

Ministry of Agriculture and Agrarian Reform

**NAPC**

National Agricultural Policy Center

# **FARMING SYSTEMS OF THE SYRIAN ARAB REPUBLIC**

**In Support of Policy Analysis**

**Horst Wattenbach**

**June 2004**

With the support of

Project CGP/SYR/006/ITA – Phase II





# Executive Summary

The development and analysis of Farming Systems is an instrument adopted in support of agricultural policy analysis at the National Agricultural Policy Centre. The specific contribution of the national farming systems study to the tasks undertaken by the NAPC lies in providing a framework of analysis based on a consideration of both the geographical differentiation as well as the socio-economic stratification of the agricultural sector of Syria.

The farming systems study considers the potential impacts of changes in agricultural policy (e.g. prices, institutional support) at the household as well as aggregate level. Within the framework of the study, staff of the Centre implemented the overall concept in a selected number of systems. Given that this is the first broad implementation of a farming systems study in Syria, a remarkable degree of differentiation was achieved, as reported in more detail in the individual systems reports.

The specific objective of the study is to define relatively homogenous areas of agricultural production, based on appropriate agro-ecologic and socio-economic characteristics. These zones of major farming systems cannot be based on statistics based on administrative boundaries. Each farming system is characterized by its natural conditions, market integration and historic influences leading to differentiation and specialization of production within it. The contribution of each farming system to the national production of major crops and the degree of specialization is presented. Within each farming system, typical households represent the socio-economic variation, which exists naturally in any rural society. These household types are developed in light of typical resource endowment, their mix of livelihood assets and changes in the last decade. The share of each household type in the farming system in combination with their production orientation allows analysing ability to adjust to, opportunities deriving from, and vulnerabilities to changing production conditions.

The methodology of the study comprises of several analytical steps. In a first step, the team defined the major farming systems, which reflect geographic zones, marked by different agro-climatic, agro-ecologic and market conditions as well as production traditions based on socio-demographic characteristics and supporting public investments. Secondary literature was used to develop a preliminary structure and criteria for differentiation, which was subsequently refined in collaboration with experts of the different regions.

This resulted in the distinction of six major farming systems. Within the analysis of the structure of these systems, field-level information resulted in sub-divisions of the broad farming systems. A number of typical villages, representing the variation of the defined farming systems, was selected and the NAPC team spent on average three days in each one of the selected villages. The purpose of the village visits was to develop and adjust household typologies and to obtain information on major changes in the agricultural sector of the particular village.

The fieldwork included the household selection for individual farmer interviews as well as group discussion focussing on the compilation of information for each of the three household types, which represent socio-economic groups and their corresponding livelihood systems. Available statistics provided descriptions on the importance of each system in the national context in

terms of contribution to production of key commodities as well as the calculation of socio-economic characteristics of each system in terms of average holding sizes and cropping pattern.

Policy change and technological innovations will affect each household type differently, depending on the relative importance of the different income sources and livelihood strategies of the household. The characterization of each farming system in the national context allows reviewing the possible aggregated effect of policy change as well as the dependence of a farming system on major crops, which could be subject to policy adjustments.

For each household type, past developments in terms of resource endowment and composition of income sources shape the capacity to adjust to future challenges. Understanding the geographical expression of these patterns permits to address aggregate as well as social aspects for each household type, based on the presented framework for analysing the agricultural sector.

A summary description of the six farming systems with reference to their internal differentiation in subsystem and characterization of prevailing household typology is summarized in the following pages<sup>1</sup>.

### **Coastal Intensive Irrigated Farming System (FS1)**

The **Coastal Intensive Irrigated Farming System** covers 140000 ha along the Mediterranean coast. It is marked by very favourable agro-ecologic conditions and a very old cultivation tradition. The high rainfall levels and humidity throughout the year combined with mild winter climate creates a favourable environment for sub-tropical crops. Despite the small size of the system (0.8% of Syria), it contributes a very high share of its specialized products, especially citrus and greenhouse crops. Small average holding sizes (1.3 ha invested land) reflect the high population density and result in a disproportional share of holders (5.6%) compared the size of the broad farming system. The specialisation in crops under free market arrangements (greenhouses, citrus, field vegetables) are specific systems characteristics, as are the extremely good infrastructure for input supply and market access and the high importance of off-farm employment across the farm size classes. These off-farm opportunities are found in the public sector located in the two Muhafazat centres (Lattakia and Tartous), the important service sector of Lattakia as a national summer resort, as well as in the agricultural processing industries.

Within the system, a differentiation between the northern and the south part is observed, with a marked specialization in greenhouse cultivation in the Tartous part of the system, while the part belonging to Lattakia Governorate specializes more on citrus cultivation. This differentiation is the result of historic processes, whereby knowledge transfer from the Syrian workers employed in the Lebanese greenhouse sector coupled with a warmer climate caused the specialization on intensive greenhouse cultivation. In the northern part, the economic success of innovators provided a stimulus for the commercially minded farmers. The gradual adoption of the most successful crops led to the expansion of citrus at the expense of the previously dominating olive orchards. The characteristics of these two parts permit the definition of two small farming systems.

In the southern, **Greenhouse-based Farming System**, 5.2% of invested land is under greenhouses, taking the border of Baniyas Mantika as the border. Such a high share under greenhouses determines the agricultural economy of the farming system, through the production, employment generation as well as forward and backward linkages in the local economy. This greenhouse area corresponded in 2002 to 85% of the entire greenhouse area of

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<sup>1</sup> The review highlights the main issues, while the Annex tables, maps and the main reports present further detail.

the country (with most of the remainder being located in the Citrus-based coastal farming system).

According to official statistics, almost 80% of the greenhouse areas of 3230 hectares were devoted to tomato cultivation, followed in order of importance by cucumber, green pepper and eggplant.

The highest share of cultivated land in the farming system is under rainfed olive, particularly in the wider southern part of the plain and towards the east, followed by 11.2% of invested land under citrus. Particularly the land under olive orchards leads average holding sizes in the system being 1.6 hectares, i.e. that average holdings in the Greenhouse-based farming systems are larger than in the northern system.

Field vegetables are likewise important, as they allow the application of skills developed under greenhouse conditions, but permit savings of input and capital costs. Their areas taken from statistics cannot be directly related to land areas because of double cropping and due to their partial cultivation as a second crop under new young tree orchards. The statistics indicate eggplant and squash as the most important field vegetables, each covering with slightly above 2500 hectares almost 6.5% of the invested land. The five most important field vegetables (eggplant, squash, cucumber, haricot and tomato) jointly occupy slightly above 22% of invested land. Recent trends include the expanding cultivation of strawberries, indicating the preparedness of the farming community to engage in new crops.

Livestock plays a relatively little role in the farming system due to the underdeveloped milk marketing system and little on-farm resources for forage production. Small numbers of dairy exist across the farm types, but are not distinguishing feature between the household types.

The average holding in the farming system as calculated from statistics has just below 1.6 hectares and cultivates 0.74 ha olives, 0.175 ha citrus, 0.35 ha field vegetables and own 0.08 hectares greenhouse areas (leaving 0.21 ha for other crops).

The northern, ***Citrus-based Farming System*** is dominated by 67% of cultivated land under irrigated citrus. It is therefore among the farming systems with the highest share of land under a single crop. Some diversification in citrus species and varieties occurs, but the basis features in terms of asset fixity on market trends of a single crop group and marketing structure remain. Rainfed olive cultivation is second in terms of area and covers 28% of cultivated land. This structure is the result of substitution of olives with citrus over the last decades. The most important other crop is irrigated tomato (3.3%), while intensive cultivation in greenhouses covers only 1% of cultivated land (equivalent to 15% of national area). The share of irrigated land in invested land is 35% in this farming system.

The almost 30000 holders jointly cultivate 32300 hectares, resulting in an average holding size of 1.2 hectare cultivable and 1.08 hectare of invested land per holder. Considering the average family size in the area, the available cultivated land per person stands presently at 0.08 hectare per person, which gives a clear indication of the limits to continued dependence on agricultural income for the population of the system.

The criteria for the establishment of household types were relatively homogenously applied in both farming systems. The three household types resulted in 75% belonging to the smallholder group, while 14% have holding sizes between 1.8 and 3.5 hectares and only 11% of holders operate larger farms. A slight, but unimportant north-south variation in this distribution exists.

Among the small farm type, livestock plays only a minor role for the livelihoods, while off-farm employment is very important as income source and future strategy. In the greenhouse-based system, the meaning of farm size is a relative one, as the economic performance depends much more on individual success in crop management and marketing than farm size itself. Most farm operations in the small farm group are carried out by family labour, with hired labour being limited to few operations with peak labour requirements, such as pruning and harvesting.

In both coastal farming systems, farming is marked by a relatively high specialization on few selected crops, with the risk spreading occurring via different citrus species and varieties. Marketing of citrus is little differentiated. Climatic risks are relatively lower than in most other systems (but existent for citrus through frost and pests and for greenhouse in storms and pests. Major risk is however, the price risk associated with any intensive crop such as vegetables. Small households are at risk because of a lack of savings to compensate crop or price failures.

Poverty levels, in comparison with many other systems of Syria, are low because farm income risk is partly compensated by high levels of off-farm employment in the public sector.

Decreasing farm sizes put pressure on the system, exacerbated by the increasing expansion of areas under construction. The low average farm size is a risky factor for future incomes of the household, especially in the case that public sector and other off-farm employment opportunities fail to keep up with the population increase. In the former agrarian reform areas, land tenure will inevitably become an issue over the next decade. The absence of commercial credit limits the possibilities for the poorest in the system to invest flexibly in new opportunities.

Environmental risks, caused by the high use of fertilizer and other chemicals in the system, require further study and attention. Potential threats from chemicals exist for farmers that are directly exposed without adequate training and equipment as well as for the general public due to limited controls of residuals in the produce and to possible damage to groundwater cause by chemical infiltration into the aquifers. Within the greenhouse system, nitrate leaching is of particular concern.

Overall, the farming systems have shown great adaptability to market opportunities and farmers are prepared to capture new production and market opportunities, taking advantage of the very favourable environmental conditions. The introduction of new species and varieties to satisfy more differentiated demand could reduce price risks. The public sector could contribute significantly through the creation of an enabling trade environment, but also by strengthening quality control, including produce relevant for the export market. Adequate attention to land tenure issues and credit development can prepare the system for a positive performance over the next decade.

