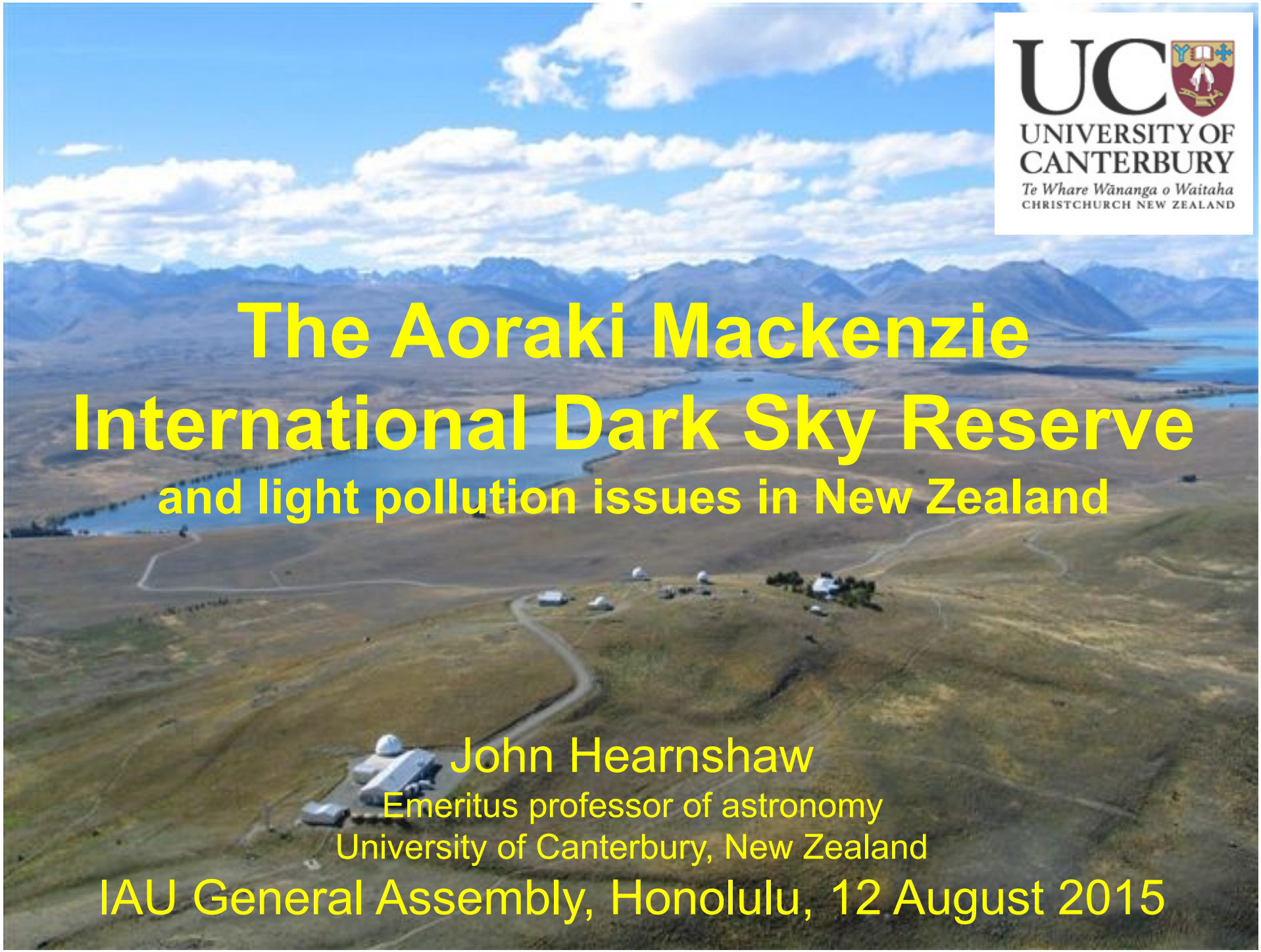


The Aoraki Mackenzie International Dark Sky Reserve

and light pollution issues in New Zealand

John Hearnshaw
Emeritus professor of astronomy
University of Canterbury, New Zealand

IAU General Assembly, Honolulu, 12 August 2015

The Mackenzie District Lighting Ordinance

1981 Lighting Ordinance drawn up in Mackenzie District Plan. Enacted through Town & Country Planning Act 1977. Controls outdoor lighting (types of light, full cut-off, limits emission below 440 nm, restricts times when outdoor recreational illumination is permitted).

