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**CHAR DEVELOPMENT AND SETTLEMENT PROJECT-III**

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BANGLADESH

# Monitoring of results of selected interventions in CDSP-I and II areas: Land retention, agriculture and soil salinity

**Technical Report No. 3**

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# SUMMARY

*Household characteristics:* The average household size in the CDSP-I and II areas is 6.8, which is larger than the national average. The main reason of the big size is that only 60% of the households exist of a singe family, the remaining 40% is formed by extended or joint family groups. Of these households only 3 percent is female headed. More than 30% of the households depend on wage labour as the main source of income, also farming and business are important income sources at 20% each.

*Land retention:* Since the official land title receiving date (12-15 years ago) 14% of the settlers have left CDSP-I areas, for CDSP-II this period is 5 years and 8% of the settlers have left in that time. In the CDSP-I areas 20% of the households have sold part of their land, but they are still living in the area, in CDSP-II area this is 4%. On the other hand households have also been purchasing new land, partly outside the area. In CDSP-I this is 25% of the households and in CDSP-II 5%. In terms of land in CDSP-I areas 15% of the initially allotted land has been sold, and in CDSP-II areas 8%. In CDSP-I areas this is more than compensated by the purchase of new land: there is a net increase of almost 10% in the land holdings. In CDSP-II areas there is a net decrease of 6%.

*Agriculture:* Of all the households 72% can be considered as farm households. The land used by the farm households on average consists for 60% of own land, the rest is either share cropped in or mortgaged in. In CDSP-I polders the total aus coverage has increased gradually over the years, from 18% (HYV: 2%) of the area in 1996 to 48% (HYV: 14%) in 2007. In the same period aman coverage has always been more or less 100%, but the HYV coverage increased from 5% to 20%. The rabi coverage has fluctuated but stands at 66% in 2006, while in 1996 it was 50%. In CDSP-II areas the area under aus cultivation has increased from 0% of the total area in 2000 to 31% in 2007 (HYV from 0% to 6%). Also here the aman coverage has been around 100% for the entire monitoring period, but HYV increased from 0% to 20%. Rabi has increased from 9% in 2001 to 40% in 2006.
In the protected areas the soil salinity shows a slightly reducing trend over the monitoring period. In the unprotected areas there is not much decrease in salinity level, but also in these areas the salinity levels stay below 4 dS/m for most of the year.

# 1 INTRODUCTION AND METHODOLOGY

## 1.1 General

This is the Monitoring Survey Report 2007 on the Land Settlement Programme of CDSP-I, implemented in three old polders during the period of 1996 - 2000 and in CDSP-II areas implemented during 2001 - 2005. This is a routine survey carried out every year generally in the months of January and February. The survey collects data over the preceding year. The present survey is the fifth one of this kind. The first survey was carried out in 2000, which was a Census Survey; it covered all the land allotment beneficiaries (*Khatian* holders) of the Land Settlement Programme. The Census Survey covered the issues related to land possession. From the second year a sample survey was undertaken with a cohort of the samples.
The data in the chapters on agriculture and soil salinity are mostly based on monitoring data from the agricultural section of the TA Team.

## 1.2 Sample Design

The sample population for CDSP-I areas is a cohort that has been surveyed by all four previous sample surveys. The sample population selected for CDSP-II is a new set of samples and will be a cohort population for future sample surveys.

The first sample survey selected a total sample of 453 *Khatian* holders (households) from a total population of about 4458 *Khatian* holders, representing about 10% of total population (*Khatian* holders) of CDSP-I. A systematic random sampling procedure was followed for the sample selection. For CDSP-II areas a total of 78 households were selected as a sample from Mora Dona (MD), out of a total number of *Khatian* holders of 1067 in this area.

In CDSP I areas the survey 2007 interviewed only those sample households that were found residing inside the polders and in the villages nearby the polders. They constitute about 7.8% of the total population (*Khatian* holders) of CDSP-I areas.

## 1.3 Sample Size and Household Analysis

Out of 453 sample households selected in first Monitoring Survey in CDSP-I areas eventually a total of 374 households have been analyzed during the previous survey (Land Monitoring Survey 2005) because the remaining 78 households (17%) have either left the polders or were non-residential allotment holders living in distant areas.
During the present survey the total sample size was fixed at 452 households, 374 from CDSP-I areas as they were available during the Land Monitoring Survey 2005 and 78 in CDSP-II area. But during the present survey it turned out that in CDSP-I areas there were only 347 households available. The remaining 22 households have left the project areas after Land Monitoring Survey 2005 Survey and seven households are living in distant villages though the previous survey interviewed them yet the present survey has left them. In CDSP-II areas out of 78 sample households 66 households have been interviewed and left the remaining 12 (15%) households because they have either left the area or are living in distant villages.
Table-1.1 shows the distribution of the sample households by location. As said above only the households living inside the project area (polders and unprotected area) and close to the project area were interviewed. Out of 452 households 413 households were

interviewed. This means that 91.4% of the sample households in the survey 2007 were available for interview.

**Table-1.1**
**Distribution of the Sample Households by Location Status**

| Project Areas | Settlers Location Status | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Inside area | | Outside | | Left Area | | | |
| | No. | % | No. | % | No. | % | No. | % |
| CM | 85 | 90.4 | 1 | 1.1 | 8 | 8.5 | 94 | 100 |
| CBD-II | 78 | 98.7 | | | 1 | 1.3 | 79 | 100 |
| CBT | 184 | 91.5 | 4 | 2.0 | 13 | 6.5 | 201 | 100 |
| MD | 66 | 84.6 | 6 | 7.7 | 6 | 7.7 | 78 | 100 |
| Total | 413 | 91.4 | 11 | 2.4 | 28 | 6.2 | 452 | 100 |

Out of 413 available households 73 households (17.7%) belong to the CV category. This percentage is more or less similar to the distribution in the total households in the area, and as such the survey is representative for the whole population, see Table-1.2.

**Table-1.2**
**Comparison of CV Status of Total Population and Sample Population**

| Land size groups | Total population | | Sample population | |
|---|---|---|---|---|
| | CV | Non-CV | CV | Non-CV |
| | % | % | % | % |
| CM | 39.2 | 60.8 | 40.0 | 60.0 |
| CBD | 32.9 | 67.1 | 28.2 | 71.8 |
| CBT | 10.7 | 89.3 | 9.2 | 90.8 |

# 2 HOUSEHOLD CHARACTERISTICS

## 2.1 Characteristics of the Surveyed Households

In this section some characteristics of the surveyed households are presented. The household characteristics include clustered village (CV) status and the types of household head (female headed and male-headed), average household size, family types, main occupation and land-ownership size groups.

### *2.1.1 CV Status of the Surveyed Households*

Table-2.1 shows the distribution of the surveyed/interviewed households by CV status. Out of 413 available households 73 households (17.7%) belong to the CV category. If considered with respect to the total surveyed households of only CDSP-I areas (that is excluding MD) the interviewed CV sample stands at 21%.

**Table-2.1**
**Distribution of Surveyed Households by CV Status**

| Project Areas | CV Status | | | | Total | |
|---|---|---|---|---|---|---|
| | CV | | Non-CV | | | |
| | No. | % | No. | % | No. | % |
| CM | 34 | 40.0 | 51 | 60.0 | 85 | 100 |
| CBD | 22 | 28.2 | 56 | 71.8 | 78 | 100 |
| CBT | 17 | 9.2 | 167 | 90.8 | 184 | 100 |
| MD | | | 66 | 100.0 | 66 | 100 |
| Total | 73 | 17.7 | 340 | 82.3 | 413 | 100 |

### *2.1.2 Sex of Household Heads*

In Table-2.2 it can be seen that at present only 3 percent of the total surveyed households are female-headed households, though the female-headed households made up 22% of the original households who got an official land title. During settlement time most of the then female-headed households did not have eligible male members (sons) for getting land allotment and were widows. In some cases widows were used as instruments for getting land title over the surplus land of the households. Now, the widows of the first categories have adult male members to be household heads.

**Table-2.2**
**Distribution of the Surveyed Households by the Present Household Head Types**

| Project Areas | Sex | | | | Total | |
|---|---|---|---|---|---|---|
| | Male | | Female | | | |
| | No. | % | No. | % | No. | % |
| CM | 81 | 95.3 | 4 | 4.7 | 85 | 100 |
| CBD-II | 77 | 98.7 | 1 | 1.3 | 78 | 100 |
| CBT | 178 | 96.7 | 6 | 3.3 | 184 | 100 |
| MD | 65 | 98.5 | 1 | 1.5 | 66 | 100 |
| Total | 401 | 97.1 | 12 | 2.9 | 413 | 100 |

### *2.1.3 Household Size*

Table-2.3 shows the average household size in different project areas. The average household size is 6.8, which is higher than the national average. The average household size is highest in CBT with 7.1 and lowest in CM (6.3).

The high average household size is justified by the existence of more extended and joint families (see Table-2.4). About 59 percent of the households are of single-family type. The remaining 40 percent are either in extended or joint family groups. The existence of the nuclear households seems very low compared with the national figure.

**Table-2.3**
**Average Household Size per Polder**

| Project Areas | Member types | | |
|---|---|---|---|
| | Total | Male | Female |
| CM | 6.3 | 3.2 | 3.1 |
| CBD-II | 6.7 | 3.3 | 3.3 |
| CBT | 7.1 | 3.5 | 3.6 |
| MD | 7.0 | 3.4 | 3.6 |
| Total | 6.8 | 3.4 | 3.4 |

**Table-2.4**
**Distribution of the Sample Households by Family Types**

| Project Areas | Types of family | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Single | | Extended | | Joint | | | |
| | No. | % | No. | % | No. | % | No. | % |
| CM | 48 | 57.8 | 26 | 31.3 | 9 | 10.8 | 83 | 100 |
| CBD-II | 43 | 55.1 | 15 | 19.2 | 20 | 25.6 | 78 | 100 |
| CBT | 109 | 61.6 | 45 | 25.4 | 23 | 13.0 | 177 | 100 |
| MD | 38 | 57.6 | 17 | 25.8 | 11 | 16.7 | 66 | 100 |
| Total | 238 | 58.9 | 103 | 25.5 | 63 | 15.6 | 404 | 100 |

### *2.1.4 Occupation Pattern of the Sample Households*

Table-2.5 shows the distribution of the household heads by main occupation per project area. It appears that 24 percent of the households are dependent on agriculture and more than 30 percent are dependant on wage labour that includes both agricultural wage and non-agricultural wage like earth cutting and works in brickfield. Wage labour is very low (19%) in CBD-II compared with other areas.

**Table-2.5**
**Distribution of the Sample Households by Main Occupation Pattern**

| Occupation types | Project Areas (%) | | | | Total (%) |
|---|---|---|---|---|---|
| | CM | CBD-II | CBT | MD | |
| | N=85 | N=78 | N=184 | N=66 | N=413 |
| Farming | 23.0 | 20.5 | 21.2 | 12.1 | 20.1 |
| Sharecroppers | 1.2 | 9.0 | 2.7 | 4.5 | 3.9 |
| Wage labour | 35.3 | 19.2 | 30.4 | 37.9 | 30.5 |
| Business | 8.2 | 11.5 | 27.7 | 16.7 | 18.9 |
| Transport workers | 7.1 | 5.1 | 3.8 | 4.5 | 4.8 |
| Fishermen | 4.7 | 6.4 | 0.5 | 3.0 | 2.9 |
| Teacher/Service Holder | 7.1 | 0.0 | 3.3 | 10.6 | 4.6 |
| Others | 12.9 | 28.2 | 10.3 | 10.6 | 14.3 |
| Total | 100 | 100 | 100 | 100 | 100 |

## 2.2 Landownership Size

Table-2.6 compares the distribution of land ownership size as it was at the time of land allotment, during the 2005 survey and during the present survey.
The table shows that there were originally no landless households in any of the areas. In the 2005 survey all CDSP-I areas did have a group of households in this category, most notably in CM were almost 22% of the households was landless at that time. For all areas the size of this group had increased again in the time to the 2007 survey, only in CBD-II the landless group is still quite small (about 8%). The difference in original distribution of land between the CDSP-I areas and MD is partly due to the fact that the maximum land ceiling for allotment was 2.00 acres during CDSP-I but during CDSP-II this was reduced to 1.50 acres. Moreover, settlers in CBT settled in the char occupying more land compared to other polders of CDSP-I.

**Table-2.6**
**Distribution of Surveyed Households by Landownership Size in Different Years**

| Land ownership size (acres) | Project Areas (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CM | | | CBD-II | | | CBT | | | MD | | |
| | Original | 2005 | 2007 | Original | 2005 | 2007 | Original | 2005 | 2007 | Original | 2005 | 2007 |
| Landless | 0.0 | 21.9 | 31.8 | 0.0 | 7.5 | 7.7 | 0.0 | 11.9 | 18.5 | 0.0 | n.a | 19.7 |
| 0.01-0.50 | 22.4 | 8.3 | 7.1 | 15.4 | 20.0 | 19.2 | 6.5 | 11.4 | 13.6 | 51.5 | n.a | 39.4 |
| 0.51-1.00 | 28.2 | 14.6 | 11.8 | 16.7 | 15.0 | 20.5 | 17.9 | 24.4 | 18.5 | 25.8 | n.a | 22.7 |
| 1.01-1.50 | 25.9 | 13.5 | 10.6 | 24.4 | 21.3 | 25.6 | 28.3 | 21.4 | 21.2 | 19.7 | n.a | 9.1 |
| 1.51-2.00 | 22.4 | 12.5 | 15.3 | 42.3 | 20.0 | 19.2 | 32.1 | 14.4 | 13.0 | 1.5 | n.a | 4.5 |
| 2.00+ | 1.2 | 29.2 | 23.5 | 1.3 | 16.3 | 7.7 | 15.2 | 16.4 | 15.2 | 1.5 | n.a | 4.5 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | n.a | 100 |

n.a. = Not available

In CM originally the population was evenly distributed over the four ownership size groups between 0 and 2 acres in the table, each contributing about 25%. However over the years the distributions seems to have spread to the extremes, both the landless and the more than 2 acres groups have grown considerably (to about 32% and 24% respectively) while the sizes of all the other groups have decreased.

