Geospatial Solutions for Critical Care Resource Evaluation and Planning

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Geographical Information Systems

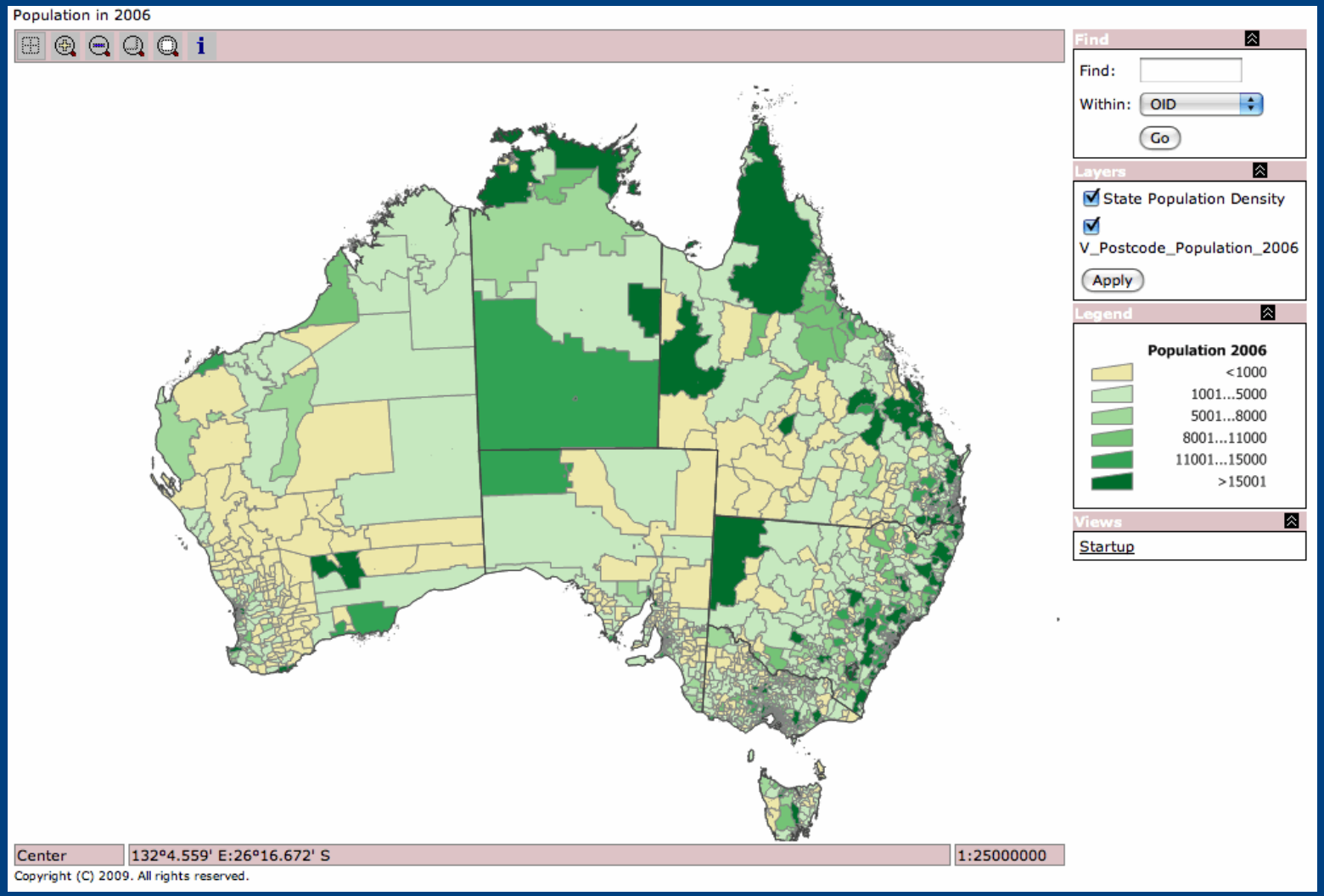
Computerised systems that allow *geocoded* data of different types and sources to be *linked*, based upon their *spatial location*, so as to explore their spatial *relationships*

Geographical Information Systems

- Used to identify population variation in relation to specialised services
- Population and geographic factors are known to substantially impact upon patient mortality and health service accessibility
- Increasing emphasis towards the regionalisation of specialised health services

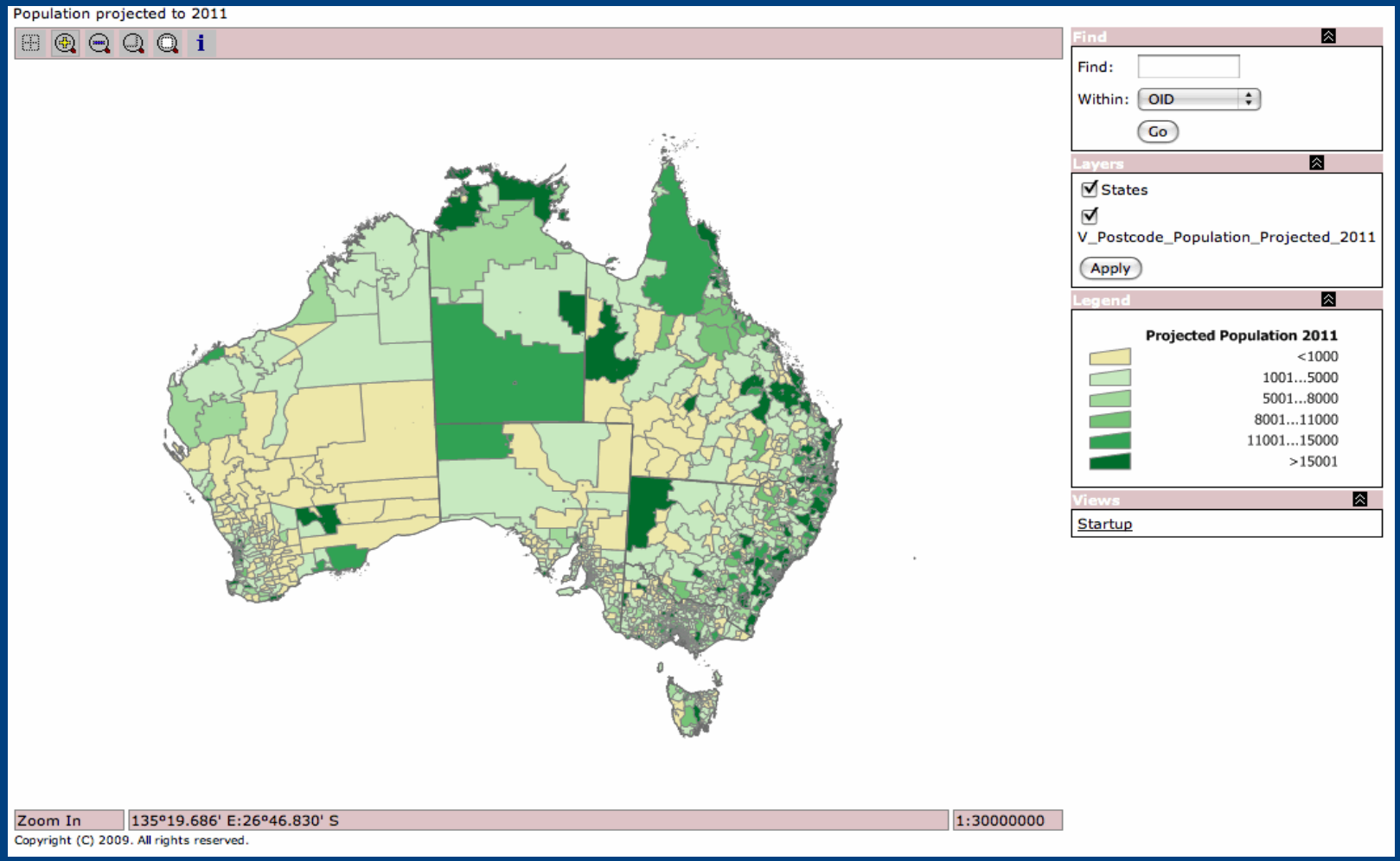
Population

(2006 census data)



