

# **Social Assessment of Land Use Change Under Irrigation**

**Wayne McClintock  
Nick Taylor  
Heather McCrostie Little**

**Working Paper 33**

ISSN 1176-3515

**November 2002**

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## INTRODUCTION

“Resource Community Formation and Change” is a research programme funded by the Foundation for Research, Science and Technology<sup>1</sup> which seeks to understand the relationship between communities and their natural resource base. The first four years of the programme (1996-2000) focussed on a comparative analysis of communities that are dependent on forestry, agriculture, mining, energy (oil and natural gas, hydro-electric power generation), fishing and tourism industries. This phase of the research provided a substantial base of information about these types of communities and the change that has occurred in them since the 1980s in particular. The information and understanding from the research can be applied to future impact assessments and social and economic development strategies (Taylor *et al.*, 2001).

The programme had a broader focus over 2000-2002, including the development of models and decision support scenarios. These models can be used by natural-resource decision makers and rural communities considering development strategies. A key model developed is of social change that occurs as a result of land use change under irrigation. This model is reported here.

In the first phase of its development the model was based on the community case studies undertaken in the Waitaki Plains in North Otago and Clandeboye in South Canterbury. In the second phase of its development, the model was tested and developed using quantitative and qualitative data, initially as part of a study undertaken for the Ministry of Agriculture and Forestry to develop key parameters for the social assessment of irrigation schemes<sup>2</sup>. For an irrigated area this MAF study was, however, confined to the Waitaki Plains. The parameters are tested and developed further in this working paper by including data from the Amuri Plains.

### *Social change and irrigation*

Irrigation can transform the land and landscape. It can also transform society (Blake and Taylor, 1986; McCrostie Little and Taylor, 2001). Recent research<sup>3</sup> has traced the development and social impacts of community irrigation schemes, attitudes and adaptations for farm families and subsequent ownership changes.

Early irrigation schemes were developed on the Waitaki River and in the Ashburton District. But irrigation and farm technology in the early days were insufficient to realise the full potential of the water. By the 1950s, however, advances in border dyke and spray irrigation prompted some groups to run what became ‘experimental schemes’. In the 1960s central government policies for national development lead them to sponsor a number of schemes throughout the country and these took place in the 1970s. Despite considerable support from government agencies, most community schemes have involved long, frustrating periods of gestation requiring strong advocacy and leadership.

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<sup>1</sup> Resource Community Formation and Change, Contract TBA X0001. For further information on the research project contact Taylor Baines & Associates (PO Box 8620, Christchurch or by email: n.taylor@tba.co.nz).

<sup>2</sup> Economic and Social Assessment of Community Irrigation Projects: Water Enhancement Policy Study 5, MAF Technical Paper No: 2002/13, prepared for MAF Policy by Stuart Ford, Agribusiness Group, Christchurch, with contributions by Geoff Butcher and Taylor Baines and Associates.

<sup>3</sup> This research includes community case studies of the Waitaki Plains, Otautau and Clandeboye undertaken by Taylor Baines and Associates as part of the FRST funded project “Resource Community Formation and Change” (Contracts TBA801 and TBAX0001), and a review report, “Study of Regional Benefits of Water Enhancement in Canterbury - Social Impact of Irrigation”, undertaken for Butcher Partners in 2001.

In North Canterbury irrigation was first mooted in the 1950's but it was not until the late 1970's that the Waiau scheme was begun; the full scheme being completed some ten years later with the commissioning of the Balmoral scheme (Hunt, 1998:5).

When irrigation was first discussed by the farming community it was not envisaged that there would be land-use change, just more intensive sheep and beef farming systems. Several generations of New Zealand farmers viewed irrigation primarily as an 'insurance' against a perverse climate rather than a production management tool. It was not until sophisticated irrigation technology developed with spray and sprinkler systems that the full potential of water application came to be realised. As that potential was realised social change became more apparent.

Farmers and rural communities soon learnt that their substantial investment in water resources is more than simply an insurance against perverse climate. The application of water becomes a new daily function with associated new irrigation and farming technology. It can mean unremitting work. Therefore irrigation is often linked to youth and enthusiasm and to new types of farmers, particularly dairy farmers, who see irrigation very much as a management tool.

So irrigation commonly leads to changes in land use and farm ownership. On the Waitaki Plains, for instance, many established, dry-land, sheep farming families sold their farms and were replaced by younger families. These new farmers modified traditional farming systems with the support of an accessible and regular water supply. They invested heavily in farm improvements, upgrading pasture for cropping and sheep, and building bigger and better homes and farm buildings (McCrostie Little *et al.*, 1998a). The Amuri replicates the Waitaki experience with 60 per cent of farms there changing ownership since the advent of irrigation (Hunt, 1998).

Furthermore, the available research shows successive ownership and land use changes coming in waves after the introduction of irrigation (McCrostie Little and Taylor, 2001).

### **A model of land use and social change under irrigation**

The Waitaki Plains case study, based mainly on qualitative data from community interviews, provided a descriptive model of these successive waves of interlinked changes in land use and farm ownership (McCrostie Little *et al.*, 1998a, McCrostie Little and Taylor, 2001).

#### First wave

The existing pastoral farmers want to improve their traditional farming base - stock breeding, meat and wool growing. They see on-farm irrigation is labour intensive and initially capital expensive. Older farmers are reluctant to incur more or new debt and can find the work too physically demanding so they retire in favour of the next generation.

#### Second wave

The second wave of new-generation farmers enter into major irrigation investment. They increase stock numbers and productivity but generally stay with the same production base. These farmers learn that pastoral farming and irrigation are not always compatible and, sometimes suffering from the results of over-capitalisation, will make the decision to sell, prompting the next 'wave' of irrigation farmers.

