new cattle have provided. Also, the genetic diversity of local breeds of livestock is at risk. In future development activities that focus on organic production, there is a need to focus on the system as a whole,. One way to address this

issue is to engage directly with the farmers through open group discussion, social learning, and further research.

Recommendation 8: Seed saving occurs with field crops (maize and rice) and some vegetables, but many economically profitable vegetable crop seeds are purchased. Many farmers relied on free seed provided by the government or seed purchased locally (and from India) rather than saving seed. Efforts need to be made to increase the germplasm available to farmers, either through saving open-pollinated varieties or establishing participatory plant breeding programs. This will require collaboration with the MoAF and the National Organic Program (NOP) as they are actively distributing free seeds to farmers.

In future agricultural development initiatives it will be important to encourage local seed banks and seed saving initiatives. Each gewog (and eventually each chiwog or village) should have its own seed bank which houses local seed adapted to local microclimates. Interested farmers would be asked to steward particular seed varieties and then distribute them within their regional seed co-operative. If successful, community resource sharing can be initiated as desired. One example given by Negi-ji of Navdanya outlines how this might work: farmers interested in borrowing seed from the local co-operative can do so at no cost, so long as they give back 50% more seed than they borrowed. This doesn't have to be a large or costly initiative and could work with few farmers able to store seed at their homes. Start small by having only a few varieties grown each year.

In fact, it was decided (and actually agreed back in 2010-11 but not implemented by the SJI leadership) that the shedra (the monastery) itself would become a seed bank for the Dewathang area. The plan was that when farmers bring their seeds to the shedra seed bank, the monks would bless the seeds, and at certain points even do a puja. It would be a way for the shedra to interact nicely with the community and provide a service that also joins spiritual practice with good agriculture methods. Following through with this arrangement might help provide the initial support needed to establish other seed banks in the region.

Recommendation 9: Find ways to reintroduce the growing of traditional crops in the area. Farmers spoke about the traditional grains they used to but no longer grow. Predation by wild animals, difficulty in threshing, and taste were reasons given for abandoning traditional grains and oilseeds like millet, amaranth, buckwheat, and mustard. Issues like wild animal predation will need to be addressed, but perhaps appropriate technologies can be introduced to aid in processing of traditional grains and provide value added products, like flour, biscuits, noodles, bread, juice, and jam. Demonstration plots on model farms and biodiversity fairs where people can taste different recipes prepared from traditional crops could help draw people to these crops, where recipes and stories about local foods can be shared. The SJI can play a role in information sharing about the importance of crop diversity in providing food security in drastic climate years and for enhanced nutrition.

Recommendation 10: The main cash crops of the region are mandarin and rice. Rice diseases and pests are generally below the economic threshold for expensive chemical treatments. Some rice farmers have voiced the need for herbicides that would control weeds tolerant to flooding. The System of Rice Intensification case study addressed and provided some cultivation recommendations and incorporation of daincha as a green manure is on the rise. Mandarin orchards, on the other hand, are reliant on inorganic inputs for long-term production. Orchard decline has become a major issue since pesticides have been phased out. Some of the pests and diseases will become less problematic once beneficial insects and weak plants are removed, but significant change will not be observed until the nutritional needs of the trees are considered. Trees are often planted on recently cleared land that is highly erodible. Even with some attempts at controlling erosion orchards become nutritionally limited. Most recently, AEOs have been promoting hedgerows of napier grass to reduce erosion and adding amendments of compost with transplanted grafted mandarin saplings. Soil conservation practices specific to orchards and paddy should be expanded.

Recommendation 11: Food loss due to storage was a big problem discussed during interviews. Some farmers lost 50-100% of any given crop in storage. Encouraging inexpensive drying (i.e., in the sun and off the ground) should help curtail losses in the short-term and before considering the introduction of solar driers or other technologies. Value-added and small scale processing should be introduced and encouraged (i.e., millet into flour and biscuits, juice concentrate and jam out of local fruit, honey, etc.). Appropriate drying and preserving options need to be explored. Subsidized electric driers have recently been offered to farmers by the government to reduce food spoilage.