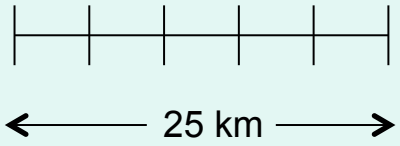
The objective of the ordinance is:

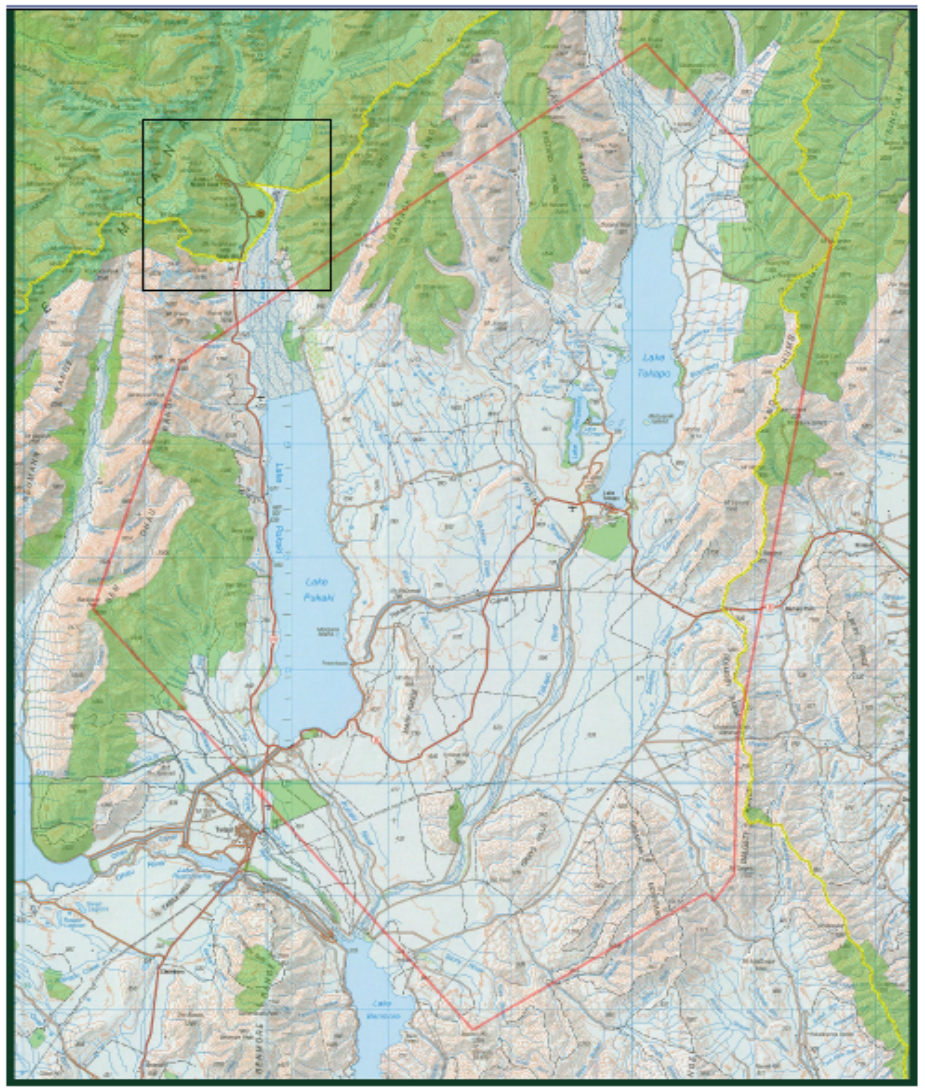
‘Maintenance of the ability to undertake effective research at the Mt John University Observatory and of the ability to view the quality of the night sky’.