In CBD-II most of the households got more than 1 acre at the time of land allotment (68%). During the 2007 survey this group still consisted of about 52% of the population. Mainly it is seen that the size of the group that was originally holding between 1.5 and 2 acres of land has halved (from 42% to 19%), while the size of all the other groups has increased. During the last survey the four groups between 0 and 2 acres each consisted of about 20% of the population, the landless and the more than 2 acres group both make up about 8%. The percentage of people with less than 1 acre (below subsistence level) increased, but at the same time the percentage of people with between 1.5 and 2 acres decreased. These numbers suggest that the average landholding size of the group owning more than 2 acres actually increased over the years.

In CBT the majority of the households originally received more than 1 acre (75.5%). Over the years the distribution of the population over the six landholding size groups spread out evenly. The percentage of households owning more than 2 acres did not change, but the group of households owning between 1.5 and 2 acres decreased considerably. Since the percentage of households with less than 0.5 acres of land shows a big increase this can only be explained by an increase of the average landholding size of the group of people owning more than 2 acres.

Contrary to in the CDSP-I areas most of the households in MD originally received less than 1 acre (77.3%). In the last survey even 82% of the households was in the group with less than 1 acre of landholdings. This increase of people with only a small amount of land is explained by the increase of the percentage of households that hold more than 1.5 acres (from 3% to 9%).

# 3 LAND RETENTION

## 3.1 Introduction

It was very likely that both land purchase and sale would take place in a dynamic rural economy. It has been observed that many setters are selling land for different purposes like consumption, dowry and also for productive investment. On the other hand, a good number of the settlers have been observed to acquire new land from different sources including purchase of land and occupying new *khas* land in new chars.

## 3.2 Land Retention: Inter-survey Period

Enumeration of land retention from the beginning of the settlement (since CDSP-I) has become complex and difficult because information about settlers who have left the area is not available. An attempt has been made to calculate the retention of land between the inter-survey period for CDSP-I and from the settlement to the survey date in CDSP-II.

The previous survey was conducted in January 2005 collecting data for the preceding year (2004) and the present one has been conducted in February 2007 collecting data for 2006 in the CDSP-I area. No survey was done previously in CDSP-II area. During the inter-survey period (a period of two years) and since the land title receiving date in MD it has been found that 6.2% of the settlers have left the polders after selling their land. The remaining 93.8% settlers are still living in the areas (ref: Table-3.1).

**Table-3.1**
**Retention Rate of the Settlers during the Inter-survey Period**

| Project Areas | Settlers retention status | | | | Total | |
|---|---|---|---|---|---|---|
| | In the locality | | Left the area | | | |
| | No. | % | No. | % | No. | % |
| CM | 86 | 91.5 | 8 | 8.5 | 94 | 100 |
| CBD-II | 78 | 98.7 | 1 | 1.3 | 79 | 100 |
| CBT | 188 | 93.5 | 13 | 6.5 | 201 | 100 |
| MD | 72 | 92.3 | 6 | 7.7 | 78 | 100 |
| Total | 414 | 93.8 | 28 | 6.2 | 452 | 100 |

For CDSP-II area retention rate has been calculated from the official land title receiving date.

## 3.3 Retention Since the Date of Land Allotment

Though it has been said in section-3.2 that the enumeration of land retention has become difficult and complex after a long period of more than a decade for the CDSP-I areas, yet in this section an attempt has been made in this regard to get an estimated idea on land retention. In the next round ($5^{th}$ round) the survey design would include the long-term retention issues.

The survey investigated into the land retention status of the settlers over a long period starting from the date of receiving official land title (*khatian*) to the interview date (January 2007). It is approximately a 12-15 years period for CDSP-I and 5 years for CDSP-II. It should be noted that most of settlers already occupied most of the allotted land before receiving the official land title. It should not be assumed that the land loss and land gain is a matter of starting from the land title-receiving day. The findings are presented in Table-3.2 and Table-3.3.

It appears from the Table-3.2 that about 14 percent of the settlers of CDSP-I have left the polders selling their land; another 20 percent have sold their land partially but are still living in the area. The rate of leaving the project area is very high in CM, where about 19 percent of the settlers have left the polder, followed by CBT where 14 percent of the settlers have left the polder after selling their land. Nangulia, being close to CM and CBT, attracts the settlers to buy the occupation of new *khas* land with an expectation that in future they will get land title officially. On the other hand more than 25 percent of the settlers who are still living in the polders have bought new land after receiving the land title.

In MD of CDSP-II area about 8 percent of the settlers have left the polder after selling land and about 4 percent have sold their land partially. This means that in CDSP-II area about 12 percent of the settlers have sold land either all or partially.

**Table-3.2**
**Retention Rate of the Settlers Since Official Land Title Receiving Date**

| Items | CDSP I areas (%) | | | | MD (%) |
|---|---|---|---|---|---|
| | CM | CBD-II | CBT | Total | |
| % of hh left polder after selling land | 18.6 | 4.8 | 14.3 | 13.7 | 7.7 |
| % hh sold partial land & living in areas | 20.3 | 18.1 | 20.6 | 20.1 | 3.8 |
| **% hh of land sale of either types** | **38.9** | **22.9** | **34.9** | **33.8** | **11.5** |
| % of hh purchased new land | 24.6 | 32.5 | 23.4 | 25.4 | 5.1 |
| N= | 118 | 83 | 252 | 453 | 78 |

Table-3.3 presents the findings on land retention in terms of land. The total amount of land lost by the settlers who have left the polder selling all their allotted land comprises 4 percent of the total allotted land in CDSP-I areas. The amount of land lost by the local settlers (who are living in the locality and have sold land partially) comprises about 11 percent of the total allotted land in CDSP-I. This means that a total of about 15 percent of the allotted land has been lost in CDSP-I areas, the remaining 85% of the allotted land is still with the original settlers.

Most of the land loss has taken place in CM followed by CBT, the reasons of which have been stated earlier (closeness to Nangulia). It has been observed that many settlers have sold a small piece of allotted land in polder areas to buy a big piece of land in a new char, since the value of the old land is much higher than that of the new char.

In CDSP-II areas the land sell is 8 percent; 7 percent by the settlers who left the area and 1 percent by the local settlers. The original settlers retain about 92 percent of the allotted land.

As showed in Table-3.3 many settlers bought land after receiving a land title. In the sample group the land holdings have increased with 24 percent from the allotted land in CDSP-I areas, especially it is very high in CM (50%). The net increase in the sample group (allotted land-sold land+purchased land) is more than 9% and in CM it is about 29 percent.

**Table-3.3**
**Land Retention Since the Official Land Receiving Date**

| Items | CDSP I areas | | | | MD |
|---|---|---|---|---|---|
| | CM | CBD-II | CBT | Total | |
| % Land of the settlers left polder selling land | 8.1 | 0.3 | 4.0 | 4.1 | 7.1 |
| % Land sold by the local settlers | 13.3 | 5.9 | 11.6 | 10.8 | 1.0 |
| Total land lost | **21.4** | **6.1** | **15.6** | **14.8** | **8.1** |
| % of allotted land remain with settlers | 78.6 | 93.9 | 84.4 | 85.2 | 91.9 |
| % of absolute land increase** | 50.0 | 10.7 | 20.3 | 24.1 | 2.4 |
| % of net land increase** | 28.7 | 4.6 | 4.7 | 9.3 | -5.7 |

Note: All the land of the settlers, who have been selected as the sample, has been taken into consideration for calculating the percentage. The land of the non-interviewed settlers has been taken as retention by the respective settlers. In case of CDSP-II areas the previous survey was not done.

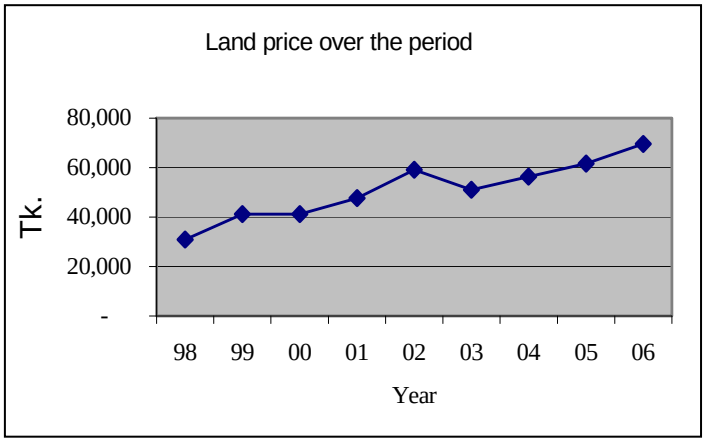
**Percentage has been calculated taking the total land allotted as denominator.

### 3.4 Land Value Over-time

Table-3.4 shows the average land value of the land allotted through CDSP over the period. It appears that the land price was Tk.31000 per acre or in other words Tk.76350 per hectare in 1997 and in 2006 it has risen to Tk. 69600 per acre or Tk. 171900 per hectare which means that the land value has become more than double over this period

**Table-3.4**
**Average Price of the Settled Land Over-time**

| Year | Value (Taka) per | |
|---|---|---|
| | Acre | Hectare |
| 1998 | 30909 | 76345 |
| 1999 | 41135 | 101603 |
| 2000 | 41105 | 101530 |
| 2001 | 47657 | 117714 |
| 2002 | 59131 | 146054 |
| 2003 | 50968 | 125890 |
| 2004 | 56393 | 139292 |
| 2005 | 61684 | 152358 |
| 2006 | 69603 | 171920 |



# 4 LAND OPERATION

## 4.1 Land Operation

All the agricultural landowning households have been divided into two categories: non-operating landowners and operating landowners. The non-operating landowners are those who lease out (either share crop out or mortgage out or both) their total landholding. The operating landowners are those who operate either all their land or part of their own land under their own management.

Table-4.1 shows the distribution of the agricultural landowning households by operating status. It shows that out of 333 agricultural land owning households 57 households are non-operating land owners and they comprise about 17 percent of the total agricultural landowning households. About 65 percent of all the landowners are full operating landowners and the remaining are partial operating landowners. The full operating percentage is highest in CDSP-II with about 74%, which means they have hardly leased out (share crop and/or mortgage out) their land.

**Table-4.1**
**Distribution of the Landowning Households by Land Operating Status**

| Project areas | Land owners categories | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Non-operating | | Partial operating | | Full operating | | | |
| | No. | % | No. | % | No. | % | No. | % |
| CM | 7 | 12.1 | 12 | 20.7 | 39 | 67.2 | 58 | 100 |
| CBD-II | 14 | 19.4 | 18 | 25.0 | 40 | 55.6 | 72 | 100 |
| CBT | 27 | 18.0 | 24 | 16.0 | 99 | 66.0 | 150 | 100 |
| MD | 9 | 17.0 | 5 | 9.4 | 39 | 73.6 | 53 | 100 |
| Total | 57 | 17.1 | 59 | 17.7 | 217 | 65.2 | 333 | 100 |

Table-4.2 shows a comparison of the tenure pattern of the own agricultural land between Land Monitoring Survey 2005 and Land Monitoring Survey 2007. The comparison is applicable for CDSP-I areas not for MD of CDSP-II area where previous survey was not done.

**Table-4.2**
**Distribution of Own Agricultural Land by tenure Types**

| Land under | Project Areas (%) | | | | | | | | Total (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CM | | CBD-II | | CBT | | MD | | | |
| | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 |
| Own cultivation | 79.3 | 74.0 | 71.5 | 68.1 | 68.8 | 67.8 | n.a. | 64.0 | 72.2 | 64.0 |
| Share crop out | 9.4 | 10.4 | 11.6 | 17.7 | 13.8 | 17.8 | n.a. | 16.6 | 12.2 | 16.6 |
| Mortgaged out | 10.4 | 15.6 | 16.9 | 14.2 | 17.4 | 14.5 | n.a. | 19.4 | 15.4 | 19.4 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | n.a. | 100 | 100 | 100 |

## 4.2 Farm Operation

### *4.2.1 Farm Status*

Table-4.3 shows the distribution of households by farm status. About 28 percent of the total surveyed households are non-farm households and 72 percent of the total households

are farm households. CBD-II has relatively more farm households (81%) than the other polders, while CM has less farm households with 65 percent. It should be noted that households without any agricultural land might be a farm households through leasing in land.

**Table-4.3**
**Distribution of Households by Farm Status**

| Project Areas | Farm status | | | | Total | |
|---|---|---|---|---|---|---|
| | Non-farm household | | Farm household | | | |
| | No. | % | No. | % | No. | % |
| CM | 30 | 35.3 | 55 | 64.7 | 85 | 100 |
| CBD-II | 15 | 19.2 | 63 | 80.8 | 78 | 100 |
| CBT | 50 | 27.2 | 134 | 72.8 | 184 | 100 |
| MD | 19 | 28.8 | 47 | 71.2 | 66 | 100 |
| Total | 114 | 27.6 | 299 | 72.4 | 413 | 100 |

### *4.2.2 Farmland by Tenure Pattern*

A farm has three sources of land; own land, share cropped in and mortgage in land. The farmland has been divided into three tenure categories accordingly. Table-4.4 shows the distribution of the farmland by tenure pattern in 2005 and 2007. In CM share cropped in land has decreased from 36% to 23% while in CBD-II it has increased from 21% to 31%, in CBT it has remained by and large the same.

