Assessing the social impacts of irrigation - a framework based on New Zealand cases

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Nick Taylor, Taylor Baines and Associates
Wayne McClintock, Taylor Baines and Associates
Heather McCrostie Little, Ruris

Abstract

Irrigation can transform society as well as land and landscapes. This paper uses ex-post and ex-ante studies of irrigation projects in New Zealand to develop a framework for assessing the social impacts of irrigation. A model of social changes in areas transformed by irrigation identified how waves of land-use change are accompanied by changes in farm ownership, and changes in workforce and demography. Several quantitative measures are used to identify social changes in two irrigated areas. Most of the data are obtained from specialised analysis of the Census of Population and Dwellings. The parameters include total population, children under 15 years, presence of young farmers and farm workers, levels of education, and school rolls. The data complement information from community research, which identifies issues for community change, workforces and business planning. In addition to social and economic impacts of land use change, the case studies identify other variables to consider, such as the impacts of constructing reservoirs and canals on host communities, visual impacts, changes in water quality and impacts on water based recreation. Furthermore, social impacts will vary over the life cycle of an irrigation project, including planning, construction and operation. While proponents argue irrigation projects will bring economic and social benefits, the social-impact framework utilises a broader analysis of benefits and costs, with ongoing social monitoring, active participation of interested and affected parties, and management of change from a community perspective.

Keywords: Social impacts, irrigation, land-use change, demographic change, New Zealand

Contact:
Nick Taylor
75 Oxford Road, Rangiora, North Canterbury, New Zealand,
Ph/fax 64 3 3138458
email: n.taylor@tba.co.nz
website: www.tba.co.nz

Introduction

Irrigation can transform society as well as land and landscapes (Blake and Taylor, 1986; McCrostie Little and Taylor, 2001). It has long been accepted in agricultural societies that the power of water managed through irrigation can transform the land. Citing historical examples from ancient to modern times, Morton (1978) points out that it is not so widely appreciated "water can transmute a society as definitely and profoundly as it transforms the landscape". New Zealand is no exception, with large areas of agricultural land in the east of both the main islands subject to severe soil moisture deficits in summer and periodic, sometimes crippling, droughts.

In a seminal publication, Coward (1980) argued irrigation could be viewed as hydrological systems, as engineering systems or as farming systems. They could also be viewed as systems of social organisation, closely linked to the bio-physical environment and engineering structures. Irrigation development is therefore a complex task involving changes to landscape and physical structures, farming systems and social life. Reflecting on Coward's work, Blake and Taylor(1984) argue that planning for irrigation must take into account the implications that changes in both engineering and farming systems will have on social life.

Practitioners of social impact assessment (SIA) should develop their capacity to contribute to impact assessment of irrigation projects. This capacity building should be enhanced by an assessment framework based on analysis of comparative cases. Comparative cases utilising ex post and ex ante examples are an essential tool for SIA partitioners to ensure there is experiential learning rather than an ad hoc approach (Taylor, et al., 2002).

This paper uses ex-post and ex-ante studies of irrigation projects in New Zealand to develop a framework based on comparative cases for assessing the social impacts of irrigation. After discussion of methods and data sources, a model is provided for social changes in eastern areas of the South Island of New Zealand transformed by irrigation. These areas demonstrate that waves of land-use change through irrigation are accompanied by changes in farm ownership, composition of the workforce, demography and community. Several measures are used to identify social changes in two irrigated areas, the Waitaki Plains and the Amuri Plains. The paper also draws on social assessment of a proposed irrigation project to develop the SIA framework of potential social impacts beyond land use change, especially impacts arising from structures such as reservoirs and canals. Furthermore, the paper points out that large-scale irrigation causes environmental impacts with social consequences, including conflict over the use of water resources, pollution of surface and ground water by intensive agriculture, changes in drainage, and effects on infrastructure such as increased traffic volumes on roads arising from intensified production.

