

## **Land Consolidation in Sweden**

**Mats Backman and Tommy Österberg, Sweden**

### **ABSTRACT**

Rural development is closely related to the improvement of living conditions in rural areas regarding housing environment, infrastructure, communications, employment possibilities, land management etc. In this context the division of land into property units as well as the ownership conditions of real properties have a great influence on rural development from various point of views – society, business and environment. In the county of Dalarna there is a unique fragmentation of real properties/parcels combined with very complex ownership conditions in large areas which causes essential disadvantages in agriculture, forestry and for the development of good living conditions in rural areas. The situation is a result of private subdivision of real properties during generations and inheritance pattern among the farmers.

Land Consolidation is the main tool used to achieve land concentration and simple ownership conditions in areas with cadastral problems. Since 1930 the Cadastral Authority has implemented Land Consolidation covering 400,000 hectares, but there is still an additional urgent need of Land Consolidation for at least 400,000 hectares.

In the County of Dalarna the authorities have established a partnership with the associations of farmers, forest owners and sawmills in order to prepare programmes for land reform activities. The possible measures are

- Voluntary or gradual measures
- Radical land consolidation including compulsory measures

The choice of consolidation scheme depends on various factors. In areas with moderate fragmentation of properties voluntary procedures are recommended. Radical Land Consolidation, however, is required for major areas which are badly fragmented and where there is an urgent need of Land Consolidation. Normally 300 – 700 participants are involved in such projects.

According to the Real Property Formation Act and present policies a Land Consolidation procedure has to be initiated by the owners of real properties. Therefore information and communication activities are essential. For the success of a project it is important to increase the awareness of the efficiency and the benefits of a better land consolidation among the land owners as well as among the public in general. Property owners in fragmented areas must be convinced that it is beneficial to them to sign the applications of the proposed Land Consolidation procedure. For both participants and authorities the following issues are important:

- Cost and financing
- Public opinion among the participants
- Influence by the participants on the procedure
- Location of the new consolidated properties
- Implementation time of the procedure

To match these requirements the Cadastral Authority has emphasised

- Elaborating a cost-efficient procedure and methodology
- Developing a trustful partnership together with other authorities and associations

- Introducing a high- technological GIS-technique
- Developing forest valuation based on remote sensing
- Establishing a trustful dialogue between participants and officials
- Attaining political support on local, county and parliament level

**The results** from implemented projects show clearly that the number of real properties has been reduced considerably with a subsequent improvement of division into property units and ownership conditions. As a result of these improvements essential benefits for society and business have been achieved.

The main **benefits to society** are:

- Decreased costs for authorities
- Increased activity and employment in agriculture and forestry and other business activities in rural areas
- Increased tax revenues
- Documentation and securing of valuable natural and cultural environments

The main economic and commercial **benefits** are:

- Decreased costs for agriculture, logging and silviculture
- 80 – 90 % reduction of the total length of property boundaries
- Clear and secure boundaries
- Simple ownership conditions

The **Cadastral surveyor** leads and is responsible for the whole process from the application until the conclusion of a Cadastral procedure. He, or she, co-ordinates information, process, decisions and investigates, evaluates and proposes solutions, negotiates and takes important decisions. The Cadastral surveyor's role in Sweden is unique – it is strong and involves great responsibility.

The **Cadastral procedure** is a good way to solve matters of land and compensation. The Cadastral procedure has proved to be capable to serve as a democratic tool in order to achieve consensus and user participation. Appeals to the courts, for example, are rare, - even in such controversial matters as compensation. In Sweden our experience of this model is very good. It is a secure, simple, neutral and cost-efficient procedure. The Real Property Formation Act has also proved to be applicable - even in large-Land Consolidation.