**Table-4.4**
**Distribution of Farmland by Tenure Pattern**

| Land under | Project Areas (%) | | | | | | | | Total (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CM | | CBD-II | | CBT | | MD | | | |
| | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 | 2005 | 2007 |
| Own cultivation | 61.1 | 73.8 | 70.1 | 61.8 | 55.0 | 59.1 | n.a | 44.4 | 59.4 | 60.8 |
| Share crop in | 35.5 | 23.3 | 21.1 | 30.8 | 38.3 | 37.1 | n.a. | 47.7 | 34.5 | 34.5 |
| Mortgaged in | 3.5 | 4.7 | 10.0 | 8.3 | 6.7 | 5.1 | n.a. | 11.4 | 6.3 | 6.2 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | n.a | 100 | 100 | 100 |

### *4.2.3 Farm Size Distribution*

Table-4.5 shows the distribution of farm households by farm size. It appears that 1.51-2.50 farm size group constitutes about 21 percent of the total surveyed farms in the study areas. The next farm size group is the 2.51-5.00 acres group with 17% of the total farms. The three lower farm groups altogether constitute about 56 percent of the total farms. In 2005 the lower three farm categories constituted 48%, the largest farm group (5.01 and above) 8% (Report on Land Monitoring Survey 2005; Technical Report No. 20, CDSP-II).

**Table-4.5**
**Distribution of the Farms by Farm Size**

| Farm size (in acres) | CM | | CBD-II | | CBT | | MD | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| 0.01-0.50 | 9 | 16.4 | 17 | 27.0 | 14 | 29.8 | 18 | 13.4 | 58 | 19.4 |
| 0.51-1.00 | 9 | 16.4 | 12 | 19.0 | 13 | 27.7 | 22 | 16.4 | 56 | 18.7 |
| 1.01-1.50 | 5 | 9.1 | 11 | 17.5 | 8 | 17.0 | 28 | 20.9 | 52 | 17.4 |
| 1.51-2.50 | 13 | 23.6 | 16 | 25.4 | 4 | 8.5 | 30 | 22.4 | 63 | 21.1 |
| 2.51-5.00 | 16 | 29.1 | 5 | 7.9 | 7 | 14.9 | 22 | 16.4 | 50 | 16.7 |
| 5.01 & + | 3 | 5.5 | 2 | 3.2 | 1 | 2.1 | 14 | 10.4 | 20 | 6.7 |
| Total | 55 | 100 | 63 | 100.0 | 47 | 100.0 | 134 | 100.0 | 299 | 100.0 |

## 4.3 Farmland Inside and Outside Project Area

The farmland has been divided into two groups: the first group refers to the land inside the project and the second group refers to the land outside the project area (which is mostly illegally occupied land). Inside the project area, except MD, embankments protect the land. In case of MD inside means the area where CDSP-II worked, particularly where CDSP settled land among the landless.

Table-4.6 shows the average land farm by land location. Location wise farm size shows that CBT has the biggest farms with 1.84 acres (0.745 ha) and CM has lowest farm size with 1.13 acres (0.457 ha) inside the project areas. On the other hand CM has the biggest farms outside the project with 0.99 acres (0.401 ha) followed by CBT with 0.47 acres (0.190 ha).

**Table-4.6**
**Average Farmland inside and outside Project Areas in Acres**

| Project Areas | N | Location of farm land | | Total |
|---|---|---|---|---|
| | | Inside | Outside | |
| CM | 55 | 1.13 | 0.99 | 2.12 |
| CBD-II | 63 | 1.27 | 0.15 | 1.43 |
| CBT | 134 | 1.84 | 0.47 | 2.31 |
| MD | 47 | 1.21 | 0.17 | 1.37 |
| Total | 299 | 1.50 | 0.45 | 1.94 |

It should be noted that some settlers in CM have land in old areas and that some of the settlers have occupied land in a new char, Nangulia, close to CM. In case of CBT some settlers have also occupied land in new char close to it. Moreover, the settlers share crop in land from outside the project areas as well.

# 5 Agriculture

## 5.1 Introduction

The data used in this chapter has been collected by the agricultural section of the CDSP TA team during their field surveys. They have collected the data since 1996, although there have been years that no data was collected.

## 5.2 Changing Cropping Intensity: Inside the Project Area

### *5.2.1 CDSP-I areas*

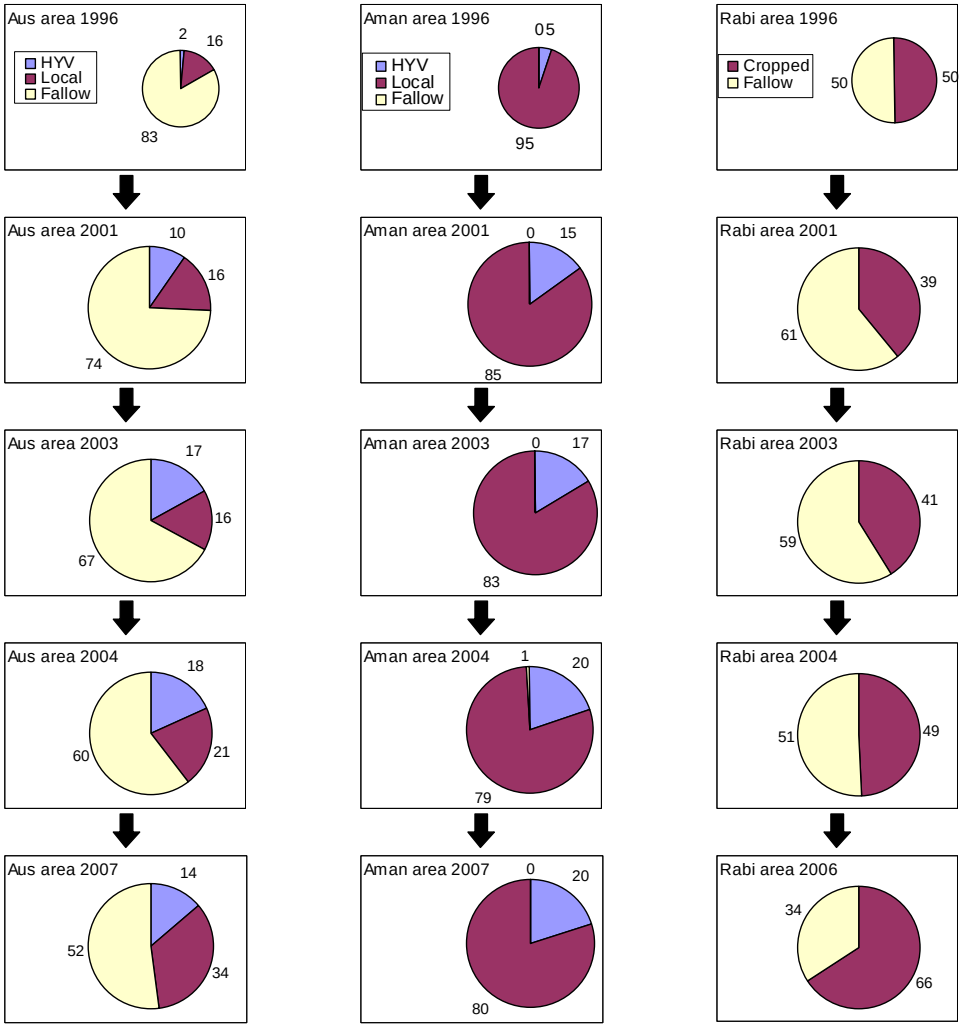



*Figure 5.1. This figure shows the change in the average crop coverage (in % of the total area) for the three monitored areas (CM, CBT, CBD-II) in five different years.*

Figure 5.1 shows that the area under aus coverage has been increasing gradually since 1996. The increase is both caused by HYV aus (which went from 2% to 14%) and by the local variety (from 16% to 34%).
In all the monitored years more or less the entire area was under cover of Aman. From 1996 to 2001 the use of HYV shows a significant increase, after 2001 there has only been a slight further increase.

After 1996 the area used for rabi first showed a decline, but after 2001 it increased, in 2004 it was almost on 1996 level again and in 2006 the rabi coverage was the highest yet at 66%.

### *5.2.2 CDSP-II areas*

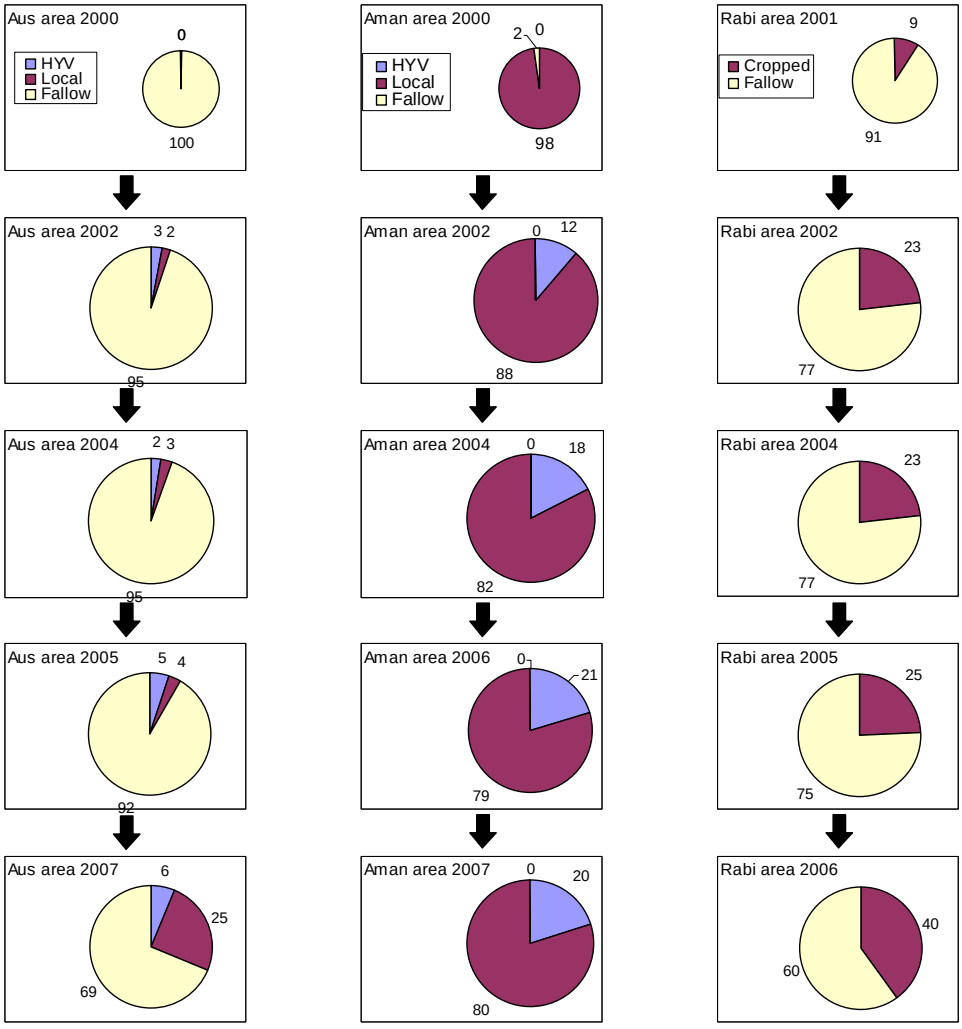
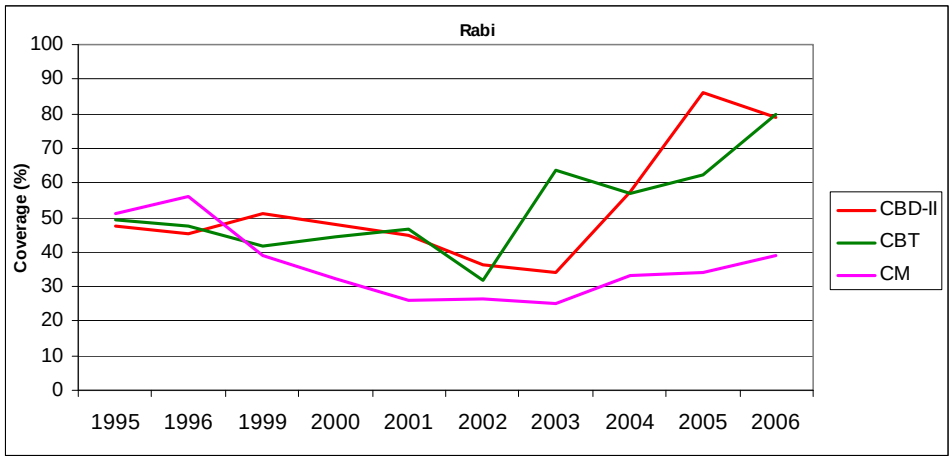


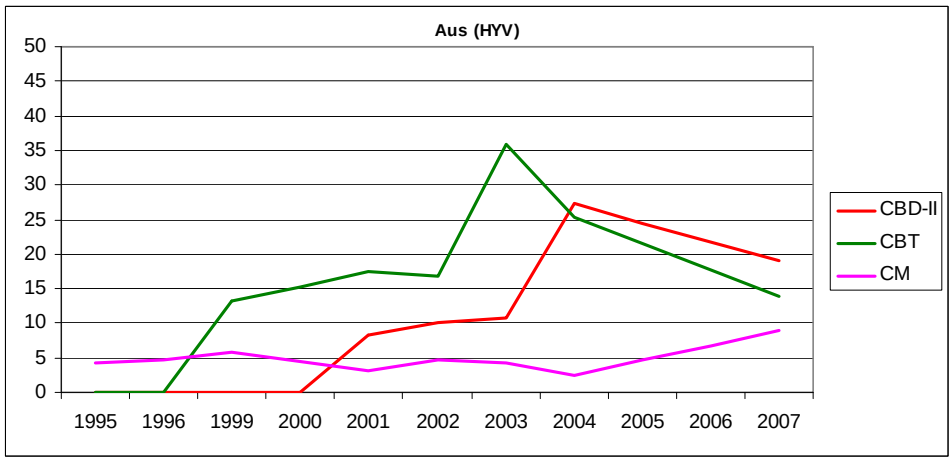

*Figure 5.2. This figure shows the change in the average crop coverage (in % of the total area) for the four monitored areas (MD, CL, GT, SH) in five different years.*

Of the CDSP-II areas only South Hatiya is protected at present, the other areas have no embankment. In figure 5.2 the total cropping data is presented, both local variety and HYV, as an average of all areas per cropping period. It can be seen that the aus coverage of the total area hardly changed from 2000 till 2005, but that 2007 shows a sudden increase. Monitoring in the following years will have to show if this increase will continue, or that 2007 was an exceptional year.
Aman on the other hand has coverage of more or less 100% for the entire area throughout the monitoring period. From 2000 to 2004 there has been a significant increase in HYV aman (from 0% to 18%), but in the years after that the use of HYV stabilized.
Rabi coverage showed a big increase from 2001 to 2002 (from 9% to 23%), stayed constant after that to 2005 and suddenly increased again in 2006 (to 40%). As with aus, future monitoring will have to show if the coverage of 2006 will be maintained in the following years or not.