Methods and sources of data

Ex post analysis of irrigation projects provided a model of social change under irrigation to form the core part of an SIA framework. In the first phase of its development, the model was based on two, largely qualitative, community case studies undertaken in the Waitaki Plains in North Otago and Clandeboye in South Canterbury. These case studies were two of 19 community studies completed as part of a research programme called "Resource Community Formation and Change", funded by the New Zealand Foundation for Research, Science and Technology[1]. The programme examined the relationship

[1] Resource Community Formation and Change, contracts TBA601, TBA801 and TBAX0001 over the period 1996-2002. For further information on the research project contact Taylor Baines & Associates (PO Box 8620, Christchurch or visit the website www.tba.co.nz).

between communities and their natural resource base, with comparative analysis of communities that are dependent on agriculture, forestry, mining, energy (oil and natural gas, hydro-electric power generation), fishing and tourism. This research provided a substantial base of information about these types of communities that can be applied to future impact assessments and social and economic development strategies (Taylor et al., 2001, Taylor et al., 2002).

In the second phase of its development, the model was tested and developed further using mostly quantitative 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[2]. As this study was based mainly on the Waitaki Plains, the parameters were then tested and developed further by data from the Amuri Plains.

Most of the data were obtained from specialised tables compiled from the New Zealand Census of Population and Dwellings for five censuses between 1981 and 2001. The parameters selected for analysis were:

- 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.

Other data were obtained from the Ministry of Education (school rolls), a local government agency, the New Zealand Business Directory Data Base and previous research.

An ex ante SIA of a proposed irrigation project in Central Canterbury, the "Central Plains Water Enhancement Feasibility Study", provided further development of the framework for impact assessment.

A model of social changes

Social research from a number of sources provides an understanding of the development and consequent social impacts of irrigation schemes in New Zealand. Changes in the attitudes and adaptations of farm families, subsequent ownership changes, and consequent demographic changes, are of particular interest to an SIA framework for irrigation.

Early irrigation schemes on the Waitaki River did not realise the full potential of water as farmers were limited by the farm technology available then (Butcher Partners Ltd., 2000). By the 1950s, advances in border dyke and spray irrigation prompted 'experimental schemes', and in the 1960s central

[2] 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.

government policies for national development lead to community schemes such as the Waitaki Plains. More community schemes took place in the 1970s. In North Canterbury, irrigation was first mooted in the 1950s but it was not until the late 1970s that the Waiau scheme began on the Amuri Plains, with the full scheme completed some ten years later (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 versions of sheep and beef farming systems, albeit less vulnerable to the vagaries of climate. Several generations of New Zealand farmers viewed irrigation primarily as an "insurance" against perverse climate events 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 by farmers. As that potential was realised social change became more apparent.

Farmers and rural communities soon learnt that if their substantial investment in water resources is more than simply an insurance against drought the application of water becomes a new daily function with associated new farming practices, including dairy farming. These new practices meant changes in patterns of work. Therefore irrigation was often linked to youth and enthusiasm, and in many instances to new farmers, particularly dairy farmers. These farmers saw irrigation very much as a farm management tool.

The available research shows successive ownership and land use changes coming in waves after the introduction of irrigation (McCrostie Little and Taylor, 2001). 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 later for dairying, and building bigger and better homes and farm buildings. The Amuri replicates the Waitaki experience with 60 per cent of farms there changing ownership since the advent of irrigation (Hunt, 1998).

The community case studies, based primarily on community interviews, provided a descriptive model of successive waves of interlinked changes in land use and farm ownership.

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.

Parameters of social change with irrigation

Social changes identified in the model were assessed using a number of key parameters. Testing of these parameters has provided an empirical basis for defining variables to use in SIA of irrigation.

Usually resident population

Changes in the usually resident population of an area indicate an inflow or exodus of people into the area and associated changes in the local economy. These population movements are characteristic of rural districts with natural resource based industries. Lower Waitaki had a steady increase in population between 1981 and 1996 which during the 1980s exceeded the growth rate of the national population. Amuri, by contrast, experienced a decline of population in the 1980s, but recovered these earlier losses with a strong period of population growth during the 1990s. Amuri's population decline during the 1980s 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 irrigation in the Lower Waitaki since the mid 1970s 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 1990s, 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.

