Central Otago – Built on gold, growing on grass.

BARRIE J WILLS
Central Environmental Services, 42 Ventry St, Alexandra
bjwills2@slingshot.co.nz

A warm welcome to our "World of Difference" to all delegates attending this conference – we hope your stay is enjoyable and that you will leave Central Otago with an enhanced appreciation of the diversity of land use and the resilient and growing economic potential that this region has to offer.

Without regional wellbeing the national economy will struggle to grow, something Central Government finally seems to be realising, and the Central Otago District Council Long Term Plan 2012–2022 (LTP) signals the importance of establishing a productive economy for the local community which will aid in the economic growth of the district and seeks to create a thriving economy that will be attractive to business and residents alike. Two key principles that underpin the LTP are sustainability and affordability, with the definition of sustainability being "… development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

The Primary Production Sector as a whole (agriculture, pastoral farming, horticulture and winemaking; aquaculture; forestry and mining) is the largest contributor (28.2%) to our Central Otago economy (Figure 1). In 2013 (2012) it accounted for 32% (31%) of employment, 34% (31%) of Gross Domestic Product (GDP), and 29% (29%) of business units. Agriculture is the major industry within this sector and accounted for 98% of that employment and 96% of that GDP. That sector contributed $303 ($250) million to the Central Otago District economy in 2013. The district was ranked 13th of New Zealand's 72 local authority areas for economic performance in 2012 (CODC 2013).

While sheep, beef and deer raising remain the dominant forms of pastoral farming, dairy conversions are occurring and an increasing amount of land is being used for dairy winter grazing. As land use has intensified, availability and management of water resources in the district has become a significant issue, as reflected in recent Otago Regional Council Water Plan (6A) changes. With the associated expiry of mining privileges in 2021, the next few years will see major changes in the intensity and diversity of farming, particularly on the valley floor areas in Central Otago.

The previous NZGA Conference held in our region was in 1986, so there has been a lot of water (literally)

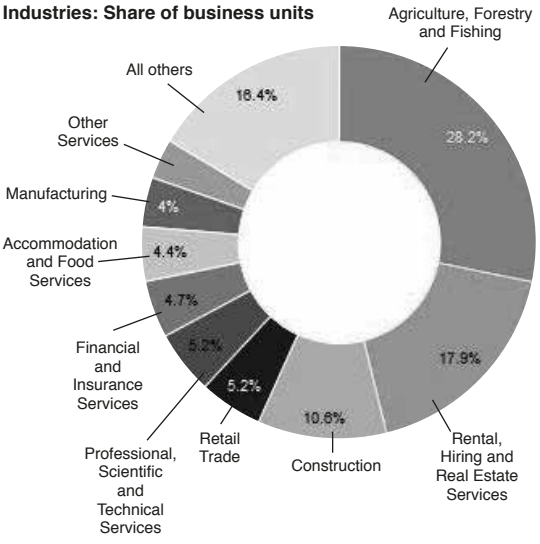

Figure 1 Central Otago Business Breakdown 2013 (Source: Infometrics Ltd 2014)

under the Clutha Mata-au River bridges in that time, including the so-called 100 year floods of 1994, '95 and '99. As a region, Central Otago is unique in many respects: the longevity of pastoral farming here (beginning in the 1850s) and the significance of indigenous grasslands to it; the recent influence of tenure review; the economic impact of gold mining (old and new) and its influence on irrigation reticulation; the landscape consisting of several parallel valleys broken by large mountain blocks; the dominance of one large catchment (the Clutha Mata-au at 21 960 km²); the relative isolation with limited road access to coastal markets but an extensive regional vehicular network serving many small and distant communities; and the (largely) semi-arid climate which places an emphasis on drought-tolerant vegetation and effective use of limited water supplies.

Geography

Central Otago is underlain by peneplaned schist and is a range-and-basin terrain with flat-topped or rolling block-faulted mountain ranges, separated by broad alluvial basins. By far the most extensive area in Otago is underlain by chlorite schist, forming the basement to the east and outcropping over much of Central Otago.