Should these farmers stay they will radically change their production base to incorporate intensive arable farming, dairying or horticulture. They realise that the land potential lies in these sorts of new land uses. The shift to dairying is often achieved via a series of interim changes, such as running a small herd

alongside the main farm, or bull beef raising. It is, however, more likely that these farmers will not make the total change from pastoral to new forms of farming such as dairying themselves, electing to sell, retire or farm elsewhere.

### Third wave

Widespread changes in land use and farm ownership now take place. Newcomers will buy into converted farms or directly convert them on change of ownership. They are usually dairy farmers by choice and experience and they frequently come into the district from an established dairying district, often from the North Island. The third 'wave' of irrigation farmers creates the 'new' dairy economy in the host district.

### **Social impacts of land-use and ownership change**

The link between farm ownership and land use change is a fundamental dynamic of these waves of irrigation development (McCrostie Little and Taylor, 2001). Ownership change is frequently ignored in the irrigation debate yet it impacts on farm families and the social structure of the host community, its settlements and small service towns.

In a generational farming community area there is considerable continuity for farm families through the process of farm succession, and this continuity flows through to the rural communities as well. Irrigation therefore poses a potential risk and some challenges to traditional farming and community stability because diverse land uses demand new farming skills and frequently attract farmers with different outlooks. On the other hand, newcomers to the community have the potential to boost demand for struggling services such as small schools.

Changes in land use can spark a local perception that the population base has 'exploded' through diversified land use and the commercial and employment opportunities offered by irrigation - when in fact growth has been more modest. For example, over the 10 years 1986 to 1996 the population of the Waitaki Plains area grew by five per cent, below the overall New Zealand growth of 7.2 per cent. The growth in population of irrigated areas does become significant, however, when compared with the fall in population of non-irrigated rural communities.

Signs of population change are also evident in the composition of the population as dairy farming impacts on the age structure of the community. In the Amuri, Hunt (1998) found that there was an overall rise in the number of younger to mid-life males and that conversely in the same district there was a decline in the 60 years cohort.

Dairy farming families are often in their lower to middle life cycle and sharemilkers are frequently young families. As a consequence, the diminishing school roll turns to increase, especially in the junior classes. An increased school roll can re-vitalise a community, where the school is at the centre of the district's identity. As the roll and staff numbers increase the school continues to operate as a hub for educational, recreational and social activities (McCrostie Little *et al.*, 1998a).

Communities undergoing irrigation development undergo considerable social change as the 'old' families move out and their place is taken by 'new' families. Potential social divisions are created as the first dairy families move in from outside. Dairy farming is often regarded by other farmers as a lower status occupation than traditional sheep and beef farming, one with very different work patterns and with a comparatively high level of farm workers. The continual movement in and out of dairy workers can create feelings of dislocation amongst those of the old community who remain. Long-term residents may find

the philosophy of the sharemilker contract, and their attitudes to stock and land, are radically different to those they are used to.

While the average age of the community may be younger, an expectation that the youth and enthusiasm will result in a higher rate of participation in community activities may not be fulfilled. The transient nature of sharemilking may mean that some families take little part in the community - often a cause of criticism from more established community members.

Another issue is the ability of the district to take full advantage of flow-on effects from the new land use activity and changes in population. Opportunities will be created for irrigation contractors and supplies, building contractors and supplies, dairy equipment services, veterinary services, transport, etc. Some farm workers and local contractors will have to change their skills base if they are to take advantage of these opportunities, or in some cases to survive where demands for previous occupations such as shearing are reduced. Increased horticultural production will bring a demand for seasonal workers (McCrostie Little *et al.*, 1998a, 1998b).

## QUANTITATIVE PARAMETERS FROM CENSUS STATISTICS

### Approach to key parameters of social change

Quantitative development of the model of social changes associated with irrigation schemes has focussed on comparing the selected parameters for two localities. The two localities are the lower Waitaki area in North Otago, where a community owned irrigation scheme has operated since 1974, and an area in North Canterbury referred to as the Amuri in this paper. The Waiiau Plains Irrigation Scheme was officially opened in the Amuri area on 25 November 1980, and replaced an open water race which was constructed almost a century before (Ministry of Works and Development, 1980).

The empirical data for this case study were obtained from two main sources: statistics from the five censuses between 1981 to 2001 obtained directly from Statistics New Zealand and from Supermap, and a mixture of quantitative and qualitative data from the Ministry of Education, a local government agency, the New Zealand Business Directory Data Base and four previous studies of these two geographical localities.

Using statistical maps from Supermap, the mesh blocks in the Lower Waitaki and Amuri irrigation scheme areas were compared with the irrigated areas. Clusters of mesh blocks were identified for each area<sup>4</sup> and census data obtained from Supermap and by a special order from Statistics New Zealand for both irrigated areas and the country as a whole. Statistics New Zealand advised that census data for these mesh blocks before 1981 would be very difficult to extract from their records so the analysis has been restricted to the five censuses between 1981 and 2001. This longitudinal analysis also raises the issue of the comparability of data between censuses which is discussed later with reference to particular parameters.

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<sup>4</sup> The mesh block numbers for Lower Waitaki were 2826900, 2827000, 2827100, 2827201, 2827300, 2827400, 2827600, 2827700, while those for Amuri were 2428700, 2429000, 2430000, 2430101, 2430201, 2430203, 2430300, 2430400, 2430500, 2430600, 2430701, 2430800, and 2430902 (irrigated area); 2429500, 2429600, 2429700, 2430103, 2430104, and 2430202 (Culverden township); and 2428802, 2430702, 2430901 (Rotherham township). The mesh block boundaries did not always coincide with the geographical boundary of these areas, but where there was some difference between the two sets of boundaries it was decided to select mesh blocks whose boundaries were slightly outside the geographical boundary.

The parameters selected for analysis from these five censuses were as follows:

- usually resident population
- age structure of the usually resident population
- age structure of the farmers and farm workers occupation group
- dairy farmers and dairy workers
- age structure of the dairy farmers and dairy workers occupation group
- highest educational qualifications held by residents
- employment by industry
- occupational status of residents
- employment status of residents
- labour force status of residents
- median of household incomes
- distribution of household incomes.