Area of the lighting ordinance

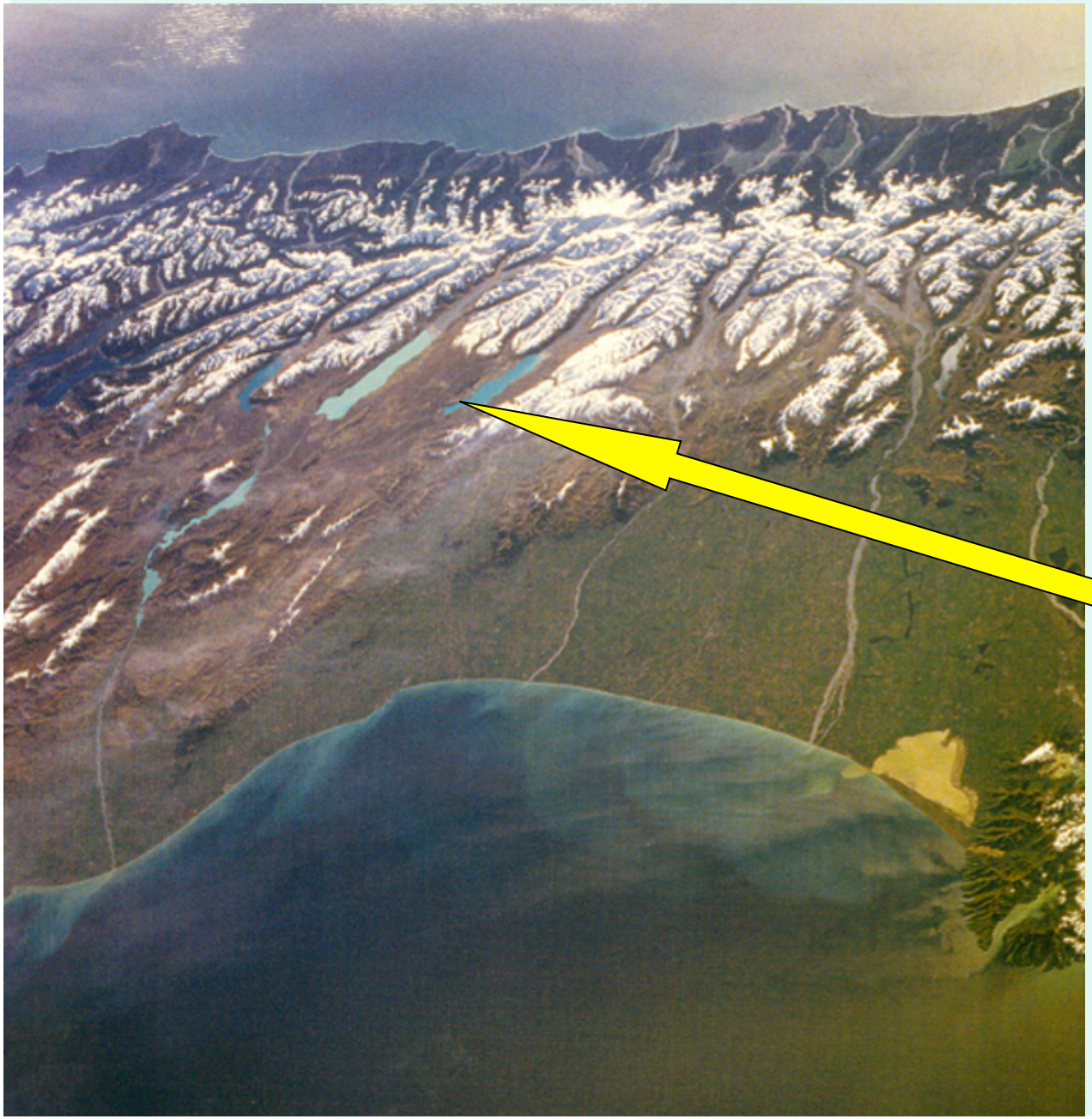
The lighting ordinance applies over a large area of the Mackenzie Basin, including all of Lakes Tekapo and Pukaki.

Area ~ 60 km EW;
~ 100 km NS.





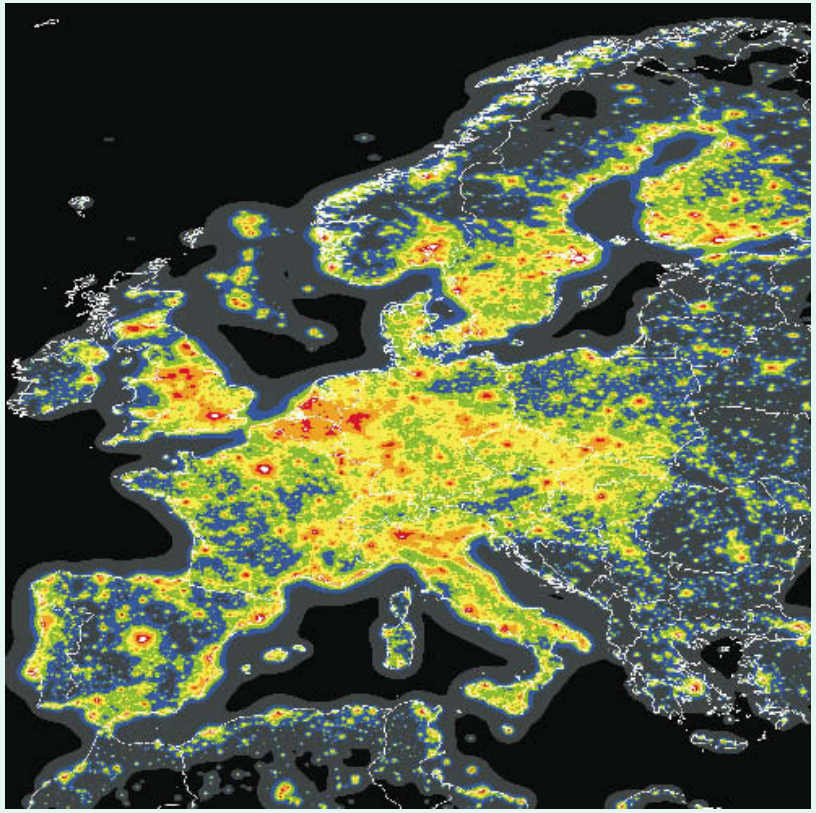
Where are we?