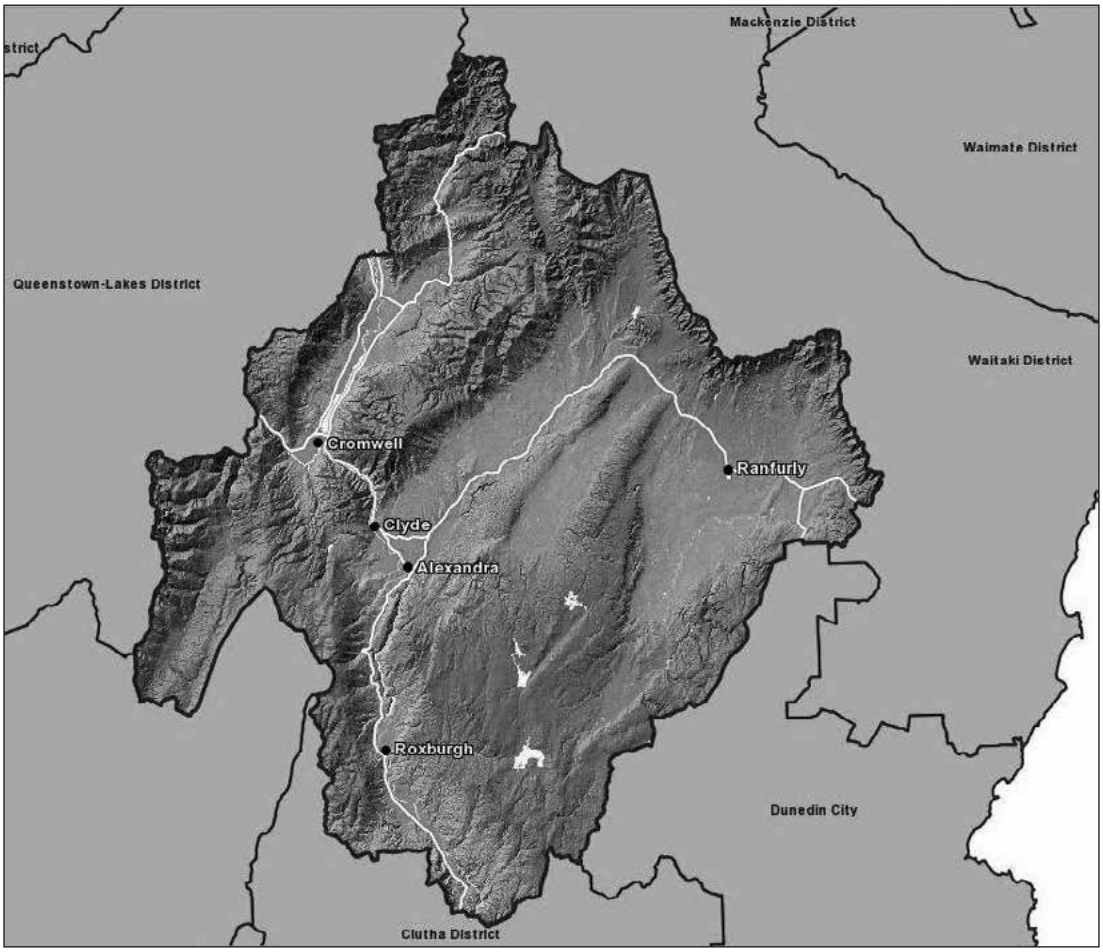

Figure 2 Central Otago topography

They are high stress metamorphic rocks, originally greywackes and argillites of the New Zealand Geosyncline. During the later stages of metamorphism they were intensely folded on a grand scale into a series of recumbent or semi-recumbent nappe-folds. Erosion rapidly stripped the overlying strata, exposing the schist rock towards the end of the Cretaceous and continued erosion extending into the Tertiary reduced the land to a peneplain. The covering forests are now preserved as lignites in Central Otago (e.g. Home Hills). At this time beds of quartzose conglomerate, sand, and white clays were laid down by slow-flowing rivers and in shallow inland lakes. Concentrated deposits of alluvial gold, originally from quartz veins in the schist, formed in many of these.

The numerous flat-topped ranges of Central Otago (e.g. Dunstan Mountains, Raggedy, and Rock and Pillar Ranges) arose mainly by block faulting during the Kaikoura Orogeny (late Tertiary and Pleistocene). Stripping of the Tertiary covering beds from the Otago peneplain and exposure of the underlying schist led to the formation of the unusual tor topography of the schist region.

The total land area within the Central Otago District (Figure 2), which comprises the bulk of the region, is about 9,960 km². The main rural servicing towns within the district are Alexandra, Cromwell, Roxburgh and Ranfurly, all having an association with our gold mining heritage as exemplified by the Otago Goldfields Heritage Trust and the popular annual cavalcades recreating the pioneer journeys of old.

Population statistics are outlined in Table 1. In terms of ethnicity, 93% of the people are of European descent, the remainder being mainly Māori. Some 37% of the population live in rural areas and the greatest population increase has occurred in the Earnscleugh/Manuherikia (Dunstan) basin, followed closely by Cromwell. The area has a population density of just 1.9 people/km²

compared to a national average of 13.1 people/km².