### Usually resident population

Changes in the usually resident population of an area indicate whether there has been an inflow or exodus of people into the area which in certain circumstances are associated with changes in the district's economy. These types of population movements are characteristic of rural districts with natural resource based industries that are subject to commodity price cycles. In areas such as the Lower Waitaki and Amuri where community irrigation schemes have been introduced, for instance, it is reasonable to expect that the intensified use of the land would at least arrest population decline or even result in a moderate rate of population growth.

The usually resident population figure provides a better indicator of population growth than the total population figure, which is also recorded by the census, because it excludes people who are temporarily visiting the area, and includes residents of the area who are elsewhere in New Zealand on the night of the census. Usually resident populations of Lower Waitaki, Amuri, and New Zealand were compiled for the 1981 to 2001 censuses, and the increases or decreases in population between the censuses were calculated as percentages. The results of this analysis are presented in Table 1.

*Table 1: Changes in Usually Resident Population of Lower Waitaki and Amuri 1981-2001*

Census Year	Lower Waitaki		Amuri		New Zealand	
	Number	% change over five years	Number	% change over five years	Number	% change over five years
1981	681	n/a	1,071	n/a	3,143,310	n/a
1986	714	4.8	1,041	-2.8	3,263,280	3.8
1991	762	6.7	951	-8.6	3,373,932	3.4
1996	795	4.3	1,008	6	3,618,297	7.2
2001	786	-1.1	1,086	7.7	3,737,277	3.3

Source: Statistics New Zealand

Lower Waitaki had a steady increase in population between 1981 and 1996 which during the 1980's exceeded the growth rate of the national population. Amuri, by contrast, experienced a decline of population in the 1980's, but recovered these earlier losses with a strong period of population growth during the 1990's. Amuri's population decline during the 1980's probably reflects the impact of the reform

of government agricultural policy which is masked to some extent in Lower Waitaki by the changing patterns of land use at that time. The presence of a community irrigation scheme in the Lower Waitaki since the mid 1970's contributed to population growth between 1981 and 1996 as dairying has become the most important farming activity in the area. Although there were a few dairy conversions in the Amuri area prior to 1991, the switch to dairying did not gain momentum until the first half of the 1990's when the proportion of dairy farmers and workers rose from just under a tenth to over a third of the area's farmer and farm workers (see Table 5). This shift to dairying in Amuri was likewise associated with a period of population growth.

### Age structure of the usually resident population

The age structure of the usually resident population provides information about the proportions of children and elderly people living in an area, and the proportion of people of working age (15-64 years) who may be available for employment in the local economy. As the age structure of an area's population changes over time the pattern of demand for particular educational, health, and social services will increase or decrease. Thus the arrival of young families in a district to work on dairy farms, for instance, may subsequently boost school rolls. Moreover, any decline in the proportion of people of working age may indicate that many people in this age group have left the area to find jobs.

Age structures of the Lower Waitaki, Amuri, and New Zealand populations were compiled from the 1981 to 2001 censuses. They were summarised in several age categories from 0-14 years and 15-19 years, then by four decades to 59 years, and finally by 60-64 years and 65 years and over. Percentages were calculated for each category, and then the percentages of these categories were consolidated for further analysis into two major age groups - people aged 0-14 years and people aged between 15 and 64 years. The results of this analysis are documented in Tables 2 and 3.

*Table 2: Percentage of Usually Resident Population 14 years & under 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	33	27.7	22.8	23	26
Amuri	30	30.3	31.4	27.5	27.9
New Zealand	26.9	24.4	23.2	23	22.7

Source: Statistics New Zealand

There has been a trend for both the Lower Waitaki and Amuri to have higher proportions of children (14 years & under) in their populations than the national average over the period between 1981 and 2001 (see Table 2). Lower Waitaki has also had an increasing proportion of people of working age in its population over this period, whereas the ratio of people comprising this age group in Amuri declined from 66 to 64 per cent (see Table 3). These demographic changes indicate that these areas have relatively youthful populations compared with the rest of New Zealand.



*Table 3: Percentage of Usually Resident Population 15-64 years 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	59.4	64.3	68.6	66.1	65.8
Amuri	66.1	65.6 <sup>5</sup>	63.9	64.2	64.1
New Zealand	63.2	65.2	65.5	65.3	65.3

Source: Statistics New Zealand

### **Age structure of the farmers and farm workers occupational group**

An examination of the ages of farmers and farm workers indicates whether there have been any changes in the age structure of residents directly involved in agricultural production. Sometimes changes in the age composition of farmers and farm workers indicate that there has been a major shift in land use in a particular area. These shifts in land use occur as a result of a combination of international, national, regional and local factors such as commodity prices, government policies, interest rates and irrigation schemes.

The age structures of farmers and farmer workers of Lower Waitaki, Amuri, and New Zealand populations were collected from the 1981 to 2001 censuses. Statistics New Zealand assembled this data by using the appropriate occupational codes for each census to separate the farmers and farm workers from the rest of the population in each of these areas. Like the data for the general population they were summarised in several age categories from 15-19 years, then by four decades to 59 years, and finally by 60-64 years and 65 years and over. Percentages were calculated for each category, and then the percentages of these categories were consolidated for further analysis into one major age group - farmers and farm workers under 30 years of age. The results of this analysis are presented in Table 4.

*Table 4: Percentage of Farmers and Farm Workers Occupation Group under 30 years of age 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	24.5	27.5	30.1	35.9	36.5
Amuri	40	35.6	31.1	29.7	30.8
New Zealand	34.1	31	24.4	24.7	22.2

Source: Statistics New Zealand

The proportion of farmers and farm workers under 30 years of age in Lower Waitaki gradually increased from about 25 per cent in 1981 to 37 per cent in 2001. From 1991 onwards the proportion of farmers and farm workers in this age category in Lower Waitaki was markedly higher than for the country as a whole. By contrast the proportion of farmers and farm workers in this age category in Amuri declined from 40 to 31 per cent between 1981 and 2001, and it was significantly higher than the national pattern over this entire period. Thus farmers and farm workers in Lower Waitaki and Amuri are relatively younger than their counterparts in the national population.

