the milk buyer. Where the data were fully entered into the computer on farm, the results were immediately shown to the farmer and there was opportunity for discussion. In all cases, farmers later received a paper copy of the results for their own farm and summary statistics for the other farms in the country.

3 Outcome of the sustainability assessment

This chapter presents the outcome of the sustainability assessment for each country and across countries. First a brief description of the dairy sector of each country involved in the sustainability assessment is included to provide some context. This is followed by a brief description of the choice of farms. These descriptions demonstrate the range and diversity of dairy systems between the countries studied, and give an introduction to the farms which participated in the sustainability assessment, before the results of the assessment in the country are presented. A subsequent section draws together findings from the different countries.

It should be noted that, in the descriptive statistics for the farms, the figure for purchased concentrate per milking animal generated is not always directly comparable with the figure available for the main population. From the data entered in the tool it was not always possible to distinguish the distribution of total concentrate between different groups of livestock on the farm. If figures are known to be affected by large numbers of animals other than dairy cows, this is pointed out.

3.1 **Austria** (Roswitha Weißensteiner)

In Austria, grassland is mainly situated in mountain areas. Therefore 70 % of all Austrian dairy farms are in disadvantaged areas and 2/3 of milk is produced there. For the rapid sustainability assessment, farms were chosen that represent the traditional alpine dairy production in this area. All farmers were members of the organic dairy cooperative “Sennerei Hatzenstädt”. The cooperative is

situated in Tyrol, an alpine province in the West of Austria. It has about 40 members, which deliver their milk to the cooperative dairy plant where it is processed into hard cheese and other dairy products.

3.1.1 Characteristics of the case study farms

Twelve farms were selected for the rapid sustainability assessment. The farms were relatively homogeneous in their structures; they were small in size and were managed as typical low input systems with relatively low milk yield, but also with low concentrate use (see Table 2).

The farms had a long history of organic production with a mean of 23 years. Farm size was typical for Austrian organic farms with the majority of the area in permanent pasture (62 – 100% of the farm area). Herd size and stocking rate were also typical. Labour units per animal and per 100ha were high compared with other countries. Liquid milk sales per cow per year were relatively low, because on some farms much of the milk was made into cheese. Total concentrates purchased were very low.

Farms were managed by the farmer´s family, which typically consisted of the members of three generations and therefore no further staff were employed. The on-site conditions were characterised by steep slopes, a short growing season and an annual precipitation of 1200 to 1800 mm. Only permanent grassland (no arable land) was farmed. All farms have several economic cornerstones: the main source of income is dairy production, in addition to incomes from forestry, direct marketing of meat, agro-tourism and other non-farm incomes. The herds consisted mainly of Brown Swiss or dual-purpose Simmental cattle, but one herd consisted of Jersey cattle. Two farms produced milk with cows from the local Pinzgauer breed.

Table 2 Characteristics of Austrian organic dairy farms and the farms selected for assessment

	Unit	Organic farms population mean	Mean of farms selected	Range of farms selected
Farm size	ha	20.1[2]	22.7	12.0 – 40.5
Herd size	No. of adult cows	10[3]	13	10 – 17
Stocking rate	Livestock units/ha	1.1[4]	1.0	0.6 – 1.7
	Grazing livestock units/forage ha		0.95	0.57 – 1.35
Milk sales	l/cow/year	6200[5]	5122	4500 – 7000
Concentrate fed to milking animals	kg/cow/year	1200[6]	247	0 – 750
Total purchased concentrate per cow [1]	kg/ cow/year		420	0 - 1460
Milking cows per Annual Labour	Milking cows/ Annual Labour		19	12 – 30

Unit	Unit			
Labour input per area	Annual Labour Units/100 ha		3.8	2.0 – 6.9

[1] Data from the tool - may include some concentrate fed to other livestock on the farm, therefore not necessarily directly comparable with the line above
[2] Data from INVEKOS 2009
[3] Data from BMLFUW (2010): Grüner Bericht 2010 - Table 3.1.28a and 3.1.28i. http://www.awi.bmlfuw.gv.at/gb (accessed 21.6.2011)
[4] Data from BMLFUW (2010): Grüner Bericht 2010 - Table 4.4.2. http://www.awi.bmlfuw.gv.at/gb (accessed 21.6.2011)
[5] Estimates of data from: ZAR (2011): Rinderzucht Austria - Jahresbericht. Die österreichische Rinderzucht 2010. Zentrale Arbeitsgemeinschaft österreichiser Rinderzuchter. Wien
[6] Data from Kirner (2009): Wettbewerbsfähigkeit von Vollweidesystemen in der Milchviehhaltung. Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie. Band 18(3). p 87-96 Steinwidder A. (2011) personal communication.