Land cover is dominated by indigenous tussock and pastoral grassland (Table 2), which is reflected in the history, extent and importance of the pastoral industry within the region.

Altitudinally the region varies from 300–400 m a.s.l. in the valleys to 1500–1600 m a.s.l. on the mountain tops where alpine cushion vegetation is found on exposed ridgelines, consisting mainly of *Celmisia, Dracophyllum, Raoulia, Aciphylla, Poa, Trisetum,* and *Hebe* species, plus numerous other genera. The higher pastoral reaches consist mainly of tall snow tussock (*Chionochloa*) species, phasing into short tussock (*Poa, Festuca, Rytidosperma* and *Carex*) species at lower altitude.

Minimal tussock burning occurs nowadays and under about 1000 m over-sowing and top dressing has often occurred, with exotic pasture plants like cocksfoot, white and haresfoot clovers, ryegrass, tall oatgrass and tall fescue often present. This mid-low altitude country is frequently scrub covered (with matagouri, coprosma, olearia, kanuka, brier rose etc.), particularly within water course environs and on shaded aspects, and is susceptible to invasive plants like *Hieracium* species, wild thyme and wilding conifers.

Leonard Cockayne (and Macpherson before him) carried out experimental plant introductions in the 1920s on Northburn Station (Douglas 1970), seeking productive species capable of growing under dry, depleted conditions, setting the scene for ongoing pastoral hill country development (these plots are now protected by a QEII National Trust covenant initiated at the 1986 conference). Within the valleys significant agricultural and horticultural development has subsequently occurred, primarily associated with sheep and beef raising, but more recently with deer, viticulture, dairy grazing and some milking enterprises. These activities are highly dependent on irrigation water that originates from the surrounding mountain ranges, much of which is still reticulated in old mining races (e.g. the "Last Chance", "Mt Ida", "Blackmans" and "Ewings" races) that often pick up several small streams as they meander along the mountain contours.

Commercial irrigation in Central Otago began in 1873 when Jean Desire Feraud, who made his fortune with a very successful gold claim at Frenchman's Point near Alexandra (Junction Township), took up land on the Dunstan Flats through the Agricultural Lease Regulations and was granted a water right by the Wardens Court to irrigate vegetables and a vineyard at Monte Christo, near Clyde (The Dunstan). Feraud is said to have sold raspberry vinegar, ginger wine, aniseed liquor, cherry brandy and all manner of other beverages as well as the fruit and vegetables that were growing on the large property. He also became the first mayor of Clyde.

Climate

The region experiences a continental/semi-arid climate (Köppen climate classification Cfb/BSk). Being distant from the Pacific and Tasman Oceans, Central Otago experiences cold winters and warm summers relative to the rest of the country. Temperatures regularly drop

Table 1 Population Statistics for Central Otago District (Source: Statistics NZ)

Population Statistics 2013				Increase or Decrease 2006 - 2013	
Central Otago District	**2001**	**2006**	**2013**	**Number**	**Percentage**
Alexandra	4407	4824	4800	-24	0%
Clyde	825	921	1011	90	l0%
Cromwell	2667	3585	4146	561	16%
Dunstan	3087	3771	4512	741	20%
Maniototo	948	1035	1077	42	4%
Naseby	99	114	120	6	5%
Ranfurly	732	708	663	-45	-6%
Roxburgh	621	615	522	-93	-15%
Teviot	1080	1071	1041	-30	-3%
Total	**14 466**	**16 644**	**17 892**	**1248**	**7.50%**

Table 2 Composition of landscape and national significance of individual components (Source: http://www.centralotagonz.com)

Land Cover Type	Central Otago District		Percentage of New Zealand total
	Hectares	Percentage of total area	
Bare Ground	21 748	2.18	1.54
HorticulturalLand	1404	0.14	3.09
Indigenous Forest	1546	0.16	0.02
Inland Water	6831	0.69	1.67
Inland Wetlands	4431	0.44	4.71
Mines & Dumps	431	0.04	13.03
Pianted Forests	6108	0.61	0.38
Pastoral Land	406 529	40.82	3.92
Scrub	33 119	3.33	1.24
Tussock Grassland	512 323	51.45	14.08
Urban Area	863	0.09	0.54
Urban Open Space	509	0.05	1.61
Total Area	**995 842**	**100**	**3.72**

below zero in winter and can rise above 30°C in the summer months (record high = 38.7°C). The highest temperature recorded in Alexandra was 37.2°C (99°F), while the coldest was −11.2°C (12°F), however much colder records do exist: Ophir recorded -21.6°C in 1995, but NIWA data now indicates an official low of -25.6°C at Ranfurly in 1903.