Recommendation 12: Most farmers indicated there were no seasonal food shortages in markets and no problem finding what they needed (food) when they needed to buy from the market. Especially in light of the new Sunday Organic Market in Dewathang, there is an opportunity for the SJI to discuss and promote buying local produce — for health, economy, community, and food sovereignty reasons.

Recommendation 13: Farmers identified having not enough labour, poor access to tools and technology, and water shortages as primary challenges in their farming. There is opportunity for the Appropriate Technology sector to work closely with farmers to develop labour saving devices and tools. An assessment of the SJI's rainwater harvesting project needs to be made with farmers to determine how feasible implementation is on individual farms. Establishing co-operative marketing groups could help ameliorate the labour shortages and facilitate resource sharing. A government or SJI initiated program in which students during their long winter break, over the dry season, could well work in groups on farms helping with needed infrastructure work — like terracing, irrigation, repairs, etc., for some kind of compensation. This could be in conjunction with current programs where farmers co-operatively construct public infrastructure.

Recommendation 14: Continue to strengthen ties between the SJI, the National Organic Program, and the Renewable Natural Resources sectors of the MoAF. This should reduce

program overlaps and work to share resources, including training manuals, outreach methods, and extension training programs and tools.

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APPENDIX A

Farm code:

Date: / /

Respondent's name:..... Household head: Self....Spouse....FatherOther (specify):

Time: S:

E:

Farm owner.....Farm renter.....Work on other farm

Was this farm previously owned by your parents? Y/ N

Slope: 1.Flat; 2.Gentle slope; 3.Steep; 4.Very Steep

Gewog:Chiwog: Village:Altitude:.....Distance from roadhead (min):.....

I. HOUSEHOLD AND OWNERSHIP

1. Please list all members in your household:

Name of family members	Relation to respondent	Age	Sex	Education (year)	Occupation	Work year-round on your farm? Y/ N AND what % of their time is spent farming	How many years have you farmed?	Have you had any off-farm work (indicate P or F time) and What kind of work?	Non-agricultural income (Nu/month)
						Y/ N %		P/ F Type:	
						Y/ N %		P/ F Type:	
						Y/ N %		P/ F Type:	
						Y/ N %		P/ F Type:	
						Y/ N %		P/ F Type:	
						Y/ N %		P/ F Type:	

II. LAND AND FARMING PRACTICE

2. Please describe your landholdings:

Land	Acreage	Acreage leased in	Acreage leased out	Any particular notes about constraints on this land?
Dry				

Farm code:

Wet				
Fallow				

3. Please tell us in detail about your crops and seeds

		Crops**	Acre	Seeds*	Seed cost (Nu/yr)	# of varieties of each crop	Annual Production					Cropping pattern		
							Yield (kg/acre)	Self consume (kg)	Feed For livestock (kg)	Sale (kg)	Income (Nu)	Inter-crop	Former crop	Next crop
Field crop	Summer			1/2/3/4										
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										
	Winter				1/2/3/4									
					1/2/3/4									
					1/2/3/4									
					1/2/3/4									
Orchard			Acre/No.											
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										
In garden Summer				1/2/3/4										
				1/2/3/4										

Farm code:

			1/2/3/4											
			1/2/3/4											
			1/2/3/4											
			1/2/3/4											
			1/2/3/4											
			1/2/3/4											
	Winter			1/2/3/4										
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										
				1/2/3/4										

Farm code:

				1/2/3/4										
				1/2/3/4										
				1/2/3/4										

*Seeds: 1= saved; 2= locally acquired; 3= distributed by AEO; 4= purchased**Number crops to indicate crop rotation

4. Please explain (draw) your cropping calendar for the year

Crop	January	February	March	April	May	June	July	August	September	October	November	December	Bare soil days

X= seeding; ○=harvesting; ▲=fertilizer application; soil cover: bare soil days (day/365)

5. Do you know about the following practices? How did you come to know about these? Which are used on your farm? What do you think the benefits are to using these practices? If you are not using these practices, explain why not.