All farms had a very low concentrate input for feeding the cows, so the quality of forage played an important role. Winter feeding in particular is a challenge: only hay (no silage) is fed to the cows in order to be able to produce hard cheese. Due to the climatic conditions of this region, farms often use indoor drying installations to achieve a short drying time for hay. Two farmers operated these installations with energy from wood chip biomass. Some farms explicitly aimed to produce milk with zero input of concentrates and therefore they used grass cobs processed from their own forage.

Many farms practised agro-tourism giving them contact with people who had no knowledge about agriculture. They opened their farms to them and thereby brought agriculture closer to the consumers.

Example of innovative or best practice examples on participating farms included:

- Using grass cobs made from their own forage to replace concentrates
- Well-functioning direct marketing of all farm-products (milk, cheese, processed meat, eggs) and the use of a special breed (Jersey) for increasing milk solids.
- Use of biomass from the farm's own forest for the hay drying installation.

3.1.2 Results of the sustainability assessment

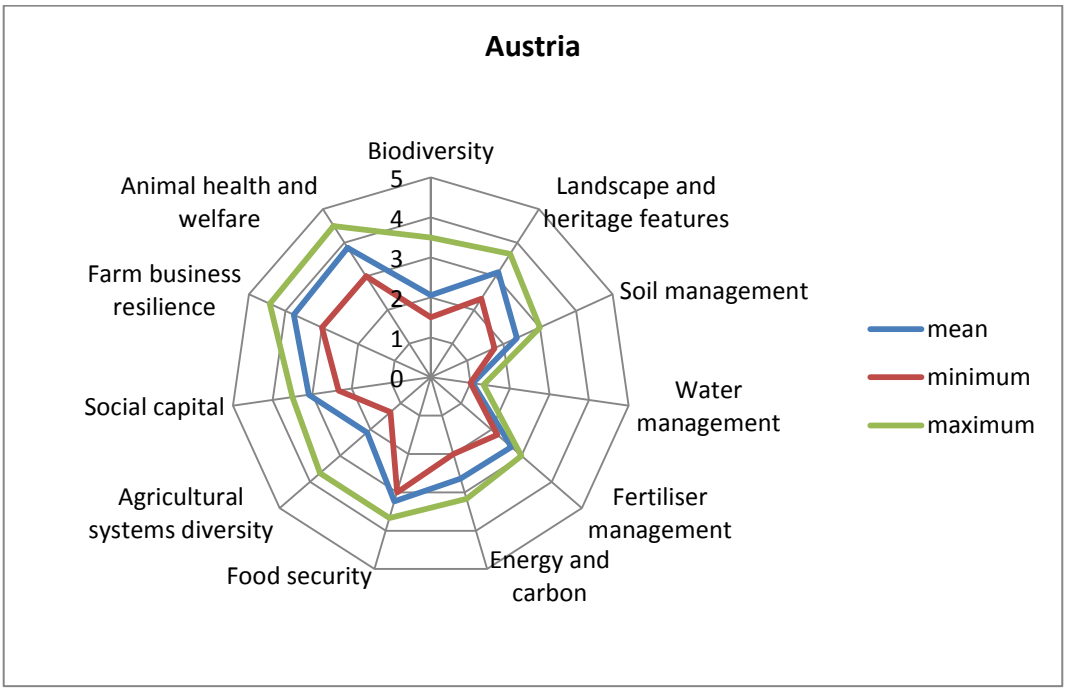

Figure 1 Spur diagram for Austria

In Austria, variation in the spur "Agricultural Systems Diversity" (Figure 1) reflected the marketing channels of the farms: some of the farms produced milk for the dairy cooperative only, so they kept only dairy cattle, while some farmers were involved in direct marketing. To be able to offer more products these farms kept several livestock species, such as hens or pigs. These farmers also used more marketing channels, e.g. farmers' markets and farm shops.

Farms scored relatively highly on "Farm Business Resilience". The main explanation for this was the several economic cornerstones of each farm, often including forestry or agro-tourism. This is in agreement with the findings of Kirner et al (2007) who investigated the effects of farming system on some aspects of sustainability of dairy farming in Austria and found that organic farms obtained higher income from agriculture and forestry than conventional farms.

"Animal Health and Welfare" also scored well because of low costs for veterinarians (mean veterinary expenditure per head was 33.74 Euros) and a relatively long grazing period, but farmers' positive perceptions of cows' freedom are questionable, as half of the cows were kept in tether barns during the winter period.

"Water Management" showed a very low score which reflects the local climatic conditions: annual precipitation is high in the region; therefore water conservation does not seem important to the farmers. They had enough water at all times, and relatively low water consumption (only for animals and cleaning; no irrigation).