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<sup>5</sup> There were difficulties reconciling the total UR population of Amuri from Supermap - 1981, 1991, 1996 - with the total UR populations of Amuri after adding up the age groups. The proportions for these three census years were therefore calculated using the totals from the age groups, and are included in Tables 2 and 3 in italics.

## Dairy farmers and dairy workers

Changes in the proportion of dairy farmers and dairy workers among the broader occupational group of farmers and farm workers indicates the extent to which particular areas have either taken up or opted out of this type of agricultural production. Although irrigation allows farmers to intensify their existing farming practices, there are often further waves of innovation as older farmers move out of the area, and the younger farmers who replace them convert their properties to other forms of land use. By examining census data about particular farming occupations over a period of twenty years the magnitude of that shift in land use can be quantified.

Data about the number of dairy farmers and dairy farmers in Lower Waitaki, Amuri, and New Zealand populations were compiled from the 1981 to 2001 censuses. Statistics New Zealand assembled this data by using the relevant occupational codes for each census to separate the dairy farmers and dairy farm workers from the rest of the farmers and farm workers in each area. Then the proportion of dairy farmers and dairy farm workers to the total number of the farmers and farm workers occupation group in each area were calculated as percentages. These percentages are presented in Table 5.

*Table 5: Percentage of Dairy Farmers & Dairy Workers in the Farmers and Farm Workers Occupation Group 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	5.7	19.4	39.7	48.7	56.8
Amuri	-	2.6	9.5	36.3	45.1
New Zealand	24.4	24	23.4	23.5	23.8

Source: Statistics New Zealand

The rapidly increasing proportion of dairy farmers and dairy workers among the broader occupational group of farmers and farm workers in the Lower Waitaki (from 6 to 57 % - see Table 5) demonstrates the major shift in land use from dryland farming to dairying that has occurred over the last 20 years. By comparison the switch to dairy production in Amuri did not gain momentum until the early 1990's. It is notable that in both areas there was a period of some 10 to 12 years after the opening of the irrigation scheme when the major focus was on intensifying existing forms of production, rather than switching to dairying. Ten years after the Lower Waitaki irrigation scheme commenced in 1974, for instance, land used for dairying comprised about a sixth of the total area. The shift to dairying gained pace over the following decade so that by 1994 a half of the total area was devoted to this form of land use (Hamilton and Elliot, 1994: 7).

## Age structure of the dairy farmers and dairy workers occupation group

The conversion of farm units to dairy production was investigated further by examining census data about dairy farmers and dairy workers. As dairy farmers and dairy workers have become a growing proportion of the farmers and farm workers occupational group in the study areas their age structure has altered the demographic characteristics of farmers and farm workers in general, and also influenced the cultural values and practices of farming itself. Thus an examination of the age structure of dairy farmers and dairy workers provides an indicator of the cultural gap between dairying and other forms of agricultural production.

The previous section describes how the data about dairy farmers and dairy workers were collected. Like the farmers and farm workers occupational group they were summarised in several age categories from

15-19 years, then by four decades to 59 years, and finally by 60-64 years and 65 years and over. Percentages were calculated for each category, and then the percentages of these categories were consolidated for further analysis into one major age group - dairy farmers and dairy workers under 30 years of age. The results of this analysis are documented in Table 6.

*Table 6: Percentage of Dairy Farmers & Dairy Workers under 30 years of age 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	-	58.3	40	50	45.2
Amuri	-	-	71.4	42.4	36.6
New Zealand	24.4	31.5	24.3	25.1	21.5

Note: Percentages were not calculated for Lower Waitaki in 1981, and Amuri in 1981 and 1986 as the number of dairy farmers and workers recorded in these areas at these censuses was below ten.

Source: Statistics New Zealand

The proportion of dairy farmers and dairy workers under 30 years of age in the Lower Waitaki area is much higher than that existing among the country's dairy farmers and workers (e.g. 45 % cf. 22 % for NZ in 2001) for the four censuses for which there were sufficient data (see Table 6). The community case study by McCrostie Little *et al.* (1998a: 6-7) of the Waitaki Plains noted that irrigation farming in the area is the domain of younger people. During the early years of the irrigation scheme these younger people, from the North Otago down lands, intensified the cropping and grazing practices in the area. Later dairy families from the North Island moved in.

The major shift to dairying in Amuri during the early 1990's was also associated with a relatively high proportion of dairy farmers and workers belonging to this age group. Many of them are newcomers to the Amuri area, who Hunt (1998: 6) notes can advance up the "dairying ladder" from shed hand through sharemilker to farm manager or owner. Thus both areas have relatively young populations of dairy farmers and workers who have transformed the pattern of land use.

### **Highest educational qualifications of the usually resident population**

The educational qualifications held by residents provide information about the quality of human resources available to employers in a particular area. Jobs earning high incomes demand skills that generally require higher educational qualifications than jobs which provide moderate or low incomes. Therefore an analysis of the highest educational qualifications held by residents would indicate whether a better educated workforce was a feature of irrigated areas.

Data about highest educational qualifications were compiled from the 1981 to 2001 censuses. Although Statistics New Zealand advised that the categories comprising "highest qualification gained" for 1981 contained less detail than the other four censuses, this did not affect the analysis as it was focussed on three broad categories of tertiary qualifications, secondary qualifications, and no qualifications. Percentages were calculated for each of these three categories, and the results for two of them (tertiary and no qualifications) are documented in Tables 7 and 8.