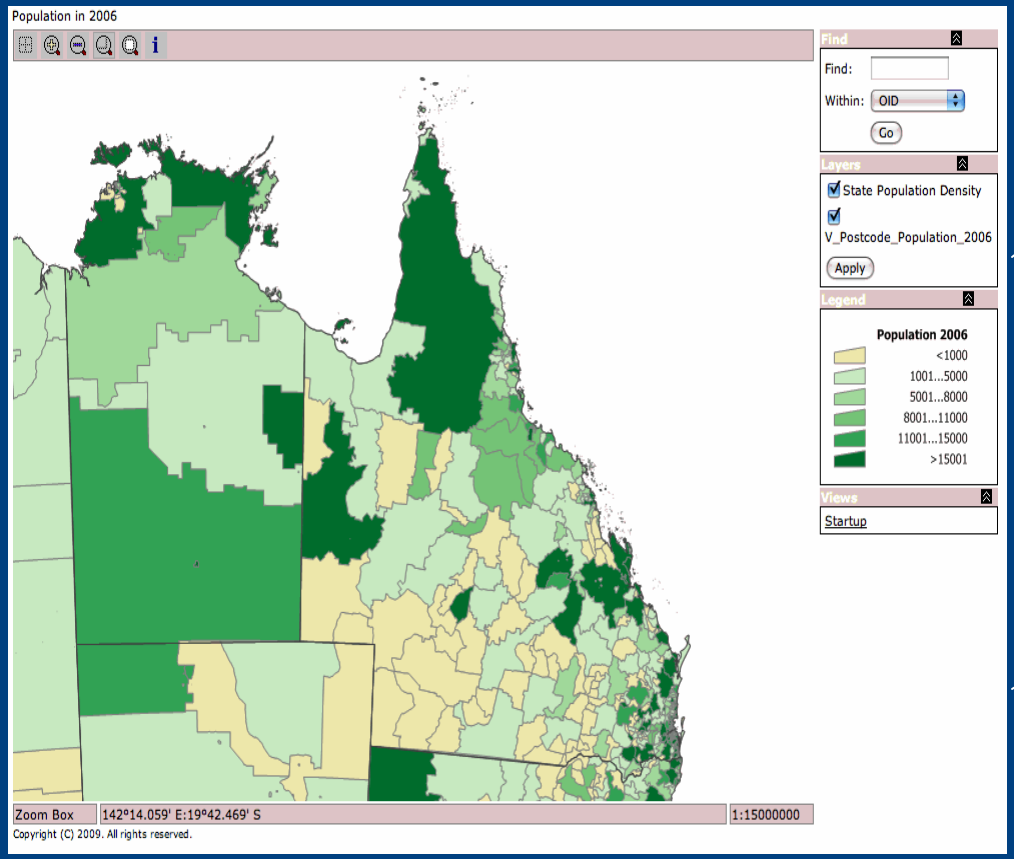
Population

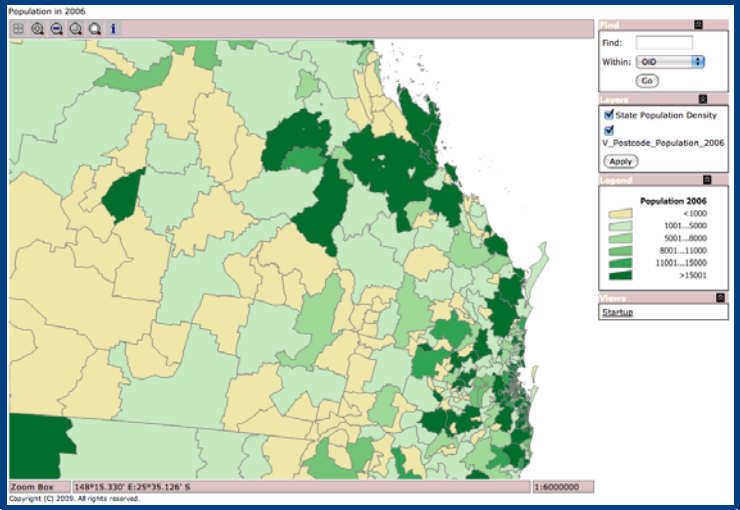
(change 1996 – 2011)

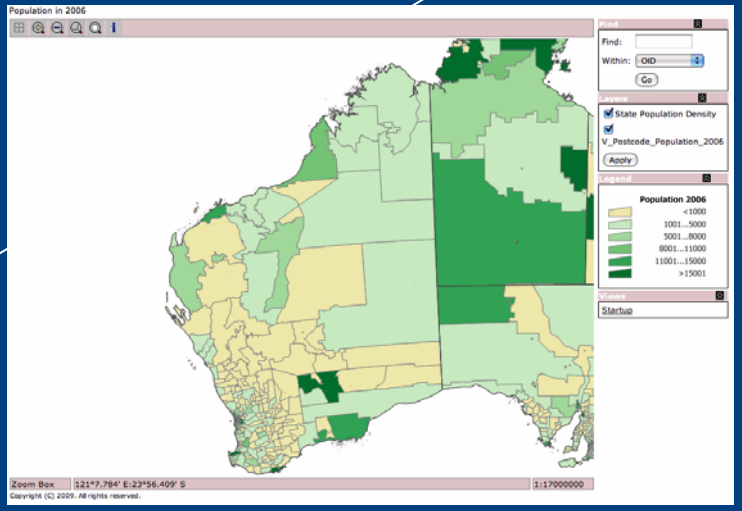


Population

(change 1996 – 2011 by state and regions)







Tertiary Medical Care

- Typically resource intensive, specialized and high cost
    - Regionalized
- Outcome may be associated with patient volume
- Aligned with other tertiary services
- Examples
    - Trauma
    - Neurosurgery
    - Burns
    - Acute spinal injury

Intensive Care

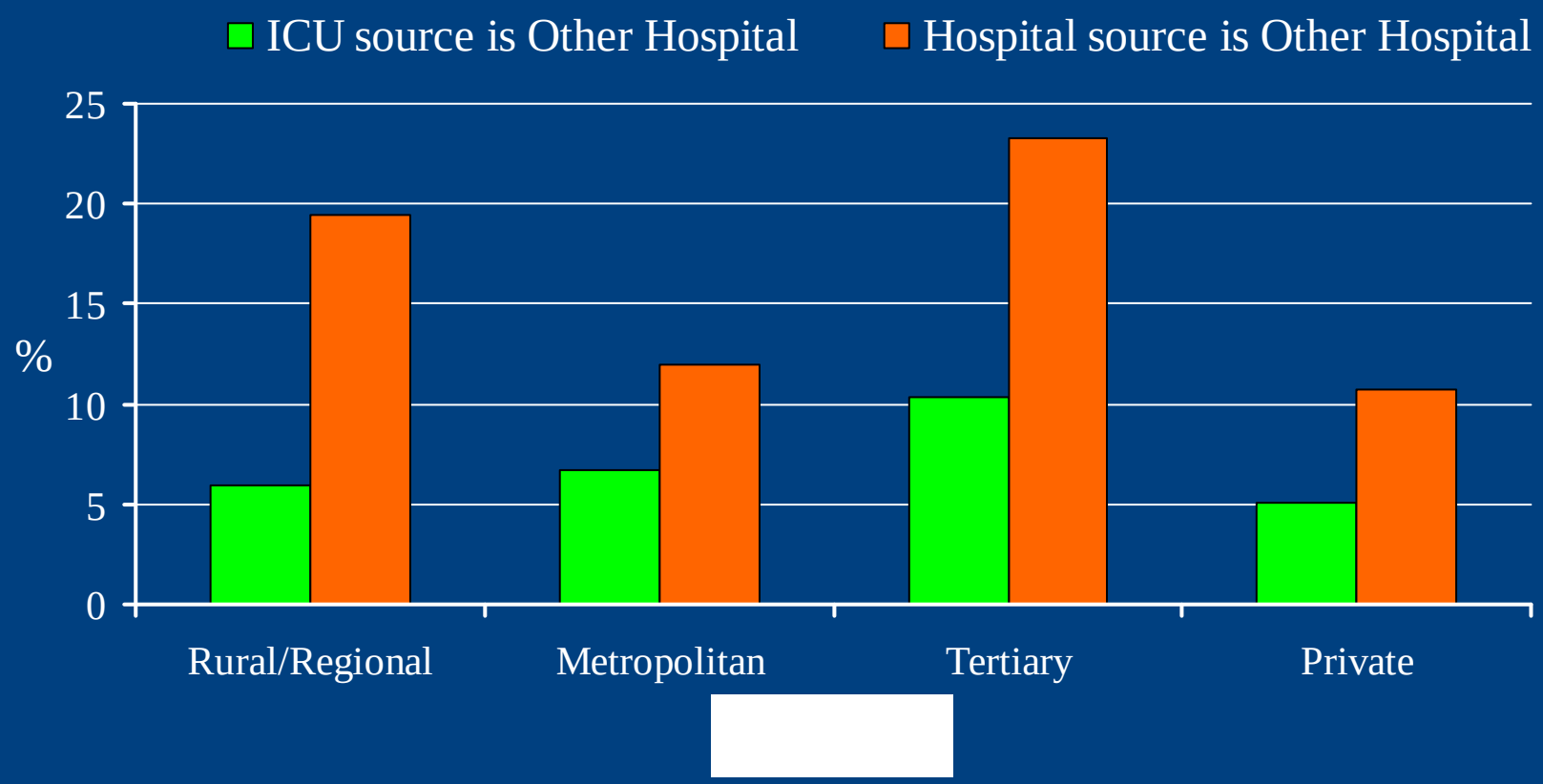
- Specialised service
- ICU admissions - 4% of all non day stay hospital separations
- Approx 125,000 pts per year in Australia
- Resource intensive
- High cost
- Emergency admissions with high severity of illness