In this region trees and hedges are structural elements of the landscape and the farms are managed at a rather extensive level. In the light of this, the low score for “Biodiversity” was surprising. There were two main explanations for this: firstly, it appeared that farmers may have underestimated the level of biodiversity on their farms. For all of them grassland management was low intensity (2 cuttings, no mineral fertilizer applied) and hedges were maintained. Secondly, farmers could not receive payments for the maintenance of these landscape elements from the Austrian agri-environmental program (ÖPUL). Therefore farmers probably did not consider these in the interviews. Kirner et al (2007) found that that smaller holdings, mountain farms and organic farms tended to provide greater environmental services than larger, lowland and conventional farms.

The scores for “Fertilizer management” were relatively homogeneous because of strict legislative constraints. The mean N balance was 95 kg/ha and P and K balances were generally close to zero (ranges: P balance -3.4 to +8.0 kg/ha and K balance 0.3 to 24.8 kg/ha). This contributed towards reasonable scores for the activity “Nutrient Use Efficiency”. Nitrogen input by fixation was estimated to average 72 kg/ha.

The farms had no arable land, only permanent grassland, so there was no risk of erosion or major leaching of nutrients and no pronounced soil management was carried out. Farmers did, however, mention a lack of soil analyses and this point seemed to be important to them.

Figure 2 shows the mean values for individual activities contributing to the overall scores for spurs. In the spur “Energy and Carbon”, the use of renewable energy received a high score because most of farms used solar panels for producing hot water. It was very difficult to collect hard data for this spur, because none of the farmers kept separate records of energy use for household and farm so these values were often estimated.

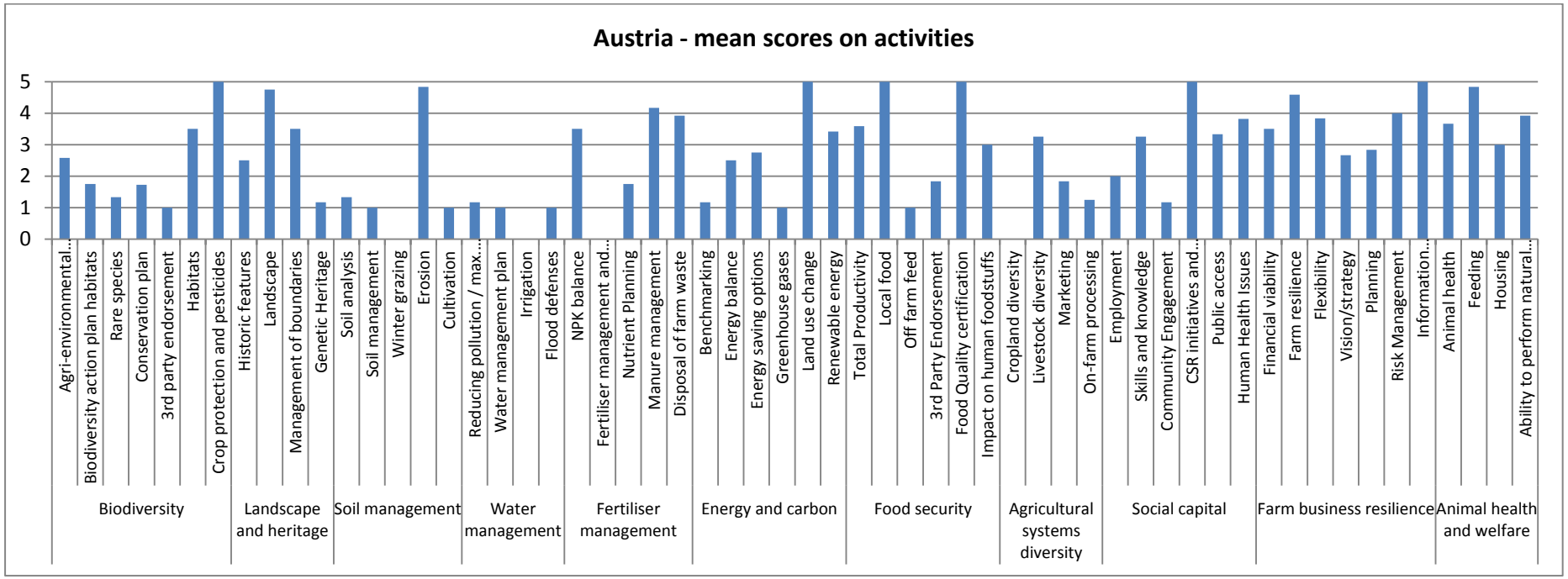

Figure 2 Mean scores for activities for Austria.