## CONTACTS

Mats Backman  
Lantmäteriet, Box 281, S-792 25 Mora, Sweden  
Telephone: +46 250 391 18  
E-mail: [mats.backman@lm.se](mailto:mats.backman@lm.se)

Tommy Österberg  
Swedesurvey AB  
SE 801 82 Gävle Sweden  
Tel:+46 26 633850  
Email: [tommy.osterberg@swedesurvey.se](mailto:tommy.osterberg@swedesurvey.se)



# Land Consolidation in Sweden

## 1. Introduction

The use of land in Sweden has developed from settlements, which developed into villages. Within the village, the different fields were divided between landowners in strips. The width of each strip was determined in relation to each owner's share in the village. The share was also a measure of each owner's part in commons, especially the forest.

Among farmers it was regarded important, in all fairness, to have a portion of every specific field belonging to the village. As a consequence, farms had a great number of narrow strips of land, which sometimes were subdivided into even narrower strips as a result from the distribution of deceased farmers' estates among the heirs.

The fragmentation of agricultural land made farmers in a village very much dependent on one another. They all had to sow and harvest at the same time, more or less collectively, and to sow the same kind of crop all of them. In the middle of the 18<sup>th</sup> century the situation was considered an obstacle to the development of agriculture for the production of food for an increasing population. According to new ideas, farmers should be given the opportunity of improving and expanding their farms more individually than before. Legislation on a land reform, aiming at land consolidation, was found necessary. Laws on land consolidation were then passed with one common purpose, land consolidation. The first land consolidation started 1757 and covered most of agriculture land in Sweden, but the reform allowed up to 4 parcels for each real property. It was followed by a more radical reform, where all parcels of a property was consolidated into only one parcel. This meant in turn that the house and the site of the farm, for many farmers had to be moved to the new consolidated parcel. This reform was possible to implement only in the plain areas of southern and central Sweden.

During the period 1828 – 1922 Land Consolidation was carried out in almost all rural villages in Sweden including arable land as well as forest land for 20 million hectares. Land consolidation in those days meant mainly reallocation in order to eliminate fragmentation of land. Up to four parcels were allowed and the reform was combined with considerable development of new land for agriculture as well as moving houses to the new plots.

After the second world war a new approach to land consolidation was developed, which can be called sporadic land consolidation as opposite to the systematic land consolidation village by village. The main tools are the rules for land consolidation in the real property formation act, acquisition control for farmland by the regional authorities, active policy to support farmers wanting to sell their land and seek other income opportunities and support those farmers, who want to continue and develop farming activities. This policy has considerably reduced the number of farms, increased the average size of each real property.

In addition to these activities, farmers themselves have through short-term leases increased their access to farm land considerably through private agreements.

The result of these reforms are shown in Appendix .

The results of the land reforms during the 19<sup>th</sup> century were good for the villagers. The cultivated land in Sweden increased about four times, from 1 million ha around 1800 to about 4 million ha around 1920. The improved division into property units remained good in

Southern Sweden but deteriorated elsewhere, especially in the County of Dalarna in Central Sweden. The reason to the deterioration of property structure has been a more liberal view on subdivision of real properties and the attitude among the villagers in Dalarna. They have continued to subdivide properties privately and have ignored the negative consequences for future generations. The holdings became smaller and smaller for most villagers and were no longer a base for the support of living. Another common obstacle for the farmers in Dalarna was the frequent joint ownership of properties, which was the result of a process lasting generations, when the heirs of a deceased farmer distributed the estate among themselves. According to Swedish law all owners of a jointly owned property must agree on every management decision.

*An example from the village of Färnäs may show the deterioration during one century. When Land Consolidation was concluded in 1860 one of the consolidated holdings was owned by one single farmer. After the conclusion of the adjudication procedure in 1960 the same holding was owned by 175 persons, most of them living far away from Färnäs, in other European countries and even in USA. Furthermore, the original holding had been subdivided privately or by the Cadastral Authority into a much larger number of parcels.*

Therefore it became necessary to carry out Land Consolidation again both from the viewpoint of society and the villagers. Land Consolidation is the main tool to achieve land concentration and simple ownership conditions in areas with cadastral problems. Prior to land consolidation it is necessary to implement an adjudication procedure. Since 1930 both adjudication and land consolidation procedures have been implemented by the Cadastral Authority as follows

- Adjudication 1 300,000 hectares
- Land consolidation 400,000 hectares

There is however still an urgent need of Land Consolidation for at least 400,000 hectares, mainly forest land.