The mean annual temperature in Alexandra is quite mild at 11.0°C (51°F). The diurnal mean temperature range is 11.8°C (21.2°F). January and February are the warmest months, the coldest being July (Table 3) and the annual wind-run is very low, particularly in winter when inversion layers may form in the valleys, trapping smoke and causing hoar frosts that can last for weeks.

The impact of this for agriculture is that positive temperature gradients in the warm season result in inland sites having a mean warm season temperature 2–3°C higher than sites at the same altitude nearer the east coast. Daily pasture production 150 km inland is therefore considerably higher than for coastal sites at equivalent altitudes. However the inland winter season, during which growth is dormant, is longer than that for coastal sites, therefore the two factors counterbalance each other and annual pasture production is similar for both regions under similar moisture regimes (Cossens 1987).

Radcliffe & Cossens (1974) compared dryland and irrigated pasture production at Cromwell and Poolburn which illustrates the disparity in growth. Irrigated pasture at Cromwell yielded a seasonal mean of 8310 kg DM/ha over 11 years (ranging from 5820 kg DM/ha in 1966/67 to 11 260 kg DM/ha in 1970/71) with a maximum daily yield during summer of 45 kg DM/ha. Similarly at Poolburn, irrigated pasture yielded a seasonal mean of 8740 kg DM/ha over 12 years (ranging from 4310 kg DM/ha in 1966/67 to 11 660 kg DM/ha in 1960/61) with a maximum daily yield during summer of 44.7 kg DM/ha. By comparison, dryland pasture at Poolburn yielded a seasonal mean of just 2800 kg DM/ha over 10 years (ranging from 770 kg DM/ha in 1967/68 to 4570 kg DM/ha in 1969/70) with a maximum daily yield during late spring of 18.4 kg DM/ha.

Evidence suggests that ongoing climate warming (possibly ±1°C during several decades) could open up a large area of land at higher elevations to pastoral activities and allow the introduction of additional warm temperate crops into the South Island (Salinger 1987)

In general Central Otago has a very dry climate, largely due to its geographic position in relation to the approximate north-south alignment of the Southern Alps, as precipitation is strongly influenced by dominant westerly foehn wind flows across them. Moisture laden air masses crossing the Tasman Sea are orographically lifted as they impact the intervening mountain ranges, cooling and releasing precipitation on the West Coast, then adiabatically warming as they descend across Central Otago as the typical hot, dry "Nor-wester". Frontal systems arising from depressions forming around Antarctica tend to be blocked by the surrounding mountain masses, so they contribute minimal precipitation to lowland parts of Central Otago but usually provide good snow cover on the tops.

With an annual rainfall of less than 400 mm around Alexandra and only 5–7 days of precipitation per month, most of that occurring during the period October to February when evapotranspiration rates rapidly increase with higher summer temperatures, effective precipitation is at a premium. To ensure ongoing agricultural productivity in the region, maintaining soil moisture levels at sustainable levels for crop growth is paramount therefore supplementary irrigation is essential.

Cold air moving downslope (katabatic wind) contributes to valley floor frosts and inversion layers in winter, but also assists fruit growing in gorges where continual air movement in spring helps prevent bud damage from frost. Aspect also has a considerable influence on vegetation type and growth, particularly on mid-low altitude, drought-prone hill country.

Soils:

McCraw (1964) and Orbell (1974) provided detailed descriptions of Central Otago soils in the Alexandra/Manuherikia Basin. Their work had been pre-dated, however, by that of Ferrar (1929) who mapped the

Table 3 Monthly Climate Parameters **for Alexandra (Source: NIWA Climate Data)**

Month	Jan	Feb	Mar	A pr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average High °C	25.1	24.8	22.3	18.0	13.6	8.8	8.1	12.5	16.4	19.0	21.1	23.3	17.7
Daily Mean °C	18.0	17.4	14.9	10.9	7.6	3.6	2.9	6.0	9.3	11.7	14.0	16.3	11.0
Average Low °C	10.8	10.1	7.3	3.8	1.5	-1.5	-2.4	-1.0	2.2	4.4	6.7	9.3	4.3
Precipitation mm	50.1	32.8	29.0	22.0	27.4	31.6	24.2	17.6	20.9	28.7	30.6	44.5	359.4
Av. Precip Days	6.7	5.2	4.9	4.0	6.9	5.8	4.3	4.4	5.4	5.5	4.8	7.7	65.7
Mean Sunshine Hrs	231.4	199.8	193.7	158.2	121.2	87.1	90.7	135.9	164.7	193.9	214.1	215.0	2005.8

topography and broadly classified the soils with the objective of determining application of irrigation water and its effects.