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

Age structure of the usually resident population

Age structure is an important parameter because changes in an area's age structure over time affects demand for infrastructure and social services, in particular education and health. Age structures of the Lower Waitaki, Amuri, and New Zealand populations, 1981 to 2001, were summarised into age bands. Two are used as indicators of social change, people aged 0-14 years (Table 2) and people aged between 15 and 64 years (Table 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*[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 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 (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 (Table 3).

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*	*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 farmers and farm workers

The ages of farmers and farm workers indicate changes associated with agricultural production and any major shift in land use, including changes due to irrigation. The age structures of farmers and farmer workers occupational groups of Lower Waitaki, Amuri, and New Zealand, 1981 to 2001, were summarised in several age bands, and then the percentages of these bands were consolidated for further analysis into one major age group - farmers and farm workers under 30 years of age (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

[3] There were difficulties reconciling the total UR population of Amuri from Supermap so the proportions for these three census years were calculated using the totals from the age groups, and are included in Tables 2 and 3 in italics.

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.

Dairy farmers and farm workers

Changes in the proportion of dairy farmers and dairy farm workers among the occupational group of farmers and farm workers indicates the extent to which areas have either taken up or opted out of dairy production. Although irrigation allows farmers to intensify their existing farming practices, the model shows further waves of change as younger farmers replace older farmers and convert their properties to new land uses. Data on the proportion of dairy farmers and farm workers quantify this shift in land use. Data about the proportion of dairy farmers and dairy farmers in Lower Waitaki, Amuri, and New Zealand, 1981 to 2001, are shown 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, using the relevant occupational codes for each census

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 per cent) demonstrates the major shift in land use from sheep and beef farming and mixed cropping to dairying that occurred over 20 years. By comparison the switch to dairy production in Amuri did not gain momentum until the early 1990s. 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 community case study by McCrostie Little et al. (1998a: 6-7) noted that irrigation farming in the area is the domain of younger people. During the early years of the of the Waitaki Plains irrigation scheme these younger people, initially from the North Otago down lands, intensified the cropping and grazing practices in the area. Later, dairy-farm families from the North Island moved in. This conversion of farm units to dairy production was investigated further by examining census data about the age structure of 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. 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 data about dairy farmers and dairy workers were broken into age categories as for the

general occupational group of farmers and farm workers. The proportion of workers under 30 years of age was selected as the key indicator of change (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 was much higher than for all dairy farmers and workers (e.g. 45 per cent cf. 22 per cent for NZ in 2001) for the four censuses for which there were sufficient data (see Table 6). In the Amuri, the major shift to dairying during the early 1990s 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. Data about highest educational qualifications, 1981 to 2001, focussed on the broad categories of tertiary qualifications and no qualifications (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. 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). 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.

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

Employment by industry of the usually resident population

Employment by major industrial sector 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 indicate how residents of an area have become more or less dependent on specific industries for their employment (Table 9). 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 a 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 1990s 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.

Table 9: Percentage of usual 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, adjusted for reclassification of sectors in 1996

Occupational status of the usually resident population

The type of occupations held by residents reveals the diversity of jobs available 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 for 1981-2001, were obtained by consolidating most of the occupational categories into two broad occupational groups, high-status occupations and low-status occupations, with adjustments for changes in categories (Table 10).

Table 10: Percentage of residents with high and low status occupations

	1981		1986		1991		1996		2001	
	High status	Low status	High status	Low status	High status	Low status	High status	Low status	High status	Low status
Lower Waitaki	6.2	76.5	7.7	79.9	12.8	70.4	13.6	71.4	19.2	70.2
Amuri	9.3	70.3	9	68.7	20.4	67.8	15.1	67	18.6	69.6
New Zealand	17.7	43.5	19.9	41.5	34.4	37	34.2	33.6	37.4	36

Source: Statistics New Zealand

The proportion of residents with high-status occupations in Lower Waitaki increased threefold between 1981 and 2001 (Table 10), while the proportion with these occupations in Amuri doubled. The shift towards high-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 low-status occupations in Lower Waitaki slowly declined over the same period, the proportion of residents of Amuri with these lower status occupations remained relatively constant at around 70 per cent.