Mt John and Tekapo from space

MJUO

Light pollution as seen from space



The light recorded in these satellite images represents light going up into space. It is wasted light and wasted energy.

(From P. Cinzano, F. Falchi, C.D. Elvidge, World Atlas of Artificial Night Sky Brightness, 2001)

Tekapo lighting

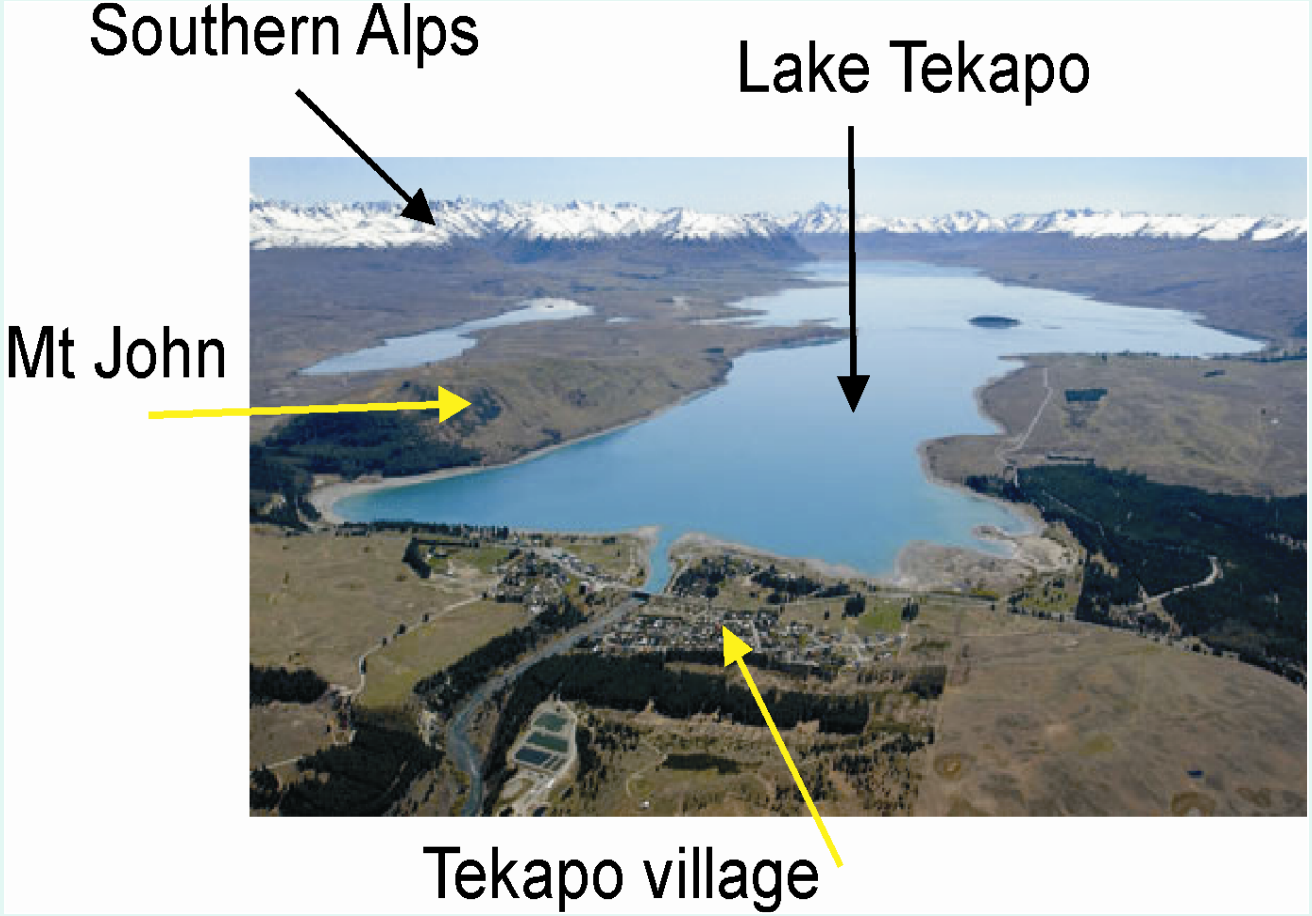
Much of the street lighting in Tekapo uses full cut-off bollards with low pressure sodium lamps. These are ideal for minimizing light pollution.