“Retrieval”

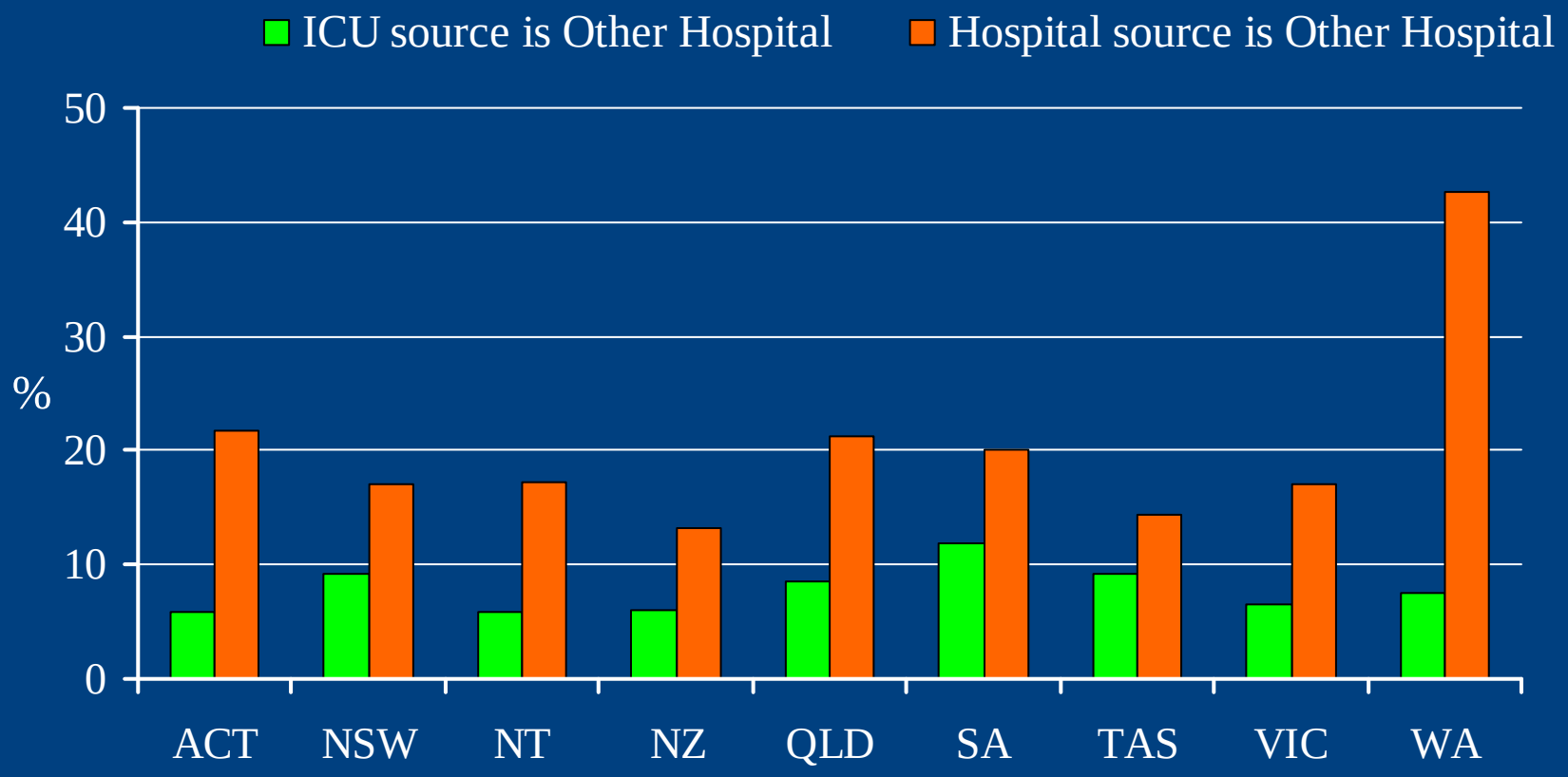
Medical escorted out of hospital patient transportation

- Born out of necessity to provide equity in acute medical service provision for the “outback”
- "greatest single contribution to the effective settlement of the far distant back country that we have witnessed in our time..."
- War time experience of rapid response, early resuscitation and prompt delivery to definitive care
- Critical Care Transport services – “ICUs in the sky”