Soils throughout the region are derived from schist, greywacke and some Tertiary sediments. Their textures are predominantly silty or sandy with some clay content under more weathered conditions. Windblown accumulations occur widely on lee aspects throughout the region. Conversely, wind has eroded soils on exposed sites, resulting in stony "pavements" that are particularly evident on outwash terrace and fluvial fan surfaces.

Those soils have been further modified by climate, topography and time. The climatic influence has resulted in zonal soils, ranging from (high country) yellow-brown earths (Brown soils) that occur in moister upland environments with limited winter waterlogging; yellow-grey earths (Pallic soils) with moderate to high base status that formed under sub-humid conditions on mid-low altitude slopes and fans; and brown-grey earths (Semi-arid soils) with high base saturation levels, often containing soluble salts, that exist under long-term moisture deficits on the lower altitude terraces, fans and slopes (Hewitt 1992).

Soil properties at lower altitudes generally reflect the dry climate. Organic matter content is often low and topsoils thin. Available water capacity (AWC) is limited and such semi-arid soils are typically below field capacity (FC) all year and can be below permanent wilting point (PWP) for 6 months or more, i.e. are sub-xerous. Subsoils are often compact and may contain hard, calcareous pans which impede drainage. In pallic soils P-retention is low (<30%), as is sulphur status (Metson 1979), but base-saturation levels are high and permeability of sub-soil horizons is often restricted, and thus root penetration may be limited. These soils are frequently associated with short tussock/scrubland vegetation cover and are, on average, below FC for more than five months and below PWP for 1 to 5 months i.e. are sub-hygrous (Brash & Beecroft 1987).

Brown soils are typically associated with snow tussock (mainly *Chionochloa rigida*) cover at mid-high altitude (1000+ m), are generally of acidic pH, well drained and allow good root penetration. Permanent snow level is usually around the 1300 m mark, but this has fluctuated considerably in recent years with increased climate variability. This season snow cover has been minimal, in direct contrast to last when stock were caught in deep snow drifts, necessitating emergency snow-raking teams to extract them. That combination of seasonal snow pack, snow tussock vegetation and deeper, but more leached, soils provides the lifeblood water source for irrigation on valley slope and floor areas in Central Otago. Therefore it is imperative to maintain and/or improve those higher altitude ecosystems to ensure continuity and quantity of water supply.

It is of some concern that Duncan *et. al.* (2001) noted a decline in species richness on schist rock and on yellow-brown and yellow-grey soils in Otago that was greater at lower elevation, but apparently unrelated to changes in the abundance of either *Chionochloa* or *Hieracium* species, to an overall increase in total vegetation cover, or to the level of grazing or burning between measurements. However, vegetation monitoring carried out by this author on Earnscleugh, Obelisk and Moutere Stations is showing improved vegetation cover and biodiversity on all but the worst hawkweed-affected sites when blocks are spelled at 3–4 year intervals to promote indigenous plant seed set (Wills 2014).

For agricultural and pastoral purposes then, the main constraints present in Central Otago soils relate to the supply and retention of moisture, the paucity of organic matter, the lack of sulphur and its impact on legume growth, the presence of soluble salts with resultant salinity and alkalinity problems in some areas, and the incidence of drainage obstructions caused by pedologic or stratification impediments within the subsoil.

Economy and Land Use:

Central Otago is a resilient region, has weathered the Global Financial Crisis reasonably well and continues to make a steady contribution to the Otago regional economy (Table 4).

Table 4 Composition of the Otago Regional economy by District, 2013 (Source: BERL Regional Database 2013)

Territorial Authority (2013)	FTEs	% of Region	GDP (2013 $m)	% of Region	Business Units	% of Region
Central Otago	10 419	11%	1000	11%	3340	13%
Clutha	8904	9%	989	11%	3017	11%
Dunedin City	49 874	53%	4921	53%	10 771	41%
Queenstown Lakes	15 695	17%	1321	14%	6461	24%
Waitaki	9608	10%	1007	11%	2884	11%
Otago Region	94 500	100%	9238	100%	26 473	100%

FTE = Full-time equivalent employment position

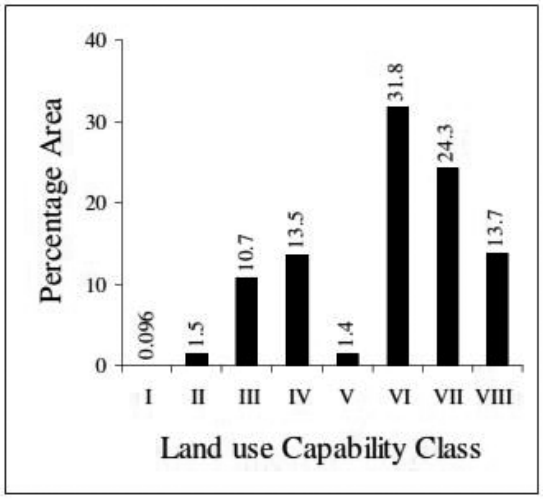

Figure 3 Land Use Capability (LUC) Classes in Otago (Source: Otago Regional Council Regional Policy Statement)