Practice	Do you know about this practice?	How did you come to know about this practice?	Do you use this practice on your farm?	What do you think the benefits are to using this practice?	If you are not using this practice, explain why not.
Organic farming	Y/ N		Y/ N		
Crop rotation	Y/ N		Y/ N		

Intercropping/companion planting	Y/ N		Y/ N		
Mulching	Y/ N		Y/ N		
Composting (pit/pile, how is this prepared?)	Y/ N		Y/ N		
Vermicomosting	Y/ N		Y/ N		
Direct application of FYM or tethering animals in field	Y/ N		Y/ N		
Increasing numbers and types of beneficial insects	Y/ N		Y/ N		

Monitoring pest populations	Y/ N		Y/ N		
Natural pesticides	Y/ N		Y/ N		
Rotational grazing of livestock	Y/ N		Y/ N		
Preventing soil erosion	Y/ N		Y/ N		
Rain water harvesting	Y/ N		Y/ N		
Beekeeping	Y/ N		Y/ N		

6(a). In which crops do you get the most weeds?

6(b). When do you get the most weeds?

7(a). Do you or did you use chemicals Y/ N?

IF YES, 7(b). When did/do you use them?

use of inputs (fertilizers, pesticides) to your water (e.g. less potable), soil (e.g. fertility, dryness, compaction, (skin and/or respiratory problems, etc.)?

you stop?

7(c). Have you ever noticed any effects from the colour of soil), crops and livestock (e.g. taste), or your health

7(d). If you stopped using chemicals, why did

8. Do you apply manure to your crops? To which crops? When and how much manure do you apply?

9(a). What are the traditional practices/knowledge/crops that your grandparents used that are still used? 9(b) Why are these still used?

10(a). What are the traditional practices/knowledge/crops that your grandparents used that are no longer used? 10(b) Why are they no longer used?

11. Do you use plants from the forest (fodder, timber, medicinal herbs, mushrooms, bamboo, etc.)?

12(a). Have you or your parents or grandparents ever practiced shifting cultivation? When and for how long? Why did they stop, explain?

IF YES, 12(b). How does shifting cultivation compare to your current farm production (i.e., are there differences in soil quality or crop productivity, etc.)?

13(a). How does your religion affect your agricultural practices (traditional calendars, planting dates, knowledge of the soil, pests, work habits, etc.)? 13(b). Who do you talk to before the season about what to grow, how to manage crops, and when to harvest (Gomchen, Village-head, etc.)? Please explain in detail:

Farm code:

14. What inputs do you use per season?

Name of Input	What	Quantity/ Frequency/Hours	Source /who (hired plus family labour)	Financial Cost
Seed	Answered in Q.3	Answered in Q.3	Answered in Q.3	Answered in Q.3
Cultivation (oxen, rototiller, etc.)				
Fertilizer (urea kg/acre /FYM (baskets per acre) / compost/ Vermicompost etc.)				
Irrigation (times)				
Pesticide (both natural and chemical) –includes insecticides, herbicides, fungicides, etc.				
Labour	for cultivating			

Farm code:

	for sowing			
	for weeding			
	for composting			
	for fertilizing			
	for harvesting			
	for threshing			
	for sorting			
	for storing			
Harvest machinery				
Thresher/Miller				
Total Cost				

15. Do boys and girls do similar farm work?

16. Which crops require the least amount of labour? 1.....2.....3.....4.....5.....6.....7.....8.....

17(a). On your farm, is the labour local/ volunteer/ hired/ exchanged/ or self?

17(b). If there are labour shortages, have these resulted from, or increased due to, young members of the family leaving the farm and moving to the city?