## 5.3 HYV Coverage: Inside Project Areas

### *5.3.1 CDSP-I areas*



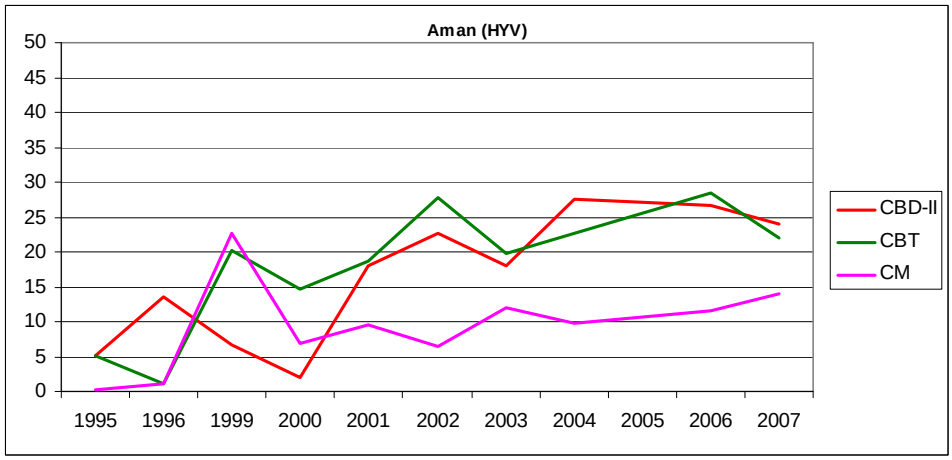




*Figure 5.3. The graphs show the HYV coverage in the three cropping seasons for the CDSP-I polders, from 1995 till 2007.*

In figure 5.3 the coverage of HYV crops as percentage of the entire area in the different seasons is shown for the CDSP-I areas.
It can be seen that the rabi coverage has especially increased in CBD-II and CBT, in CM on the other hand it decreased.

Initially HYV aus and aman showed some increase after introduction, but in all areas the HYV coverage has stabilized or even decreased after that. In CM the HYV aus coverage is very small, while in CBD-II and CBT it is somewhat higher. The most recent monitoring data shows that in all three areas the coverage of local variety was higher than of HYV.
Some of the differences between the polders can be explained by the date of their completion. CBD-II has been completed in 1991 already, while CBT was closed around 1996 and the sluice of CM has only been completed in 1998.

### *5.3.2 CDSP-II areas*

As can be seen in figure 5.4 the coverage of rabi differs greatly between the CDSP-II areas. SH shows the highest increase, from 22% in 2000 to 81% in 2006. Also MD has seen an increase in rabi coverage, though not as much as in SH (it went from 18% to 47%). In GT the coverage varies a lot from year to year. In 2006 the coverage was higher than in 2002, but because of the earlier fluctuations and the short monitoring period it cannot be said if this is a trend or an exception. In CL the coverage is low throughout the monitoring period, and so far there is no sign of it increasing.
Aus coverage in all areas except for SH has been very limited during the monitoring period, and the HYV use is hardly increasing in the three unprotected areas.
For all areas there has been an increase in the use of HYV aman since the beginning of CDSP-II, but only in SH the rise continued in the recent years. Especially in MD and SH HYV forms a significant part of the total aman coverage (around 30%), while in CL and GT it is limited to around 10% only.

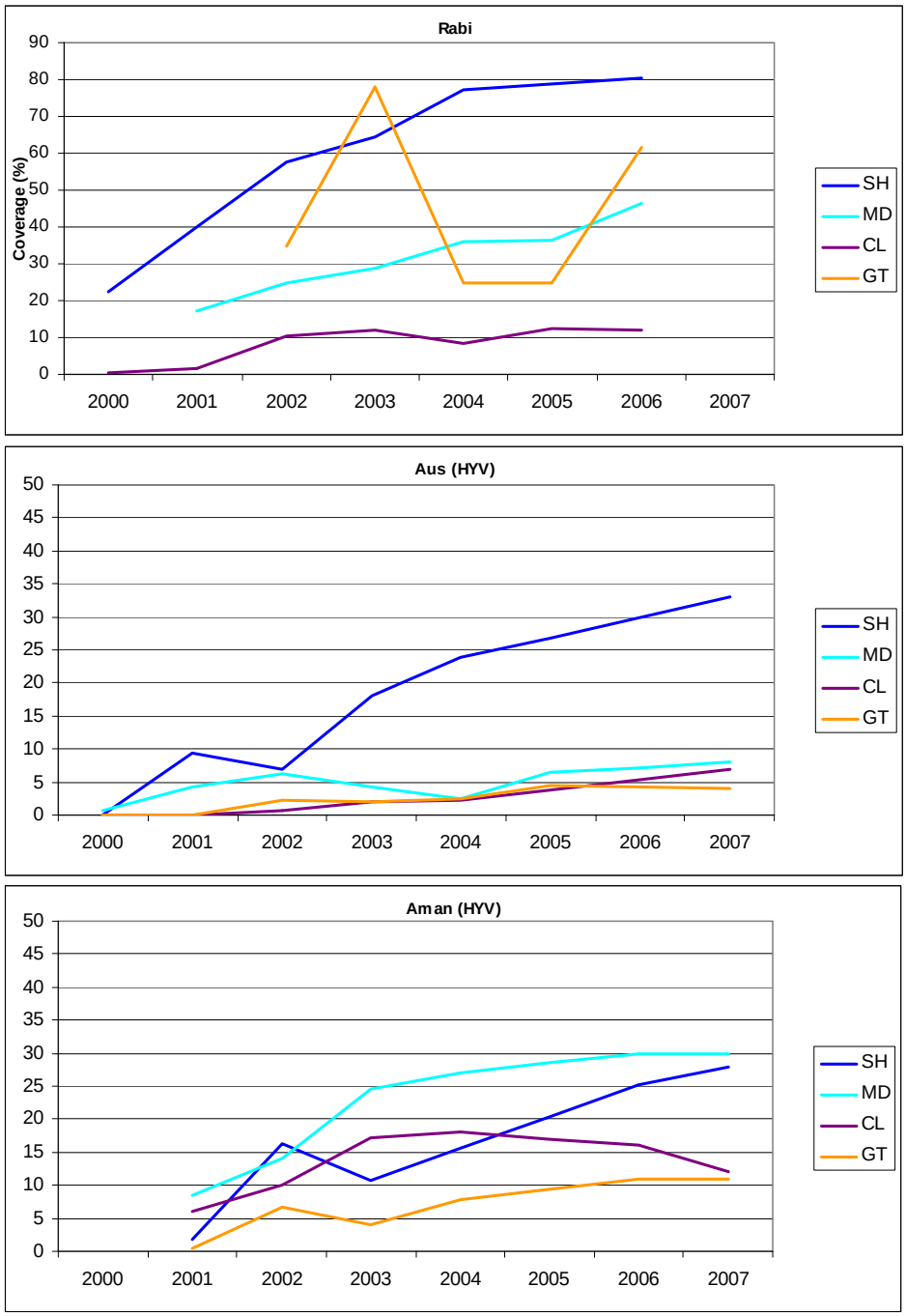



*Figure 5.4. The graphs show the HYV coverage in the three cropping seasons for the CDSP-II polders, from 1995 till 2007.*

### *5.3.3 Conclusion on HYV coverage*

The use of HYV of both aus and aman in CDSP-I and –II areas only increased in the first years after introduction. After that the use of HYV stabilized, and especially in the aman season stayed considerably lower than the coverage of local variety. In the aus season the difference between HYV and local variety is much smaller, in most years the coverage of both varieties is similar. In this season though most of the lands still lie fallow in all areas, but especially in CDSP-I areas this is decreasing. The coverage of rabi seems to increase slowly in all areas over the years, especially 2006 shows a big increase compared to preceding years.

In the CDSP-II areas the influence of the embankment can be seen, as especially during rabi and aus (HYV) coverage of the only protected area (South Hatiya) is much higher than that of the other areas.

# 6 Soil Salinity

## 6.1 Introduction

In this section the development of the soil salinity levels in CDSP-I and –II areas over the years is discussed. In each polder the salinity has been measured at three different locations and per location at two different levels (0-10 cm and at 10-30 cm). The three locations per polder represent high, medium and low saline soils – based on data from the time the measurements were started. Selected were plots with a high salinity level at that time, one with medium salinity level and one with low salinity level. After that the measurements have always been taken in these same plots. This means that those names represent the (fixed) locations of the measurements, and not necessarily the highest, lowest or middle value in later years.
Up to 2004 six salinity measurements per year were taken, after that (during CDSP-III) the number was reduced to only once or twice per year.
In the following sections overviews of the monitoring results per polder are given, for the measurements in the topsoil (0-10 cm).

Per area the development of the salinity levels for a certain month over the monitoring period was analyzed. For instance for one polder the measured values for February in the different years were compared and analyzed.
The reason for this approach is that during a year the values show a big variation, mainly because of the influence of the monsoon and the dry period. During the monsoon the saline groundwater is pushed down and the values will be lower, during the dry period the saline groundwater rises and the salinity will typically be higher. This makes it impossible to compare the value of the soil salinity in February of one year with the value in August in another year and say something about the long-term trend in soil salinity.

## 6.2 Introduction to soil salinity graphs of CDSP-I and II areas

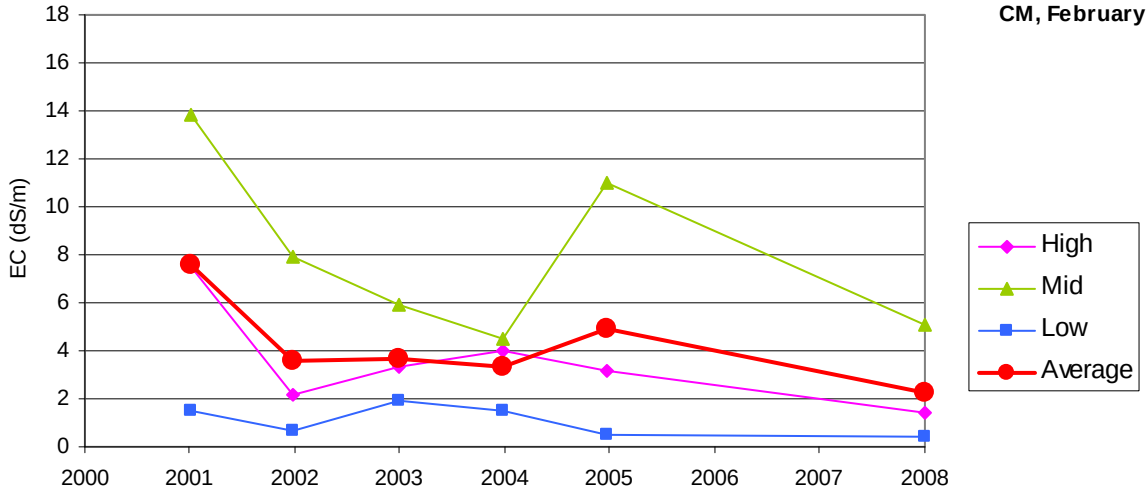
For every area the trend in soil salinity is shown and discussed for four different months: February, April, August and December. Per graph (month) four lines are shown:
- High
- Mid
- Low
- Average

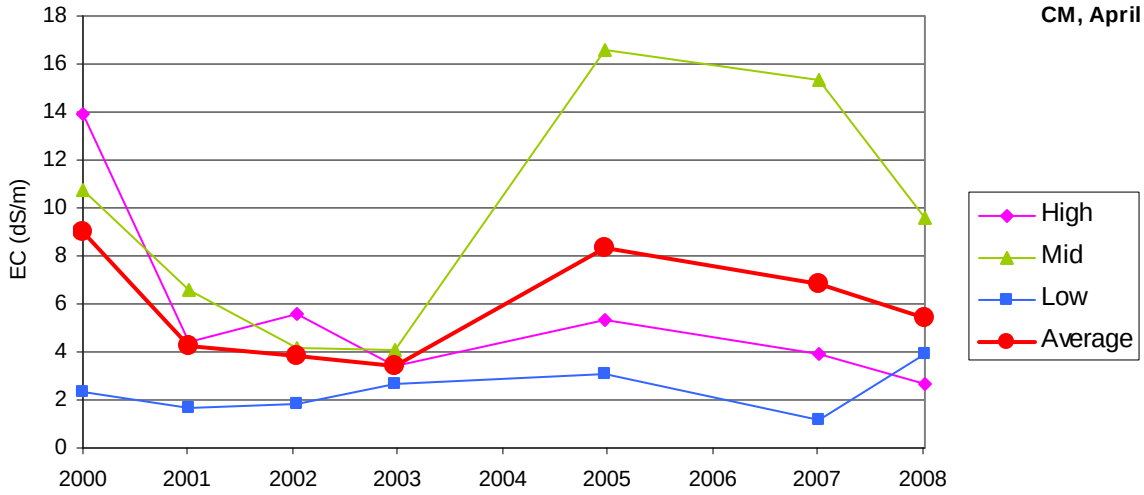
High, mid and low show the measured values from three different plots in the area, as explained in the previous section. Because the values tend to fluctuate over the years for the three locations a fourth line has been added to the graphs to show the general trend in soil salinity of the area. This line shows the average value of the three sample locations.