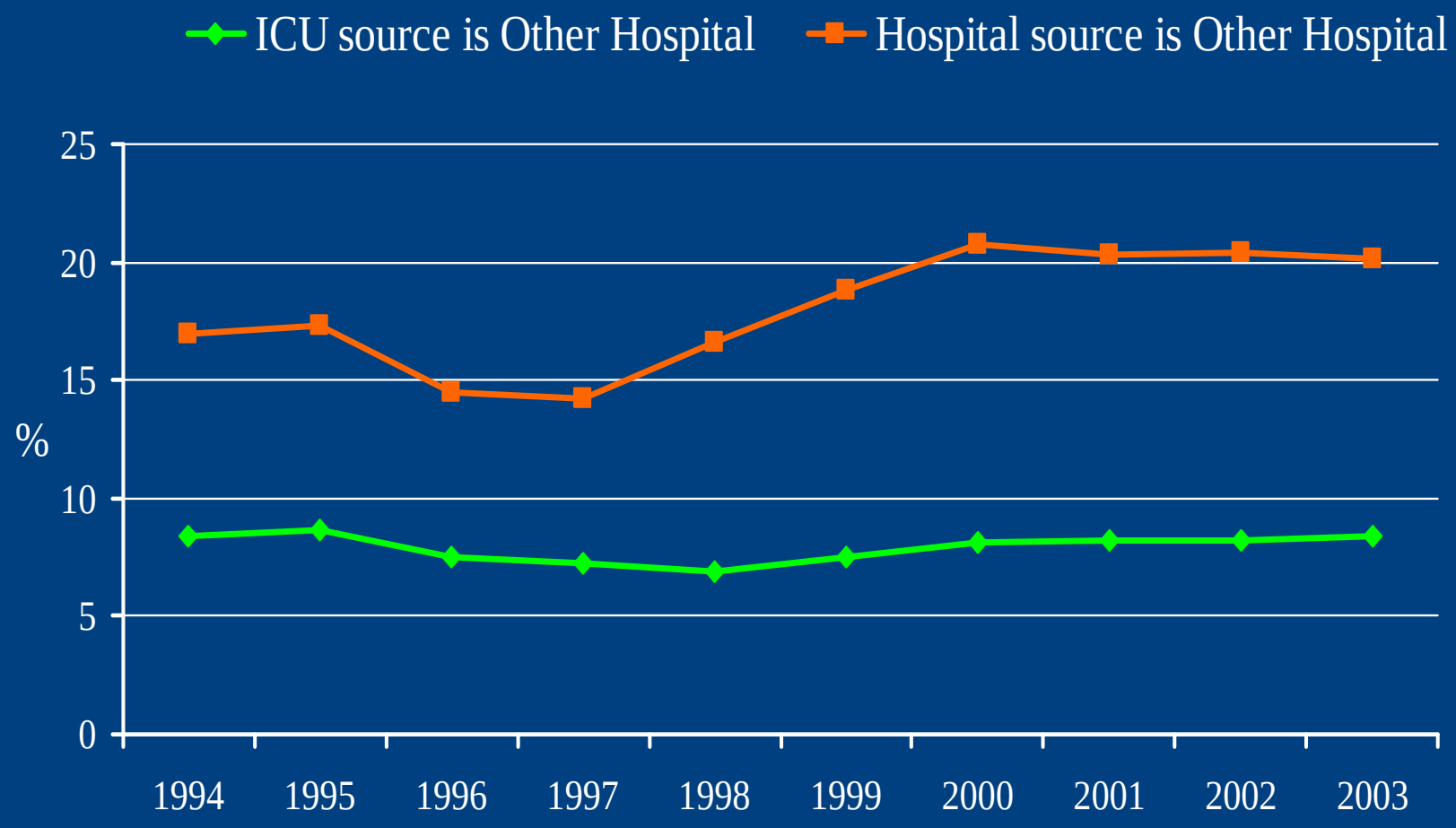
Patients admitted to an ICU



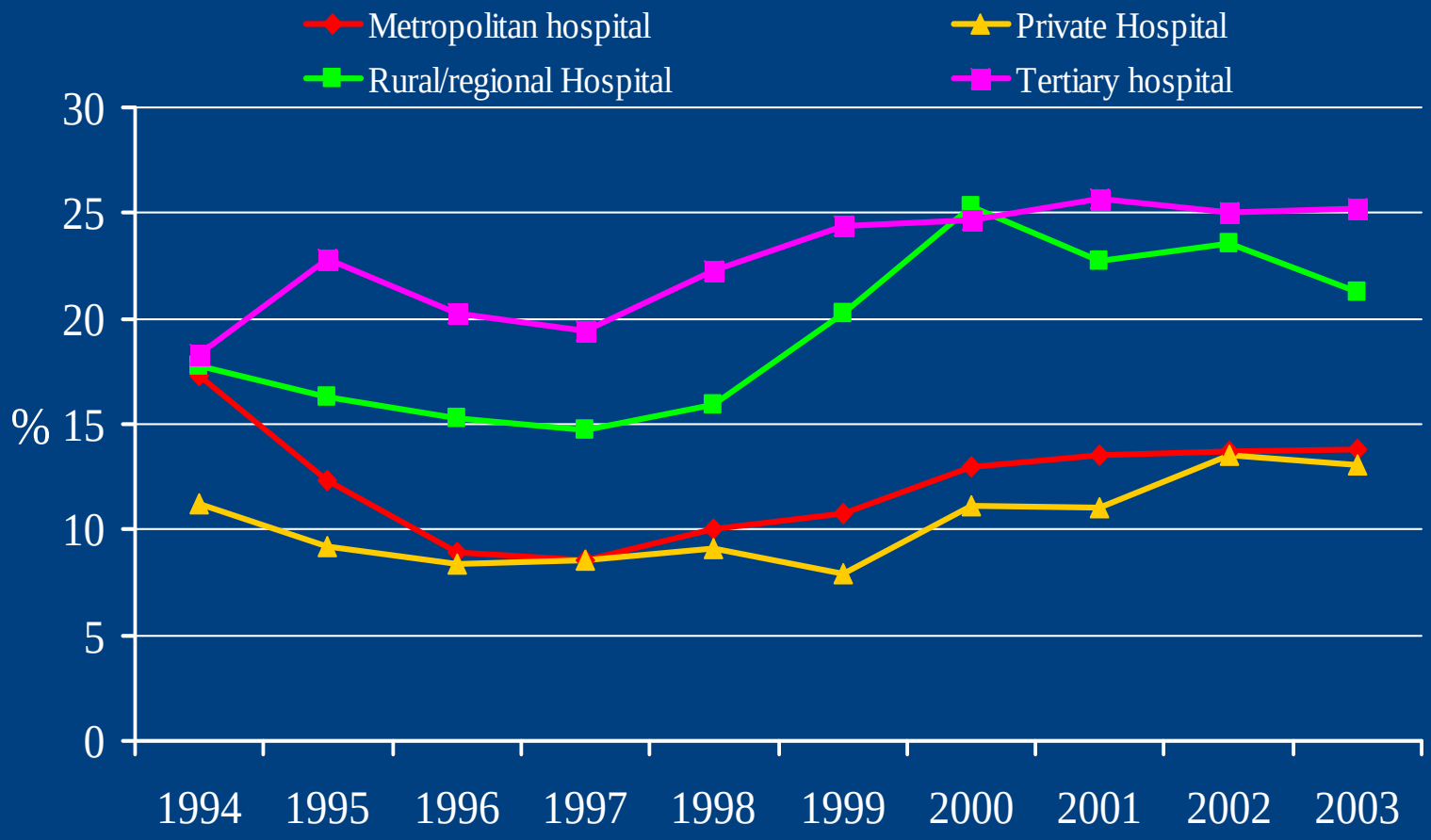
Patients admitted to an ICU and source is other hospital by Region



Patients admitted to an ICU and source is other hospital by year



Patients admitted to an ICU and hospital source is another hospital by ICU type and Year



	ICU source of Admission			
	Operating Theatre	Emergency Department	Ward	Other Acute Hospital
Age	62.7 (CI 62.6, 62.8)	54.1 (CI 54, 54.2)	63 (CI 62.3, 63.2)	55.7 (CI 55.4, 55.9)
APACHE II score	13.1 (CI 13.1, 13.2)	15.4 (CI 15.3, 15.4)	19 (CI 19, 19.1)	18.2 (CI 18.1, 18.3)
APACHE II Risk of Death	0.149 (CI 0.15, 0.15)	0.224 (CI 0.22, 0.23)	0.332 (CI 0.33, 0.33)	0.302 (CI 0.30, 0.31)
ICU length of stay (days)	3.0 (CI 2.97, 3.02)	3.4 (CI 3.4, 3.43)	4.9 (CI 4.86, 4.98)	5.4 (CI 5.3, 5.5)
Hospital length of stay (days)	19.2 (CI 19.1, 19.4)	11.8 (CI 11.6, 11.9)	26.4 (CI 26.1, 26.7)	15.6 (CI 15.4, 15.9)
Hospital Mortality	7.6%	16.7%	31.1%	30.1%
Standardised Mortality Rate	0.51	0.75	0.94	1.0

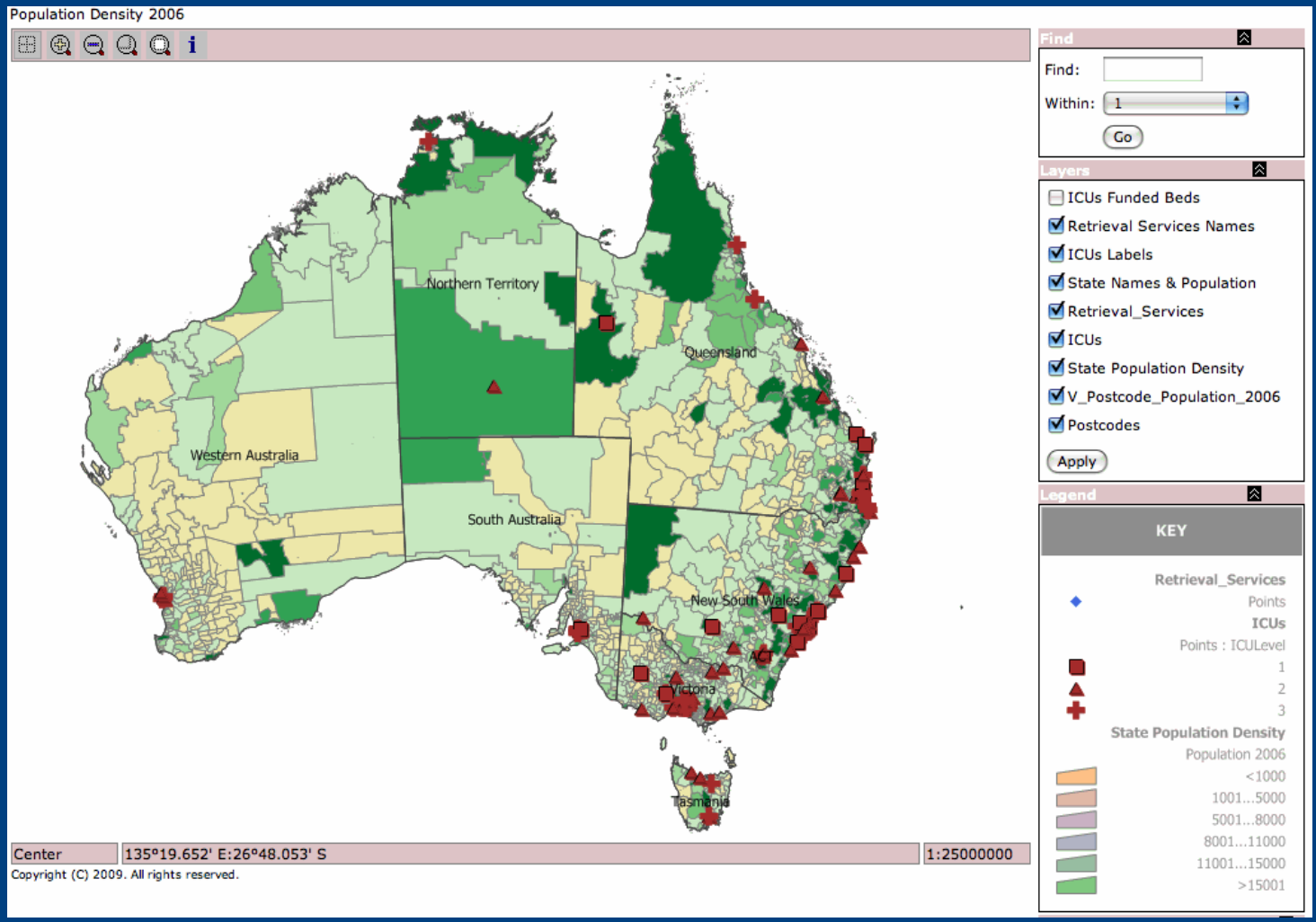
Retrieval Services

- 65 services completed a survey
    - one non responder
- 11 from NZ and 54 from Australia