Central Otago land use has generally mirrored the rural changes seen in the wider Otago region over the past few decades, but at a slightly slower rate. Only 26% of Otago's total land resource is arable (LUC Classes I, II, III or IV) and just 8% of this land contains high class soils. LUC classes for the greater Otago region are shown in Figure 3. Otago's high class soils are limited to the Taieri Plain, North Otago downlands, South Otago lowlands, parts of Central Otago and the Strath Taieri and along some river margins.

Probably the most visual land use change since the 1986 NZGA Conference has been the spread of viticulture. From meagre beginnings back then (Blackridge Winery near Alexandra was one of the earliest), there are now some 1900 hectares currently producing about 8500 tonnes of grapes in Central Otago (Figure 4).

The majority of these vineyards grow Pinot Noir grapes and are situated on the lower slopes and terraces between Alexandra and Tarras, mostly sited on sunny aspects and utilising dripper irrigated semi-arid and some pallic soils.

GDP in the Horticulture & Fruit Growing sector was $40.3m in Central Otago for 2013, compared to $1200m for New Zealand as a whole, or 3.4% of national activity. Growth in this sector between 2000 and 2013 averaged 0.8% (c.f. 0.1% for New Zealand) and was at a peak in 2009 (at 113%). It employed about 930 people or 3.5% of national employment and supported 321 business units (Infometrics Ltd 2014). Overall, employment in this industry group increased 46% between 2003 and 2013. Employment in stone fruit growing increased by 113% and for grape growing it increased by 151%. However, employment in apple and pear growing declined by 83% (BERL 2014).

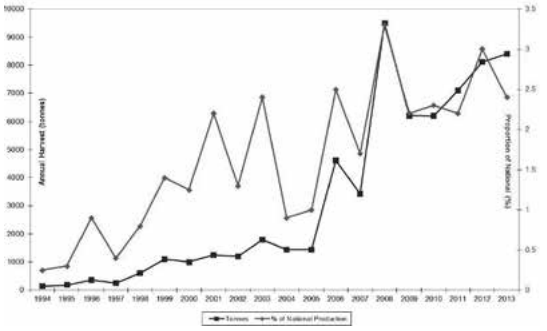

Figure 4 Tonnes of grapes harvested in Central Otago Region 1994-2007. (Source: New Zealand Winegrowers).

At the previous Central Otago conference, Kelly (1987) discussed the changing nature of farming and some of the problems it faced then in the wake of the Land Development Encouragement Loan Scheme and the Livestock Incentive Scheme, both of which had an enormous impact on pastoral farms. Since then, sheep numbers on pastoral runs have gradually decreased but that trend has been largely offset with genetic gains in fecundity, fleece specification and immunity/ resistance; also by diversification on the better, agricultural irrigated valley floor land (Table 5) along with increasing numbers of dairy stock and deer.

GDP in the sheep and beef cattle sector was $50.0m in Central Otago for 2013, compared to $2752m for New Zealand as a whole, or 1.8% of national activity in that sector. Growth in this sector between 2000 and 2013 averaged -0.2 % (cf 1.0% for New Zealand) and was at a peak in 2009 (at 89 %). In 2013 it employed about 760 people or 2.3% of national employment and supported 388 business units.

In contrast, GDP in the dairy cattle sector was $7.65m in Central Otago for 2013, compared to $4369m for New Zealand as a whole, or 0.2% of national activity in that sector. Growth in this sector between 2000 and 2013 averaged 4.0% (cf 0.4% for New Zealand) and was at a peak of 110% in 2004. In 2013 it employed about 100 people or 0.3% of national employment and supported 31 business units (Infometrics Ltd 2014).

In terms of the impact of primary production GDP on Central Otago's economy, 2013 was an extremely good year and the longer-term performance has also been very strong. Between 2003 and 2013, GDP in the sector increased by 85.9% and its share of total GDP in Central Otago increased from 24.4% to 30.3%. During the same period, GDP in agriculture increased by 93.7 percent, and GDP in services to agriculture increased by 34.4 percent. Although the industry faces challenges as it adjusts to tightening environmental standards; to global

fluctuations in meat and wool sales; to the multitude of pests now present (internal parasites, blowflies, clover root weevil, varroa mite, hawkweeds, rabbits etc.); to debate over foreign/corporate ownership and ongoing tenure negotiations, further diversification is likely as new markets and products arise (like "Icebreaker" merino garments and "chevon" meat).