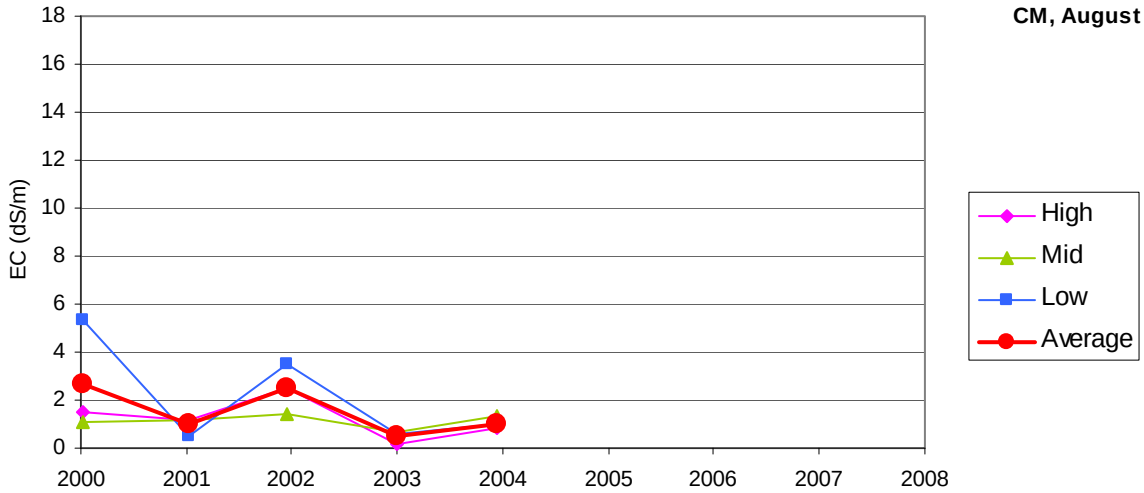
First the situation in the protected areas will be discussed, after that the situation in the unprotected areas.

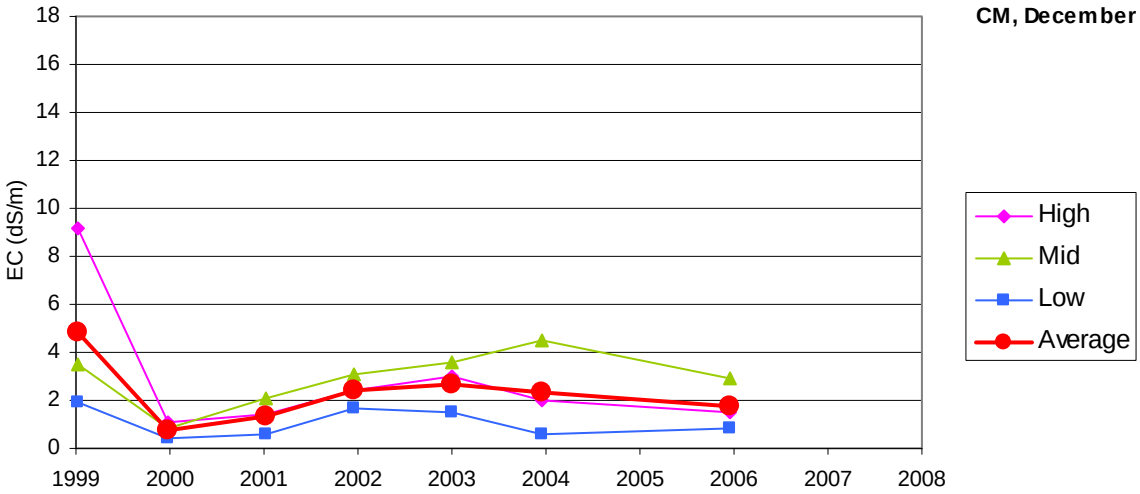
## 6.3 Protected areas

### *6.3.1 Char Majid*



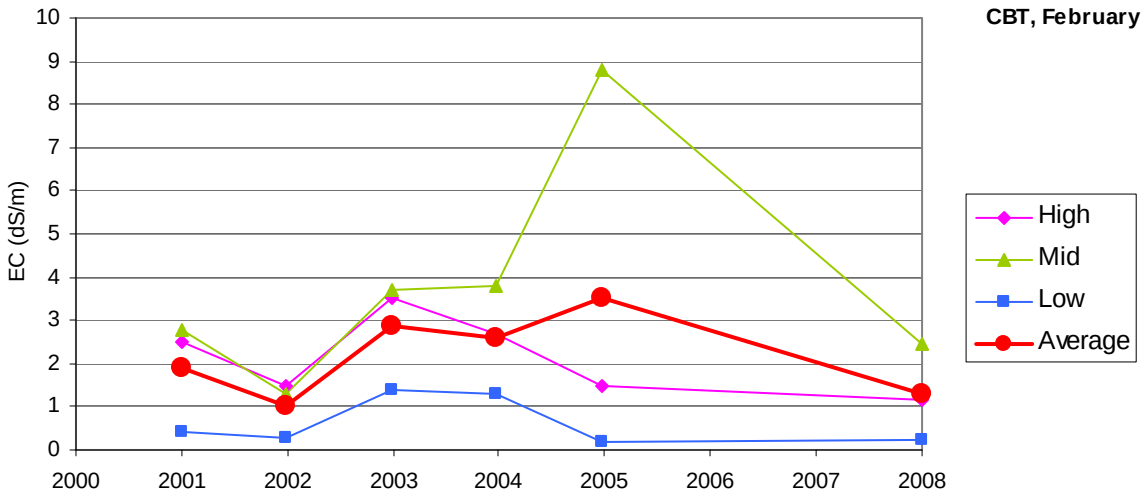



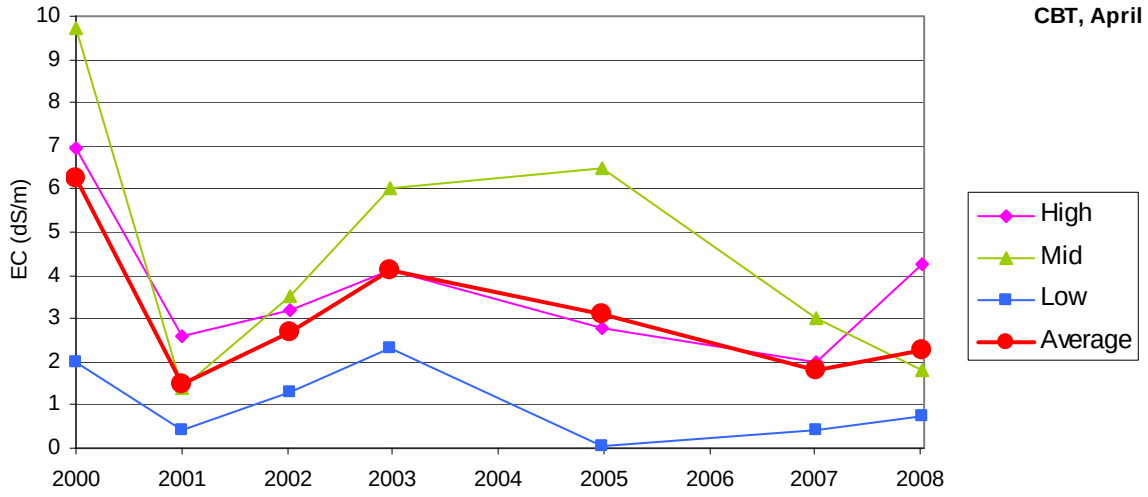


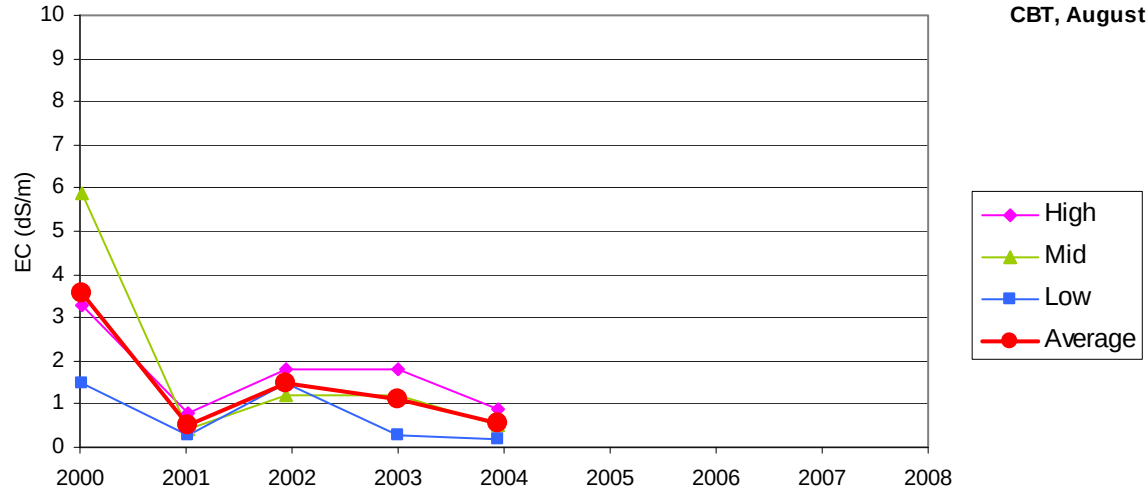

For February, April and December the values of the soil salinity in Char Majid show an initial decrease, followed by a moderate rise in the middle of the monitoring period. In the recent years the values decreased again. On the whole the soil salinity has decreased somewhat since monitoring was begun.
It has to be said though that the values between the plots show quite some differences. Especially the initially selected middle plot turns most often out to be the plot with the highest soil salinity, with especially in the dry period values that are in some years much higher than that in the other two plots. The high and low plots show quite stable salinity levels that do not show much fluctuation after the first year of measurement.

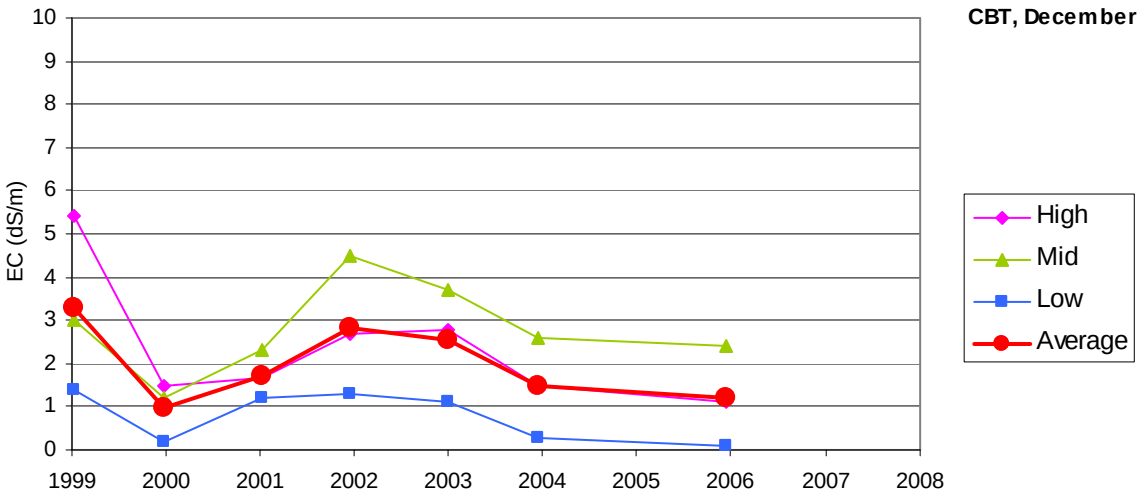
Because it is not known how much of the area would fall in each of the three categories it is difficult to say something about the effects of soil salinity for the polder as a whole, based on these data. Even in the dry period on average the values do not get much higher than 8 dS/m. But the results from the mid location show that there are areas in the polder where the values can get as high as 16 dS/m. This means that in some parts of the polder soil salinity can cause serious damage to crop production in the dry period.
In the rainy season the soil salinity stays mostly below 4 dS/m, allowing the production of crops withouth significant production loss.