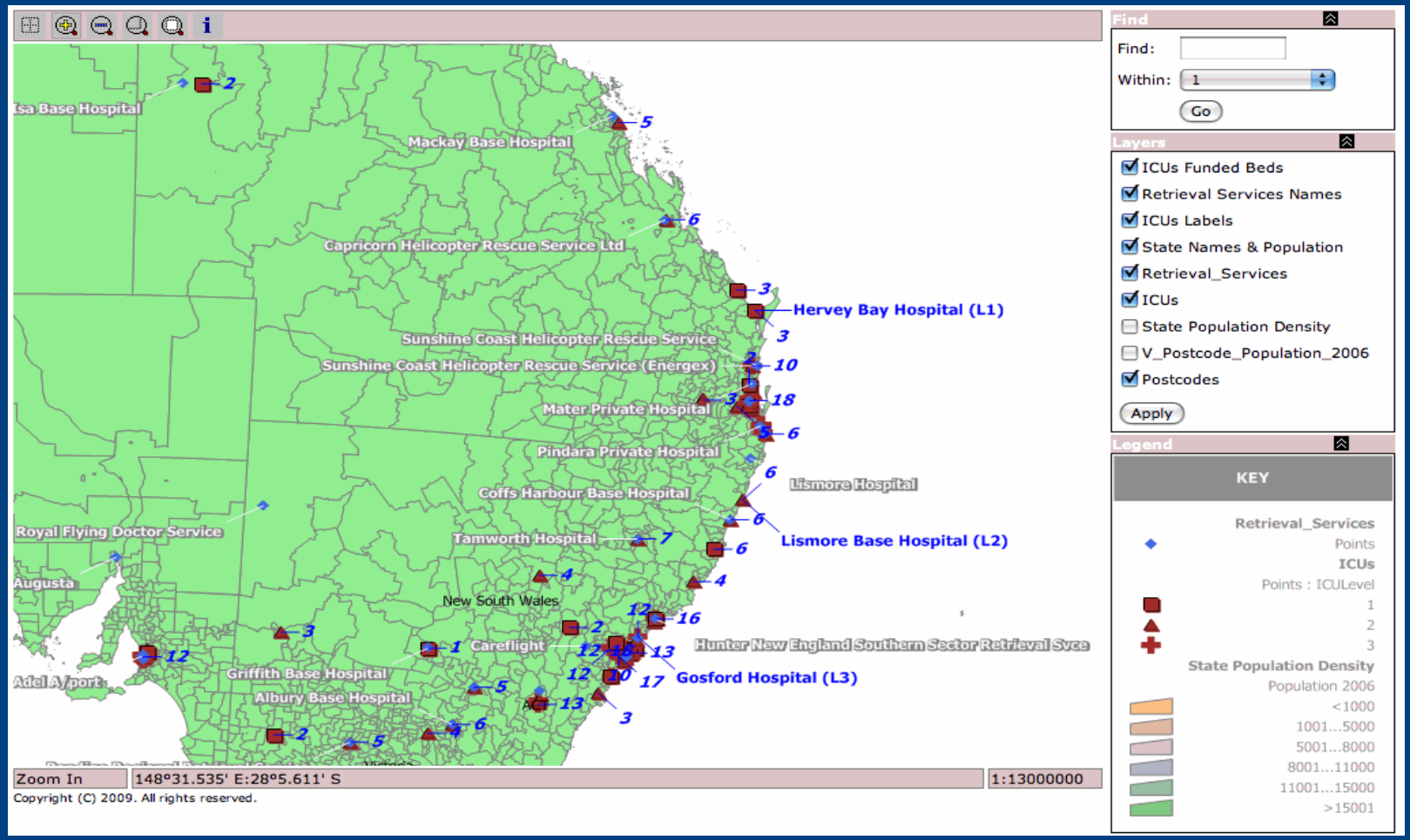
- 58.5% being hospital affiliated
    - 36% Metro regional hospital
    - 36% Rural regional hospital
    - 28% Metro

- 63% utilised Helicopter
- 69% utilised fixed wing
- 91% utilised road vehicles
- 55% utilised all 3 modes of transport