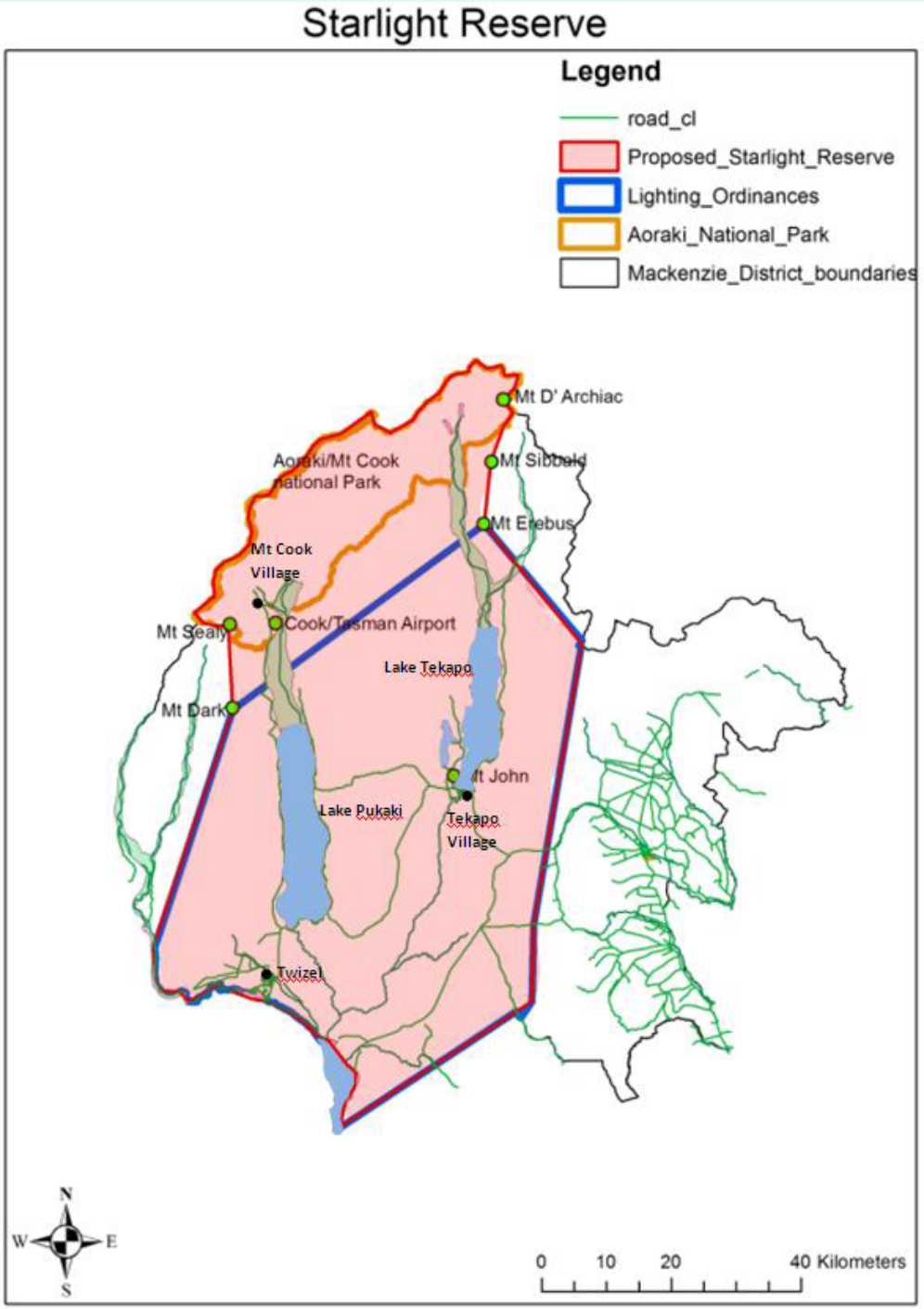
Tekapo village from Mt John

Tekapo from Mt John: there is still some light pollution, but the situation is generally good. Tekapo skies are still very dark.

We have had a lighting ordinance for over 30 years.

So why do we also need a Dark Sky Reserve??





Aoraki Mackenzie International Dark Sky Reserve

The Reserve covers almost all of the Mackenzie Basin and all of the Aoraki/Mt Cook National Park.

Recognized by the International Dark-Sky Association Tucson USA

Created June 2012.

Area 4367 km^2

First IDSR in southern hemisphere.