*Table 7: Percentage of Usually Resident Population aged 15 years & over with tertiary qualifications 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	13.6	23.5	30.7	29.8	24
Amuri	19.2	29.8	34.3	30.3	27.1
New Zealand	19.5	29.2	35.4	32.2	27.7

Source: Statistics New Zealand

As Table 7 reveals, the proportions of residents in both Lower Waitaki and Amuri with tertiary qualifications increased steadily until 1991. Over the last ten years, however, this trend has been reversed with declining proportions of tertiary qualified residents in both areas being recorded at the last two censuses. The substantial growth in the number of residents of Lower Waitaki and Amuri holding tertiary qualifications over the first three censuses may partly be explained by the shift to dairying in these areas as this type of production generally requires farm operators and managers to be highly educated.

*Table 8: Percentage of Usually Resident Population aged 15 years & over with no educational qualifications 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	59.1	40	37.5	36.6	31.2
Amuri	40	41.2	35.6	34.3	29.8
New Zealand	44.4	37.1	31.1	32.2	23.7

Source: Statistics New Zealand

At the other end of the educational scale there were declines in the proportions of residents in both areas who reported they held no educational qualifications (see Table 8). Except for 1986, Lower Waitaki had a higher proportion of residents with no qualifications than did Amuri, while both areas had relatively higher proportions of residents belonging to this category than the national population. Although dairying requires highly qualified operators and managers, it also needs a pool of young people to provide relatively unskilled labour for milking and other farm tasks.

## **Employment by industry**

Employment by industry records the numbers of residents of a particular area employed by major industrial sectors. This information reveals the range of industries in which residents are employed. It also provides a profile of the local economy, although that profile may not entirely be accurate as some people work outside their area of residence and other workers employed in local industries reside outside the area. Over the long term (i.e. 15 to 20 years) changes in employment by industry may indicate how residents of an area have become more or less dependent on specific industries for their employment.

Data about employment by industry were obtained through Supermap and Statistics New Zealand. The standard industrial categories were basically the same for the 1981, 1986 and 1991 censuses<sup>6</sup>, but reclassification by Statistics New Zealand for the 1996 census expanded the number of industrial categories from nine to seventeen. Percentages of the number of residents employed in each of the industries were calculated for all five censuses even though there were a higher number of industrial categories for the last two censuses. It was possible to compare changes over this 20 year period by

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<sup>6</sup> Finance, insurance, real estate and business services (1981) had two subsequent name changes in 1986 and 1991.

deducting the percentages of residents employed in the primary sector<sup>7</sup> and those whose source of employment was “not specified” from 100 per cent to determine the percentage of residents employed outside the primary sector. The results of this analysis are presented in Table 9.

*Table 9: Percentage of residents employed outside the primary sector*

	1981	1986	1991	1996	2001
Lower Waitaki	41.3	42.6	44.3	38	40
Amuri	49.4	46.4	46.7	36.2	40.1
New Zealand	87.6	88.3	87.9	84.6	86.4

Source: Statistics New Zealand

Table 9 shows that the proportion of residents of Lower Waitaki who were employed outside the primary sector remained relatively constant at around two-fifths over the 20 year period. By contrast an declining proportion of Amuri’s’ residents held employment outside the primary sector, falling from 49 per cent in 1981 to 40 per cent in 2001. These trends indicate that although the population of Lower Waitaki increased by 15 per cent over 20 years and the population of Amuri only grew by just over 1 per cent (see Table 1), most of their residents continue to be employed in the primary sector. In Amuri, the major shift to dairying that occurred in the early 1990's is reflected in the sharp decline from 47 to 36 per cent in the proportion of residents employed outside the primary sector which occurred between 1991 and 1996. Thus an irrigation scheme may not only stimulate population growth, or arrest rural depopulation, but it may also provide greater employment to an area, provided the new land use (e.g. dairying) contributes more on farm jobs than existing forms of agricultural production.

### **Occupational status of residents**

The type of occupations held by residents of a particular area reveals the diversity of jobs that are available to them and provides information about the access they have to quality jobs with high status and better than average incomes. Longitudinal data about occupations can indicate whether residents of an area have improved their economic welfare through holding higher status occupations.

Occupational data were obtained through Supermap and Statistics New Zealand. There were seven occupational categories in 1981 and six in 1986, with the sales workers and service workers categories of 1981 being combined into one category (i.e. sales and service workers). In 1991 the number of occupational categories was increased to ten and several were reclassified. Then in the 1996 census the armed forces category was removed. There were nine occupational categories for 1996 and 2001, and their classifications remained the same as in 1991<sup>8</sup>. Percentages of the number of residents employed in each of the occupational categories were calculated for all five censuses even though there were different numbers of occupational categories except for the last two censuses. Changes were compared over this 20 year period by consolidating most of the occupational categories into two broad occupational groups -

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<sup>7</sup> The agriculture, hunting, forestry and fishing category for 1981 to 1991, which subsequently became the agriculture, forestry and fishing category for 1996 and 2001.

<sup>8</sup> The minor exception was elementary occupations which had “(incl. residuals)” added at the 2001 census.

higher status occupations and blue collar occupations<sup>9</sup> - and then calculating the percentages of residents belonging to each of these groups. The results of this analysis are presented in Tables 10 and 11.

*Table 10: Percentage of residents with higher status occupations*

	1981	1986	1991	1996	2001
Lower Waitaki	6.2	7.7	12.8	13.6	19.2
Amuri	9.3	9	20.4	15.1	18.6
New Zealand	17.7	19.9	34.4	34.2	37.4

Source: Statistics New Zealand

The proportion of residents with higher status occupations in Lower Waitaki increased threefold between 1981 and 2001 (see Table 10), while the proportion with these occupations in Amuri doubled. The shift towards higher status occupations in Lower Waitaki was much stronger than the national trend suggesting that over this period residents of this area have gained access to higher quality jobs. Although the proportion of residents with blue collar occupations in Lower Waitaki slowly declined over the same period, as Table 11 reveals, the proportion of residents of Amuri with these lower status occupations remained relatively constant at around 70 per cent.