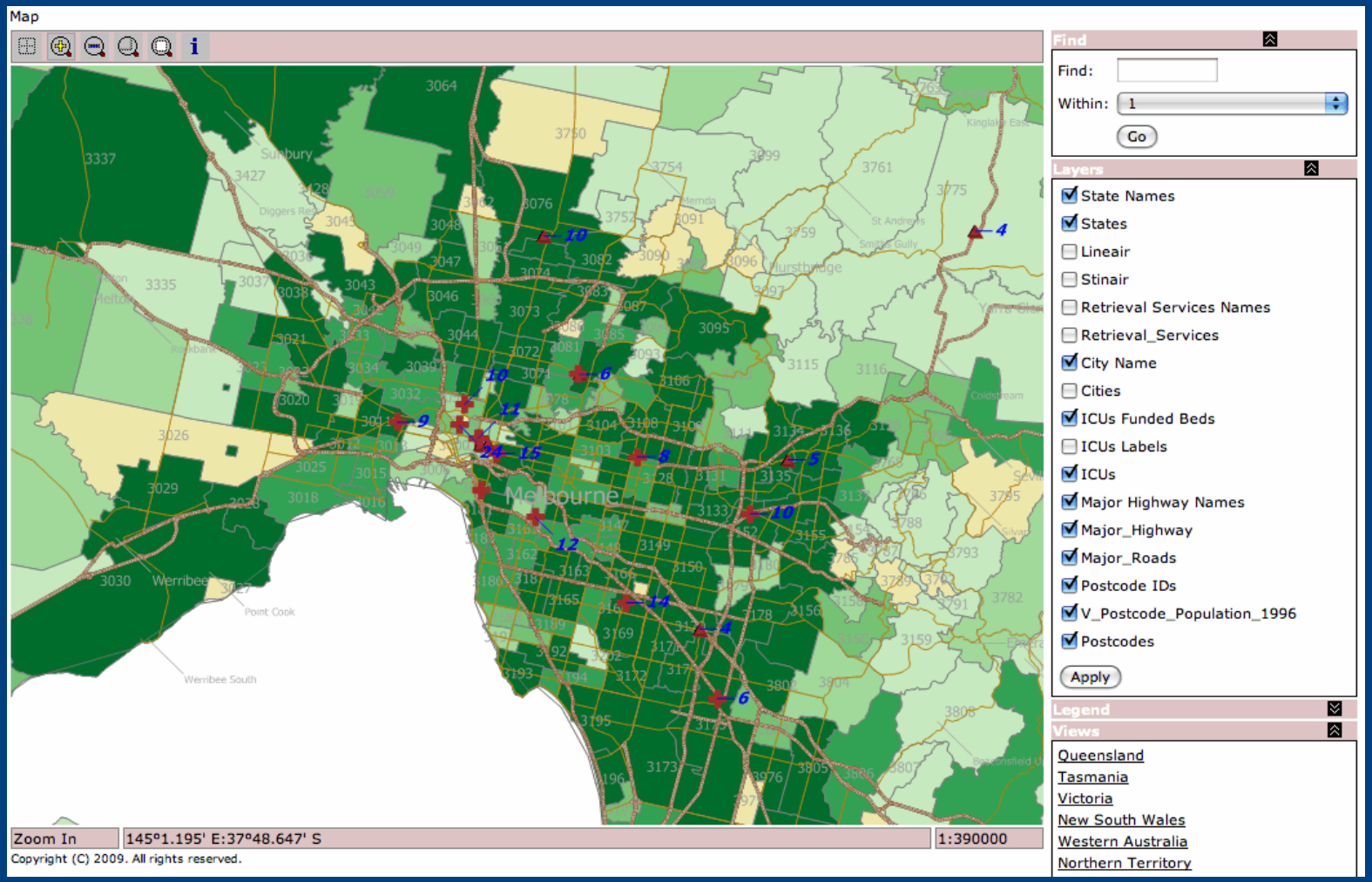
Global perspective



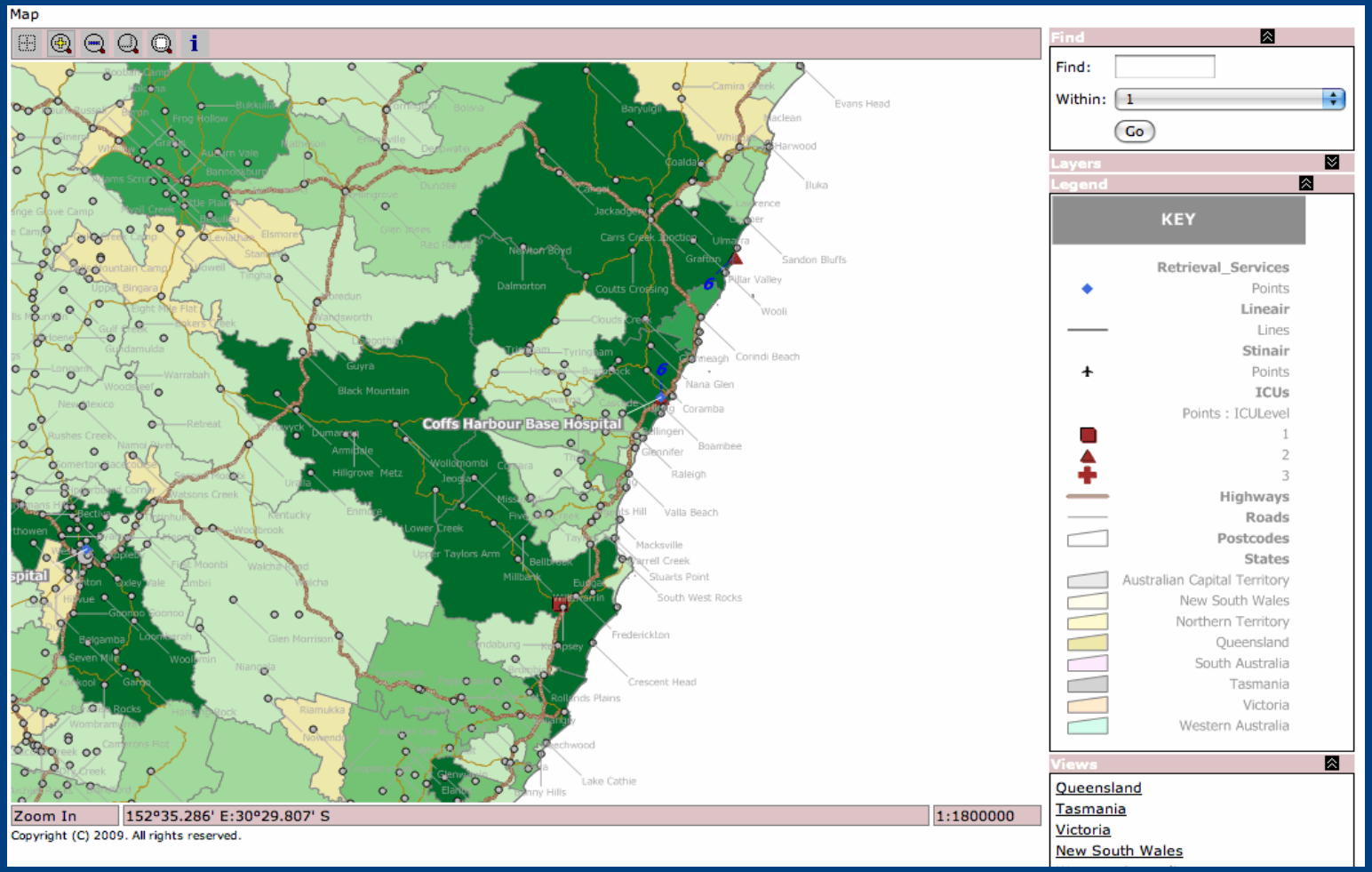
Focusing on Regions – ICU and Retrieval resources