III. NATURAL CHALLENGES

18. Please explain the challenges you've experienced with your farming:

Pest	Pest specifics	Which crops are affected?	How much of your crop do you	How do you deal with this problem (method, quantity of solution applied, etc.)?	Has this pest problem gotten better or worse over the years?
------	----------------	---------------------------	------------------------------	---	--

	(names if known)		loose each year (%)		
Insects					
Disease					
Weeds					
Wild animals					

19. Have there been changes in your crop yields over the last ten years? Decreased/ Same/ Increased

20. Have there been changes in soil fertility over the last ten years? Decreased/ Same/ Increased

21(a). Do you have problems getting sufficient irrigation water?

IF YES, 21(b). When are the water shortages most problematic? 21(c). How do you deal with these problems?

22(a). Have there been any changes in the monsoon rains over the past ten years? Decreased/ Same/ Increased/ Erratic?

22(b). Have there been any changes in winter rains/snow over the past ten years? Decreased/ Same/ Increased/ Erratic?

22(c). Have there been increases or decreases in the size of the natural forest?

IV. STORAGE

23. Do you have any spoilage (insects, humidity, moisture, etc.) or food storage problems?

24(a). What percentage of your crop is lost in storage each year?

24(b). How do you deal with spoilage and storage problems?

25. What methods do you use to save your seeds?

V. LIVESTOCK

26. Please explain your livestock farming

Livestock (breed)	Number of animals	Main Purpose of Keeping Animals				Initial cost (Nu)	Income (Nu/yr.)	Grazing (hr/day)	Grazing where (fallow field, forest, etc.)?
		Manure	Draft	Production (month)	X12 = Production/yr				
Cow (local)		Y/N	Y/N	Milk (L)					
Cow (Jersey)		Y/N	Y/N	Milk (L)					
Buffalo/ox		Y/N	Y/N						
Sheep/Goat		Y/N	Y/N	Milk (L)					
Pig		Y/N	Y/N						
Chicken (egg birds)		Y/N	Y/N	Eggs (no.)					

Farm code:

Chicken (meat birds)		Y/N	Y/N					
Other, specify ()		Y/N	Y/N					

27. Fodder and consumption

	Feed source		Amount (kg/month)	Grown on farm or purchased?	Price (Nu)
	Fodder (green material/purchased feed)	Concentrates			
1					
2					
3					

28. Has the number of livestock changed on your farm over the last ten years? Decreased/ Same/ Increased

29. Do you have any problems with your local cows, crossbreeds, or Jerseys (disease, productivity, etc.)?

VI. SECONDARY FARM PRODUCTION AND MARKETING OF PRODUCE

30. Please explain if you make any cheese, butter, jam, juice, pickles, alcohol and/or dry any vegetables, meat and/or fish for your self-consumption or for selling:

Raw product (e.g. milk)	Value added product	Quantity	Self.../ Selling	Income (month/Nu)	Who makes it	Who helps
			Self.../ Selling			
			Self.../ Selling			
			Self.../ Selling			

31. If you have any surplus produce, where and how do you sell this surplus?

Farm code:

Crop/Product	Direct farm sale	Wholesale dealer	Restaurants	Market	Co-operatives	Others, specify ()

32. Which of the above marketing options do you prefer? And why?

33. How do you transport farm products to the market? How do you do this in the different seasons, especially in monsoon season?

34. Which crops are most profitable for you? 1.....2.....3.....4.....5.....6.....7.....8.....

VII. MARKET AND NUTRITION

35. What food must you purchase from the market?

Imported food	Amount (month/ kg)	Price (month/ Nu)	Purchase origin (i.e. market/villagers)
Rice			
Maize (Tegma/Kharang)			

Farm code:

Maize (For livestock)			
Vegetables			
Fruits			
Meat			
Egg			
Milk			
Oil/Sugar/Salt			
Other, specify ()			

36(a). Who cooks in your family?..... 38(b). Who in your family decides what to eat?.....

37(a). What did your grandparents eat that you no longer eat?

37(b). Why do you not eat these foods?

38(a). Are there any times that you don't have enough food? When?

IF YES, 38(b). How do you manage?