*Table 11: Percentage of residents with blue collar occupations*

	1981	1986	1991	1996	2001
Lower Waitaki	76.5	79.9	70.4	71.4	70.2
Amuri	70.3	68.7	67.8	67	69.6
New Zealand	43.5	41.5	37	33.6	36

Source: Statistics New Zealand

## **Employment status of residents**

The employment status of residents provides information about the numbers of residents of a particular area who are wage and salary earners, employers, self-employed, and unpaid family workers. This information can be used to assess changes in the scale of local enterprises, and to ascertain if more jobs are being generated in the area whether they be on farm or in agricultural support industries.

Employment status data were compiled from Supermap and Statistics New Zealand. Although the six categories of employment status in 1981 were replaced by five categories from 1986 onwards, and there were some minor changes in the descriptions of the categories, the classification system is relatively consistent over all five censuses. Three of these categories of employment - wage and salary earners/ paid employees, employers, and self-employed - were selected, and percentages of the number of residents employed in each category were calculated for the censuses. These percentages are presented in Tables 12, 13 and 14.

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<sup>9</sup> Higher status occupations comprise the professional, technical and related workers; and administrative workers in 1981 and 1986, and legislators, administrators and managers; professionals; and technicians and associate professionals in 1991, 1996 and 2001. Blue collar occupations comprise agriculture, animal husbandry and forest workers, fishermen and hunters; and production and related workers, transport equipment operators and labourers in 1981 and 1986, and agriculture & fishery workers; trade workers; plant and machine operators and assemblers; and elementary occupations in 1991, 1996 and 2001. Clerical workers, sales and service workers; and armed forces (1991) were the occupational categories that were excluded for the purposes of this analysis.

*Table 12: Wage & Salary Earners/Paid Employees as Percentage of Residents 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	50.5	55	54.5	57	55.3
Amuri	68.5	61.5	57.8	50.3	56
New Zealand	81.7	75.7	70.1	68.6	69.7

Source: Statistics New Zealand

*Table 13: Employers as Percentage of Residents 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	19.7	17.1	15.9	21.2	24
Amuri	15.2	14.3	14.9	19.3	22.8
New Zealand	5.9	6.8	6.9	6.9	6.9

Source: Statistics New Zealand

*Table 14: Self Employed as Percentage of Residents 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	23.1	19.8	17.4	11.3	12
Amuri	12.7	15.4	19.5	13.9	15.5
New Zealand	7	8.2	10.2	10.5	11.5

Source: Statistics New Zealand

An examination of Tables 12 to 14 reveals that Lower Waitaki had increasing proportions of wage and salary earners and employers among its residents between 1981 and 2001, whereas the proportion of self-employed residents was nearly halved from 23 to 12 per cent. For Amuri, however, the proportion of wage and salary earners decreased from 69 to 56 per cent, the proportion of employers grew from 15 to 23 per cent, while the proportion of self employed increased from 13 to 16 per cent. These findings indicate that the scale of enterprises has increased in the Lower Waitaki as there are more employers and wage and salary earners among the population, and that additional jobs have been created in the area. Many of those additional jobs would have been on farm as dairying has increased labour requirements compared to sheep farming.

### **Labour force status**

The labour force status of residents of a particular area allows the quality of jobs in a particular area to be appraised. The classification of jobs into full-time and part-time provides a relatively unsophisticated measure of the quality of employment. A shift into part-time employment by residents with a concurrent loss of full-time jobs would indicate a decline in job quality; particularly in the current climate where part-time employment has become associated with unskilled and low paid work.

Data about the labour force status residents were obtained from Supermap and Statistics New Zealand for the five censuses. The number of labour force status categories at each census varied between three and four<sup>10</sup>. There were also some minor changes in the naming of these categories. Percentages of residents employed full-time were calculated for each census and the results are recorded in Table 15.

<sup>10</sup> The four categories although varying in their names were full-time, part-time, unemployed and not in labour force. The unemployed category only appeared in the 1981 and 2001 census data supplied by Statistics New Zealand.

Table 15: *Employed Full-Time as Percentage of Labour Force 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	53.6	55	54.5	59	63
Amuri	61.8	59.5	54.6	54.4	58.3
New Zealand	51.9	54.3	49.3	45	46

Source: Statistics New Zealand

In terms of holding full-time jobs the residents of both Lower Waitaki and Amuri have fared relatively well compared with other New Zealand citizens. As Table 15 shows the proportion of Lower Waitaki's residents with full-time employment increased from 54 to 63 per cent between 1981 and 2001. The share of full-time jobs held by residents of Amuri fell from 62 to 58 per cent over this period, while at the national level the proportion of people employed full-time declined from 52 to 46 per cent. Thus Lower Waitaki's residents have benefited from major changes to the district's economy, including the irrigation scheme and the shift to dairy production, through additional full-time employment.

### Median of household incomes

The median of household incomes provides a benchmark to compare levels of economic welfare between different areas at a particular time. Unless it is adjusted for inflation, however, it is a less reliable indicator of changes in economic welfare within a particular area over the long term.

The data for household incomes for all censuses were obtained directly from Statistics New Zealand. The medians of household income were recorded at the bottom of tables that reported the distribution of household incomes. The median household incomes of Lower Waitaki and Amuri are presented in Table 16.

Table 16: *Median Household Income (\$NZ) 1981-2001*

	1981	1986	1991	1996	2001
Lower Waitaki	14,222	18,688	31,059	34,744	43,864
Amuri irrigated area <sup>11</sup>	15,749	17,584	24,063	34,698	42,001
New Zealand	14,957	23,234	30,910	34,707	39,588

Source: Statistics New Zealand

As Table 16 reveals the median household income of Lower Waitaki was higher than that for the Amuri irrigated area at all censuses except 1981, and from 1991 onwards it was also higher than the median household income for New Zealand. The Amuri irrigated area, by comparison, had a lower median household income than New Zealand in 1986 and 1991, but it rose significantly during the 1990's to be higher than the national median household income in 2001. These findings indicate that both Lower Waitaki's and Amuri irrigated area's households have improved their incomes relative to the rest of the country, with some of that improvement due to the shift to dairying in these areas.