Agriculture has always been a mainstay of Central Otago's economy, it has a bright future and will likely remain so for decades to come, particularly now with considerable investment in more efficient spray irrigation systems and new scheme proposals such as that from the Manuherikia Catchment Water Strategy Group. There is some 46 000 ha of irrigable land in the region, about half of which is currently flood-irrigated and half spray-irrigated (Statistics NZ 2013), but that is changing rapidly at present.

A change in the pattern of land use is also occurring. Lifestyle blocks are becoming a significant feature of rural land use, particularly near larger urban settlements, and many rural towns are being rejuvenated as the network of cycle trails, funded in part from New Zealand Cycle Trails, expand from the original Otago Central Rail Trail. Some 15 000 people now complete that trail annually, with 70 000–80 000 doing parts of it, and it contributes about $12m to the local economy (up ±70% from 2008/09), directly employing about 120 people. With about $9m invested in the Roxburgh Gorge and Clutha Gold trails, which are now open, similar benefits are being seen in the Teviot Valley.

In response to these market trends, landholders adjacent to trails have diversified into areas such as farm stays and accommodation. Central Otago is also gaining a reputation for Nordic skiing and as an adventure, wilderness or eco-tourism holiday destination, with landowners retaining their traditional pastoral use while people utilise Department of Conservation parks such as the Kopuwai (Old Man Range), Oteake (Hawkdun Range) and Flat Top Hill Conservation areas. The recent announcement of the 53 000 ha QEII National Trust covenant which will protect iconic high country over most of Motatapu, Mount Soho, Glencoe and Coronet Peak stations, whilst maintaining productive outputs from lower country, is indicative of the benefits that can arise from an alternative approach to land ownership and sustainable pastoral farming methodology.

The hydro lakes Roxburgh and Dunstan have also become increasingly popular with the boating and fishing fraternity, taking some of the pressure off Lakes Wakatipu and Wanaka, although lakeweed (*Lagarosiphon*) and didymo (*Didymosphenia*) remain problematic in these aquatic environments.

Future Challenges:

Firstly, how well have we fared in terms of the opportunities identified in Kelly's (1987) "Towards 2000" bullet points?

1. On-farm specialisation: Is well advanced, particularly in terms of recording and analysing the various parameters of farm management (paddock details and inputs, stock movement and performance, genetic imprinting, farm financial status, etc.) and the uptake of new technology.
2. Plant species for dryland farming: Not a great deal of change here as lucerne is still "king", however increasing use of irrigation is providing the opportunity to utilise a wider range of pastoral plants, many of which are refined cultivars of existing genera. Indigenous tussock species are still invaluable plants for hill and high country and I believe their management and environment requires greater care and consideration, especially for their contribution to water-holding capacity. Availability of environmentally adapted dryland legume species to provide supplementary N-inputs within tussock grassland pastures is still constrained despite earlier work on *Lotus* and alternative clover species (Brown & Green 1987).
3. Fibre production: Outputs have fluctuated as dictated by global markets and as niche markets have been developed for fine wool products. Goat/cashmere fibre production has not developed to any great

Table 5 Changes in stock numbers and fertiliser application in Central Otago since 1976 (Source: Statistics NZ)

	1976	1986	1990	1995	2012
Total Sheep	2 142 000	1 955 143	2 094 878	1 968 745	1 543 135
Breeding Ewes	1 505 000	1 308 933	1 340 000	1 175 000	1 090 560
Beef Cattle	95 000	86 000	50 178	60 822	80 236
Dairy Cattle	n/a	1039	3180	2600	48 384
Cows in milk	n/a	726	?	?	31 858
Deer	n/a	6946	8342	13 486	39 557
Fertiliser (t)	?	86 150	24 999	30 105	55 458
Phosphate		55 750	?	?	43 970

extent as predicted. In time reliance on hydrocarbon-based artificial fibres will ease as oil prices inevitably increase so a resurgence in demand for natural fibres is likely.

