

## **RURAL FIRST YEAR UNIVERSITY STUDENTS: AS ENGAGED, ASPIRATIONAL AND MOTIVATED AS ANYONE – BUT DIFFERENT SCIENCE 'CHOICES' IN YEAR 12 AND UNIVERSITY**

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### **ABSTRACT**

This paper reports on findings from the Interests and Recruitment in Science study, which explored the experiences of first year students studying science, technology, engineering and mathematics (STEM) courses in Australian universities. First year STEM students who went to school in rural or regional areas were as engaged, aspirational and motivated as their more metropolitan counterparts. However, they were less likely to have studied physics or advance mathematics, and more likely to have enrolled in an Agricultural or Environmental Science degree. The relationships between these results and broader contextual issues such as employment and Higher Education budgetary and policy settings are discussed.

**Key words:** first year university science students, STEM courses, employment

### **INTRODUCTION**

We are experiencing interesting times in science and science education in Australia. Relative declines in participation are continuing in the enabling sciences of physics, chemistry and mathematics at school (Kennedy, Lyons, & Quinn, 2014; Lyons & Quinn, 2010). In response to the problems the Chief Scientist of Australia (Office of the Chief Scientist, 2012) has made a raft of recommendations to enhance maths, engineering and science teaching and learning. The arguments put forward have been by and large economic, citing the importance of growing the supply of appropriately qualified graduates as a *critical underpinning for the future of innovative economies* and to help to develop a *high technology, high productivity economy* (p. 6). On the other hand, the recent Report on the Review of Demand Driven Funding Model for university places commissioned by the Federal Minister of Education (Kemp & Norton, 2014, pp. 28–29) claims that there have been recent rapid increases in science enrolments, particularly but not only, Biology, which have led to employment problems for graduates. They state (p. 28) that *it is a poor outcome when graduates looking for full-time work struggle to find it, and especially so if their course choices were influenced by misleading signals from the government*. We share the concern about post-graduate employment opportunities in some Science, Technology, Engineering and Mathematics (STEM) disciplines. However STEM feeds into a huge diversity of employment fields and the employment prospects can differ markedly across many of these fields.

Market signals potentially influencing Higher Education STEM choices have clearly been dialled up in the 2014-2015 budget. These include the proposed deregulation of Higher Education Institutions and associated changes to course fees, reduced income threshold for repayment of the *Higher Education Loan Programme* and higher interest on HELP loans.

Our view is that the rationale for studying science, engineering and mathematics must take account of, but also transcend, direct economic considerations, as Australia is sorely in need of scientifically literate citizens who can adjudicate between different positions on current serious and controversial socio-scientific issues such as coal seam gas extraction and climate change. We also need innovation in science: examples with particular relevance to rural and regional Australia include renewable energy sources, food security, climate change mitigation and adaptation and more:

*Regional Australia holds the keys to a sustainable future for Australia. It is where solutions can be found to key national and global challenges such as: food security; biodiversity; climate change; water solutions; preservation of Indigenous cultures and Indigenous economic development; and, social inclusion (Regional Universities Network, 2014).*

This pivotal role for regional Australia in solving some of these socio-scientific problems emphasises the importance of the scientific education and scientific literacy of rural and regional young people, and of engaging them in Higher Education so that they can make a difference to their local communities and to society more broadly. However, young people in regional and rural areas are already less likely to aspire to a higher education than their metropolitan counterparts, with a study by Richardson and Friedman (2010) finding that while 63 per cent of young people in metropolitan areas intended to enrol in higher education, only 39 per cent of regional youth and 32 per cent of young people in remote areas had tertiary education aspirations. Likewise, fewer parents in regional areas aspire for a tertiary education for their children than their metropolitan counterparts (Australian Government: Australian Institute of Family Studies, 2011).

Science education, aspirations and employment are hence interlinked in complex ways, with some issues on the horizon particularly important in rural and regional areas. This paper explores some of these important relationships by focussing on the aspirations, educational backgrounds and university subject choices of first year Australian STEM undergraduates, comparing rural and regional cohorts with students from larger city centres. We situate our findings in the broader context of the employment, and the proposed changes to education, employment and science funding in the 2014-2015 Federal Budget.