## **Hilly and Mountainous Farming Systems (FS 2)**

The **Hilly and Mountainous Farming Systems** cover the Syrian western mountains from Lattakia and Rural Damascus to the northern hills in Idleb and Aleppo governorates. They account for 6.5% of the area of Syria, 17% of its population and about 27% of the agricultural holders. High annual rainfall with relatively little variability, sloping terrain, and a high share of perennial crops and forest areas characterize the system. The basic farming systems characteristics of the broad farming systems are their smallholder structure based on tree crop cultivation and a high reliance on off-farm income and little livestock presence.

The high population density for a mountain system leads to holding sizes of just above 2 hectares, which is the lowest average after the coastal system. Combined with high population growth, this results in increased fragmentation of agricultural land. The agricultural income of the producers depends mainly on Olive, Apple Cherries and Tobacco. The specialisation of the farming system in these crops leads to high shares of national production stemming from this system (66% of olives, 70% of cherries, 63% of apple and 84% of tobacco).

Poor and medium households dominate the system (60% and 30%, respectively), with a high reliance on off-farm and non-agricultural income combined with relatively high education levels. Within the systems zones, the differences in production orientation related to the agro-ecologic conditions has led to a sub-division of the broad farming system in two units.

Low hills and gentle slopes at altitudes of 300-500 meter above sea level characterize the ***Hilly Farming System***. It is mostly located in Idleb Governorate and includes 470000 hectares of total land, of which 275000 hectares are cultivable. Most cultivable land is invested, with almost no fallow and only 15% under irrigation. The average holding size is approximately three hectares with almost two-third of cultivated land under rainfed olive production. The only field crop with some importance is rainfed wheat (9%). This area provides the national market with 31% of its olives, 24% of its cherries and 64% of its Kakis.

Limiting production factors are the small agricultural holdings, the reliance on rainfall and restrictions of capital access, especially for the poor. The farming system is self-sufficient in labour and exports surplus labour to neighbouring systems, especially skilled agricultural labour for orchard operations. International labour migration is likewise important (Lebanon and Gulf States).

The household types for the farming system were developed, based on holding size, livestock ownership as well as assets and income indicators and resulted in an estimated distribution of households into poor (60%), medium (28%) and better-off (12%) holders. The groups differ in their livelihood sources, strategies and production orientation. It is estimated that poor farmers obtain an annual income in the order of magnitude of 75000 SP, compared to 300000 to 500000 SP for the better-off farmers.

Based on their income sources, poor farmers obtain 25% of their income from crop (and livestock) production, while 35% is derived from off-farm casual work and 30% from non-agricultural employment. For some farmers in this group, considerable income is earned through international migration, which is estimated to generate 10% of income in the household type. Better-off households, in contrast, obtain a higher share of their income from agriculture (40%), but off-farm employment is also important in this household type, with medium households falling in between (i.e. they differ mostly in scale of income and holdings, less in the composition of income sources).

Changes within the livelihood system in the last decade refer to decreasing livestock numbers and cherry areas as well as a decrease in the share of off-farm casual income and an increase in non-agricultural income. In addition, some expansion of olive areas within the system coincided with more rapid expansion at the national level.

For their future strategies to increase income and ensure food security, poor farmers focus on non-agricultural and off-farm strategies, while better-off farmers focus on the agricultural intensification and diversification in addition to increasing their agricultural land. Moreover, in the case of poor farmers, exit from the agriculture is considered, while better-off farmers still have the opportunity to combine non-agricultural and agricultural income.

The ***Mountainous Farming System*** stretches from border with Turkey to the coastal mountains to Rural Damascus and includes approximately 725000 hectares (of which 270000 hectares invested) and 175000 holders, resulting in an average holding size of only 1.5 hectares. The farming system is characterized by high rainfall dependence (78% rainfed cultivation) for the dominant perennials, mostly olive and apple trees. The only crop with strictly controlled agricultural plans is tobacco, which covers 3% of invested land, mostly in concentrated niches under the influence of the processing factory. The system includes Mantikas in Lattakia, Tartous, Aleppo Idleb, Hama, Homs and Rural Damascus governorates.

The extremely small average holding size of land on steep slopes with narrow areas and shallow agricultural soil characterizes this farming system particularly and explains the high importance of off-farm employment for the livelihoods (casual agricultural labour as well as international migration) of the majority of holders. Livestock cannot play an integrating role in the farming system, partly due to the absence of grazing areas.

The farming system provides the national market with more than 30% of the olive production, 59% of apple production, 82% of quince production and 42% of cherries. Within the system, farmers produce 67% of the Syrian tobacco. Other commodities like pomegranate, fig and almonds are produced in small quantities, in addition to crops for home consumption i.e. wheat, barley, lentil, onion, legumes and vegetables.

A special feature of the household types in the mountainous farming system is the absentee owner. These 20% often keep their land with their relatives and migrate for higher income. The remaining rural population is classified in three household types: poor (60%), medium (30%), better-off (10%), where the threshold income levels between the groups are somewhat lower here than in the previous system (50-75 thousand SP and 200-500 thousand SP).

The importance of livelihood sources differ between household types, whereby poor households obtain only 20% of income from crop (and some livestock) production, while 40% each come from off-farm casual and from non-agricultural work (including work outside the country). In contrast, better-off households obtain a higher income share from agriculture (40%) and 10% from the livestock.

The above income composition affects their future strategies. Poor farmers are oriented towards non-agriculture and off farm strategies, while better-off farmers focus on agricultural intensification and diversification. For poor farmers, exit from the agricultural sector is considered, while better-off farmers focus more on a combined agricultural and non-agricultural strategy.

Several changes occurred in the farming system, starting with a strong decrease in livestock numbers, as well as cherry and apple areas with negative effects for the casual labour market. Olive areas expanded. The role of non-agricultural employment increased and women have a larger share of formal employment due to better education and social change.

These developments are shaped by several cross-cutting factors: Land scarcity and land fragmentation increases, which makes land ownership the most limiting agricultural production factor. The high share of unregistered agrarian reform and public land influences the adjustment possibilities of agricultural holders. Easing the land administration process, envisaging transparent procedures for the sale of agrarian reform land and registering land rented from the state under private ownership could contribute to reduce land pressure.

The formal credit market relies heavily on the ACB, which deals with individual farmers either directly or indirectly through the cooperatives. Credit access is complicated by two factors, which particularly hamper smallholders in their development by causing liquidity constraints. First, poor and medium private farmers often lack sufficient collaterals from small holdings; second, they possess incomplete documentation of ownership (unregistered and agrarian reform land). A particular concern is the credit needed to reclaim uncultivable land.

All policies that affect the areas under cotton in neighbouring systems impact the off-farm income possibilities within the system by decreasing the work for the migrating labour groups, particularly contracted for harvesting cotton. Similar effects occur with developments in the coastal greenhouse- and citrus- based farming systems, whereby these changes are more based on market trends than on policy decisions. Furthermore, the labour market has been affected negatively by the new introduction of modern irrigation, such as drip irrigation, in citrus orchards. Non-agricultural work gains importance, supported by public investment in rural education allowing surplus labour to seek employment outside the system.

Most crops of the farming system are subject to free marketing arrangements, with exception of tobacco, which is subject to monopoly arrangements with the GEOT. The GEFV has mostly disengaged from direct marketing of fruits and vegetables or their market regulation.

Particularly poor farmers with market access difficulties resort to advance sales contracts for credit and reduction of price risks, particularly in case they require credit.

Official tobacco prices are determined in an annual review of estimated national-average unit-cost-of-production and apply pan-territorially. However, producer prices have not increased since 1996, despite the increasing cost of production, in order to reduce the differences between domestic and international prices. Stable prices have nevertheless proven attractive and farmers tend to expand areas beyond licensed areas. Private traders purchase additional quantities.

The apple market operates without public intervention, since the production share marketed by the GESMAAP is below 2% and marketing through it provides an element of price stability. The apple area exceeded its peak following expansion from 1993-2001, promoted then by public reclamation projects combined with apple planting and marketing support. Increasing input costs (chemicals), pest resistance and price risks led to a reduction in the apple area, mainly of poor and medium holders. The increasing role of product quality and diversity of varieties relatively favours better-off farmers, who have better access to timely market information.

A so-called “quantity approach” led in the past to rapid expansion of olive areas. Attempts to export the increasing production initially failed due to quality constraints and difficulties in the post-production chain. Increased attention to these constraints shows positive effects on the olive oil quality, but securing export markets is still needed to stabilise the key role of olive in this farming system. Public attention to encourage improvements in storage, processing and to ensure quality control are required.

Suitable agricultural diversification could spread the labour peaks; generate additional income and minimizing the risk associated with the high dependency on olive production. Considering the agricultural land nature and the prevailing farm sizes (small) in the system, most field crops are unsuitable, especially in the Mountainous farming system. There are already tendencies that statistics over-represent some crops (e.g. cereals and lentils) as these records are partly estimates due to lacking facilities for recording.

In the Mountainous and Hilly Farming Systems, agricultural remains vital to the livelihood of many farming families, despite the importance of non-agricultural income. Increasing off-farm income and acquiring non-agricultural employment are the most important strategies for the future, especially for poor and medium households. Preferred strategies of better-off farmers are agricultural diversification and intensification, complemented by non-agricultural work. The poorest farmers, who tend to improve their skills through higher education, often envisage exit from agriculture. In addition, due to population growth, poor farmers need to increase the share of income from non-agricultural income to prevent declining living standards with falling holding sizes in the future.

The Government incentives to expand olive cultivation (e.g. in FS3) could negatively affect olive farmers within this farming system, especially if this policy should result in price declines. These would particularly hurt poor and medium farmers. Negative effects could be prevented, if the expanding production is met with increased and competitive processing capacities and the access to niche markets for low-input high-quality olive products from this system.

The beauty of the landscape and the view on the sea offer a potential for rural development policies, which aim at environmentally friendly and aesthetically attractive agriculture. This in turn would strengthen linkages in the rural economy by attracting tourism and could generate employment and income from accommodation, restoration and the marketing of locally processed products.