IDA International Dark Sky Reserves

#	Name	IDA tier	Year founded	Area (ha)
1	Mt Mégantic, Quebec, Canada	Silver	2008	5845
2	Exmoor, UK	Silver	2011	69,200
3	Aoraki Mackenzie, NZ	Gold	2012	436,700
4	Namibrand, Namibia	Gold	2012	172,200
5	Brecon Beacons, Wales	Silver	2013	134,679
6	Pic du Midi, Pyrenees, France	Silver	2013	311,200
7	Westhavelland, Germany	Silver	2014	78,660
8	Kerry, Ireland	Gold	2014	70,000
9	Rhön, Germany	Silver	2014	172,000

Why do we need a Dark Sky Reserve?

The answer:

A dark-sky reserve is about
- marketing and branding;
- education;
- inspiration.

A reserve helps promote the *romance* of astronomy, and allows people to connect spiritually with the universe.

It also reinforces the message on the need to control light pollution.

These aims are very different from those of the lighting ordinance, which is strictly a legal document to protect the night sky, mainly for astronomical research, with public stargazing as a secondary aim, and the development of astro-tourism is not mentioned at all.

Photo: Fraser Gunn

Mt John Observatory with Mt Cook behind at 30 km

Mackenzie Basin and World Heritage

- World Heritage convention held in Christchurch, 2007

- Beginning of campaign to lobby for WH recognition of dark Sky above Mackenzie Basin

- The Basin adjoins the WH site Te Wahipounamu (inscribed 1990). It is an area of magnificent primeval vistas: snow-capped mountains, glaciers, forests, tussock grasslands, lakes, rivers, wetlands and over 1000 km of wilderness coastline with OUV.

- We completed short and full thematic case studies on the Aoraki Mackenzie site for IAU-ICOMOS International WG on Astronomy and World Heritage.

- In Jan 2012 we applied to IDA for Dark Sky Reserve status.

World Heritage Criteria require OUV (Outstanding Universal Value)

Two of the WH criteria for natural sites may be relevant to the Mackenzie Basin in New Zealand

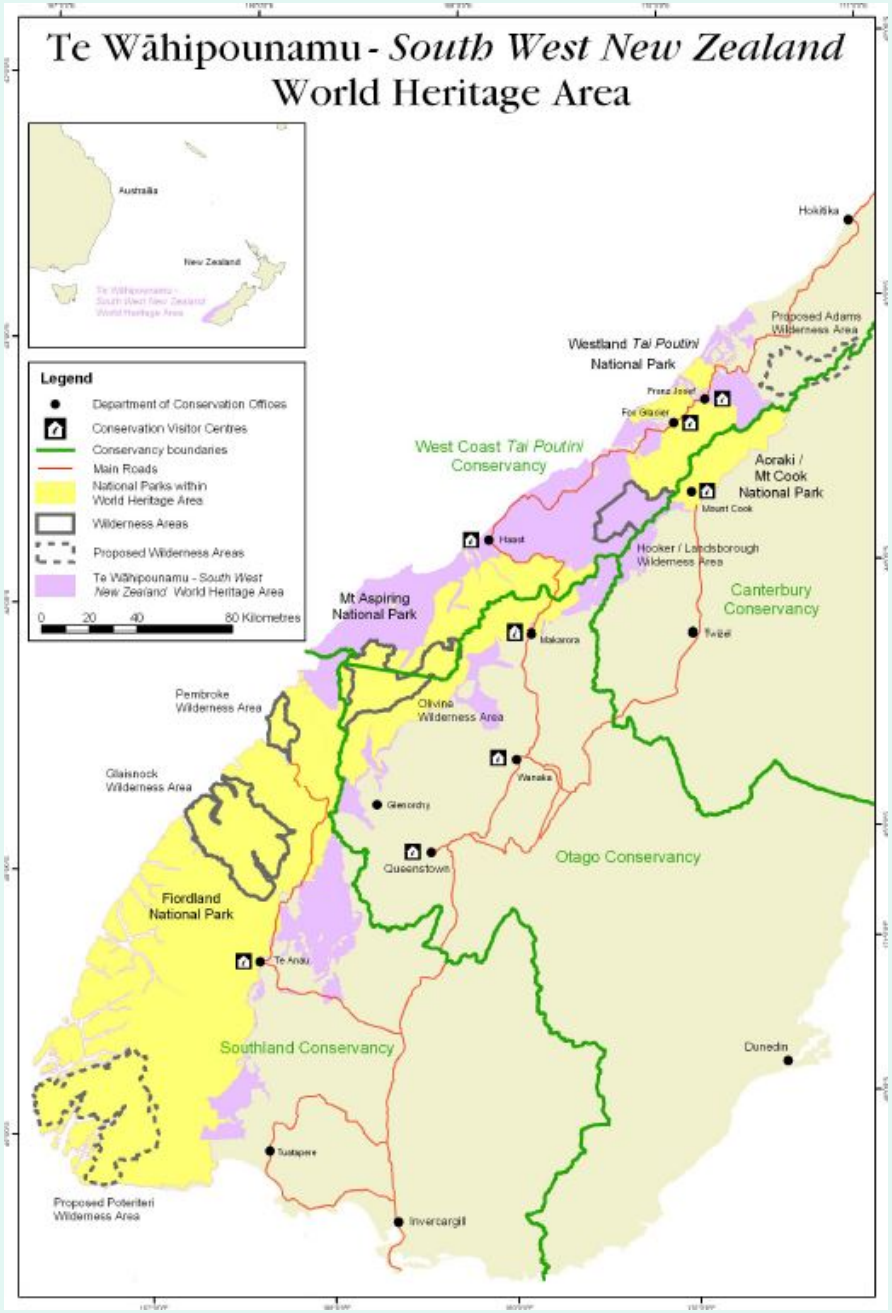
(vii) to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;