4. Meat production: Again very market-sensitive and not helped by what has been a somewhat fractious processing industry. The growing utilisation of Merino sheep and Boer goat meat is a positive diversification.
5. Tourism: Still much potential for development here and landowners close to trails and conservation areas are tapping into those opportunities. The annual Easter bunny shoot organised by the Alexandra Lions is well supported and the Blossom Festival "Wool On" creative fashion event is going from strength to strength. Central Otago's physical environment is an asset that, through good management of lifestyle and recreational opportunities, can help develop the local economy but it must also be conserved and preserved for current and future generations.
6. Deer/Goat farming: Continues to expand but venison is battling a sluggish global market. There is huge international potential for Boer goat meat (chevon). Several top New Zealand restaurants already consume much local production, but processing still presents problems. On well-fenced properties they can also provide excellent scrub weed control in conjunction with other animals.
7. Horticulture: Continually improving with steady export demand. New growing systems such as upright fruit offshoots, use of growth regulators and underlays to improve ripening are being used for cherries but variable summer weather patterns remain a challenge. With stone fruit there are several new, late season, high brix, varieties coming into production specifically aimed at the Asian market. Pip fruit production, especially organically grown, is making good progress again as new marketing strategies are employed.
8. Dairy farming: Winter grazing in particular will continue to develop in Central Otago as irrigation systems mature and adjustments are made to accommodate environmental issues. However the heady days of up to $3.5k/ha profits are unlikely to be repeated in the foreseeable future as global production increases, demand eases and product prices continue to stabilise at around the $5.50–$6.50/kg mark.

Further extrapolation scenarios involving development of Central Otago's economy through to 2020 are discussed in the Central Otago Economic Development Advisory Group's Report (COEDAG 2002). No economy can remain static and there is plenty of change on the horizon for the region as high-level reviews are made of the ORC Regional Policy Statement and the CODC District Plan, quite apart from reform within local government currently being driven by the Productivity Commission's "Towards Better Local Government" report and The Local Government Act 2002 Amendment Bill (No 3) which passed its second reading in May 2014. The long term effect of these changes on the resilience of our Central Otago economy will be interesting, meanwhile we await the outcome of the recently announced "Taskforce to tackle loopy rules and regulations" with bated breath.

The future challenges that I see for agriculture in our region include adapting to ongoing climate change. The reasons can be debated, but seasonal climatic variability is increasing and temperatures are rising, thus agricultural development must identify and take advantage of any opportunities that arise. We must also actively shift future investment emphasis towards international markets, rather than domestic ones. Only by identifying, initiating and growing high-value export-based business, be that based on primary industries or technological ones, will Central Otago continue to thrive, assuming global economics remain stable for the longer term.

That must be accompanied by upkeep of the regional transport system which, with only four main exit points to coastal processing plants, shipping and airports, remains a potential constraint. Unlike some territorial local authorities, recent changes to New Zealand Transport Authority funding assistance rates should not have a major effect on road maintenance in Central Otago as, of our ±1900 km of roads, only about 500 km are high-cost sealed carriage-ways. However council is grappling with an expensive bridge replacement and maintenance program – about 35 of our 176 bridges are due for major work within the next 30 years at a cost of $13–22m, depending on budget options, and we currently spend about $70k/yr. on maintenance which will increase. Many of these are old, single lane rural bridges with wooden decks and low (but often overweight) traffic counts servicing just a few properties. What are the alternatives for farm servicing if council cannot afford to retain these bridges?

Many parts of Central Otago struggle with network interconnectivity and the rollout of Ultrafast Broadband for general users is a high priority. Many rural users experience slow broadband speeds and bandwidth restrictions across telecommunications lines. Nominal download speeds of 1–5 Mbps within urban boundaries are rarely attained and, when combined with irregular power brownouts in rural regions, cause much frustration. An effective communications network is essential to economic development and must keep up with technological developments.

Educational development is paramount and Otago

Polytech Cromwell is taking a positive role in this with the recent introduction of a new National Certificate in Farming Skills course, "the only farming programme in New Zealand with a high country flavour". However, as long as agriculture and horticulture, and their servicing industries, are perceived to be traditional lifestyles, commodity-based, seasonal and often low-paying, attracting and retaining new recruits will remain a significant challenge.

Fragmentation and urbanisation of rural land must be addressed to preserve primary industry outputs within our region. Problems associated with the spread of lifestyle blocks and peri-urbanisation, including pest control, diminished productivity and increased demands for servicing, must be dealt with by local government authorities. Diversification through creating opportunities for greater involvement with semi-passive tourism (walking, hiking, cycling, astronomy, photography etc.) and accommodating those within our rural infrastructure will be a positive move.

The greatest challenge ahead in my view is how we best maintain an environmentally acceptable balance between productive agriculture/horticulture outputs and conservation of natural resources for the long term betterment of our wider communities. In Central Otago water ***IS*** gold and no-one can grow productive crops without it. ***We must therefore at least maintain, and preferably improve, the yield and quality of water from well monitored vegetation and soil resources in our hill and high country catchments then sustain that down through our irrigation systems, watercourses and groundwater reserves for future generations.*** Providing ambulances to pick up the pieces at the bottom of the cliff is no longer an acceptable strategy.

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