### **Farming System of the Northern and North-eastern Plains (FS 3)**

The **Farming Systems of the Northern and North-eastern Plains** are the largest one in terms of area (4.7 Million hectares), covering one quarter of the national area, one third of agricultural holders (346000) and almost half of the invested land (2570000 hectares, i.e. 47%). A high dependence on so-called strategic crops, relatively large holding sizes and low market access conditions characterize these farming systems. Rainfall levels are in parts relatively good and are in other (large) parts improved with public investment or private wells.

From an administrative point of view, the areas in stabilization zones one to three from four Muhafazats (Der-Ezzor, Al-Hassakeh, Al-Rakka and Aleppo) are completely located within this system, as well as the areas under publication irrigation networks in stabilization zones four and five. The system therefore includes rainfed farming in the northern part (partly complemented by private irrigation from wells or small rivers) as well as intensive irrigation from public irrigation schemes. Due to the concentration of public irrigation from the Assad Lake and along the Euphrates River (including the tributaries), large irrigation schemes show specific characteristics useful for classification.

Crops considered strategic by the Government, especially wheat (51%), cotton (6%) as well as barley (18%) and olives (6%), dominate the invested land in the farming system. The latter are the result of recent Government projects in the western part of the system.

Given the large size of the system, its' major and sometimes even crops with a minor share of invested land within the system contribute a huge share of their national cultivated area. The most noticeable among them are rainfed and irrigated wheat (77% and 79%, respectively), cotton (80%) and rainfed lentil (68%). A particularly good example for the effect of the size of the system is sugarbeet, of which one third of the national area falls into the system, even though it covers only 0.4% of the invested land in the system.

The vast size and low population density within the system give it an overall more rural structure than the other farming systems (with exception of FS6), implying that public sector and other fixed employment are relatively less important. Educational levels are considered lower than at the national level (85% of the system population was estimated not to exceed basic education levels, with a disproportionate share of women among them).

Livestock is of medium importance, with sheep having some relevance for part of the producers. Dairy supports mostly the family needs, except where large villages and cities create a market.

The scale of the system zone in combination with the large average holding size attracts huge flows of seasonal casual labour from all across Syria, most dominantly from the neighbouring agro-pastoral system, but also from the mountainous and hilly as well as the central plains farming systems of FS4 (Idleb, Homs and Hama areas). Casual and seasonal employment is of high importance for the poorer households.

The subdivision into two separate farming systems was based on the exclusion of large public irrigation networks for their special characteristics in terms of average holding size, water availability, dominant crops and tenure regime. Therefore, the broad farming system is further analyzed as a smaller, intensive irrigated farming system and the larger part as mixed rainfed and irrigated farming system.

The **Irrigated Farming System** is based on large-scale irrigation schemes covering approximately 180000 hectares. Land use is by definition extremely intensive and the implementation of the agricultural plan is relatively closely monitored. Water access is by definition a less distinguishing feature, leaving holding size and the role of the complementary income sources (livestock and casual labour) as main criteria for household classification.

The relative importance of crop income for the total livelihoods is least important for the poor households, as they own or sharecrop-in less than 1 hectare of irrigated land. They depend

primarily on income from off-farm work, complemented by small livestock income from up to 10 heads of sheep. This household type represents approximately 40% of holders in the system.

Medium households, making up half the holders, typically cultivate 2.5-4 hectares of irrigated land, complemented by 7-10 hectares under rainfed conditions outside the irrigation scheme. Small sheep numbers (25-35) are typical, while one cow complements income occasionally. The rainfed land is mostly cultivated to wheat in areas with higher rainfall reliability, but also to barley where rainfall is less reliable.

In terms of the cropping pattern on irrigated land, poor and medium households follow a surprisingly similar pattern and differ mostly in scale. Mostly poor, but also medium households tend to exceed the licensed cotton area to increase household income. The recent drought has affected the livestock assets of many households and the reduction of irrigation water availability has partly resulted in credits for financing crop inputs remaining unpaid.

Approximately 10% of holders are better-off households, depending mostly on agricultural income, with a dominance of the crop sector and a variable contribution from livestock (in function of the local feed availability). The success of the introduction of intensive crops such as maize in the Al-Rakka area promotes increasing crop livestock integration, particularly for this household type.

The preferred strategy of small farmers and to a lesser degree of medium farmers is clearly on producing wheat for home consumption and as a food security crop. The main limiting factor for the increased crop-livestock integration in these households lies in the lack of capital to invest in animals. The high reliance on cotton as cash crop should be reviewed, as its long occupation of the land limits the possibilities for intensification of land use. The same is true for sugarbeet. However, any considerations of alternative crops should carefully consider the strong preference of farmers for price stability.

The vast majority of the land in the broad farming system (almost 96%) relies on a combination of rainfed farming and complementary irrigation. This ***Mixed Farming System*** has as distinguishing features a more variable water supply and a north-south decrease of average annual rainfall parallel to the so-called stabilization zones (SZ). SZ1 and SZ2 are most suited for rainfed cultivation, but complementary irrigation is frequently applied. Rainfed wheat (mostly durum) exceeds irrigated wheat. Where the risk perception of the farmer allows it, wheat is preferred to barley. The optimal choice of crops shifts to more drought-resistant species towards the south and barley gradually replaces wheat as the lead crop. Families who have heavily invested in sheep tend to shift more rapidly to barley cultivation to reduce the potential hazard caused by drought. The total barley cultivation area in 2002 was recorded as 475000 hectares (40% of national production area). Since cultivation was banned in SZ5 in 1995, the barley area tends to decline, even though records of harvested areas obscure the trend because of the high share of barley used for grazing.

Lentil and cumin occupy jointly approximately 5% of invested land and as rainfed crops are preferred in the northern, more humid parts of the farming system. Lentil varieties differ by area, with white lentil dominating in northern Aleppo and red lentil in Al-Hassakeh. High price fluctuations characterize Cumin (e.g. 35 SP/kg in the previous season compared to 85 SP/kg on average). Both crops are much less mechanized than the leading cereals, hence their influence on labour allocation and seasonal employment, especially for the harvesting operation.

Briefly, the farming system has the following regional variation. In terms of complementary crops, the Aleppo side includes more beans and cumin and little lentil cultivation. Towards the east of Aleppo, perennials are increasingly added to the system due to the Ali Ali project (olive and pistachio). The Rakka area is dominated by wheat, cotton and maize, while Deir-Ezzor systems are extremely focussed on wheat and cotton (i.e. maize is not favoured there). In Al-Khabour, wheat and cotton dominate in the high rainfall parts and on irrigated land of its villages. In Al-Hassakeh, wheat and barley are complemented by lentil. In the rainfed areas

north of Rakka, well-based wheat and cotton tends to contribute to the overexploitation of water, while wheat and barley dominate the rainfed parts.

The West of the system belongs to the traditional cultivation area of Syria and is under a much higher urban influence than the eastern part of the farming system. Land expansion in the east is a phenomenon of recent decades and heavily influenced by public investment in land reclamation and water provision for large-scale irrigation and private well drilling.

Near Aleppo, market access leads to more diverse cultivation patterns and a higher share of crops under private marketing arrangements. The specifics of this urban influence are not part of this report, though.

The household types vary largely within the farming system due to the variation in production orientation, while the basic distinguishing features are similar to the irrigated system. Lower population densities lead to much larger average holding sizes in all three household types.

Differing degrees of land scarcity among the villages has led to poor households being defined as cultivating between 0.5 and 1.0 or 3-5 hectares, reflecting also different water availability. With 50% of holders, this is the largest household group. Medium households make up 40% of holders and typically cultivate 7 hectares of rainfed land or 12 hectares under mixed conditions. Large farms typically cultivate 15-17 hectares and farmers classify 10% of holdings into this group (with large farms of the group considerably exceeding this number). The role of other livelihood sources is similar to the irrigated system, with the additional feature of asset ownership (tractors and threshers as well as cars) of the better-off farmers.

The resource endowment and livelihood sources lead to different vulnerabilities between household types. Specific risks for poor households in the system stem from their double exposure to drought effects: Crop loss affects all households in the system, while the poor also lose the important casual employment opportunities. Particularly the loss of capital in the recent drought period left most marginal households without working capital and credit-worthiness with traders and public institutions alike, which critically affect their possibilities to recover economically. Medium and particularly better-off households recover relatively easier, as they are able to start from a broader capital basis and with better institutional credit access. This is particularly the case where holders are in possession of title deeds to use them as collateral. Livestock ownership increases parallel with the social strata in this farming system. The availability of capital to purchase complementary feed makes better-off households less exposed to animal losses, despite of similar risks for cheap grazing between all households and better information and access to transport facilities make their adjustment to drought easier. Social relationships and higher social capital (education) clearly reduce the vulnerability of better-off households. In terms of adjustment and modernization, the lower vulnerability, better working capital endowment and education levels of better-off and medium households make them potential promoters of modernized agriculture. Prime candidates for modernization are technologies for increasing water use efficiency, which would conserve scarce resources and allow expanding irrigated areas at the same time. The structure of water user fees could provide better incentives for increasing water use efficiency than at present.

Crop management differs between household types, as better-off households operate with higher capital intensity and mechanization than smaller and poorer households. This is reflected in the technology levels, whereby most better-off households mechanize all input applications such as seeds, fertilizer and herbicides, as they usually own the machinery. Poor households, in contrast, focus on expenditure avoidance and self-employment in most circumstances and apply seed and fertilizer by hand. Better-off households also tend to plough land twice, while the poor do it only once.

The marketing structure favours the better-off farmers in the system due to economies of scale and allows them to sell non-strategic crops at better markets, while poor households tend to rely on traders buying on-farm, hence obtaining lower gross margins for their crops. These

marketing arrangements are often associated with credit provision by traders, which may provide an entry point for asymmetric arrangements. Particular exposure of poor households exists, when water shortage depresses yields and farmers fail to produce the quantities to repay the credit. Credit provision is partly the primary objective when traders enter marketing arrangements.

The development options within the farming system differ notably from all other Syrian farming system, given the high reliance on strategic crops, water availability and generally lower population density. Market access is often the limiting factor to crop diversification, parallel to state incentives to focus production on the few dominant crops. Near the urban centres in the system, tendencies to diversification are observable, but the low population density limits spreading of the strategy. Crop livestock integration exists already, however across farming systems as it provides an important share of the feeding requirements of migrating sheep from the agro-pastoral and pastoral farming systems. The farm sizes are likely to decrease in the future parallel to population growth, however in this farming system starting from a high level.