39(a). Are there some foods (or other things) you want or need to buy that you can't get in some seasons? 39(b). If YES what and when?

VIII. HEALTH

40. How much do you approximately spend, both in time and money, acquiring health care during the year?

41(a). Is there a local healer in your village or gewog?

IF YES, 41(b). Do you visit that healer or does the healer visit you?

42(a). Do you know any local medicinal plants?

IF YES, 42(b). Are they cultivated? Do you use them?

42(c). When do you use them? How are they used?

43. Have the medicinal plants that were here at the time of your grandparents since disappeared?

44. Do you use any plants (or plant parts) other than the ones you intentionally cultivate for food and/or cultural practices, (i.e., seeds, weeds, herbs, trees, [essential oil, incense], etc.)?

IX. HOUSEHOLD AND GENDER ROLES

45. What agricultural decisions do men make and women make? Are there differences?

46. What do women and girls do for household work?

47. What do men and boys do for household work?

X. HOUSEHOLD ECONOMY

48. Do you have enough money at present to feel comfortable, feed, and look after your family?

49(a). Do you feel you are generally better off or worse off than last year?

49(b). Do you feel you are generally better off or worse off than 2 years ago?

50. In your opinion, is your farm large enough to support your family?

51. Please explain your financial situation

Non-farm income (Nu/year)	Loan (Nu/year)	*Source (1/2/3/4)	Are you able to save any earnings?

*Source: 1=govt.; 2=bank; 3=relatives; 4=other

52(a). Who handles/keeps the money at the farm (husband/wife)?

52(b). Do women have the same access to money in the house as men?

XI. MIGRATION

53(a). Have any members of your family left your farm/village for the city? Who?

53(b). Have any of your neighbours had family members move to the city? Who?

53(d). When these people leave what happens to you, your neighbours, and your village? Please explain:

53(e). Do those who leave find good jobs and send money back to support the family?

54. Has the number of people farming changed over the last ten years? Decreased/ Same/ Increased

XII. COMMUNITY COOPERATION

55. Where do you go when you have questions about, or face challenges with your farming? Please check all that apply and circle the primary source.

Other farmers.....Gomchens or other spiritual advisors..... Village-head.....Gup.....Newspapers, magazines or other publications.....AEO.....Television.....Radio.....Internet.....Village groups/ Co-operatives.....Traditional prayers, rituals, etc.....Other (specify).....What articles/TV programs if yes?.....

56. In what ways do you work together with other farmers (e.g., getting your produce to market, sharing farm equipment, helping each other during harvest season, sharing bullocks for ploughing, giving each other advice, etc.)?

57(a). Are there any community groups in your village or gewog (e.g. vegetable, seed, livestock, women’s, community forest, etc.)?

57(b). Are you a member of any of these groups?

58(a). Do you think a co-operative or farmers group could help with your marketing, seed saving, storage, sharing bullocks, etc.?

IF YES, 58(b). Have you talked with your neighbours about forming groups/co-operatives?

59. What do you like the most about farming?

XIII. TRAINING

60. Previous training attended: SJI launch/ OFAI/ Navdanya Study Tour/ Negi ‘11/ Dr. Bhatt ‘11/Negi ‘12/Other (ex. NOP, AEO, RNR, etc.,) specify:

What was taught in these trainings?.....

61(a). Did you receive any training in organic farming? Y/ N

IF YES, 61(b). How have these trainings helped or hindered your farming?

62(a). What are the biggest problems you have with your farming?

62(b). What do you need to make your farming better (tools, seeds, pest control training, etc.)?

64(a). What is important in your life that makes you happy?

64(b). What makes you unhappy?

65(a). What do you think your village needs most to move forward?

65(b). What do you think Samdrup Jongkhar needs most to move forward?

66(a). Have you heard of the SJI? Y/ N

IF YES, 66(b). What have you heard?