## **2. Techniques for realisation of Land Consolidation**

### **2.1 Promotion of the implementation of Land Consolidation**

#### **2.1.1 Organisation of the activities of the land agencies focusing on land reform**

In the County of Dalarna there are particularly unsatisfying conditions with small properties frequently consisting of several parcels. Furthermore the size, design and spatial location of the parcels are bad. Areas with fragmented property structure are often characterised by complicated ownership conditions. A fragmented property structure, combined with bad ownership conditions, makes it difficult – or even impossible – to run an efficient agriculture and forestry business and limits the possibilities for active farmers to get an acceptable income. In many cases the bad structure results in such high management costs that the interest for active use is weakened. Investments in buildings and land facilities are neglected. Arable land is used extensively which results in bad cultivation. Bushes and trees will enter on uncultivated land. Farmers who do not cultivate their arable land themselves are unfortunately reluctant to long term lease of land. The efforts from society to promote employment and subsistence in remote rural areas are therefore obstructed.

For forestry, unsatisfying structural conditions and high management costs will hinder the achievement of sustainable timber production. Fellings on the fragmented properties do not give sufficient surplus for the desirable investments in silviculture. As a consequence the level of forestry activity on these properties will be very low. In this way the quantity of timber kept back from forest industries has importance both in terms of business and national economics.

It is also documented that joint ownership generally results in lower felling activity and less qualified silviculture in forestry. The joint management by the shareholders is often unqualified and affects the capacity to make both short term and long term measures in agriculture and forestry. Ownership by estates causes similar problems and a decrease of joint ownership is strongly recommended.

To sum up there are strong commercial and social arguments to support measures to improve the situation in fragmented areas with

- adequate subsidies
- additional legislation
- taxation rules that stimulate the farmers to initiate land consolidation
- taxation rules that facilitate an increased supply of properties to the “Land Fund”

The regional authorities – the County Administration Board, the County Forestry Board and the Cadastral Authority - have the responsibility to investigate which measures should be implemented in different areas depending on the circumstances and prerequisites. In the County of Dalarna the authorities have established a **partnership** with the associations of farmers, forest owners and sawmills in order to prepare programmes for these measures from the principle of “*bottom up*”. This means that the main focus should be from the viewpoint of the participating farmers. The co-operation of all participants in the partnership is very valuable in the efforts to elaborate adequate solutions of the problems and to make the best choice of measures in order to achieve profitable business for agriculture and forestry. The proposed measures must however comply with environmental objectives and be seen to benefit society.

The possible measures may be divided into

- voluntary or gradual measures
- radical land consolidation including compulsory measures

The elaborated programme should be confirmed by the County Administration Board, the governing body. The final test of such programmes will be made at the presentation for the farmers in the different areas. The response and attitudes among the farmers will determine the possible progress of the proposed programme or if some changes might be necessary in order to satisfy the farmers.

### 2.1.2. Providing information

Land consolidation involves great changes for the participating proprietors regarding the management of their properties. And the provision of adequate information given as early as possible is therefore essential to avoid misunderstanding or even misleading rumours. Misunderstanding and lack of knowledge is frequent during the initial stage of a consolidation project. Correct information and good communication between participants and authorities is

of great importance also for the formation of public opinion. The information should be adjusted to the knowledge and attitudes within different concerned groups and be given in various ways by the authorities including giving advice to visiting owners of real estate, in study circles and information meetings. Brochures have been printed and used in the information work as well as frequent contacts with representatives from media.