Policies relating to strategic crops are particularly important here, due to their share in cultivated land in all household types, but particular of the poor. Wheat is more important as a cash crop for the better-off farmers, who are able to benefit from economics of scale, while poor and medium households depend much more on cotton due to their higher return to land and its productive employment generation (return to labour). Poor households depend even more on the employment opportunities on other farms created by industrial crops. Often, the local administration does not impose the limits for industrial crops from the agricultural plan to smallholders. Medium households employ only complementary casual labour, but devote a high share of self-employment for the production of the labour intensive crops. These factors determine the different exposure of the three household types to policy decisions on the price level of these crops or the strictness with which agricultural plans are being implemented.

Credit access to finance crops is a concern for all, but particularly for poor households. The heavy dependence on the ACB for formal credit has closed credit access for many farmers, particularly those who defaulted as a consequence of the recent drought years. Traders provide alternative sources of credit through the advance sale of crops, but the terms factor in the default risk and credit is therefore expensive.

Policy decisions and research orientation should particularly consider their impact on land use intensity and water use efficiency within the system. The high reliance on long season annual crops leads to surprisingly low land use intensities for a system with huge public investment in irrigation development. Complementary crops, which would allow increasing crop-livestock integration and soil fertility management need to be considered. However, the farmer reliance on crops offering price security needs to be carefully considered in policy decisions.

### **Farming Systems of Al Ghab and the Central Rainfed and Irrigated Plains (FS4)**

The **Farming Systems of Al Ghab and the Central Plains** cover an area of approximately 1.15 Million hectares (6.3% of national land) along the central section of the international road, which also connects Aleppo and Damascus. Due to its mostly long settlement tradition, historic cities or special development efforts, its infrastructure was regularly upgraded in recent decades, creating overall very good market access to large urban markets, combined with relatively good rainfall levels and water availability.

The combination of a relatively favourable temperate climate with the good market access has led over time to a varied cultivation pattern with a number of local niche systems. The common feature is, however, a relatively modern farming community, which includes almost 1620000 holders (17% of national figure) with a very diverse cropping pattern. Land use in the system is fairly intensive, frequently also including irrigation from wells and partly from public networks.

Average holding sizes within the broad farming system is 4.76 hectares of cultivable and 4.54 hectares of invested land. Across the system, 63% of invested land is rainfed, 27% irrigated and 10% fallow. Of the invested land, 52% are under so-called strategic crops and 4.2% under industrial crops. Within the above general characteristics of the broad farming system, three geographical sub-units are defined which are differentiated by public sector involvement and irrigation prevalence with the associated farming systems differentiation.

The ***Intensive Irrigated Farming System of Al-Ghab*** (Al-Ghab system) is the only farming system, which is already a separate unit in the agricultural statistics of MAAR. Homogeneous ecological conditions, intensive irrigation and cropping patterns based on the agricultural plan jointly with the dominance of Agrarian Reform Land are typical for the farming system. Intensive cultivation of wheat, cotton and sugarbeet dominate in the 141000 hectares of the system (0.8% of the national total). High population density (41000 registered holders and 80000 rural families) compared to other rural areas of Syria, results in an average holding size of 2.1 hectares per registered holder. Al Ghab was created by huge public investment to drain the swamps starting 45 years ago and these drainage canals serve at the same time as main irrigation water source in the zone. The reclaimed land from this investment, which is the larger part of the farming system, was distributed under the *Agrarian Reform Law* and resulted in homogenous holding sizes and land tenure regimes.

Al Ghab is the farming system with the highest share of invested land under irrigation (92%) and no fallow land. The most dominant crops are wheat (52% of invested land), followed by industrial crops (cotton 13.6% and sugarbeet 11.1%). Despite the small size of the system, the specialization on industrial crops makes it a major producer even at the national level and almost one third of the sugarbeet area of Syria is located there, driven by investment in processing plants and the advantage of relatively low transport costs in the densely developed area. The large cotton areas in other farming systems reduce the national importance of the cotton area in the system somewhat, but they contribute nonetheless 6% to national crop area (compared to 1.6% of invested land). The farming system further includes 17% of the national irrigated potato area and is a major contributor to the national market.

Several changes have occurred in the farming system during the last decade. The strict application of the agricultural plan, coupled with a considerable decrease in the available water has changed the relative importance of the three strategic crops in the cropping patterns. This resulted in a decline of the cotton and sugarbeet areas in favour of wheat. However, the expansion of the irrigated area in the southern part of the system, which was the result of drilling deep wells, has partly offset the change, where the area of cotton has increased at the expense of previously rainfed wheat. The intensive cultivation of cotton and sugarbeet accompanied partly with unsuitable land management has caused soil deterioration especially in the north of Al-Ghab. This resulting yields decline reduced farm income.

The criteria for developing a household typology Al Ghab were mostly farm size combined with water cost and livestock ownership. The poor households constitute approximately 80-85% of holders, who cultivate less than 2.5 hectares of irrigated land, or slightly above that size under poor irrigation conditions. These holders derive the major part of their income through casual agricultural labour with instable income throughout the year. Poverty is most prevalent among landless and where the entire holding was received during the agrarian reform process, (i.e. limited to original receipt of 25 dunum under irrigation), but water provision is insecure or the farm is located far from the canal (i.e. high pumping cost). This situation is exacerbated in large families who informally need the scarce land to employ several nucleus families.

Medium households are those 15-25% of holders with up to 5 hectares under irrigation, which occurs mostly in villages where private land was held in addition to land received under the agrarian reform process. In villages of originally rainfed agrarian reform land (i.e. they received 50 dunum), part of the families benefited from the expansion of irrigation canals to their land at a later stage. Part of these households complement agricultural income with public employment.

Better-off households holding more than 5 hectares (50 dunum) of irrigated land are a minor share of holders (1-2%), and they are more numerous in the southern part of the system where land is less scarce. Higher-level off-farm employment, fishery activities or trade may complement income, but exclusive farming is also possible in this household type.

Some variation of the system-wide cropping pattern is observable due to variations in soil quality and hence crop suitability, leading to the local importance of peanut, bean or cucumber. A special adaptation to the land scarcity is the accommodation of *freekeh* within the rotation to increase the land use intensity. *Freekeh* is harvested one month earlier than wheat and resolves land use conflicts with the long-season cotton crop. Poor and medium households cultivate most non-controlled crops, while the better-off focus on strategic crops for their easy marketing.

The part not belonging to the Al Ghab farming system (1 Mio ha of total and 685000 ha of invested land) is under the influence of the good market access, the presence of two major cities and a differentiated production structure of commercially focussed farming and off-farm income possibilities. Calculated average holding size for the 121000 holders is 5.7 ha of invested land. Nevertheless, the differences in characteristics, trends and development options based on their water availability, justify treatment in two different units. The first part is the Irrigated Farming System of the Central Plains (the Irrigated Farming System), and the second one is the Rainfed Farming System of Central Plains (the Rainfed Farming System).

The ***Irrigated Farming System*** has benefited from public investment for the construction of the public irrigation canals, resulting in one third of invested land being irrigated. The 475000 hectares under this system include 76000 holders, i.e. on average 3.9 ha invested land. 36% of invested land in this system is under cereals, most of which is wheat. The second most important crop group (1/3 of invested land) are trees, of which olive is dominant across the system, but others (such as pistachios and almonds) are extremely important in their specialized pockets of cultivation.

The household stratification in the irrigated system is mostly based on access to irrigated land, but depending on the pockets of production orientation, size limits vary. The field survey results suggest that the better-off farmers of the irrigated system have higher tendency to cultivate regulated crops (wheat, cotton, and sugarbeet), while the poor and medium farmers have more focus on fruits, vegetables, and some spices such as cumin and anis.

Some of the pockets of cultivation within this farming system are highly specialized and proven commercially viable even at the international level, most notably the pistachio based local system of Mourek, where a strong farming community provides a high share of the Middle Eastern fresh pistachios. The case is remarkable in two respects: It has evolved from a mere producing area with marketing in Aleppo into a wholesale market with direct export links. In addition, it is noticeable for the integration between producers and extension unit staff, where agents are producers themselves and provide effective links between the public administration and the agricultural sector, which is free of the notion of plan-control associated with the extension units in so many other farming systems.

The ***Rainfed Farming System*** is located to the east of the broad farming system and is influenced by bans to expand well drilling out of environmental concerns. Nevertheless, 6.6% of the invested land (363000 ha) is irrigated, while 15% of it was fallow in 2002 (a high rainfall year). Given the lower land productivity, average holding sizes are 8.2 ha of invested land, with one third of it being under barley cultivation, implying that the barley area exceeds wheat by 3:1. Tree crops play a role in the system, but almond exceeds olive areas (jointly 15% of invested land) in this farming system. Cumin is an important cash crop, but at lower productivity levels than in the FS3. Part of the perennial crops in the system has been established under support from the Green Belt Project.

Off-farm income sources in the rainfed farming system depend mainly on casual agricultural or non-agricultural labour. The reasons are mainly the low yields of agricultural crops due to the

rained cultivation in area of low rainfall (less than 250 mm per year on average), coupled with the scarcity of other income sources. The rained cultivation is the consequence of the Government policy to prevent drilling wells in that area due to water conservation concerns.

Several cross-cutting themes will influence the further development of the systems: Population growth will predictably increase pressure on land resources and reduce the average farm size, unless off-farm jobs opportunities absorb the excess labour outside of the agricultural sector. Constraints in the land market prevent adjustments in the holding structure. In Al-Ghab, the land tenure arrangements stemming from the *Agrarian Reform Law* imply that most land is collectively owned and selling such land is prohibited. On the other hand, inflated land prices in the irrigated farming system render land purchases unfeasible for most holders. Some subdivision of land goes unreported in statistics, while the families effectively divided it. The *Agrarian Reform Law* makes such approaches a necessity, while in the other two farming systems it occurs due to slow administration of the cadastral system. Specific difficulties are caused by the backlog of issuing updated land titles even on private land.

One of the objectives of pricing policies of regulated crops (wheat, cotton, barley and sugarbeet) is to achieve stable, reasonable farm income, which is in reality only partly achieved due to administrative procedures for the delivery of cotton and wheat to the Establishments. Especially in Al-Ghab, a significant part of poor farmers is unable to credit even for regulated crops due to accumulated debt with the ACB. Consequently, they resort to private credit at high interest rates and part of the subsidies is transferred to the traders. In both central plains farming systems, small (poor) farmers devote a major share of their production to home consumption (especially wheat, vegetables, and dairy products); although surplus sale occur in good rainfall years. Hence, administratively increased wheat prices result in marginal additional cash income for small farmers compared to large ones.