(viii) to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

But note that an outstanding night sky free of light pollution is not recognized as OUV by the WHC, and is unlikely to be any time soon.

New Zealand and World Heritage Sites

- New Zealand already has 8 natural sites on its tentative list for consideration as WH sites, but there has been no movement on this list in the last 8 years.
- A possible strategy is to apply for an extension of the adjoining Te Wahipounamu WH site so as to include the Mackenzie Basin, citing criteria (vii) and (viii).
- At present NZ has only three WH sites (only one in South Island).



Te Wahi Pounamu, the South Island of NZ's only WH site.

2.6 million hectares of OUV wilderness and natural beauty.

Professor John Hearnshaw University of Canterbury, IAU GA Honolulu, 12 August 2015

The IDA application

Our original (naïve!) aim: to seek World Heritage status. But numerous problems need to be overcome in an international arena before WH might recognize starlight reserves.

From mid-2011, we focussed on IDA Dark-sky Reserve application.

We employed three summer students to research and collate material (funded by Canterbury Development Corporation and University of Canterbury).

Most of IDA application (179 pages) written Dec 2011 and Jan 2012 – a marathon effort by over half a dozen people!

Main strengths of our case (as we saw it)

- Wide community support
- Three decades of the Mackenzie Lighting Ordinance
- Presence of a significant astronomical research observatory – Mt John University Observatory
- Presence of several flourishing astro-tourism companies in region, especially Earth and Sky
- Easy access to Mt John by tourists
- Extraordinary beauty of the natural landscape (lakes, mountains, rivers, glaciers)
- An energetic team in our Working Party
- Excellent support along the way from Local Government and University.

- Held at Lake Tekapo, June 2012
- 64 participants from 11 countries
- Astronomers, lighting engineers, tourism operators, lawyers, aesthetes, Maori astronomy experts, educators, conservationists all came together.
- Starlight conference proceedings have 40 interdisciplinary papers on a wide variety of topics related to the beauty of the night sky and stargazing and how to combat light pollution.


Tekapo’s Church of the Good Shepherd recorded by Fraser Gunn has become a symbol of our Dark-Sky campaign

Sign on SH8 at Burkes Pass, entry to the Reserve

Mt John has a very dark and unpolluted sky

Survey of night sky brightness at new moon using Unihedron Sky Quality Meters (Fraser Gunn) June 2011 to Jan 2012.

Unihedron Sky Quality Meters used for our sky brightness survey

Mt John has exceptionally dark skies averaging visual mag. 21.7 per sq. arc second.

A summary of the SQM measurements collected in the survey is summarised in Table 7-1 below (refer to Appendix C for the complete SQM data set).

	Primary Core		Secondary Core	Peripheral Regions		
	Mt John (Main Car Park)	Mt John (South Car Park)	Mt Cook Airport	Lake Alexandrina	Mt Cook Village	Tekapo Village
Darkest (mag arcsec^{-2})	21.80	21.65	21.48	21.82	21.66	21.89
Brightest (mag arcsec^{-2})	21.22	21.21	21.33	21.49	20.96	20.61
Average (mag arcsec^{-2})	21.67	21.51	21.40	21.66	21.36	21.39

Table 7-1. Night sky brightness measurements of the Mackenzie Basin. The difference in brightness of each magnitude corresponds to a factor of approximately 2.5.