### *6.3.2 Char Batirtek*



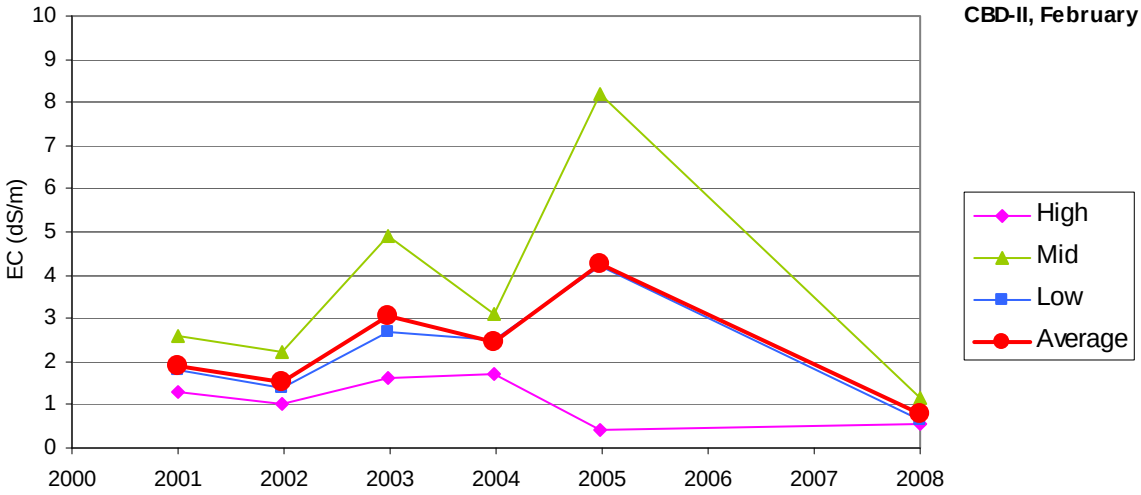



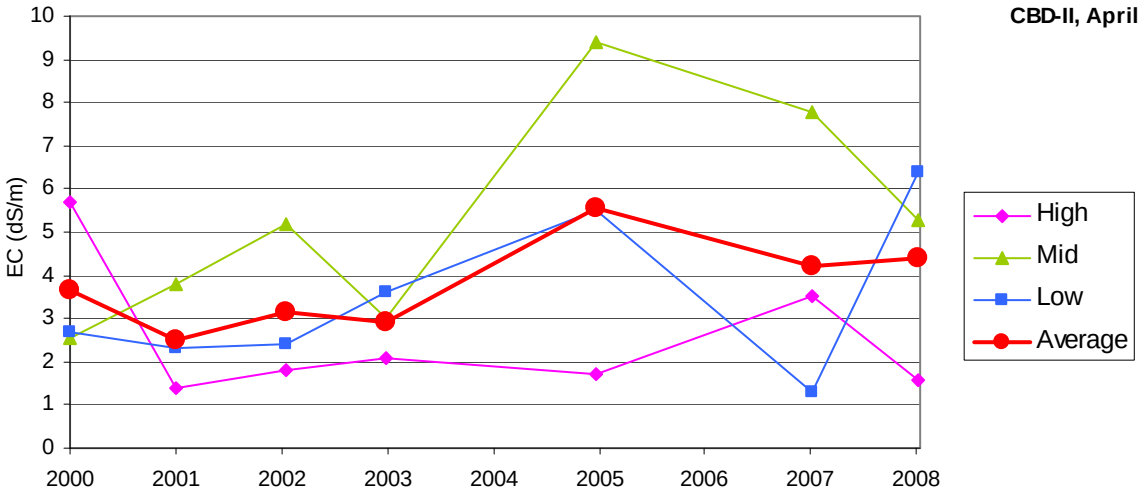


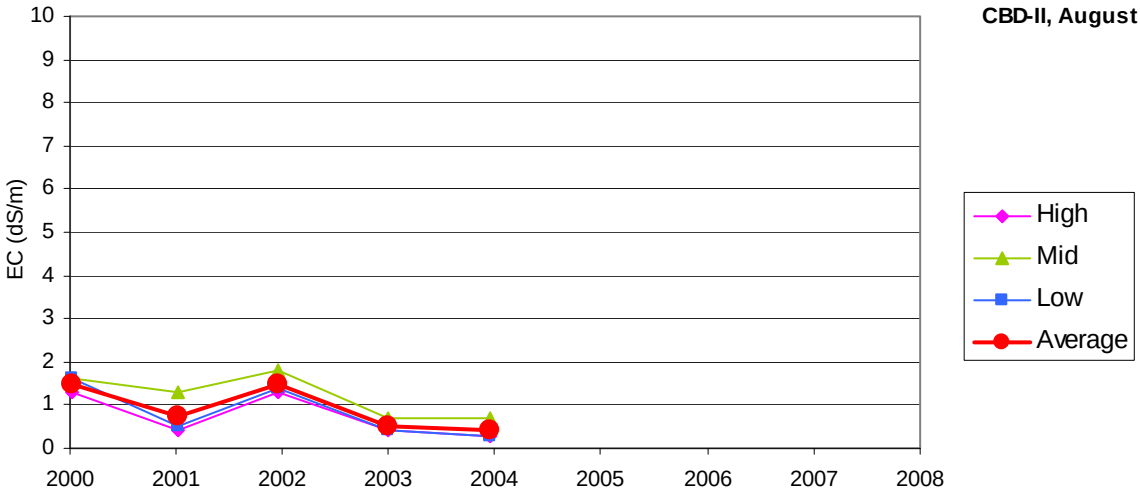

The soil salinity levels in Char Bhatirtek mostly show a slightly decreasing trend over the whole monitoring period, in all months. There are some years though with higher salinity levels, but the differences are not big on average.
Mainly the mid plot shows some high values in February and April, but mostly the salinity levels stay below 4 dS/m throughout the year.

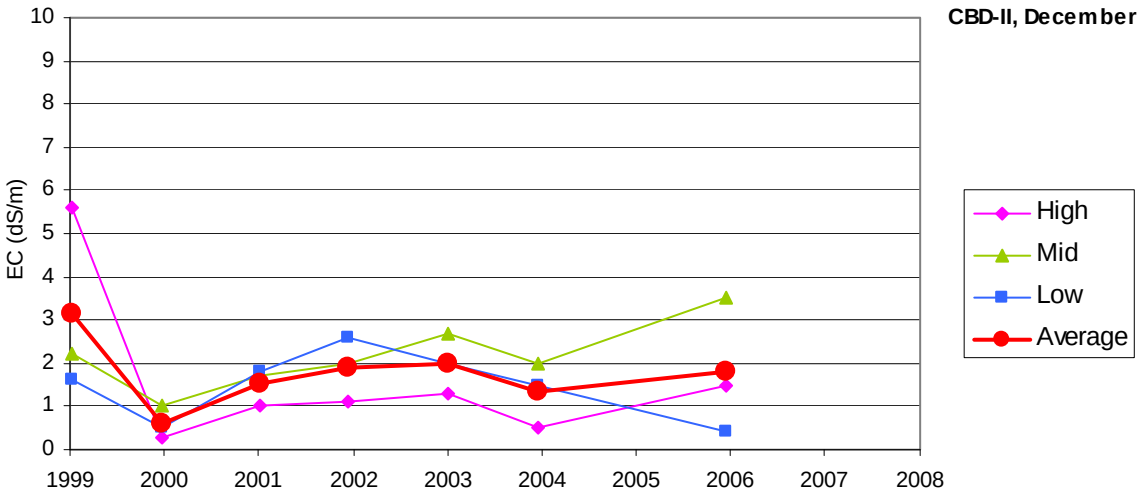
The values of the mid plot in February and April show that despite the decreasing trend it is still possible that the salinity in parts of the polder can rise to levels that hamper the production of crops.

### *6.3.3 Char Baggardona II*



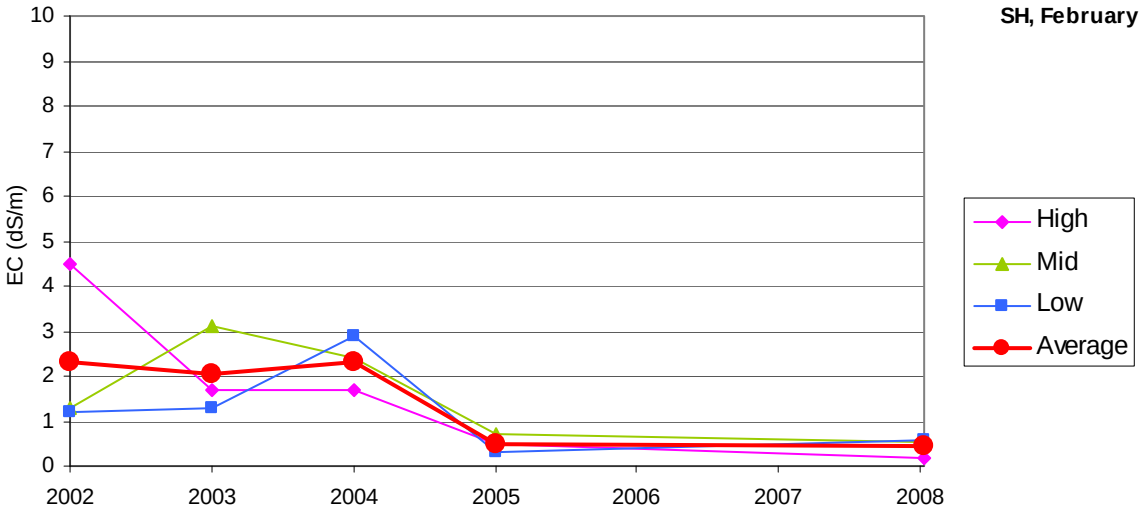



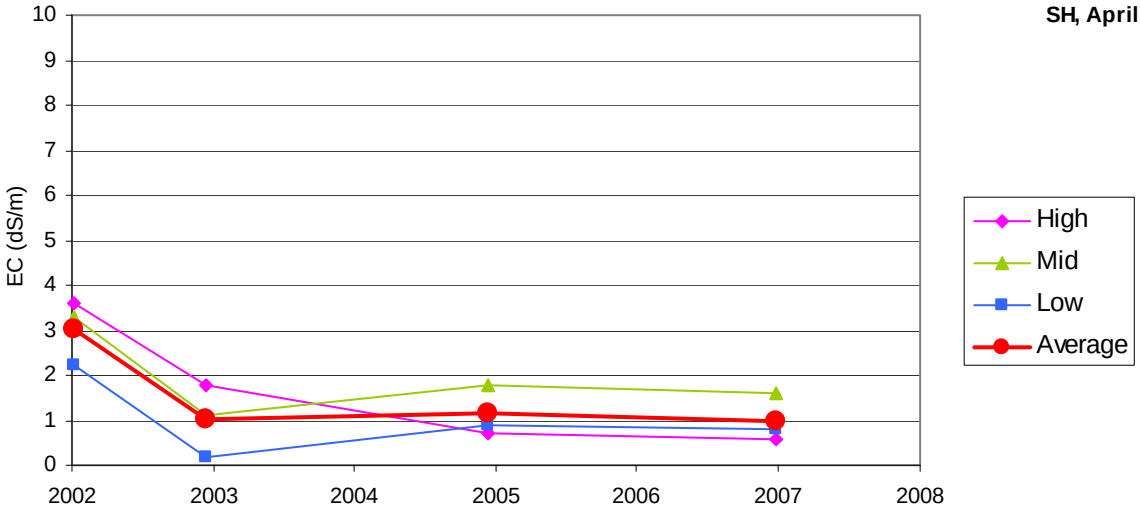


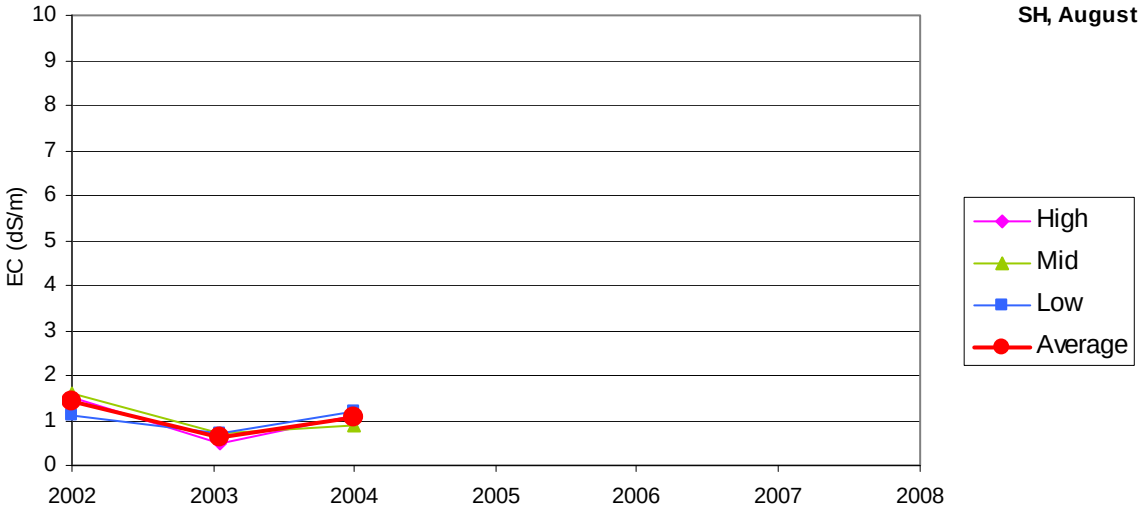

Especially in February and April the average soil salinity levels in Char Baggardona-II have shown mostly a small rise, with the notable exception of February 2008. Because there is no data available from February 2006 and 2007 it is difficult to say if this last value indicates a reducing trend in recent years or if it is only a single year with low levels. Future measurements will have to make this clear.
In both these months the values for the plots show quite some variation from year to year. In the April graph it can for instance be seen that each of the plots at some point has the lowest value of the three locations, while in another year it has the highest value. In this month the values are regularly higher than 4 dS/m, and for the mid plot even higher than 8 dS/m.

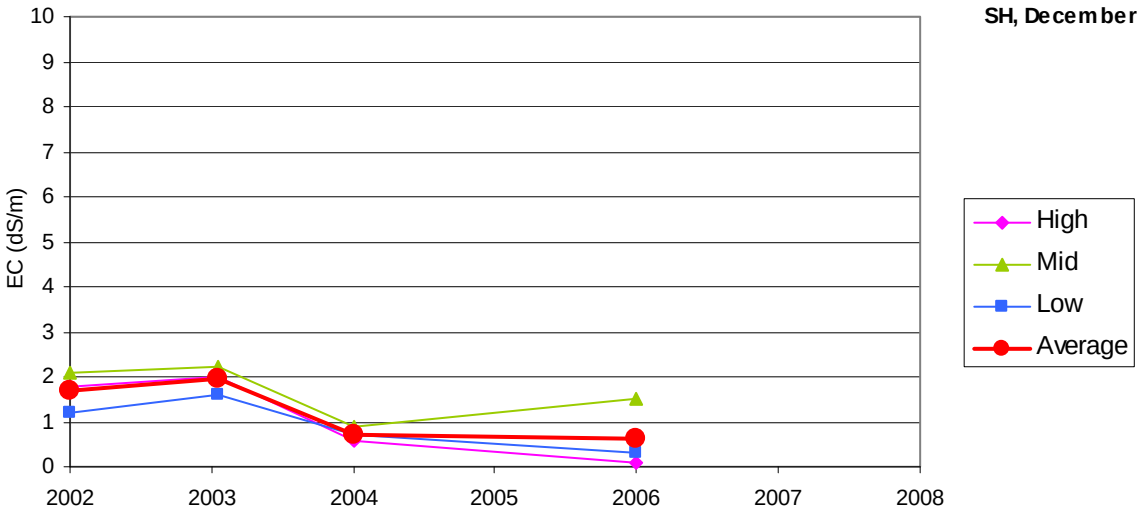
In August and December the soil salinity shows more stable values. Despite the low initial levels in August the salinity even seems to have reduced a bit more, while in December the values are around 2 dS/m throughout the monitoring period. For both these months it can be expected that future levels will remain low.