Due to the integration into international markets, price reductions of the strategic crops wheat, cotton, and sugarbeet are likely, which would probably have a negative impact on profit margins of farmers. This effect applies to all farmers in Al-Ghab, while it would mainly affect better-off farmers in the irrigated farming system, as poor and medium farmers focus more on fruits and vegetables production.

Farmers' reaction to such changes would differ between farming systems and household types. Poor and medium farmers in the entire farming system are likely to diversify production, including into dairy keeping or expanding crops such as peanuts or cabbage. However, these adjustments could be hampered if markets for such products are not developing. Milk markets far from major urban centres are clearly under developed.

The negative impact of the policy change upon better-off farmers is expected to be lower in both systems, due to their higher flexibility in adapting to new conditions, associated to no liquidity constraints, since they can operate depending on their own finance. This adaptation can be achieved through the adoption of new cost-saving technologies.

In order to support incomes of poor farmers, Government policies should focus more on intensifying and increasing the value of products such as fruit and vegetables, for which Syria has a comparative advantage, and that are mainly produced by poor and medium farmers. Government policy towards better-off farmers should focus more on increasing their efficiency by encouraging them to be more capital intensive.

In fact, the land use intensity in both plains farming systems is relatively low (R-value almost 1). Therefore, the increase in the intensity could have a positive impact on farmers' incomes especially if animal-plant integration is taken into consideration. The latter can be encouraged through the introduction of fodder crops in the cropping pattern, coupled an enabling environment for improved markets for local livestock products. Both changes would improve soil management and soil fertility.

Public investment, particularly of irrigation canals, shaped the distribution of production systems, without exploiting so far the potential of the farming systems fully. Among the most important barriers for further development are low irrigation efficiency and limited credit access especially for poor farmers. Their removal would increase production intensity, conserve water and lead to productive employment creation for the increasing population.

### **Farming Systems of the Southern Semi-arid Mountains and Plains (FS 5)**

The **Farming Systems of the Southern Semi-arid Mountains and Plains** cover an area of 1.9 Million hectares (10% of total), of which 610000 ha are cultivable (2/3 of which are invested). The systems contain an estimated agricultural population of 1 Million (out of a total of 1.7 Million) and are bordered by the agro-pastoral system to the east and north-east, while Jebel Sheikh of the neighbouring hill farming systems (FS2) is a landmark towards its north-west.

The FS5 is characterized by a highly market integrated production structure, good market access to the main national market in Damascus as well as a strong tradition of export to neighbouring countries. Its agriculture is dominated by freely marketed crops under conditions of generally good rainfall conditions, which are in the west complemented by a large number of (increasingly licensed) private wells. Crops considered strategic are cultivated on 48% of invested land, which is below the national average (61%). Tobacco is the only industrial crop of the system, which occupies 0.4% of the invested land (compared to 4.3% at the national level). The system contains one third of land under cereals (wheat and barley), 12% tree crops and 55% of other crops (most prominent are 13% of chickpea). The latter group (legumes, field vegetables etc) is the highest share in any of the farming systems.

Average holding sizes are on average one third below the national average (3.7 ha compared to 5.6 ha). Agro-climatic and market factors have led to a variation within the farming system, which permits the differentiation of two farming systems. Their main distinguishing feature is the nature of the terrain and differences in production orientation, while average holdings sizes are rather similar. The two farming systems are the mountain farming system and the farming system of the rainfed and irrigated plains, with key features as summarized in the following paragraphs.

The **Mountain Farming System** is located in the eastern part and totally included in Sweida Governorate, with an altitude ranging between 650 and 1800 meters and cropped cereals in the marginal eastern part of the Mountain and rainfed fruit trees (apple, grapes, and other perennials). The estimated size of the farming system is 550000 hectares and contains a population of approximately 37000 holders (218000 persons). About 20-30% of the land areas is uncultivable due to volcanic rocks.

Agriculture on the mountain is based on considerable investment of capital and labour for land improvement. The farming system is famous for the cultivation of perennials (traditionally grapes but recently shifting to apple cultivation), which shape the general impression of the system. Cereal cultivation is mostly confined to marginal zones.

The three **household types** established in the Mountain farming system have the following characteristics: **Poor households** cultivate about 1 ha of land and constitute 25-30% of the families in the system. They reside mostly in the marginal cereal areas, i.e. outside the areas where public investment in land reclamation has improved production conditions in the last decades. These families derive part of their income from the low productive cereals, but migration to urban areas has increased and remittances to families remaining in these households play a significant role. Where available, livestock is used for cereal cultivation or needs to be rented or borrowed, as the rocky area is unsuitable for mechanized cereal farming. A small number of families maintain low-intensity tree orchards, but due to low soil quality and water deficiencies, they are not comparable in productivity to the improved land.

Medium households own 2.5-5 ha, which applies to 60% of holders. This household type includes a small share of the holders in the marginal cereal zone, but is mainly composed of the small and medium producers in the improved land in the higher rainfall part of the mountain farming system. On average, the area pertaining to medium households is planted to 70% apples, 20% pears, and 10% grapes. Medium households own cows mostly for household needs. Cattle in the marginal area is used agricultural work and is rented inside the village. Off-farm work is the main source of income of poor and medium households. Crop sales, particularly of apples, are the second important income source. Non-agriculture income is least important due to declining possibilities to work abroad, leading to pressure on the income levels.

Better-off households are those 15% of holders who own above 5 hectares. The largest part of their cultivated land (75%) is under fruit trees (apples, grapes, olives, and pears), while 5% is under winter field crops (which remain fallow in summer). They have more livestock than the other two household types and own 40% of all cows in the system. Part of these households owned sheep for milk production in the past, but keeping them in the farming system has been banned as a consequence of land use conflicts in recent years. Fixed employment complements crop income of this group, based on their generally above-average education levels.

The main change within the farming system during the last decade in the reclaimed land areas, was the expansion of apple areas from 20% to 70% of the cultivated land, while the grape area decreased from about 80% to 10%. Peach trees are recently are expanding. The role of income from non-agricultural work as well as from working abroad has decreased. Changes in the marginal cereal land were minimal due to a lack of profitable investment opportunities for owners as well as lack of capital to do so.

In conclusion, apple offers the highest return to land and labour, evidenced by its increasing share of land, followed by pear. Both are at the same time perceived to create most employment for both family and hired labour. On the other hand, apple prices are in decline and the price risk appears to increase. Given the high specialization of farms on apple production, this risk is serious should it continue, as the orchards are still increasing production. Similar effects have been reported for pears, which contribute a lower share of household income while being more perishable. Marketing channels and prices are critical for the future strategies of the large household type. In case of transfer income, most farmers express interest to intensify existing orchards and to diversify, while desires for land expansion are difficult to put in practice.

The mountainous farming system has potential for production intensification based on effective management of natural resources and improved market access. Development options are conservation agriculture on slopes and vulnerable soils, cover cropping under trees, water resource management and water harvesting methods besides the available few dams, and the introduction of new crops and varieties to cope with the short growing period and droughts.

In the eastern, marginal areas, part of the households face difficulties to produce enough cereals for home consumption under conditions of decreasing holding sizes and the marginal cereal production areas. Emigration to urban areas and increasing reliance on off-farm income and transfers to the remaining population are increasing under such conditions, considering the lack of productive investment opportunities.

Wind erosion and inappropriate land management are increasing environmental concerns. Especially the poor can often not afford to apply fertilizers and consequently mine the soil. The success of improved soil fertility and productivity is closely related to higher water use efficiency. Given the difficult water situation on the mountain, investment in expanded irrigation – if feasible at all – may not necessarily be economic unless for higher value crops. A cheaper alternative could be measures for increasing the crop water use efficiency, Runoff water is probably the cheapest water source from an economic perspective, but the social acceptability of runoff farming unclear at present. Decisions about public funding for further land

reclamation within the marginal Basalt plateaus would require should carefully consider the benefits from alternative investments.

The ***Plain*** (Horan Plain) ***Farming System*** covers the western part of Sweida and the Dara'a and Quneitra Governorates. It is a diversified farming system of approximately 280000 hectares invested land (out of a total area of 1.35 Mio. ha), based on commercial and highly mechanized agriculture under mixed water use conditions (rainfed and irrigated). On average, one quarter of the invested land is fallow, with 57% being fallow and 17% irrigated. The average holding size in the farming system is 3.7 ha of invested land. Wheat is an important part of the rotation, but rainfed and irrigated legumes contribute an important part. Characteristic for the system are field vegetables (mainly tomato, cucumber, and eggplant), often using modern (drip) irrigation.

Owners and investors were identified as the two main agricultural household types, whereby the investors are leaseholders owning no or only part of their cultivated land. Their family may traditionally own small holdings and seek investment opportunities or are sons of large families seeking to expand their holdings. This groups mostly invests in vegetable and crop cultivation except in tree orchards. Where holdings exceed the management capacity of the owner, partly if children found other employment, all or part of the land is rented to these investors. Alternatively, holders who lack labour often engage in sharecropping arrangements, which reduces supervision costs. Owners provide capital and inputs for either the fourth or the third of the output at the end of the season. These farmers plant trees (grapes and olives) and crops in the smaller areas.

The owners (only) do not exceed one-third (30%) of the households, while the investors are the majority (70%). The average holding of large owners (10% of farmers) is 4-7 ha, but frequently considerably exceeds this range. 60% of their land is allocated for trees (olives and grapes), 30% of their land is for wheat, and 10% is under tobacco and summer vegetables on wheat land. A wheat-legumes-fallow rotation (rainfed parts) or a double rotation without fallow is applied. Farm income stems mostly from vegetable production. Drip irrigation has reached 90% in the study villages (which is probably above the average of the system).

The Plain farming system has changed in the last 20 years ago with a rapid expansion of well drilling, which created the basis for the now dominant irrigated cultivation. The originally formally illegal practice was not sanctioned at the time and the wells are becoming licensed in recent years. New crops entered the system due to new irrigation technologies, especially drip irrigation, more productive varieties and new experiences of the farmers.