Aoraki Mackenzie Starlight Festival

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

- 1st Festival held at Lake Tekapo, 11-13 October 2013
- 2nd Festival will be at Twizel, 9-11 October 2015

- A celebration of the Dark Sky Reserve, astronomy and star-gazing for families and school students of South Canterbury. See www.starlightfestival.org.nz

- Public astronomy lectures by international astronomers, star-gazing, exhibitions, a concert under the stars, poetry and essay competition, assembling and using Galileoscopes. In 2015 with endorsement of IYL.

In summary, our International Dark-Sky Reserve is about:

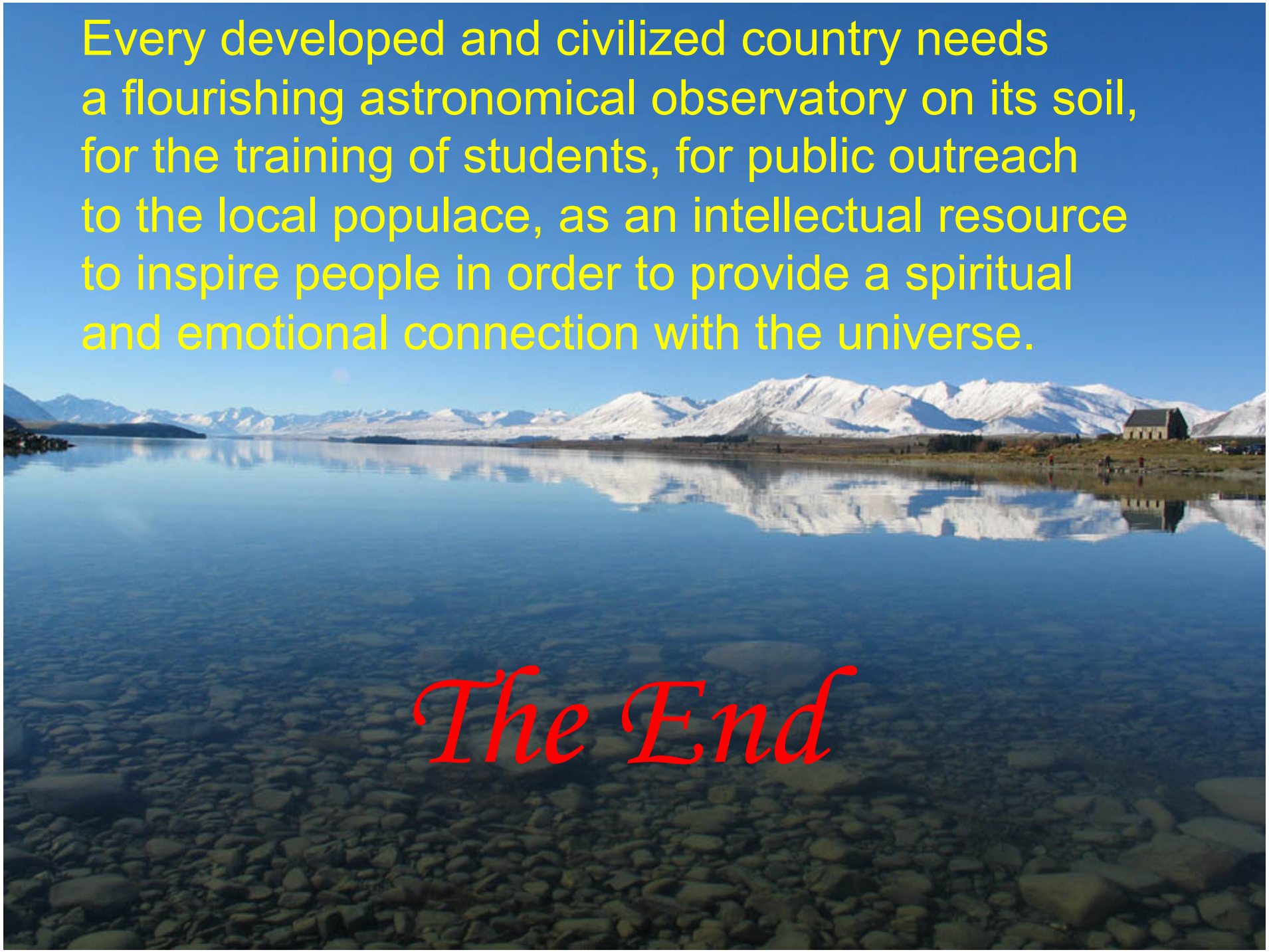
Passion for astronomy

Romance of the heavens

Inspiration of astro-tourists

Zeal of night-sky guides

Education of the public


Every developed and civilized country needs
a flourishing astronomical observatory on its soil,
for the training of students, for public outreach
to the local populace, as an intellectual resource
to inspire people in order to provide a spiritual
and emotional connection with the universe.
The End