### *6.3.4 South Hatiya*



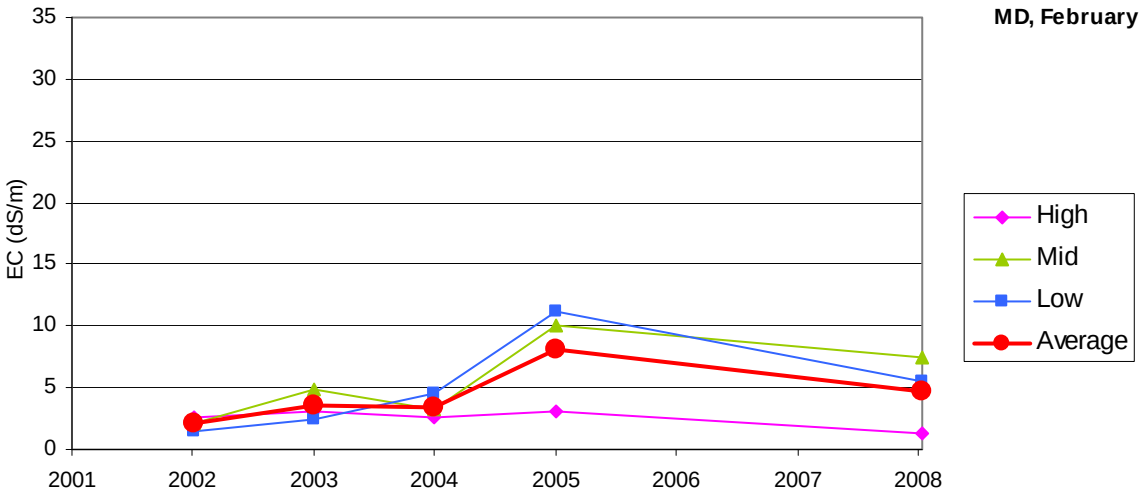



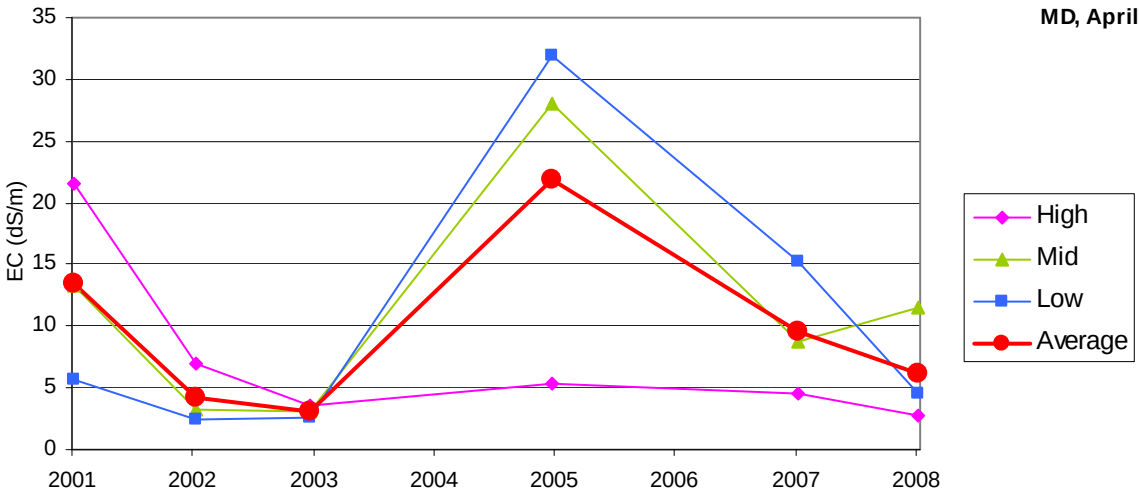


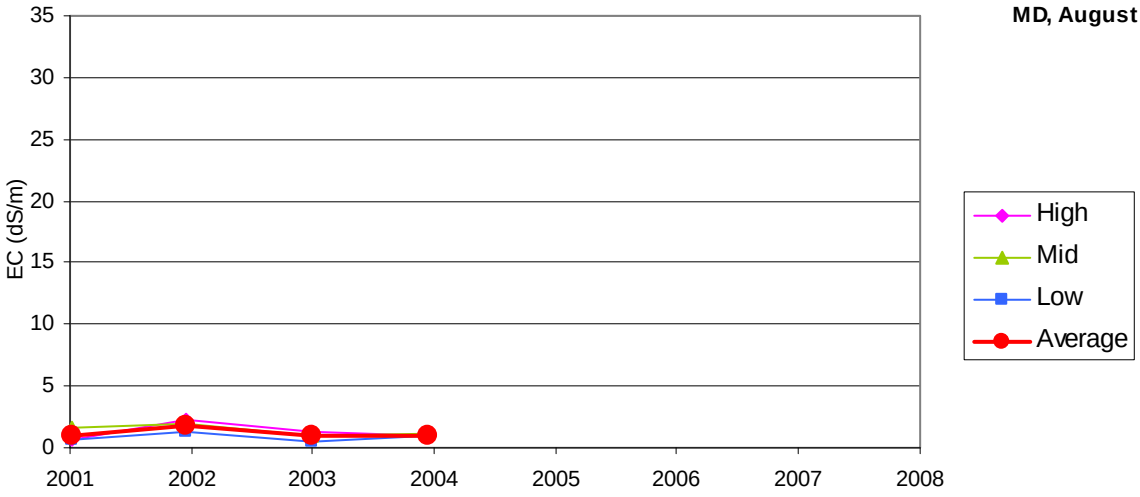

During the whole monitoring period South Hatiya has low soil salinity levels, which even have decreased a bit after the first few years. In the last few years the soil salinity has stayed below 2 dS/m for all months.