In conclusion, the southern plains farming system is at present amongst the most dynamic ones in Syria and it attracts considerable private investment, which includes land purchases and the renting of wells for the irrigation of intensive crops. These processes are at the same time highly diverse, as in some villages returning workers from abroad exit the agricultural sector and sell their land, while in other villages available capital is heavily invested in land expansion.

Wheat is the most profitable crop for large holdings, particularly as it offers a calculable return due to fixed prices and the relatively good climatic conditions in the farming system. At the same time, wheat also generates the highest returns to irrigation water compared to vegetables. The main disadvantage of the latter is the price risk. Tomato and other vegetables are less profitable due to the unstable prices and the absence of storage possibilities. Livestock is kept for its return to family labour and price stability. Land expansion is permanently present as a strategy among investors, as they consider it a profitable investment for the future, even if they need to engage in sharecropping arrangements to reduce supervision costs.

The plain farming system is a recipient of seasonal agricultural immigration. The outside workers come from the northern governorates of Syria in the summer for the high wage rates. Sharecroppers are part of the system structure, as they are the ones who cultivate the land for which the investors provide the capital. A particular social component of these sharecropping

arrangements compared to the alternative employment in the construction sector in Lebanon is that the entire family can stay united and is employed in vegetable cultivation.

Particular development concerns of the plain farming system are the high volume of water extraction from deep aquifers, which contributes to declining water tables. Larger local involvement in water use management could increase the awareness and acceptance of water conservation measures. Legal and institutional constraints associated with attempts to reduce the average crop-water demand needs further study. Market-related problems due to saturation of the local market with the varieties of some kind vegetables add insecurity to the development of the farming system. Further differentiation of market demand in terms of new vegetable varieties and species could reduce the risks associated with excessive degrees of specialization in the system on a small number of vegetables.

### **Pastoral and Agro-Pastoral Farming Systems (FS 6)**

The **Pastoral and Agro-pastoral Farming Systems** represent slightly over half (ca 10 Mio ha, i.e. 55%) of the Syrian area, making it the largest farming system in terms of size. According to estimates from Al Badia directorate, the system includes slightly above 1 Million inhabitants, who jointly raise the far majority of the 12 Million sheep. Of the broad farming systems, 890000 hectares or 7.5% are invested land (one third of which was fallow in the high-rainfall year 2002) and slightly above 70% of the cultivated area (600000 ha) was planted with barley.

The farming systems cover most of the area located in the so-called Stabilization Zone 5, marked by land unsuitable for rainfed cultivation, an average annual rainfall below 200 mm (after exclusion of the parts under irrigation schemes, mostly along the Euphrates River), high rainfall variability and the associated sparse natural vegetation. Furthermore, these farming systems include most of the Stabilization Zone 4, defined as rainfall of up to 250 mm, characterized by cereal cultivation under high risk of failure of the grain harvest. Given the high to exclusive reliance of the population on sheep (and occasionally camel) raising, the frequent absence of a barley grain harvest is not perceived as a failure but part of the natural cultivation conditions in the system. Pockets of irrigated farming from oasis and wells have a long tradition, often in small areas.

This entire zone is marked by considerable Government intervention in terms of settlement policy of its population, social organization (promotion of co-operative organization of Bedouins), provision of social services and subsidized feed and intervention in the grazing rights of the traditional social groups. Definition of boundaries for the legal cultivation of the fragile environment and the permit system for the establishment of wells are important policy decisions influencing the development of the systems.

Within the above area, the composition of livelihoods, development options and policy interventions suggest the definition of three farming systems, of which two are defined geographically, while the pockets of irrigated farming are subject to special regulations and disperse in nature. Presenting the distribution of population and sheep between the farming systems is not feasible due to the migratory nature and the fact that the registration of residence provides little information on the source of livelihoods.

The **Pastoral Farming System** represents the traditional land use type in Al-Badia, based on a livelihood system adjusted to the fragile and highly variable environmental conditions. Taking the SZ 5 as indication, this farming system covers approximately 8.5 Million hectares (including the cultivated niches). Migratory cycles to provide the sheep, goats and camels with their feeding requirements were established on negotiated grazing areas with other tribes and detailed movements are adjusted at the lower levels of social organization, i.e. the clans and families.

The annual movement cycle involves grazing in the Badia in spring and early summer, followed by migration to cultivated areas where sheep feed on crop residues, starting with cereal stubbles

(or dry plants) followed by cotton plants. In irrigated areas, other crops such as maize and vegetable fields or legumes are grazed. In the winter, the families return to Al-Badia and feed their animals on concentrated feed, part of which is provided at subsidized rates through the co-operative system. Hence, the migrations traditionally include moving beyond the farming system into the cultivated areas to graze crop residues, particularly in the irrigated and rainfed crops in the north and the west of Syria. The length of these migration cycles depends on the quality of forage within the system, while their general direction is more a function of family ties. Apart from the income derived from sheep products, mainly milk and meat, off-farm income and self-employment are the only available livelihood sources. Most of the sheep milk is processed, partly by the family or traditional processors (*Jaban*), while wool processing is increasingly limited to complement family needs.

The Badia area has been subject to cycles of expanding and contracting encroaching by cultivation, with noticeable damage to the natural habitat. Cultivation in SZ 5 has been banned for that reason. Over the last decade, the Government established a large number of forage reserves on land under the jurisdiction of the Badia Department and partly on co-operative land. These grazing reserves had indicated the technical feasibility of improving the range quality through regulated access. The decentralized management responsibility of the local communities has so far not been sustainable and been hampered by events of the past drought years. The provision of subsidized feed was established to buffer feed shortages in drought years and their provision support the winter-feeding by reducing feeding costs. Co-operatives as a social organization, including management of designated grazing areas, have been tested, but the exclusive use of co-operative land was granted only in exceptional cases. Grazing boundaries for most co-operatives were abolished during the recent drought and open access is the standard situation.

The differentiation of household types in the pastoral population depends only on the combination of livestock with off-farm income sources. Poor households make up about 60% of holders, who have small ruminant herds below 200 heads (typically up to 100), which are often village-based. They rely heavily on off-farm and transfer income, partly seeking employment as herdsmen. The capital loss in drought years affects them very seriously, as they have no access to credit to re-stock. Some minimum livelihoods are guaranteed by local and state transfers at a low level, which do not suffice to exit poverty, though. Access to employment possibilities even in the irrigated farming system (cotton harvesting) are limited for this household type, as contracts for cotton picking are partly given with preference to families from within that system, who have experience in cotton farming.

Medium households typically own 200 to 500 heads of sheep, making up about 30% of holders, who partly complement their income through casual labour. The larger owners in the group may employ a herdsman, but these cases are unusual for the household type.

The better-off households own large herds (above 500, but herds above 1000 are exceptional) and derive all their livelihoods from it, unless they are absentee herd owners. Capital access and urban relatives (transfer income) make them less vulnerable, as they can more easily buy feed in case of drought and can recover more easily than the poor. Off-farm employment is unimportant for the better-off, who with more regularity employ herdsmen. Their good access to the social network provides them with information on market opportunities, improved feed access and considerable economies of scale. Camel Bedouins are relatively few in number, but are generally considered part of the better-off households. Large herd owners often prefer a northern migratory cycle and graze in areas where stubble grazing is paid for, as under clear grazing arrangements, the exclusive use of fields and flock management are easier.

The structure of the system allows only two strategies within the system. The first one is to expand herd sizes to build capital and be prepared for crises or to rebuild herd sizes after a crisis. Markets provide the possibility to those with information access and skills to react to it. Alternatively, employment can be sought, which is available as herdsmen, in casual employment

or outside the farming system. The possibilities for income generation through processing are largely limited to milk processing and they are largely exploited. The household possibilities to explore the different strategies are obvious when considering the asset and skills available in each household type.

NGOs and Government programmes often focus on traditional weaving and traditional Bedouin handicrafts in promoting opportunities for increased self-employment. Marketing of these items is frequently a constraint and the opportunities for higher sales margins by the Bedouin families are related to the general development of tourism in the country. Additional income generation could stem from the involvement of Bedouins in the tourism sector, either through provision of accommodation, guided tours to natural scenery or wildlife sights. At present, some initial developments are observable, but they are confined to the Palmyra area and mostly organized by Hotels. Additional and largely unexplored potential exists near other historic sites (such as Resafah), but their development requires careful development and possibly international guidance.

The co-evolution of the farming system with its' harsh ecologic environment resulted in livelihood strategies, which have shown high resilience to stress conditions. Policy change is one factor, which could add stress to the system. The acceptance of policy signals as new frameworks, which should guide the development of the farming system, such as grazing management regulations or water access regulations, occurs only over time. Too frequent and sporadic policy change leads to mistrust in the institutions identified with these measures. In case the confidence to institutions is lost, a second driving force derived from a harsh ecological system might otherwise be applied, which is the rapid exploitation of new opportunities without entering long-term commitments.

Such behaviour should not be seen as backwards or reminiscence to the past, but as an asset: once, range management strategies have become engrained in the society, they become stress resilient - if sufficient flexibility for local range management decisions is permitted. The pastoral farming system can only then contribute to valorisation of the steppe areas, if its livelihood system can survive the stress from the natural and the institutional framework. Locally managed and socially acceptable range management strategies are a key to its success, such as are stable and predictable policies influencing the pastoral farming system. Range policies have not always provided incentives, which encouraged social groups (co-operatives or traditional forms of social organization) to reap the benefits from improved management of the range.

The ***Agro-Pastoral Farming System*** is a transition between the traditional grazing areas of the pastoral farming system and the crop-based farming systems in the north and the west of the country. The agro-pastoral system is mostly located in the so-called stabilization zone four (200–250 mm average annual rainfall), as rainfed farming is permitted, but rainfall is too low and insecure for crop-based livelihood strategies. The system covers approximately 1.7 Million hectares and is characterized by the close barley-sheep integration. The system faces high risks to produce a grain harvest due to the rainfall variation, even when planting mostly barley. The frequent use of the crops for grazing instead of grain production is an inherent part of the system. Off-farm income and casual employment is a frequent element of the livelihood strategy. The agro-pastoral farming system is relatively free of large-scale policy interventions (except on the establishment of wells) and operates under free marketing of its produce.