Household incomes

The median of household incomes provides a benchmark to compare levels of economic welfare between different areas at a particular time (Table 11). The median household incomes of Lower Waitaki and Amuri, 1981-2001, reveal the incomes 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 1990s to be higher that 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.

Table 11: 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[4]	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

School rolls and other information about schools

The rolls of schools, and qualitative data about schools, are important indicators of social change in rural communities. Rural schools provide an important focus for community activities, both directly associated with the school or using the school's facilities. These activities create and maintain social networks and sustain community vitality. Data about the rolls of schools were obtained from the Ministry of Education (Table 12) and other information from community studies by Houghton (1980) and the community case study. These studies indicated dairy farmers and farm workers moving in with younger families, making the school rolls "bottom heavy" with large junior classes. Hilderthorpe's closure suggests schools are not always closed because of declining rolls as the Ministry of Education

[4] The settlements of Culverden and Rotherham are excluded.

has a policy to consolidate rural schools. 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 12: School rolls at 1 July 1991-2001 (two year intervals) - Lower Waitaki and Amuri

School	1991	1993	1995	1997	1999	2001
Papakaio (Lower Waitaki)	75	56	73	87	98	116
Hilderthorpe (1) (Lower Waitaki)	19	28	35	38	-	-
Amuri Area School	263	234	262	309	313	303
Rotherham (Amuri)	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. Over a period of at least ten years they often reflect the social change that has occurred in a rural community. Evidence for the Waitaki Plains (Hamilton and Elliot, 1994: 7) and the Amuri (Hunt, 1998: 34) indicates the influx of dairy farming families alters the degree and pattern of participation in community activities.

Data on the numbers of community organisations in the Lower Waitaki area and Amuri show there is a wide variety of support services and organisations. Most of those organisations are based in the larger settlements nearby. There are numerous community organisations based in the Lower Waitaki irrigated area itself, several at Papakaio where there is a large multi-facility centre with a heated swimming pool, squash courts and golf course. 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.

The Amuri irrigated area, with 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).

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. The case studies showed communities undergoing irrigation development undergo considerable social change as the 'old' families move out and their place is taken by 'new' families, creating a difficult period of social change. In the Lower Waitaki, social divisions grew between the old and the new families, especially with the entrance of the first dairy families from outside. Within the traditional social context, dairying was not a "highly rated occupation" and social dysfunction was caused by a lack of understanding of the work patterns of the different groups of farmers. While the average age of the community may be younger, an expectation youth and enthusiasm will mean community involvement may not be fulfilled. The daily pattern of dairy farm work, and the transient nature of much dairy-farm

work, may mean some families take little part in the community, causing friction with more established community members. Here the leadership role of those families who remain, changing their own skills base and upgrading their existing production to effectively utilise irrigation, is critical. They help both to validate the new land use and maintain some sense of stability in the community.

Impacts associated with capital works and operational activities

While the main focus of this paper is on social impacts of land use change, the comparative cases identify other factors to consider, such as the impacts of constructing reservoirs and canals on host communities, visual impacts, changes in water quality and impacts on water based recreation.

Construction impacts - construction of works such as dams and canals creates physical impacts such as noise, heavy traffic movements and dust (remembering the environment will be inherently dry) and these impacts have social consequences including stress for nearby residents. Construction is also likely to interfere with farm management practices such as stock movement. Workers for the major construction activity will probably have to come to a rural area from a wide labour market, and be housed and integrated with the community for a period of time.