Giving information to the politicians in municipalities, counties and parliament is also important, however. This information will provide general knowledge about issues like benefits to society, the importance of rural development, public opinion among the participants and their possible influence during the procedure.

Prior to Land Consolidation it is necessary to provide adequate information to all parties involved. Such information should show the influence of different factors on the profitability in agriculture and forestry. The influence of the various factors may be expressed as follows

<b>Factor</b>	<b>Effects</b>
Increased size of treatment areas	Reduced costs in agriculture and forestry
Reduced number of parcels – concentration of land	Reduced costs in agriculture and forestry
Wider parcels	Reduced costs in agriculture and forestry
Improved access to truck roads	Reduced costs in agriculture and forestry
Reduction of boundary length	Reduced maintenance costs
Joint ownership > “one-person ownership”	Prompter decisions, less conflicts
Accurate cadastral information	“Law and order”

*Information about the financing* of proposed projects and the availability of subsidies is one of the most important factors, influencing public opinion among farmers. In times of insufficient subsidies it is necessary to involve the central authorities, ministries etc to solve the financial problems. The participants are entitled to know the costs of the procedure before they can decide if the proposed project is interesting or not from economic and other aspects.

According to guidelines decided by the County Administration Board, the governing body, the fees for radical land consolidation should be paid with 50 % subsidies and 50 % by the participants. The portion paid by the participants shall always be distributed among the farmers concerned in relation to the benefit of the procedure for each one (equal to the increase of the value of each property less the cost for the same property owner)..

### 2.1.3. Opinion issues

Public opinion among farmers in an area, where Land Consolidation is proposed, is the key issue to failure or success of the consolidation procedure. A negative opinion will create a bad atmosphere and generate difficult negotiations thus resulting in delays and higher implementation costs. Relevant and correct information combined with good relations between authorities and participants is highly recommended. Local opinion moulders with personal experience from other already implemented projects will have great influence in the formation of the opinion in a particular project. Farmers often pay more attention to information given by other farmers than from authorities.

Public opinion must be investigated by the Cadastral Authority among the participants before the property formation decision may be made. The investigation should not be made until the participants have obtained sufficient information about the most important matters, i.e. the cost for the procedure and location of their new consolidated properties. If the investigation is made too early the participants will have insufficient knowledge and will be more negative due to anxiety, because they believe that their wishes and claims will not be met. The appropriate time for this investigation should therefore be chosen when the participants are well informed and able to foresee the consequences of the procedure clearly. If opinion against the proposed procedure is too strong – majority by number or by area, - then the procedure has to be cancelled but only if the opponents can justify his/her “no” with considerable arguments. If the opponents are in minority they cannot stop the procedure.

## **2.2 Methodology, decision making**

### **2.2.1 Methodology**

Successful large-scale Land Consolidation projects require both rational and cost effective procedures but justice is also important and must not be neglected. An appropriate methodology, project management and decision making during the procedure will achieve these objectives.

A well prepared methodology is necessary for a successful implementation of a consolidation project.. It is important to analyse the whole procedure step by step from the start until the end. Such a scheme will serve as a base for the working plan, budgeting and manning. In present consolidation projects the following methodology is applied

- Strategy of the project
- Information meetings with the owners
- Individual talks with the owners about their wishes and claims
- Photographic interpretation
- Field inventory
- Working out of a reallocation design
- Surveys of the ”new” boundaries
- Economic settlements (balances)
- Decision making

The various steps will be briefly explained below.

The *strategy of the project* will include discussions together with officials at the regional authorities to select the appropriate project area with regards to the degree of fragmentation of properties and the interest for structural improvements shown by the farmers.

All farmers in the selected area will then be invited to an *information meeting* in a village hall. Local Authority officials will briefly describe the proposed project, present statistics about the area concerned, provide information about the different steps in the procedure and describe the consequences of present fragmentation, possible costs and benefits, time schedule etc of the proposed project. The participants will also be informed about their possibilities to influence the procedure before decision making.