The criteria for developing household types include herd size, but also the size of cultivated land, off-farm income and asset ownership. Poor households depend mainly on agricultural or non-agricultural casual labour (50%). The preferred employment is often as a herdsman, as skills can be directly applied against a fixed wage without changing the lifestyle. Many households lost the majority of their sheep during the drought and they have found no possibility to recover the livestock loss. Consequently, sheep income contributes at present only 20% of family income, compared to half before the drought. The capital loss and lack of credit has partly reached levels that they rent their land to investors, who provide the capital and who are able to face the

production risk. After each consecutive crop failure, the investor enters a new agreement based on the condition that for the new attempt to cultivate the share of output is adjusted in his favour. Important parts of the marginal barley and wheat cultivation in that system are therefore carried out by urban investors and not by the land owners. The better-educated members of these households pursue a clear exit strategy from the system, while people with lower education seek possibilities to re-invest in sheep.

The better-off households are characterized by high (30-50%) off-farm income from agricultural or non-agricultural income, while sheep provide only 10-20% of income. Cultivation is estimated to provide only 10% of income. A special development occurs in the western part of the system, where experiences from the green belt project have been transferred into the agro-pastoral farming system and farmers invest in establishing olive orchards. In addition, capital is invested in poultry farms, which permit a quicker recovery of capital than crops or investment in sheep. The latter strategy is only available to those with access to credit or capital available from other income sources. These new strategies document a considerable shift in livelihood strategy, as in the study villages, half of the income in that group was said to be obtained from sheep a decade ago.

The cropping pattern in the agro-pastoral farming system is very simple; rainfed barley is the main crop, even though with low average grain yield (but very high yield variation due to the lack of water in most years). Wheat plays a minor role. Perennials expanded in the west, especially olives under influence of the neighbouring Green Belt Project.

The ***Pockets of Irrigated Farming*** are based on licensed wells and are developed either in oasis or in newly licensed well areas near the Euphrates River. Cultivation restrictions for water conservation apply these areas as well, but sheep are frequently an important component of these systems as well. To the extent possible, farmers cultivate regulated crops such as cotton and wheat with reportedly high yields.

Policies affecting the pastoral and agro-pastoral farming systems relate to the marketing conditions, input pricing and resource management. Major changes have occurred in all of these areas. Changes in the meat export policies in 2000 have supported income generation from exploiting the preference for Awassi meat in Arab countries, which could be further exploited if combined with policies on the feed provision side aimed at encouraging increased returns per head of sheep and per grazing-day in the Badia. Investors from outside the farming system presently carry out most fattening. Support to the engagement of traditional breeders in fattening of lambs should be explored to generate additional income while reducing pressure on the range. A stronger role of traditional social organization or of co-operatives (particularly where the tribal structure coincides with co-operative affiliation) in the supervision of improved rangelands could ensure more sustainable management of emergency feed resources. This would prevent particularly medium-size holders from losing their herds (i.e. capital stock) in drought situations. Exercising such a role is a long-term development, though, in order to develop confidence that the benefit of feed resources accrues to the managers without fear of spontaneous external interference in stress situations. Technical possibilities for increased the forage production in the traditional run-off areas in Al-Badia (*Faydat*) (instead of the barley cultivation, which occurred in these flood plains prior to 1992) should be considered. Experiences for area-based insurances for breeders could be explored, but careful implementation in a socially adjusted manner and a long horizon for slow implementation would be indispensable to be accepted and sustainable. Policies allowing particularly poor and medium holders to recover from their loss of capital should be pursued, which would involve allowing careful re-stocking, but also working capital provision of rainfed producers in the agro-pastoral system to prevent the long-term resource use of these lands by external investors. The development of additional income sources beside sheep breeding will be indispensable to raise the living standards of a growing population, but increased resource use efficiency and income generation within the farming system could considerably reduce this pressure.

## COMPARATIVE REVIEW OF FARMING SYSTEMS

The farming systems of Syria show a remarkable degree of differentiation in terms of production orientation, but also in their socio-economic characteristics of the typical producers. The former influences the contribution of each farming system for the agricultural sub-sectors of Syria, which sometimes differs vastly from the size of a farming system. The latter reflects the differentiation social impact of the underlying trends and effects of policy and institutional changes. This comparative review summarizes the agricultural differentiation and specialization, before presenting the main conclusions relevant for policies to support the adjustment process of these farming systems.

### Systems level comparison:

The summary of the six major farming systems of Syria lays out their expected relative importance for the contribution of major food and industrial crops. Given the size of the system, the farming systems of the northern and north-eastern plains contributes more than half the production area of wheat, cotton and lentils and a high share of many other crops. The medium size crop-based broad farming systems (FS2 & FS4) are the main contributors to crop areas of their specialized crops, such as tobacco, olive and cherry in case of FS2 and almond, irrigated pistachio and almonds (FS4). A high degree of specialization brings from the perspective of contribution to the national crop areas even the small farming systems to the attention. The coastal irrigated farming systems (FS1) contributes above 90% of the national greenhouse and citrus production, while the small Al-Ghab farming system (part of broad FS4) contributes from its 0.8% of total area one third of the national sugarbeet cultivation.

From a farming systems perspective, the relative resource endowment of its producers is likewise a main consideration, as it influences the production orientation and development potential, particular in the context of a growing population. Based on the late settlement and investment in land improvement, the northern plains farms are on average endowed with by far the largest farms (7.5 ha), which are even larger after exclusion of the smaller holdings of its irrigated part due to the land attribution under agrarian reform regulations. At the other end of the spectrum is the densely populated coastal farming system (FS1), where average holding sizes of invested land are 1.3 ha. The high availability of off-farm income and non-agricultural employment in FS1 makes others more critical from a poverty perspective. The Al-Ghab farming system (in FS4) provides little possibilities for non-agricultural employment and has average holdings of only 2.1 ha (based on statistics, but smaller in reality due to informal sub-divisions). Similar farm sizes prevail also in the hilly and mountainous farming system (FS2: 2.0 ha) in difficult terrain and under a high percentage of olives, cherries and other perennials, which provide productive employment potential. The pastoral and agro-pastoral farming systems are particularly vulnerable, as the main capital of the holders consists of livestock, which is easily lost in drought years or must be sold at considerable loss at depressed prices to purchase feed.

Most systems (except FS1) produce a high share of so-called strategic crops, many of which are subject to much less practical regulation compared to the past. In terms of sensitivity to policy reform, most relevant is therefore the reliance on industrial crops. The national average of 4.5% of invested land is exceeded most in the Al-Ghab farming system (26%) and absent in the coastal and the farming systems of the southern mountains and plains (FS5).

The characterization of the farming systems in terms of their individual crops is not very well suited to analyze the risk exposure due to the large number of crops grown across the country. However, the dependency on four major crop groups was used as an entry point for discussion (cereals, industrial crops, tree crops and other crops).

At the level of major farming systems, it is noticeable that FS1 has the most extreme reliance on tree crops (80%), followed by FS2 (56%). The farming systems FS4 and FS5 (16% and 12%)

represent approximately the national-average (13%) share of invested land under tree crops, while they are relatively unimportant at present in FS3. The characteristics of tree crops in terms from a farm management perspective should be recalled, in that they present a long-term investment, which considerably restricts the adjustment possibilities of farmers. Among the tree crops, olive represents a high share in FS2 and FS4, which are characterized by lower price fluctuations than the fruits and nuts dominating the other FS. The citrus dominating the FS1 (especially the northern FS) permits some storage on the tree, while apple (FS5 and 2) compete for limited storage space as production increases.

Industrial crops (tobacco, sugarbeet and cotton) provide price security given much importance by farmers and areas are most strictly controlled compared to all other crops. The national average of 4.3% of industrial crops driven by the 6.6% cultivated in the huge FS3, while it constitutes 4.2% of the invested land in FS4. However, due to the specialization within FS4, the AlGhab FS is cultivated to almost 25% with industrial crops. These crops are relatively unimportant at the aggregate level in FS2 (1.7%), but are extremely important within pockets of tobacco cultivation near processing plants and are nearly absent in the other FS.

Cereals dominate the cropping pattern of the vast majority of the cultivated land and constitute over half (53%) of invested land at the national level, with the highest share (70% in FS3, followed by the FS4 (43%) and FS5 (33%). Cereals are particularly suitable for larger farms due to the achievable economies of scale, but traditional wheat farming (animal traction) still exists in the marginal cereal producing areas of FS5. The share of barley in the cereal crop increases parallel to increasing rainfall risk (in absence of irrigation) and a high share of barley is grazed as part of the livelihood strategy of sheep breeders. Price risk is not an issue for the cereal producers, while climate risk is a serious problem.

The last crop group comprises mostly crops under private marketing arrangements, including most importantly legumes (important in FS3 to FS5) and field vegetables (FS1 and FS 5). The former group is more characterized by climatic risks, while the second group is regulated when based on irrigation and subject to very high price risk, but offers high profit to growers who succeed to market at the correct moment.

This presentation by crop groups allows the differentiation of different **vulnerability factors**, notably the vulnerability to price shocks (by relying highly on crops subject to price fluctuations), climatic risks (mostly drought vulnerability of the system) and policy change (notably by controlled areas and adjustments in the official prices). The comparative review indicates the highest exposure to policy change is FS3 due to the high reliance on wheat and cotton, the latter particularly of the poor farmers who frequently exceed the permitted share under the agricultural plan. Policy change at the broad farming system level is next important for FS4, while at a close look, the Al Ghab FS within is overall strongest exposed to political prices and agricultural plan adjustments (25% of invested land under industrial crops). Policy sensitivity of the FS6 is of a very different nature, as the system is not affected by direct output price control. Policy decisions have affected in contrast mostly resource use decisions, frequently out of environmental concerns. The first intervention area has been through the ban to cultivate floodplains in or the Badia itself. The second intervention refers to restrictions on water use from wells for the irrigation of crops, for which exemptions are reportedly under consideration. The establishment of grazing reserves and the provision of subsidized feed are supporting the population living in a risk-prone environment. At the same time is this support outside the influence of decentralized institutions close to the Bedouins, which adds insecurity to a system where it requires certainty. Past policy decisions on grazing area access and the role of co-operatives have raised concerns about the stability of policy decisions. The Badia policies are theoretically neutral to scale, i.e. poor farmers get the same benefit for their animals as large holders. Asymmetric information on markets and credit access make better-off member of the system less vulnerable and adjust quicker to the risks of the system.