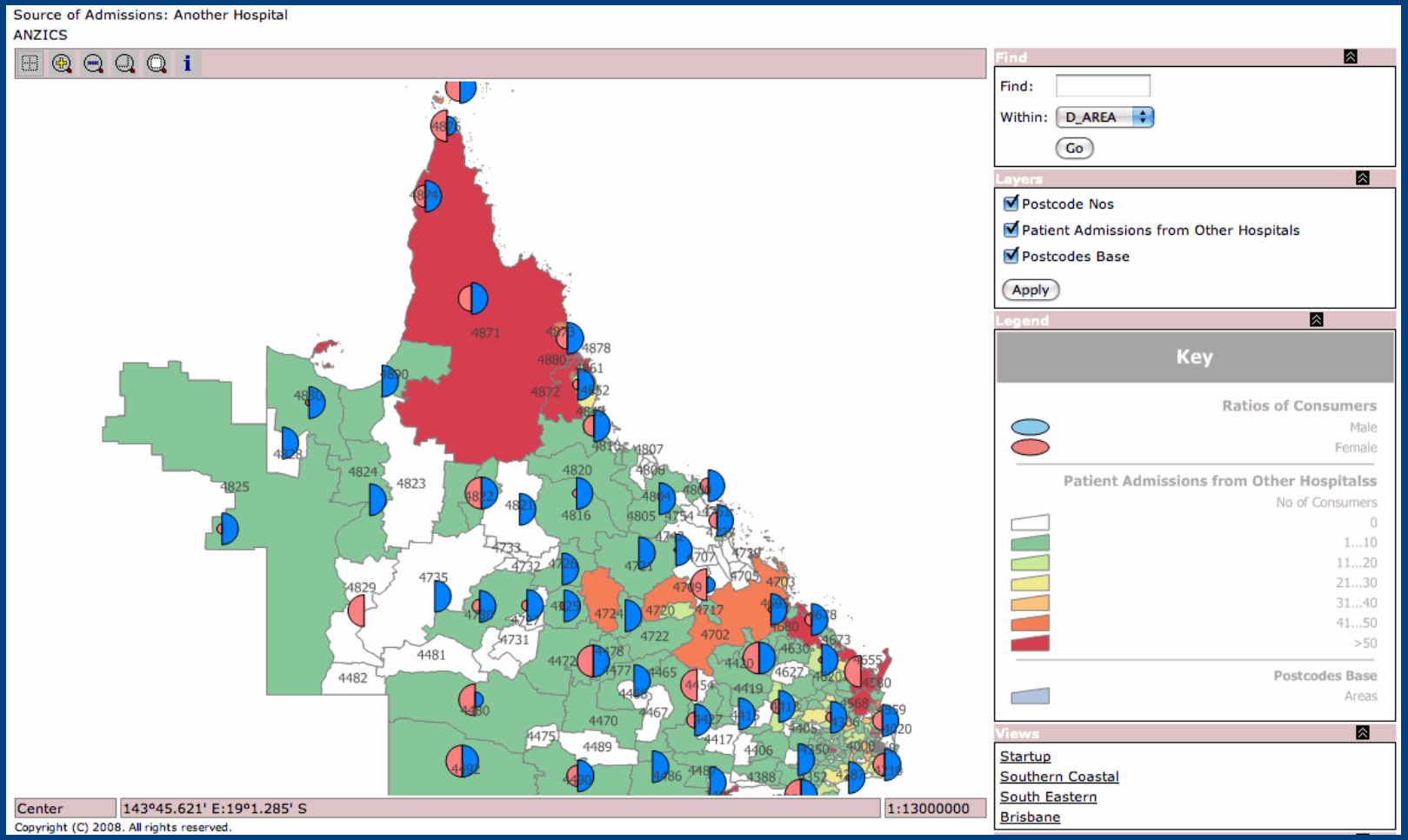
Focusing on Regions - urban



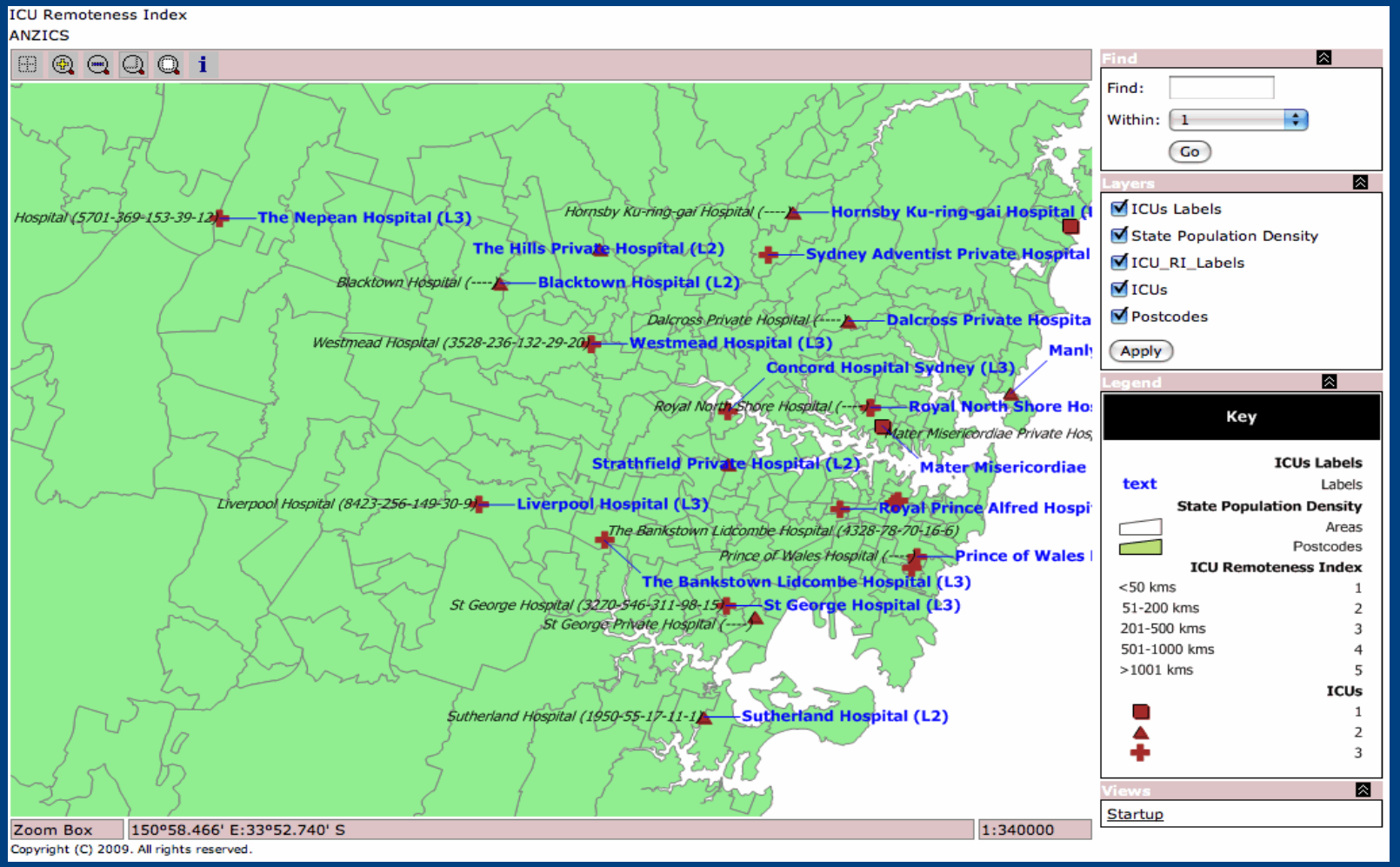
Focusing on Regions - rural



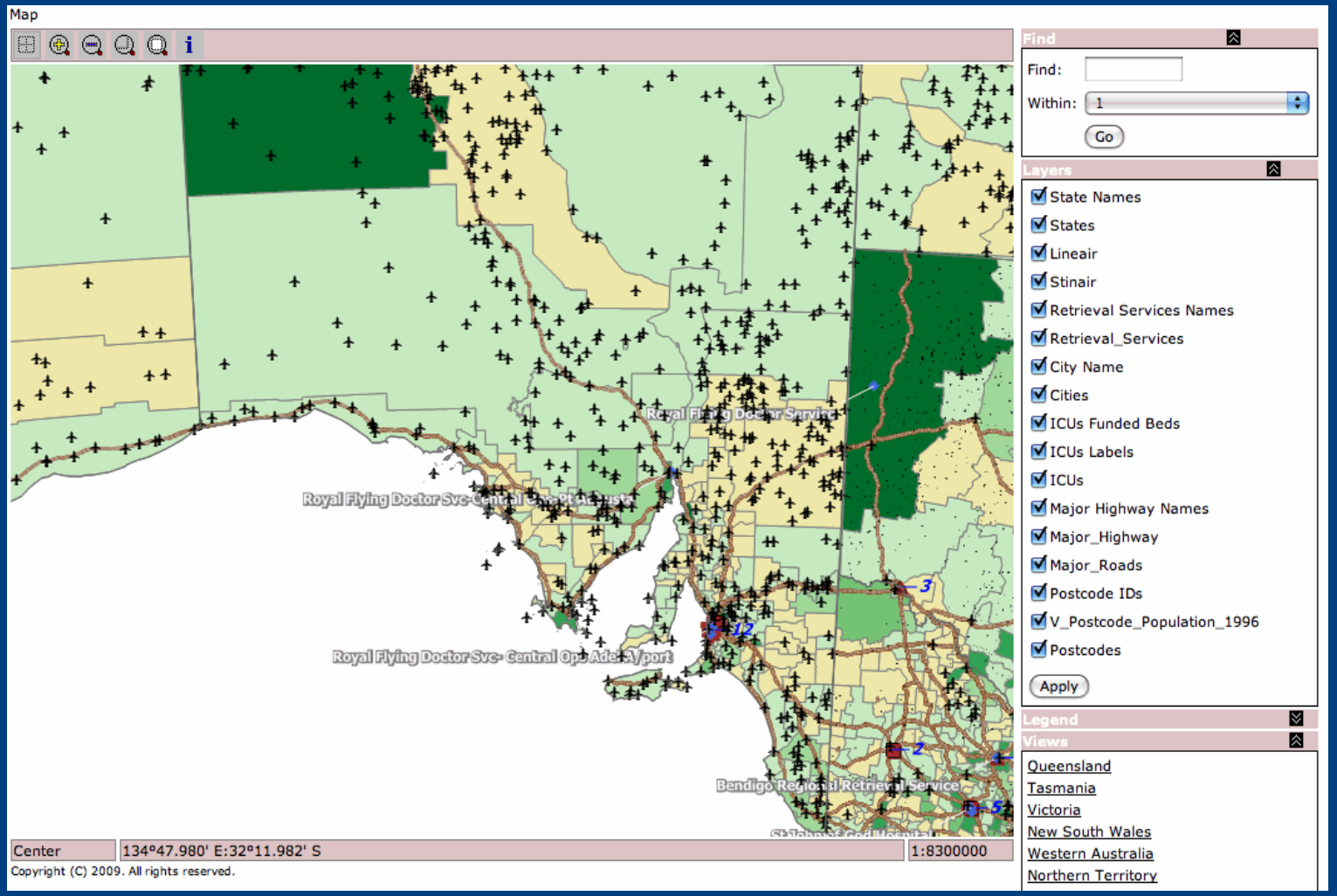
Source of patient whose ICU source of admission is another hospital