Impacts arising from structures such as reservoirs and canals after construction - these include visual impacts, re-routing of highways, and physical risks in the more unlikely event of an earthworks failing. In New Zealand, with high engineering standards, this risk is acute in the minds of residents adjacent to any new dam following the partial collapse of the new irrigation dam on the Opihi river.

Abstraction of water - withdrawal of surface water creates potential conflicts with other users over the use of water resources, with recreational users affected in particular. While new storage areas and canals have some potential use for recreation their values are usually limited by widely varying water levels, low levels in the driest times of the year, and operational restrictions. Ground and surface water abstraction also potentially impact on downstream users such as groundwater irrigation and urban or industrial water supplies.

Changes in drainage - irrigation infiltration can recharge aquifers and potentially alter drainage patterns downstream.

Pollution of surface and ground water by intensive agriculture - is a major indirect consequence of new forms of land use through irrigation. Because of the high capital costs of irrigation, plus high operational costs, farmers are inevitably drawn to higher yielding crops, often requiring higher inputs of fertiliser and other chemicals. Dairying also adds considerable animal waste into the system, raising concerns about both ground and surface water quality.

Infrastructure changes such as transport associated with intensified production - dairying is an example where heavy transport loads are created with daily tanker movements to farms. Small rural roads and bridges are often simply not built with such use in mind.

Disadvantaged groups

Some groups in the irrigation area may be disadvantaged by the proposed irrigation scheme, and its operation. Possible effects on their welfare include:

- the loss of amenity values for nearby residents who have chosen to live in a rural area for lifestyle reasons
- small business operators whose turnover may be reduced by construction work, rerouting of a highway, or the position of canals
- farms and households that need to be relocated because of inundation by a reservoir or other work.

The theme of compensation is directly related to those groups of people identified as being disadvantaged by the proposed irrigation scheme. There is a concern that compensation measures not only address issues concerning the market value of a property but also recognise that other factors, such as changes in lifestyle, disruption to future plans, and effects on amenity values have to be addressed.

Application of the framework

Irrigation, associated on-farm technology and land-use change bring new farming routines and work patterns, ownership changes, demographic changes and community changes. There are flow-on effects for farming and rural service providers, contractors and small business people, and community organisations. Construction and operation of an irrigation project also has the potential to cause bio-physical effects with social consequences.

The framework in this paper is intended to provide a guide to scoping SIA for an irrigation project, especially for considering the coverage of the SIA and identifying the relevant variables. While proponents argue irrigation projects will bring economic and social benefits, the social-impact framework utilises a broader analysis, as the basis for ongoing social monitoring, active participation of interested and affected parties, and management of change from a community perspective.

Key social changes this paper has identified for irrigation and associated land-use changes are:

- Growth in rural 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), with flow-on effects on school rolls.

- 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 in 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.

- An increased proportion of residents with full-time jobs due to the rising demand for labour on dairy farms - 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 land use and social change appears robust for the comparative case areas of the Waitaki Plains and Amuri, however, use of the information to support social assessment and decisions about future irrigation projects elsewhere in New Zealand, or internationally, should be made with caution. Observations to note are:

- The social and economic conditions, including population trends, when the comparative cases began operation may be vastly different from those existing when new irrigation schemes are being investigated.

- The pattern of pre-irrigation land use in the comparative cases may be different to those in any new areas of irrigation.

- The primary new land use, dairying in both these cases, has distinct farming system and social features.

Any SIA that tries to quantify predictions of social change based on the research 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.

Furthermore, social impacts will vary over the life cycle of any single irrigation project, from planning, through construction and operation. While proponents argue irrigation projects will bring economic and social benefits, the social-impact framework utilises a broader analysis of benefits and costs. Ongoing social monitoring is therefore required, with active participation of interested and affected parties, and management of change from a community perspective.

In conclusion, the data from this research confirms that the introduction of irrigation into farming systems can create distinct social impacts through changed and new farming systems, wider demographic and community changes, and social consequences of bio-physical impacts. The findings from these comparative cases can be used to build professional capacity through development of a conceptual framework for ex ante SIA of irrigation projects.

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