Signed *applications of the proposed consolidation procedure* are a prerequisite to initiate the procedure. The Real Property Formation Act does not prescribe a certain number of applications to start the procedure but as many applications as possible is recommended.

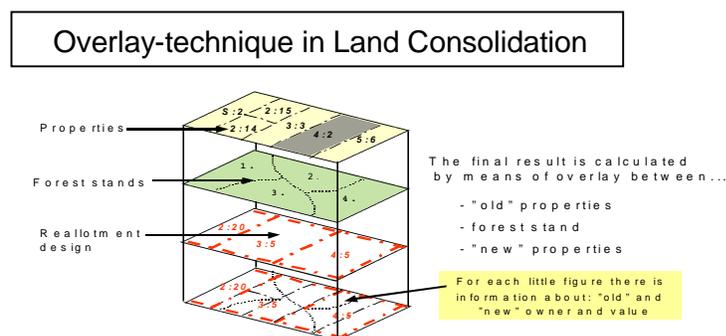
*Individual meetings* between participants and officials is the next step in the procedure. Each owner has the opportunity to express which measures he/she wishes to be taken regarding their properties/parcels. These meetings offer an excellent opportunity for a understanding of the possible measures available for the individual owner. Normally these talks will result in a fruitful dialogue and a more positive attitude regarding the proposed procedure. It is important to reach as many owners as possible in these talks to facilitate the working out of the reallocation-design (redistribution of properties).

*Photographic interpretation* of fresh aerial photographs is done with a stereoinstrument (Leica B8 or similar) and will include the delineation of boundaries between forest stands with different characteristics. The purpose is to achieve stands that are as homogenous as possible regarding volume per hectare, diameter, site class, species, age class, logging conditions etc. Certain important environmental areas will also be identified like wood habitats (valuable biotopes) and swampy areas. Most consolidation projects cover forest land and therefore *field inventory* is very important and time consuming. Its importance is due to the fact that forest land is normally regarded as highly valuable by the participants. In order to achieve confidence among the participants for the whole procedure an accurate valuation of each property/parcel is a prerequisite. An accurate and cost-efficient valuation method of forest land has been developed at the National Land Survey as follows

- Photographic interpretation
- Field inventory
- Control inventory (adjustments for bias)
- Inspection by the owners

A field inventory will be made for each forest stand and includes checking the boundaries and other data from the photographic interpretation. When the field inventory and control inventory is finished, a preliminary valuation will be made and serve as a base for the working out of the new redistributed properties.

The *working out of the reallocation design* is very important for the participating owners and for the Local authority “architects” as well. Since almost ten years ago the reallocation design has been computerised and managed with the help of PC:s by means of software from ESRI (ArcInfo, ArcView etc). In this process, data from the Real Property Register, forest stand map and valuation are combined by overlay-techniques which is shown in the picture below.



Hills, ridges, lakes, rivers/creeks, swamps and roads constitute the main frame work for the redistribution work. The redistribution is a delicate task because claims from many owners have to be considered simultaneously. Many individual meetings and negotiations between participants and the authority will occur at this stage of the procedure. Normally the first proposed design has to be revised two or more times until a high degree of acceptance among the participants has been achieved. Public opinion among the participants regarding the consolidation procedure is now investigated – to see if they accept or are against the procedure.

At this stage it is time to *survey the new boundaries*, including boundary marking in accordance with the definite reallocation design. When the field survey is finished the new coordinates for the boundary points will be calculated and entered into the Cadastral Index Map. A description of the real property will be worked out with information about property designation, number of parcels, area information, possible shares in joint properties, easements etc. When the Property formation order has got force of law, the description is then entered into the Real Property Register which is updated.