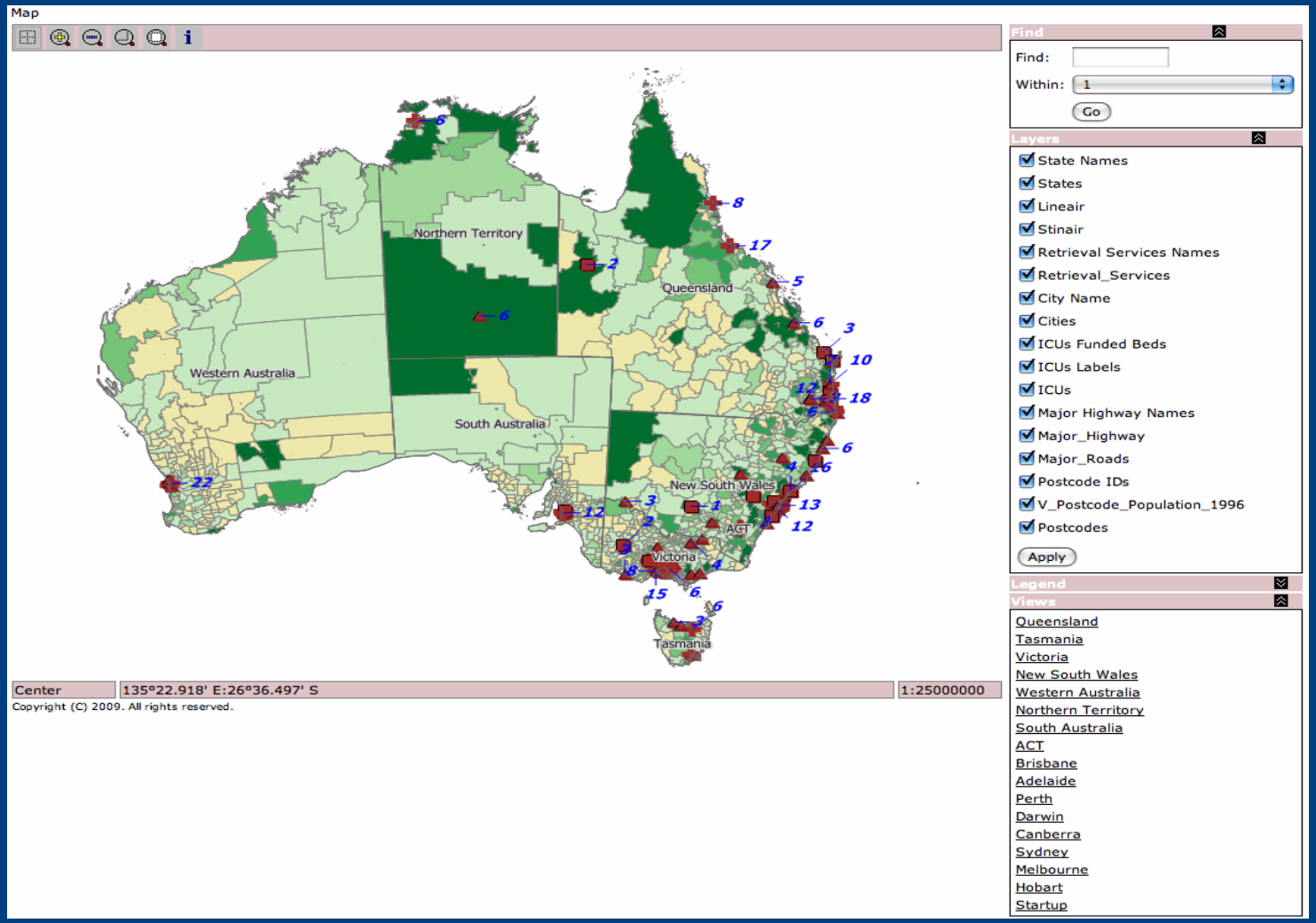
Accessibility to an ICU



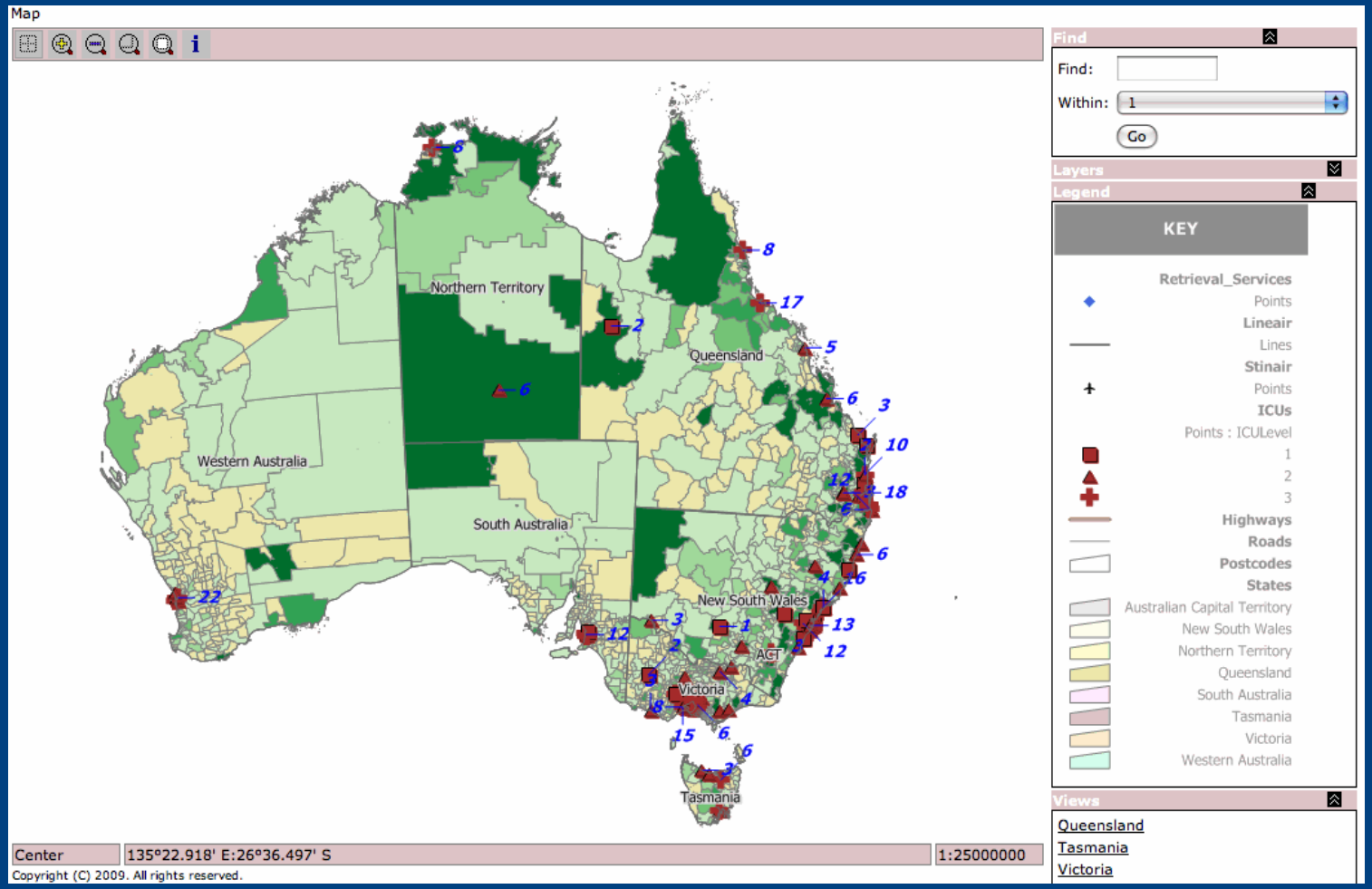
Infrastructure



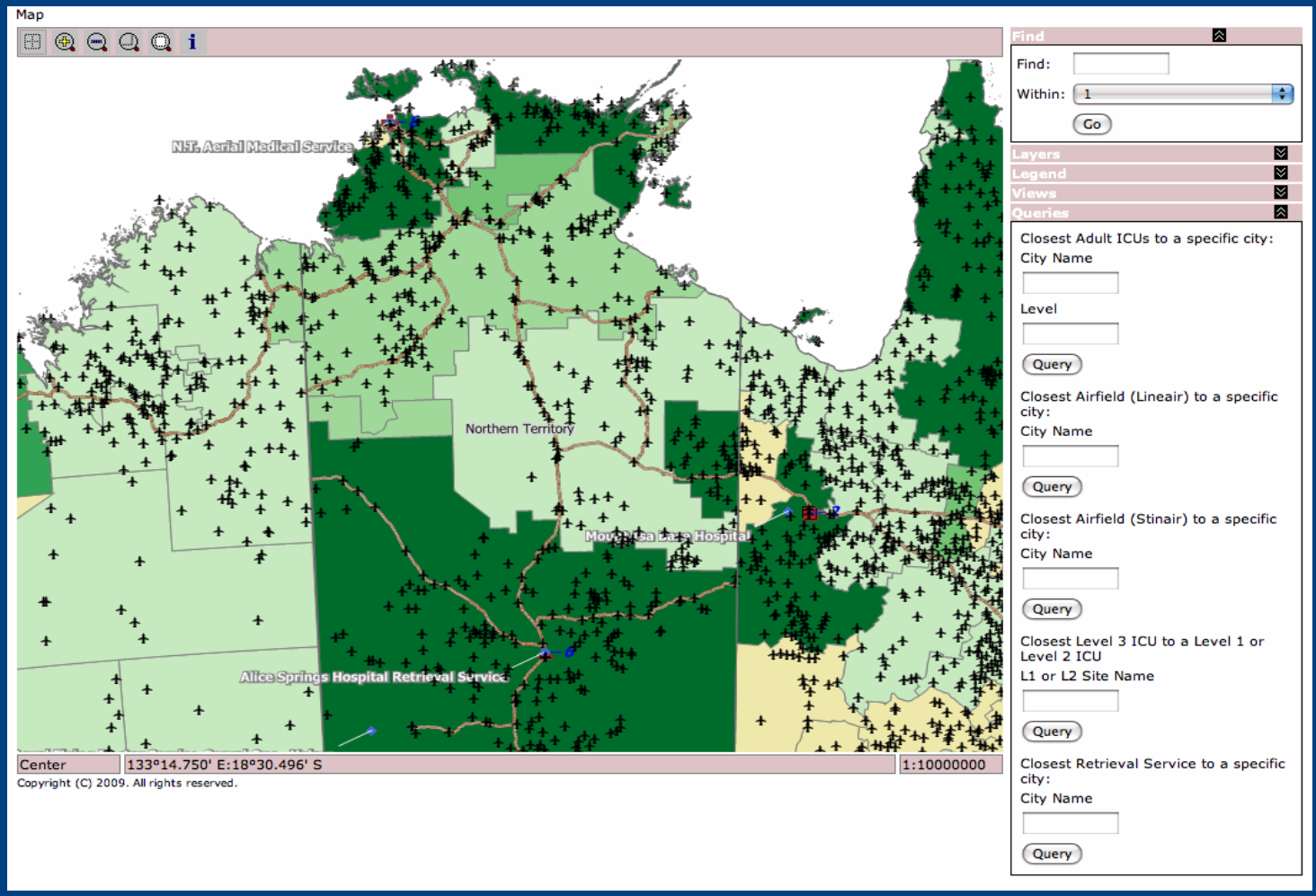
GIS Program capacity - layers



GIS Program capacity - legend



GIS Program capacity - queries



Summary

Regionalization and accessibility are contrasting challenges for delivery of equitable health care..

…do influence patient outcomes…

….thus equity and delivery require planning, strategic positioning and regular evaluation

Summary

Associations between population demographics - medical resources - patients - infrastructure can be examined by using geospatial methods.

Advantages over “conventional” less “visual” methods.

Complimentary

Summary

Implications for *planning* of ICU *resource allocation*, improving *accessibility* (eg Retrieval utilization) and impact of any such actions upon *patient outcomes* and *resource costs*.