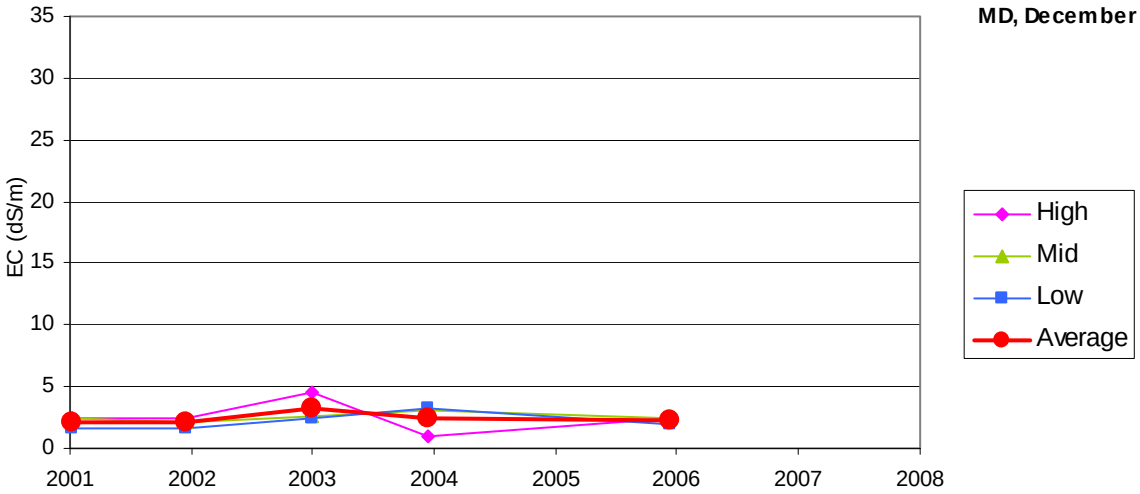
## 6.4 Unprotected areas

### *6.4.1 Char Moradona*



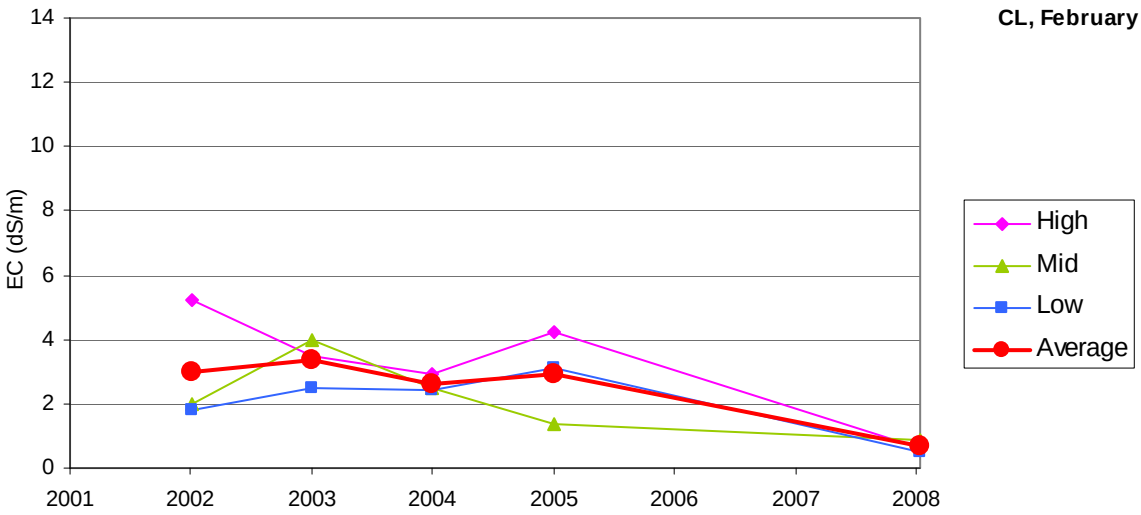



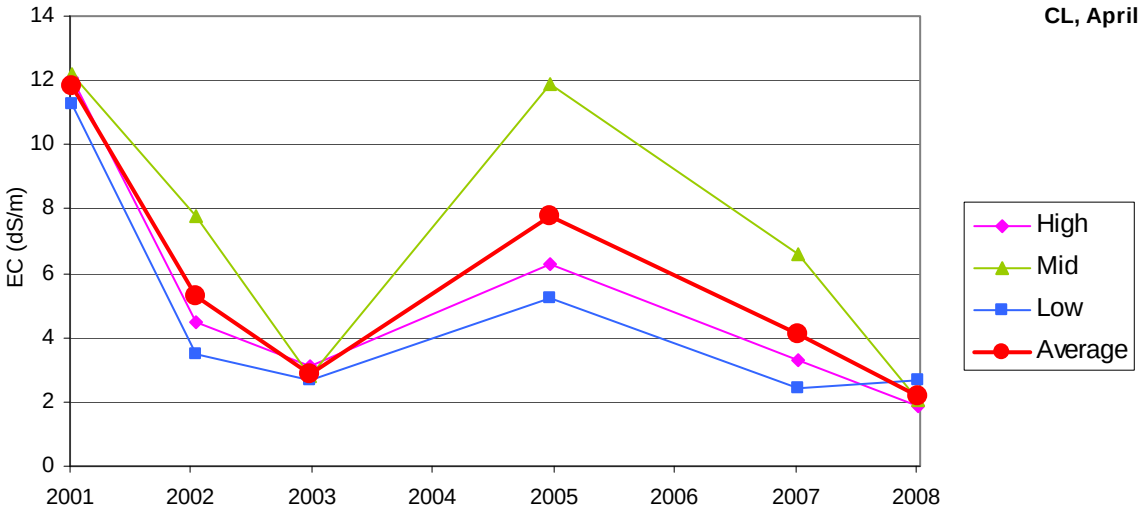



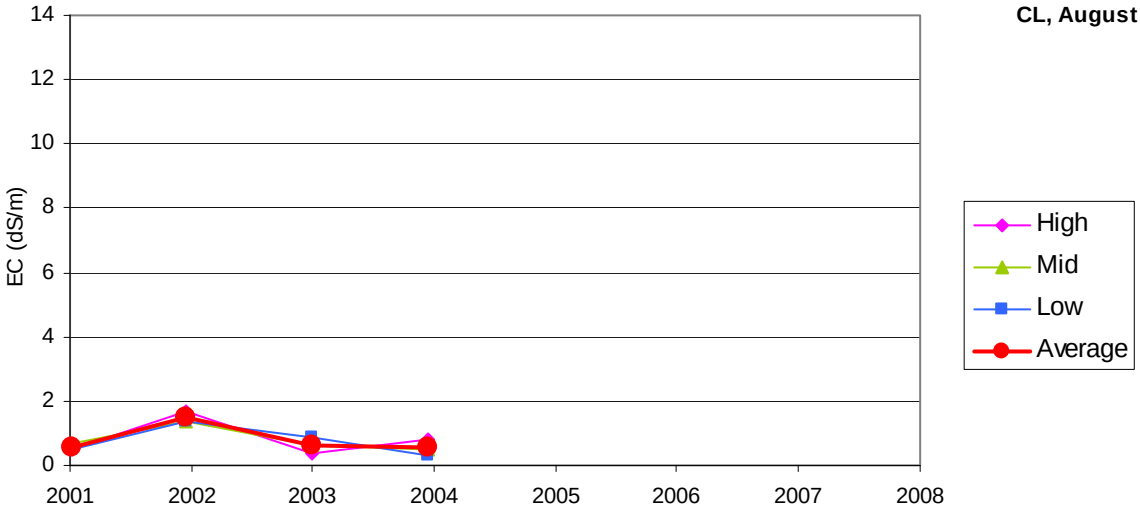


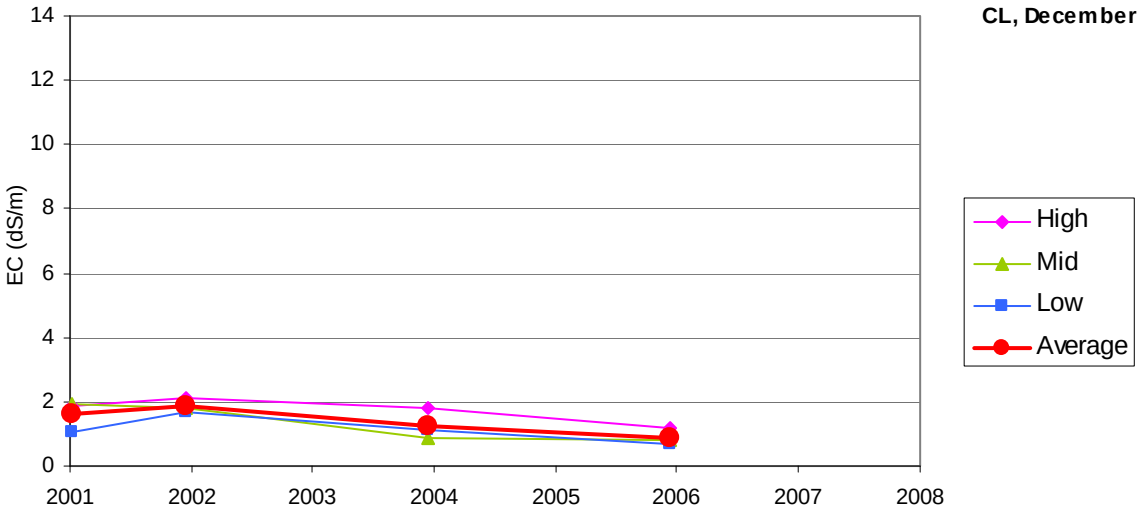

Especially in April the soil salinity levels in Char Moradona can reach very high levels, with a peak of more than 30 dS/m in one plot. These extreme values occurred only in one year though, in all the other years the average values were half or less of this extreme. Like in February the values for the other years show a more or less stable level, with some differences between the years (from 5 to 10 dS/m).
August and December show very stable average salinity levels in Char Moradona, with values below 4 dS/m.

### *6.4.2 Char Lakshmi*



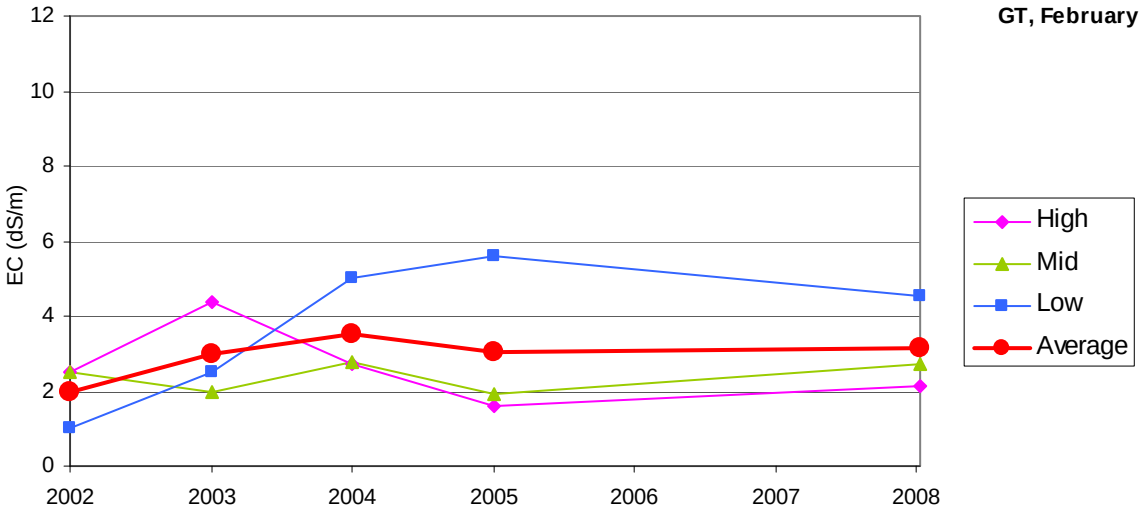



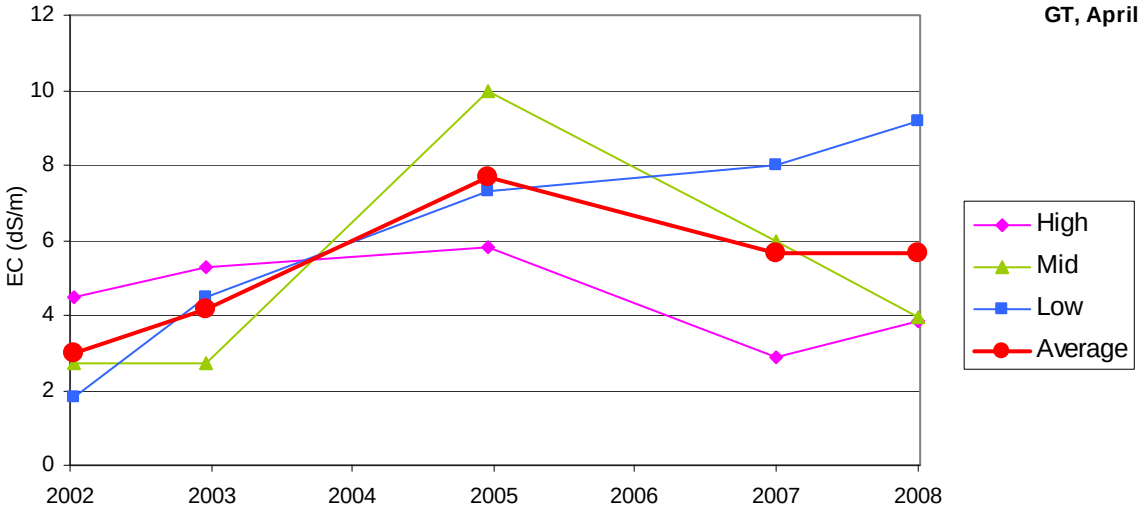



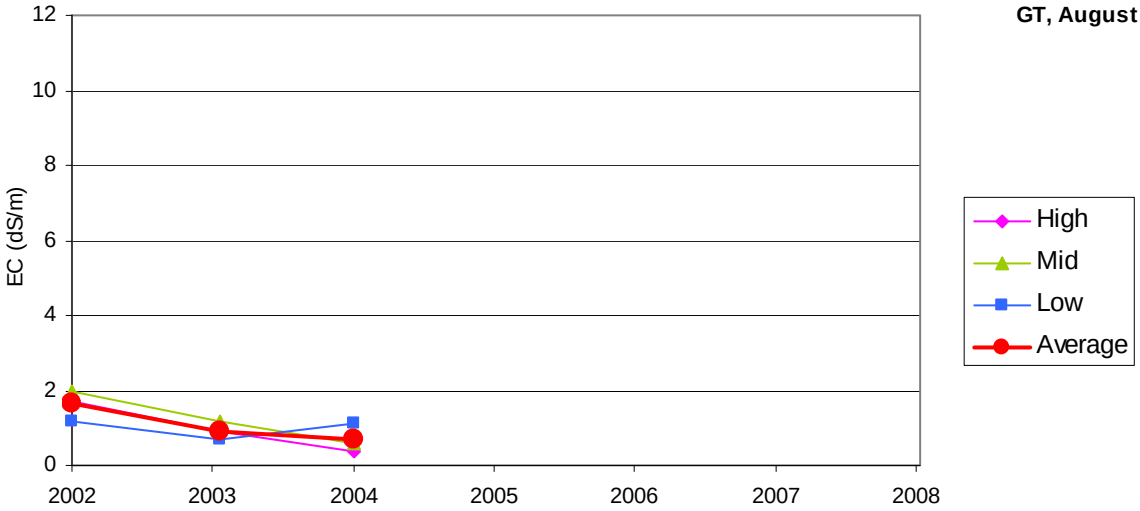


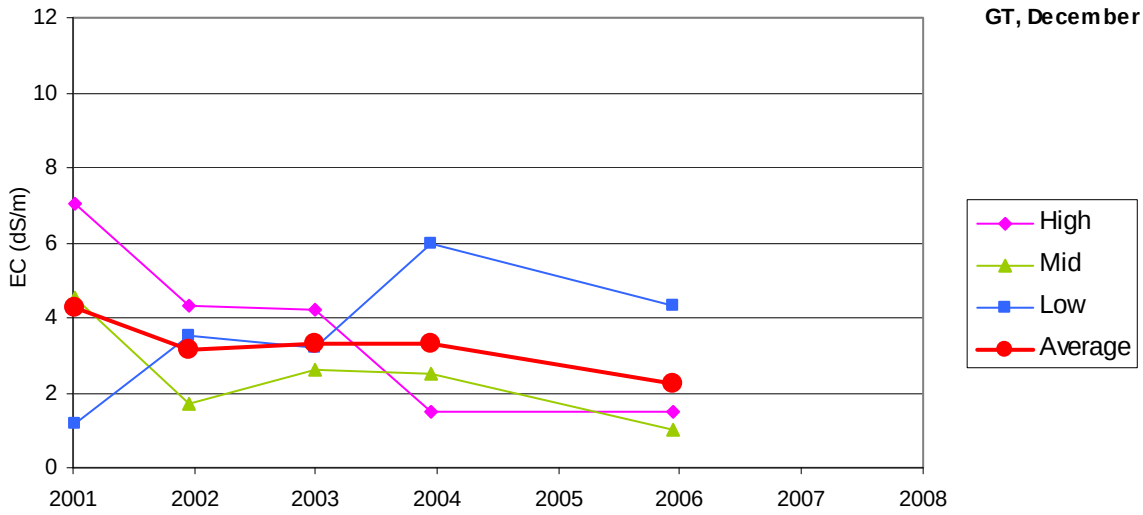

In February and April the soil salinity levels in Char Lakshmi have mostly been decreasing during the monitoring period, with the notable exceptions of April 2001 and 2005 when reasonably high values were measured. Future measurements will have to show whether or not the decrease in April in the last two years indicates a trend, or that the values will be higher again in other years.
In August and December the values stayed below 2 dS/m for all plots during all monitored years.

### *6.4.3 Gangchil-Torabali*






The graphs of soil salinity in Gangchil-Torabali show a different picture for each month. The values of February are stable on average, but the soil salinity of the low plot has risen from about 1 dS/m in 2001 to 4.5 dS/m in 2008. In April the values especially showed an increase in the first half of the monitoring period, after that the average stabilized at about 6 dS/m. Also in this month the low plot shows a constant increase in salinity levels.
In August the values have decreased slightly, staying below 2 dS/m for every sample. December shows slightly decreasing soil salinity on average, staying below 4 dS/m for most of the years. In this month the values of the high and mid plot have decreased over the years, while on the other hand the values of the low plot have increased.

## 6.5 Conclusion

Especially the protected areas show mostly a reducing trend in soil salinity, with the exception of the dry period in CBD-II. In the unprotected areas a more stable salinity level is observed. In these areas reduction only takes place in or just after the rainy season, the dry period even shows some increase at places.

In general it can be said that rice has a salt tolerance of 4 – 8 dS/m. In most of the chars the salinity level stays below 4 dS/m for most of the year, with the exception of the February to May period. But even in this period in the unprotected areas the average soil salinity stays below 10 dS/m, only for individual sample locations it gets higher at times.

What is seen in almost all monitored polders is that the relation in salinity level between the selected plots is not stable. Salinity levels fluctuated independently in all plots, making sometimes one plot more saline and at other moments another plot. Therefore the question can be raised how reliable the data of distribution of land by soil salinity is (percentages of saline free, mild saline, strong saline lands in an area), apparently this is changing year by year. With the data used for this report it is not possible to say how the distribution per polder is, since data is only available for three locations per polder.

**Table-6.1**
**Summary of soil salinity trends**

| Area | Month | Average trend (whole period) | Values [dS/m] (last measurements) | Remarks |
|---|---|---|---|---|
| Protected | | | | |
| Char Majid | February | Reduced | 3-5 | One plot large fluctuations |
| | April | Slightly reduced | 5-8 | One plot large fluctuations |
| | August | Slightly reduced | 2 | |
| | December | Slightly reduced | 2 | |
| Char Bhatirtek | February | Stable | 1-3 | One plot large fluctuations |
| | April | Slightly reduced | 2-3 | One plot large fluctuations |
| | August | Reduced | 1 | |
| | December | Slightly reduced | 1-3 | |
| Char Baggardona-II | February | Slightly increased | 1-4 | Last sample reduced |
| | April | Slightly increased | 4-6 | All plots fluctuations |
| | August | Slightly reduced | 1 | |
| | December | Stable | 2 | |
| South Hatiya | February | Slightly reduced | 1 | |
| | April | Slightly reduced | 1 | |
| | August | Stable | 1 | |
| | December | Slightly reduced | 1 | |
| Unprotected | | | | |
| Char Moradona | February | Slightly increased | 5-8 | |
| | April | Fluctuating | 5-10 | Extreme peak in 2005 (35) |
| | August | Stable | 2 | |
| | December | Stable | 3 | |
| Char Lakshmi | February | Stable | 1-3 | Last sample reduced |
| | April | Down/fluctuating | 2-8 | |
| | August | Stable | 1 | |
| | December | Slightly reduced | 1 | |
| Gangchil-Torabali | February | Stable | 3 | |
| | April | Slightly increased | 6-8 | |
| | August | Slightly reduced | 1 | |
| | December | Slightly reduced | 2-3 | |