A high reliance on crops under free market arrangements, particularly if these are perishable and highly seasonal exposes farmers to great profit opportunities but also vulnerability to price shocks. FS 1 and mostly is southern, Greenhouse dominated part, are most sensitive to it. Years with high losses is the most important factor preventing the smallholders within that system to continue cultivating in all seasons due to capital loss. Successful farmers there and in the southern plains farming system of FS 5 are on the contrary well prepared to make high profit, particularly where they combine good crop management knowledge with knowledge about the commercialization of their produce. The substantially improving supply with fruits and vegetables in the last decade provides testimony for this success.

Climatic risks increase generally from west to east, making FS1 and FS2 least exposed. FS6 is clearly most risky one of all systems due to the direct dependence on the range. Within FS6 again, the non-migrating herd owners (coinciding with the poor ones) have least flexibility by migrating to other areas compared to owners of larger herds. In a drought situation, these farmers lose the highest share of their capital as they lack resources to purchase feed at increased prices and small herd sizes make migration uneconomic. Within FS3, the irrigated farming system (Euphrates Basin and tributaries) are less exposed to climatic risk than rainfed areas, as water deficiencies are prevented through irrigation. In practice, however, not all irrigation systems are resilient to fluctuating rainfall conditions and in the Khabour basin particularly, low rainfall years transmit their effect through the irrigation system through reduced water quantity and coverage of the schemes. Lack of irrigation water affects household differently depending on their position in the scheme and sharecroppers lose the possibilities to engage into cropping arrangements. Climatic risks and policy risks increase each other partly, when the agricultural plan announcement (irrigated or rainfed “plan” in an irrigation scheme) is announced belatedly due to insecurity of the planners themselves to provide water in the irrigation scheme. By nature, the vulnerability level of rainfed agriculture is highest, be it the rainfed barley cultivation of the agro-pastoral farming system (of FS6) or the mixed farming system (of FS3). Access to complementary water resources, such as wells, is correlated with the socio-economic classification and owners of deep wells are less likely to be hit hard. Poor households are often losing not only their own crops in a drought, but also their casual labour possibilities, often in harvesting cotton or other crops.

This review of vulnerabilities is focussing primarily on short-term effects. Perennial systems are subject to specific price risks in cases where long-term price declines occur when a steadily increasing supply is not met with increasing demand. Some citrus varieties appear to be in such a decline (due to the private expansion from late adopters of a successful strategy), as might occur with apple and olives in the future due to public promotion of orchard expansion. Ensuring markets for these crops is important to avoid the negative effects of asset fixity of farmers’ investments, as declining margins would hurt poor producers most.

Apart from the natural conditions, several **cross-cutting themes** influence the present structure and development potential of the farming system.

The endowment with land as the principal agricultural resource was a long-standing public concern in Syria and social equity concerns led to the agrarian reform process of the 1960s. Nevertheless, the growing population and sub-division of land requires further attention to the role of land fragmentation when discussing the farming systems of Syria. Agrarian reform was achieved through the redistribution of large, privately holdings as well as the distribution of public land, partly after considerable state investment in land reclamation. No systematic study on land tenure was part of the present study, but the legal restrictions of holders of such land arouse frequently. Comparing the share of agricultural land under restrictions from the agrarian reform law, it is apparent that the Al Ghab (FS4) and the irrigated farming system of the northeastern plain (FS3) have the highest share of agrarian reform land.

The farming systems are furthermore differentiated by the prevalence of absentee and part-time farming. The remoteness of many holdings from urban centres leads many large farmers in the

rainfed plains of FS3 to visit their holdings mostly for the supervision of agricultural operations, which are highly mechanized for the dominant wheat. The phenomenon is at the same time associated with holdings, where owners engage in share-cropping arrangements to reduce supervision costs. This is most important in labour intensive field vegetable cultivation and on irrigated land. Share-cropping is therefore most important in the irrigated parts of FS3 and the plains of FS5, while it is less important in the plains farming systems of FS4. In several tree-based systems, smallholdings do not provide sufficient employment capacity for full-time presence on the farms, resulting in seasonal absence from farms in FS2 and the mountain FS5. The land relation policies, e.g. the law of agrarian relations, intends to protect share-croppers, but at the same time reduces the interest of land owners to engage in new longer commitments which could affect their ownership rights.

Poor and landless individuals and families seek employment within their own farming systems and move to other farming systems known for their need for casual labour in specific seasons. A review of employment generation in the farming systems involves considering the potential for productive employment generation for family labour as well as the possibility of a system to absorb casual labour (often resource-poor or even landless households) on a seasonal basis. Apart from the self-employment on their managed land, casual agricultural income within the system is a standard feature and the extremely high importance of this income source across all systems has been pointed out.

Seasonal agricultural labour flows to the areas with cultivation of the labour demanding cotton or sugarbeet, but also regions with field vegetable cultivation, among others. The most importance receiving systems are FS3 (particularly the irrigated system), FS5 and FS1, while the areas of out-migration are the agro-pastoral farming system of FS6, FS4 (particularly Al-Ghab) as well as FS2. The poor households within a system (particularly harvesting) mostly migrate for unskilled labour, while better-paid skilled operations such as pruning of orchards attract to a higher degree also medium household types. Population growth and increasing labour availability within the systems (declining average holding sizes over time) leads to an increasing reliance on labour from within the systems, which appears to affect the employment possibilities for the poor from the agro-pastoral FS in the FS3 (particularly the irrigated part). A similar trend exists for local casual employment in the FS1. Poor households from within FS3 are preferred for cotton picking as they provide higher experience in the operation. The irrigated plains of FS5 continue to attract casuals for field vegetable cultivation, but also engage migrant labour to a considerable share through share-cropping arrangements. These labourers, for example originating from FS2 and FS4, complement these contracts with migration to non-agricultural work, e.g. in the construction sector of Lebanon. With increasing labour supply and use of internal labour within the system, the capacity to absorb surplus labour between the systems is likely to decrease, which will increase pressure on the labour market. This has already happened in the rainfed part of FS3, where labour flows within the system are now more important than in the past.

The environmental concern most commonly raised across all farming systems are those on the present and future water availability, possibly less marked in the FS1 & FS2. Policies restricting the drilling of new wells tapping into already overexploited aquifers are in place, but enforcement is partly an issue. More attention on the role of water use or service fees for demand management is required, in order to increase the crop-water use efficiency. Efforts for upgrading traditional to modern irrigations have been more successful in FS5 than in most other farming systems, particularly FS3, partly due to unresolved technical problems. The role of runoff management under rainfed conditions deserves more attention than at present, including for forage production. The success of better soil fertility management especially under rainfed conditions is closely related to water management as well as credit facilities.

A particular environmental concern in vegetable cultivation, most markedly under greenhouse conditions, is the pesticide and insecticide use. Spraying intensity has not specifically been

studied, but the public facilities presently appear underdeveloped to analyse for a significant sample the compliance with prescribed waiting periods after application and potential hazards to ground water resources. Pesticide application in cotton is at levels considerably below many other countries and offers the possibility to seek price premiums if used for marketing. The control function of the public sector in ensuring the quality of sold products in the interest of farmers and consumers should be strengthened. The requirements for obtaining training and licenses by agro-chemical traders should be assessed from this perspective, as should procedures to ensure the safe and efficient operation of spraying equipment.

One of the most important concerns for increasing the flexibility of farm management across Syria is the access to seasonal as well as longer-term credit policies. Particularly where farming systems have been affected by the recent drought and assets have been lost, e.g. FS6 and part of FS3, mechanisms need to be established to give these farmers new access to crop finance. Marginal producers will otherwise face serious difficulties to avoid expensive alternative credit sources. The governing procedures for guaranteeing credits within the co-operative system include an element of decentralized social control for debt repayment, but are not fully functional at present.

Governing policies on the registration of land and the transfer of registered ownership of agrarian reform land require urgent attention. The transition from original reform beneficiaries to the next generation has started. It will rapidly broaden the negative effects faced by holders without title deeds in the near future. Under the practical difficulties to obtain credit using such land as collateral, part of the farmers informally sought pragmatic solutions, which occasionally involve formally illegal land sales and distribution of land among several young families. This approach is relatively inefficient and carries with it the risk that particularly smallholders negotiate from a weak position in these circumstances and are consequently forced to accept expensive credit arrangements. In some farming systems, holding sizes will become too small to be viable and the social implications if such resulting holdings cannot be sold should be considered.

The gradual move towards an indicative planning process has led to the decentralization and flexibilization of many production decisions. The agricultural plan for non-strategic crops serves mainly as approximate orientation point of a desired situation except for well-irrigated crops affected by water conservation policies. Industrial crops are under the strictest control of their cultivated areas, which is necessary to contain excessive budget effects and meet the requirements of processing facilities or to meet export objectives. The policies and procedures for influencing the cultivated areas, delivery time and product quality are at the same time expensive, complex and not always transparent in their application. Other critical areas are the procedures to obtain yield estimates, the assignment of delivery dates (sugarbeet) and inefficient delivery mechanisms to factories causing long waiting periods and additional cost. Procedures for grading of industrial crops are a necessity to ensure the quality of supply. Area control may also be required as long as crops remain highly desirable for many farmers and production tends to exceed requirements of factories (which imply no statement about the economic efficiency of the commodity chain as such!). However, from a social point of view, inefficiencies of the procedures tend to favour large producers compared to smallholders, which is partly compensated at the local level in that smallholders are permitted to exceed licensed areas without sanctions. At the same time, the monetary importance of the administrative process of certifying product grades (as certificates of origin) becomes a part of a negotiation between employees and farmers. Part of the illegal practices are possible because of the serious cash and liquidity constraint faced by farmers with irregular cash flows and where delayed payments by public institutions are particularly hurting.

Given that the extension unit is the branch of the agricultural support system with the most regular and direct contact with the farming community, it is heavily involved in the collection of local information and the transmission of agricultural decisions from the higher administration.

The activities required for the planning, data collection and supervision of the agricultural plan are among the most important and time-consuming extension unit tasks, particularly in farming systems with a high importance of industrial crops. Agricultural extension advice in the sense of providing information on modern farming practices and being an active partner of farmers in solving practical problems receives therefore less attention. Apart from the time aspect, the role as a control institution, which at least historically had even the task to have illegally cultivated crops destroyed, occasionally reduces the precision of information given by farmers. The research-extension linkage is presently relatively weak and the generation of technical solutions would benefit from a better information access to international research results by researchers. The outreach capabilities in the extension systems should be strengthened.