<sup>11</sup> Only data for the Amuri irrigated area (MBs 2428700, 2429000, 2430000, 2430101, 2430201, 2430203, 2430300, 2430400, 2430500, 2430600, 2430701, 2430800, and 2430902) are included in this table. The settlements of Culverden and Rotherham are excluded.



## Distribution of household incomes

This section complements the analysis of median household incomes by examining the distribution of household incomes in particular areas. The manner in which incomes are distributed between households provides another benchmark with which to compare the economic welfare of particular areas. Like median household incomes it is not a reliable indicator of long term changes within a particular area unless an adjustment is made for inflation.

The distribution of household incomes for all censuses were obtained directly from Statistics New Zealand. They were presented in income bands ranging from a loss and zero income through intermediate levels to a variety of top income levels<sup>12</sup>. Percentages were calculated for all these income bands, and then they were added together to comprise two broad income categories - households with incomes of \$30,000 and under, and households with incomes of \$50,001 and over to allow comparisons to be made over all five censuses. The results of this analysis are recorded in Tables 17 and 18.

*Table 17: Percentage of Households with Incomes of \$30,000 and under*

	1981	1986	1991	1996	2001
Lower Waitaki	71.8	54.9	42.4	35.8	27.4
Amuri	74.8	74.5	55.4	39.8	33.8
New Zealand	75.2	56.1	42.5	36.7	32.3

Source: Statistics New Zealand

The proportions of households with incomes of \$30,000 or under in Lower Waitaki, Amuri, and New Zealand declined rapidly over this 20 year period as shown by Table 17. Much of this decline during the 1980's was due to the high rates of inflation rather than rising real incomes. Lower Waitaki consistently had a smaller proportion of households in this lower income category than Amuri throughout this period. Furthermore, as Table 18 reveals, Lower Waitaki had a greater proportion of households with incomes of \$50,001 and over than Amuri in all five censuses. Although these results provide further evidence that Lower Waitaki's households have improved their incomes relative to Amuri, they are inconclusive as to how that area's households have fared in comparison with the nation's households.

*Table 18: Percentage of Households with Incomes of \$50,001 and over*

	1981	1986	1991	1996	2001
Lower Waitaki	5.6	4.2	15.3	26.3	34.7
Amuri	4.7	0.9	10.7	21.1	28.9
New Zealand	1.9	9	22.9	27.4	31.9

Source: Statistics New Zealand

## OTHER QUANTITATIVE AND QUALITATIVE PARAMETERS

The parameters selected for the analysis of data about Lower Waitaki and Amuri from other sources were as follows:

- school rolls and other information about schools, and
- community organisations and support services.

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<sup>12</sup> These top income levels were \$60,000 and over for 1981, \$50,001 and over for 1986, \$70,001 and over for 1991, and \$100,000 or more for 1996 and 2001.

## School rolls and other information about schools

The rolls of schools, and qualitative data about schools, provide important indicators of demographic and social change in rural communities. Not only do schools provide educational services to children, but they often provide an important focus for community activities. Those activities which may be directly associated with the school itself, or use the school's facilities, create and maintain social networks that sustain the vitality of a community.

Data about the rolls of schools in Lower Waitaki and Amuri were available for the years 1990 to 2001. They were obtained in electronic form from the Ministry of Education in Wellington, and are documented below in Table 19. This table includes the three schools currently operating in the Lower Waitaki (Papakaio) and Amuri (Amuri Area School and Rotherham) areas as well as a school in the Lower Waitaki (Hilderthorpe) which has closed during the last ten years. The roll counts are listed at two year intervals from 1991 onwards. Other information about schools in the Lower Waitaki were obtained from community studies by Houghton (1980) and McCrostie Little *et al.* (1998a).

Houghton (1980: 120) identified four primary schools operating in the Lower Waitaki area in 1980. The schools were Awamoko, Papakaio, Hilderthorpe and Waitaki Bridge. Awamoko was a single teacher school, and Papakaio had three teachers. There was no information in her study about the rolls of those schools. The Papakaio school was staffed by four full-time and two-part-time teachers in 1998, and Hilderthorpe School was under threat of amalgamation with Papakaio. Sharemilkers were arriving in Lower Waitaki when their children were two or three years old, and leaving when their children were between nine and eleven. This made the schools' rolls "bottom heavy" with large junior classes (McCrostie Little *et al.*, 1998a: 15).

The rolls of schools operating in Lower Waitaki (Papakaio and Hilderthorpe) and Amuri (Amuri Area School and Rotherham) over the last 11 years are shown in Table 19. While Papakaio has had a strong growth in student numbers since 1993, much of that growth is probably due to the closure of Hilderthorpe. Hilderthorpe's closure suggests that schools are not always closed because of declining rolls. Sometimes school closures may be more the outcome of Ministry of Education policy and local politics than the result of rural depopulation. Although the roll of the Amuri Area School has increased from 263 to 303 pupils between 1991 and 2001, the roll of the Rotherham School has fluctuated between 21 and 32 pupils. Dairy farmers and their workers in the Amuri area are more likely to have young children than their traditional pastoral counterparts (Hunt, 1998: 34), and this has helped maintain the viability of the two local schools.

Table 19: School rolls at 1 July 1991-2001 (two year intervals) - Lower Waitaki and Amuri

School	1991	1993	1995	1997	1999	2001
Papakaio	75	56	73	87	98	116
Hilderthorpe (1)	19	28	35	38	-	-
Amuri Area	263	234	262	309	313	303
Rotherham	21	30	32	27	31	23

Source: Ministry of Education

Notes: (1) Closed after 1998.