To compare rural/regional and metropolitan university students in STEM we have drawn from a recent international project in which we have been involved the Interests and Recruitment in Science (IRIS) project. IRIS was established and funded by the European Commission in response to the problem of too few young people (especially women) enrolling in STEM at university, and to enhance recruitment and retention in science. The IRIS project has explored perceptions and experiences of students in their first year of STEM university courses in six European countries, and subsequently Australia. This study is an outcome of the Australian extension of IRIS that we have conducted (Lyons et al., 2012), and presents some selected findings related to rural and regional first year STEM students in Australian universities.

The specific research questions at the focus of this study are:

1. Do rural and regional students who have made it to university report their aspirations and motivations any differently to their metropolitan counterparts?
2. Is the STEM school subject background for rural and regional first year university students any different to their metropolitan counterparts?

3. Are the STEM subject choices of rural and regional first year university students any different to their metropolitan counterparts?

## METHODS

Data for this study were collected from 2999 domestic Australian university students using a slightly modified online version of the IRIS questionnaire developed and piloted by the European IRIS partners. Students' priorities and aspirations for the future were explored by a bank of nine four-point Likert-type items in response to the question 'Regarding your priorities for the future; how important are the following factors to you?' anchored at either end from 'Not important' to 'Very Important'. The factors included options such as: 'Doing something I am interested in', 'Contributing to sustainable development and protection of the environment' and 'Opportunities to earn a high income'. Students' motivation and self-efficacy were explored by a set of five five-point Likert-type questions, such as 'I am very motivated to study this course' and 'I am confident that I am good enough at the subjects in this course'. Other questions pertinent to this study included items about respondents' school science backgrounds and their university courses and subjects.

University courses were categorised according to the Australian Standard Classification of Education codes (Australian Bureau of Statistics, 2001), and four categories ranging from capital cities to small rural or remote towns (following Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006) were adopted to categorise students across different geographical contexts according to the location of the high school they attended.

Data were analysed using conservative and robust non-parametric techniques of cross-tabulations and chi-squared contingency table tests. Where meaningful significant differences were found, adjusted standardised residuals (ASR) were used to evaluate the sources of the differences detected by significant chi-squared relationships. Because of the relatively large sample size and large number of tests conducted, a significance level of 0.001 was adopted to prevent spurious claims of significance: consequently there may be some significant relationships among the data at the 0.05 level that are not identified in this study. Further details about the questionnaire, including a full copy of the instrument, the pertinent items, the sample and the data analysis are available from Lyons et al. (2012).

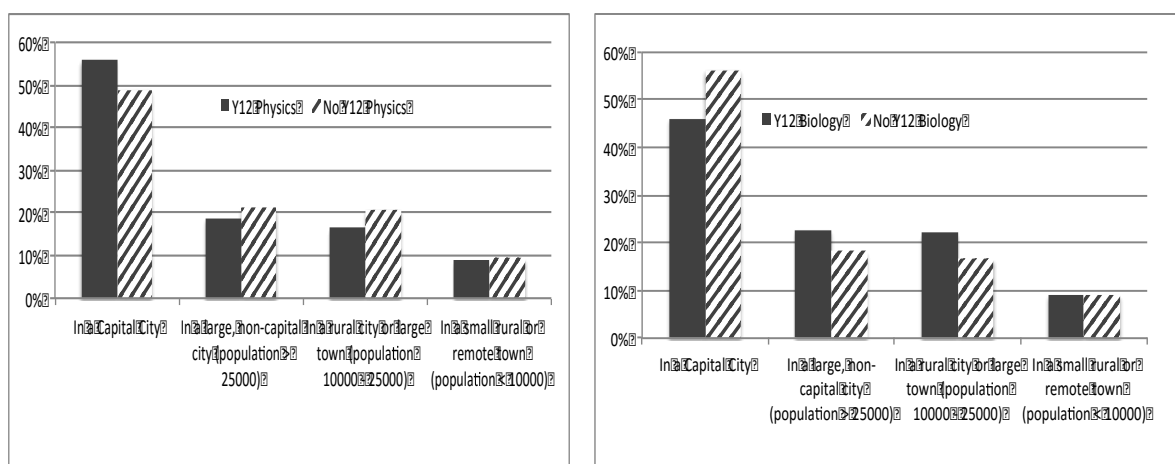
## RESULTS

### **Research Question 1: Aspirations and Motivations**

In terms of priorities and aspirations for their future; and motivations and self-efficacy, cross tabulations between the four geographical locations and responses to the relevant Likert items showed no significant associations. Hence the ratings that students ascribed to these items for the sample overall (Lyons, et al., 2012, pp. 53, 71) do not differ significantly between rural, regional and metropolitan students. As far as aspirations go, 'Doing something I am interested in' and 'Using my talents and abilities' were the most frequently endorsed items, while pecuniary considerations were less important to rural, regional and metropolitan students alike. In terms of motivation and self-efficacy, students overall agreed that they were motivated and would do well enough at their course.