The procedure is now in the final stage, when *economic settlements* (balances) have to be calculated and vital *decisions* made. It is a prerequisite that the whole procedure including the decisions has to be in accordance with the Real Property Formation Act. The most important decisions are **property formation order (the new division into property units), compensation order, possession order, order of apportionment of the procedure costs and conclusion order**. These decisions will be made by the Cadastral surveyor and two trustees at a cadastral procedure meeting with the participants. Every participant will be summoned to the meeting. In cases of disagreement with the decisions every participant is entitled to appeal to a land court within four weeks from the date of the decision.

### 2.2.2. Project management

A cost-effective procedure requires a rational project management as follows:

- Planning, budgeting
- Leadership
- Data support
- Effective data capture
- Real Property Register

The headings mentioned under *project management* will contribute to ensure cost-efficiency. The budgeted cost for the procedure will serve as a target for all officials involved in the implementation of the project. Consolidation projects require an experienced surveyor as a good leader in charge of the project who is responsible to attaining the objectives – budgeted cost, time schedule, trustful dialogue with the participants and decisions in accordance with the Real Property Formation Act.

In consolidation projects a huge amount of data is used. Efficient *data support* is therefore a necessity. PC:s with sufficient speed, memory size etc and adequate software for data capture, calculations and analysis are required. GISOM is the important GIS-tool consisting of a cluster of different programs like AUTOKA-PC, ArcInfo, ArcView, AccessAjour, BMS-Win (valuation program) etc. GISOM has recently been developed at the Cadastral Authority and matches our demands of capacity and efficiency in the work with redistribution of properties,

analysis, calculations of values and economic settlements (balances), documentation etc. The over-lay technique, especially, - has been a great step forward. Such work done before GISOM was developed was much more time-consuming and neither was it possible to extract the same valuable information as with GISOM.

An *effective data capture* to the central data-bases is also very important. During the last five years the local Cadastral offices have obtained direct access to the Real Property Register which includes the Cadastral Index Map in digital form. This map includes an orthophoto, topography and cadastral boundaries. This has been a major step towards cost reduction.

The **Cadastral surveyor** leads and is responsible for the whole process from the application of a Cadastral procedure until the conclusion of the procedure. He, or she, co-ordinates information, process, decisions and investigates, evaluates and proposes solutions, negotiates and takes important decisions. The Cadastral surveyor's role in Sweden is unique – it is strong and involves great responsibility.

The **Cadastral Procedure** is a good way to solve matters of land and compensation. Both private and public interests, together with other aspects, can be examined and balanced against each other in one single procedure. The Cadastral procedure has also proved to be capable to serve as a democratic tool in order to achieve consensus and user participation. Appeals to the courts, for example, are rare, - even in such controversial matters as compensation. In Sweden our experience of this model is very good. It is a secure, simple, neutral and cost-efficient procedure. The Real Property Formation Act has also proved to be applicable in all kinds of Property Formation procedures- even in large-scale Land Consolidation.

### 3. Results of land consolidation

#### 3.1 Benefits to society

There are two important objectives related to Land Consolidation – land concentration and simple ownership conditions. If these objectives are fulfilled, then Land Consolidation will give considerable benefits of various kinds such as benefits for society, business economics and environment and the conditions of life and employment in rural areas will be improved. The main *benefits for society* are as follows

- Increased activities and employment in agriculture and forestry
- Increased possibilities to combine agriculture and forestry with other income-generating activities in rural areas, such as tourism, hunting, small-scale enterprises etc.
- Increased tax revenues
- Decreased costs for authorities in land management issues
- Higher quality in the Real Property Register (which includes the Cadastral Index Map in digital form)
- 

An official report from the government shows that the annual costs for regional authorities in the county of Dalarna exceeded those costs for neighbouring counties with 8 – 10 M SEK (1 SEK is approximately 0.1 USD). The improved silviculture and better management of the properties will contribute to a sustained increase of timber-production, an increased supply of sawlogs and pulpwood to the forest industries and also have a positive effect on employment as well.