67(a). Are you currently, or are you interested in, participating in training or implementing farming practices you've learned? Y/ N

IF YES, 67(b). What type of participation/training are you interested in? 67(c) Would you be willing to share your successes and techniques with other farmers?

Direct Observation

- What is the condition of housing?
- What are toilet facilities like?
- Is there electricity? Y/N; If no, what are the main sources of energy/ lighting?
- Where does water come from (tap in or outside the home)? Where is the source?
- Do individuals/households filter or boil water before drinking?
- Describe what household assets do individuals/households own:
 - furniture,
 - refrigerator,

- television,
 - bicycle, etc.
 - other
-
- How many rooms does the house have not counting the kitchen and bathroom?

APPENDIX B

Qualitative Questionnaire

1.) Adoption

- how long have you had Jersey?
- what did you have before?
- for what reason(s) did you decide to adopt? (factors, most important, concerns?)
- how did you come to a decision? who did you discuss it with?
- who did you learn about the Jersey from?
- what was the role of the MoAF?
- did you attend any meetings about Jersey? what did you learn?

2.) Communication

- if you have an issue or questions about your maize (rice, oranges etc), who do you call for help?
- in general, where do you look for information about crops and livestock?
- is there anyone in the community that is more knowledgeable than others?
- who are the experts?
- does anyone try new things, experiment?
- how often do you use your mobile and what for?
- Do you have a TV, radio, Internet, get the newspaper? (if obvious, or as a follow up – do you watch / listen to the farming programs? What sections do you like in the newspaper?)
- do you find these useful? Have you seen or heard anything that you currently use on your vegetables or livestock?

3.) Networks and Organizations

- are you a member of the community forestry program, milk marketing group or vegetable coop?
- are there any other community organizations here?
- who has the leadership roles?
- what is your role as a member? What are the benefits? Are there any drawbacks?
- are there many women participants?
- is there a difference between farmers that participate and those that do not?
- how do you become a member?
- how do you feel as a member (pride?)

4.) Livelihoods

- are you organic? **
- production of crops? Livestock? Tree fruit, nuts? Garden vs. cash crops?
- Sell vs.. keep for yourself?
- off farm income (gender)
- forest products?
- do you have money left over at the end of the year?
- savings or a loan?
- remittances?
- migration for work?
- Buy vs. produce?
- Do you consider yourself to be wealthy, poor or something else? *[is there a better way to get at this?]
- are you every worried that you will not be able to afford or find at the market what you need? / able to produce what you need?
- hire labour or exchange?
- this time of year, what activities do you do in a day? (wife / husband)
- who do you rely on for support? Who works together?

- you purchased x for the farm, is there anything else you would like to purchase? Is there anything holding you back? Would you receive any support?
- what are your main concerns? What do you worry about the most?
- if you had more money what would you purchase?
- what are your food staples? What are luxuries?
- what do you feed your children? If you had more money what would you feed your children?
- would you rather purchase food from the market or grow it yourself?
- do you have any land that is fallow, fertile, but not being used?

APPENDIX C

Farmer Questionnaire

Background

Name: _____ Village: _____

Number of family members living at residence:

Number of years farming:

Area (Acres) of land under cultivation:

10 years back-Presently-

Socioeconomic Information

Could you please tell me about your life here on the farm?

-Number of family members participating in livelihood generation:

-Type of work and percentage of income generated by each:

(Agriculture/cash crops) (Crafts) (Off farm labor/Work) (Government Service) (Other)

-Types of income generating crop/s:

-Are women in your household engaged in farming activities? **How?**

-Are you able to meet your economic needs through farm income? **Y/N**

-Are you receiving any support in the form of support, training, or information? Y/N

-If yes, from where are you receiving the support?

-If no support is provided, what kind of support would you like to receive?

-How much food are you able to produce for household consumption, and how much do you need to buy? %

Management Practices

Have you noticed a change in farming practices in your village since you were a child?

(shifting cultivation, permanent settlement, change in crops, etc.)

Where do you get your seeds from?

How do you maintain soil fertility?

Do you practice pit composting? Heap composting?