## Community organisations and support services

The variety and number of community organisations and support services provide information about the vitality of community life in a particular area. When the lives of these organisations can be examined over a period of at least ten years, they often reflect the social change that has occurred in a rural community. There is evidence from the studies of the Waitaki Plains (McCrostie Little *et al.*, 1998a: 17-18, Hamilton and Elliot, 1994: 7) and the Amuri (Hunt, 1998: 34), for instance, that indicates the influx of dairy farming families to a district alters the degree and pattern of participation in community activities.

A current directory of community organisations and support services in the Waitaki District was obtained from the North Otago Citizens Advice Bureau. This directory provided information for a list of organisations whose primary purpose is to serve the Lower Waitaki area. Other information about organisations in this area was obtained from a community study of the Lower Waitaki (McCrostie Little *et al.*, 1998a). For the Amuri area information about community organisations and support services was obtained from the NZ Business Directory CD-Rom (UBD, 2001). These sources of information were examined and short accounts of community organisations were prepared.

In the Waitaki Valley there is a wide variety of support services and organisations. Most of those organisations are based in the larger settlements of Kurow and Duntroon which are to the west of the irrigated area. Residents of the Lower Waitaki also participate in community organisations in Oamaru. There are several community organisations based in the irrigated area itself, including a Lions Club, a branch of the Plunket Society, a play centre, tennis club and garden club. Several of these organisations are based at Papakaio where there is a large multi-facility centre with a heated swimming pool and squash courts, and a golf course (McCrostie Little *et al.*, 1998a: 18). Hamilton and Elliot (1994: 7) note the establishment of this multi-facility centre was the outcome of renewed confidence in the community and the arrival of “younger families associated with the irrigation development”. Although the community is more affluent than it was before irrigation was introduced, both the local church and the Country Women’s Institute have closed (McCrostie Little *et al.*, 1998a: 18).

The Amuri irrigated area, which includes the settlements of Culverden and Rotherham, also has a range of support services and organisations. They include a service centre of the Hurunui District Council, a community health centre, Plunket Clinic rooms, St Johns Ambulance, police, fire brigade, a community library, a book discussion group, local branches of the RSA and CWI, five sports clubs (golf, netball, rugby, tennis and indoor bowls) and four churches (UBD, 2001).

Both the Lower Waitaki and Amuri areas are well served by community organisations and support services. Without further community research it is difficult to assess what effects economic changes such as the irrigation scheme or the shift to dairying has had on activities and membership levels. Moreover, these short accounts of community organisations based on secondary sources provide little understanding of the economic and social changes that have transformed the everyday lives of people in these two areas since 1980.

## CONCLUSION

Irrigation technology, new farming routines and work patterns are seen by the farming community as the realm of 'youth and enthusiasm'. So there is a demographic change towards younger farm families when irrigated farming systems are adopted. Irrigation and associated land uses also demand a wider skills base amongst farm workers, farming service providers and contractors, rural service providers and small business people.

New land uses such as dairying bring newcomers with different skills who replace families holding traditional skills. As a result the community can initially be destabilised. The leadership role of those families who remain, changing their own skills base and upgrading their existing production to effectively utilise irrigation, is critical during this interim period. They help both to validate the new land use and maintain some sense of stability in the community. They become 'social anchors' for the emerging community. Furthermore, a stabilised or even increased population can have a positive impact on local schools, sports and recreation facilities and other social services, strengthening rural communities.

The data from this research confirms that the introduction of irrigation into farming systems creates distinct social impacts through changed and new farming systems, and wider demographic and community changes. The data also confirm the waves of change suggested previously by community case studies.

Key social changes that accompany irrigation and land-use change are:

- Growth in population as farms convert to dairying. This trend was particularly evident during the first 15-20 years after the schemes commenced operation.
- Higher proportions of people 14 years and under, and people of working age (15-64 years).
- Changed age structure of farmers and farm workers as farms convert to dairy production with a gradual increase in the proportion of farmers and farm workers under 30 years of age.
- Growth in the proportion of dairy farmers and workers in the farmers and farm workers occupation group as farms convert to dairy production.
- A higher proportion of dairy farmers dairy and workers under 30 years of age than the national pattern of this occupation group.
- An increased proportion of residents with tertiary qualifications due to the arrival of highly qualified operators and managers of dairy farms, while the proportion of residents with no educational qualifications may follow national trends as dairying also requires a pool of young people to provide relatively unskilled labour.
- Maintenance of the proportion of residents employed inside the primary sector as dairying and other more labour intensive forms of primary production such as specialised cropping and horticulture provide employment.
- An increase in the proportion of residents with higher status occupations with the arrival of highly qualified operators and managers of dairy farms.
- A growing proportion of wage and salary earners, while the proportion of self-employed residents declines as additional jobs are created as the result of the shift to dairying.

- An increased proportion of residents with full-time jobs due to the rising demand for labour on dairy farms this could be offset by an increase in horticultural production.
- An improvement in median household income relative to the rest of the country as the conversion to dairy production proceeds.

The model of change appears robust for the Waitaki Plains and Amuri areas, however, use of the information to support social assessment and decisions about future irrigation projects should be made with caution. Observations to note are:

- The social and economic conditions when the Lower Waitaki Plains and Amuri irrigation schemes began operation were vastly different from those existing today when new irrigation schemes are being investigated.
- The pattern of land use in the Lower Waitaki Plains and Amuri area will be different to those in any new areas of irrigation today.
- The Lower Waitaki Plains and Amuri areas came into irrigation from a period of population decline whereas new schemes may have population growth as a result of land subdivision.
- The Lower Waitaki Plains and Amuri were dryland farming areas prior to the introduction of the schemes, whereas parts of areas proposed for new schemes are already irrigated from groundwater.

These observations limit the application of the Waitaki and Amuri areas as historical and comparative cases. In particular, any exercise that tries to quantify predictions of social change could be based on dubious premises. Descriptive scenarios of change will be more robust, and the experiences documented in this paper can contribute to a broad discussion of demographic and social trends expected as a result of a new irrigation project on the East Coast of the South Island.

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