More activities and employment will also increase the *tax revenues*. For the consolidation projects finished during 1994 – 1996 the increased tax revenues were estimated to approximately 125 M SEK which is approximately equivalent to the amount of subsidies given to these projects.

In conclusion, the above mentioned benefits to society provide strong arguments for supporting Land Consolidation financially with substantial subsidies from the government and EU.

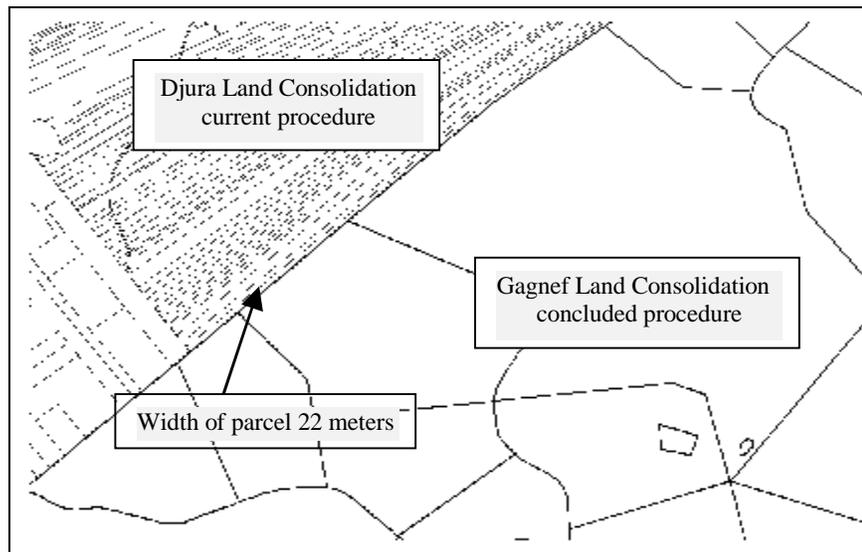
### 3.2 Commercial and economic benefits

The commercial and economic benefits are shown in the following summary:

- Larger cultivation areas ñ ñ increased stumpage, lower costs for silviculture
- 80 - 90 % reduction of boundary length ñ ñ decreased costs
- Clear and secure boundaries ñ ñ less disputes
- "Green" management plans for all forest owners
- More effective management ñ ñ prompter decisions
- Simple ownership conditions

Land concentration is one important objective for Land Consolidation and this is shown in the concluded Land Consolidation of Gagnef in picture below

#### CONTRASTS BETWEEN FRAGMENTED AND CONSOLIDATED AREAS



Fragmentation into properties combined with bad ownership conditions are real obstacles for a rational *management* in agriculture and forestry. The following table show the radical change in one of the greatest consolidation projects ever implemented in Dalarna from the viewpoint of some owners. The table shows very clearly how the large number of properties and parcels that existed before consolidation have radically been reduced with a simultaneous great improvement of the ownership situation.

Name	Property size	Structure before						Structure afterwards		
		Villages	Prop	Joint prop	Parcels	100 % ownership - parcels	Joint ownership parcels	Prop	Parcels	Joint prop
Mrs Meit	35	9	71	189	532	1	531	1	2	2
Mr Mats	28	2	52	47	204	2	202	1	3	2
Mr Lennart	115	3	11	92	220	21	199	1	2	1

The management situation before the consolidation did not make sense for a great majority of the participants in that area. After the consolidation the management conditions are excellent in this area for both agriculture and forestry and the owners of the properties can make prompt decisions if necessary. That was completely impossible before consolidation for most participants.

### 3.3 Benefits from the viewpoint of environment

. As land consolidation projects affect the landscape it is important to consider the environmental elements in order to protect these values. During the last five years the following aspects have been emphasised in Land Consolidation:

- Ecological working concepts for the countryside to promote income-generating activities that supports a sustainable environment.
- The securing of valuable natural- and cultural environments by the formation of joint properties
- Environmentally adapted reallocation plans
- "Green" forest management plans for all forest owners