Do you weed your crops? When?

Have you noticed an increase in diseases? Which ones?

Have you noticed an increase in pests? Which ones?

How do you deal with diseases and pests?

Do you practice intercropping or polyculture?

Do you use Irrigation systems?

Environmental/Climate Perceptions

Have you noticed a change in weather patterns in the past 10 years? If so, explain:

Have you seen a decline in your crop productivity?

If YES, what do you believe is the reason for this?

Linking the Past and the Future

How important are traditional practices and religious/spiritual beliefs on your current farming practices?

Do you believe that you, as a farmer, have the power to influence the outcome of your crops?

What are some ways you are doing this?

Are you involved in any farmer co-operatives groups?

Which ones?

What activities do you do?

If not, would you be interested to participate in an organized farmer co-operative in your region?

Explain:

What is your dream for the future?

Thank you for your time!

APPENDIX D

SJI Narrative-Style Interview Questions

1. Can you tell us a bit about what you farm (crops, livestock) and the methods you use? What sorts of inputs do you use and when (during which season, or on which crops, etc.)? Where do you get your seeds?

2. How long have you farmed? Do you enjoy farming? What successes and challenges do you experience? What do you do to address particular challenges?

3. What sort of help do you have on your farm and from within your village? Who does what type of work, when?

4. What sort of help/support do you receive from outside your farm? Are you supported by extension agents, farmer groups, or other programs? How do these help you? How could they help you better? Who do you consider farmer experts? Why?

5. Can you please explain about the significance of traditional agriculture in your family, community, and/or village? What are the practices you use that are guided by traditional knowledge? Do religion/spirituality play a role in how you farm, like in what dates you plant, what crops you grow, what methods you use, what/when you harvest, etc.? Do these things influence older generation farmers? How? Please explain these in as much detail as possible.

6. Do you visit anyone to get advice about your agriculture (village heads, spiritual teachers, AEOs)? What sort of advice do you get? How important is this to helping you making decisions about when and what to grow, what management decisions to make, and/or what to harvest? Do AEOs and other authorities listen to local/traditional perspectives on agriculture? Are local/traditional agricultural practices being used in your village and are thriving? Or are they being replaced by modern practices?

7. Can you please explain how agriculture has changed in your village since you were a child (e.g. shifting cultivation, permanent settlements, agricultural technologies, seed varieties saved and grown, environmental quality, etc.)? What are your detailed thoughts about these changes?

8. Have you adopted the use of chemicals in the past or present? How have these positively or negatively impacted your farming?

9. Do you produce enough food for your family, or are there shortages in any seasons? How much crop do you lose each year to pests and storage? How much food do you need to buy from outside your farm and how often? Where do you get the money to purchase these goods? Do you ever trade goods, labour, or other resources, etc., with villagers? Do you sell your crops/produce? If so, where?
10. What foods does your family consume? Does this change with the seasons? During meal time, who eats first and what do they eat? Does this differ from what others in the family eat? Do you exchange foods with others to acquire foods that you don't have? What do you buy and what do you exchange? What do you sell?
11. Do you think you have enough support for your farming? What could be better done by the government or outside (development) groups? What perspectives of yours would you share to these bodies if you could?
12. Have you participated in any farm trainings? Which ones? How were these—informative, helpful, not helpful? What could be done to improve these trainings? Were local ideas considered? What was taught? Were the techniques adopted and utilized? Which ones? Why? Were the techniques rejected? Which ones? Why? Are you interested in participating in any future farming training? Are there any particular topics/methods you are interested in? Would you be willing to share your successes and personal farming methods with other farmers in the area? In what ways?
13. Did you attend any of the Navdanya agriculture trainings? What did you learn from these trainings? Do you continue to apply what you learned?
14. How has the modernization of Bhutan influenced you, your family, and your village? Do you see modernization as positive or negative for Bhutan? Have GNH or modernization changed your traditional perspectives of agriculture? Have they changed how farming is practiced in your village?