### **Research Question 2: School Science Subjects Studied**

There was an association between geographical location of students' secondary schools and the Year 12 science subjects taken by the students. This is shown in Figure 1.



**Figure 1: Percentages of Respondents from Four Geographical Categories who Studied Physics and Biology in Year 12 at Secondary School.**

As suggested by the frequencies depicted in Figure 1, significantly more respondents from capital cities studied Year 12 Physics than not ( $p < 0.001$ ), and significantly fewer respondents from rural cities or large towns took Year 12 Physics than not ( $p < 0.005$ ) ( $\chi^2(3) = 16.6$ ,  $p < 0.001$ ; Cramer's  $V = 0.07$ ). This pattern for Year 12 Physics was reflected in a similar but weaker pattern in Year 12 Advanced Maths ( $\chi^2(3) = 12.04$ ,  $p = 0.007$ ; Cramer's  $V = 0.06$ ). More respondents from capital cities tended to study Year 12 Advanced Maths than not ( $p < 0.05$ ), and fewer respondents from rural cities or large towns tended to elect to study Year 12 Advanced Maths than not ( $p < 0.05$ ).

An opposite situation exists in the case of Year 12 Biology. Significantly fewer respondents from capital cities studied Year 12 Biology than not ( $p < 0.001$ ), while significantly more students from large or non-capital cities ( $p < 0.005$ ) and rural cities or large towns ( $p < 0.001$ ) studied Biology than not ( $\chi^2(3) = 32.05$ ,  $p < 0.001$ ; Cramer's  $V = 0.10$ ).

In short, these results show a trend of metropolitan respondents being significantly more likely to have undertaken Physics at school, with a similar tendency in the case of Advanced Maths, while their rural counterparts are more likely to have taken Biology.

### Research Question 3: First Year STEM Education Field

The frequencies of students from the different geographical categories enrolled in the four STEM-related ASCED broad level fields of education are shown in Table 1.

Table 1 shows that the reported percentage of respondents studying different ASCED fields was significantly associated with the geographical location of their secondary school ( $\chi^2(9) = 51.96$ ,  $p < 0.001$ ; Cramer's  $V = 0.08$ ). In relation to the field of Agriculture, Environment and Related studies, significantly more than expected respondents from rural cities or large towns and small rural or remote towns were enrolled in this field of education, while significantly fewer than expected respondents from capital cities were enrolled. Significantly more respondents from capital cities were also enrolled in Engineering and Related Technologies. Not shown in the table but noteworthy is that the sample of ASCED broad field of Agricultural, Environment and Related studies there were 5.5 times as many students enrolled in Environmental Studies as Agriculture.

**Table 1: Percentages of Respondents from Four Geographical Categories Studying First Year University STEM subjects (ASCED Level 1 categories) <sup>#\*</sup>**

		ASCED Level 1 Fields of Education				
		Natural & Physical Sciences	Information Technology	Engineering & Related Technologies	Agriculture, Environmental & Related studies	Total
In a capital city	Count	727	154	533	72	1486
	% of row	49%	10%	36%	5%	100%
	% of column	51%	59%	57%	36%	53%
non-capital city (population)	Count	305	39	172	38	554
	% of row	55%	7%	31%	7%	100%
	% of column	21%	15%	19%	19%	20%
city or large town (population)	Count	279	46	144	55	524
	% of row	53%	9%	28%	11%	100%
	% of column	20%	18%	16%	28%	19%
rural or remote town	Count	122	22	79	34	257
	% of row	48%	9%	31%	13%	100%
	% of column	9%	8%	9%	17%	9%
						<b>2821</b>

# Shaded cells indicate significant differences between observed and expected cell counts were the variables not associated. Light grey cells indicate more than the expected number students from that area studying that ACSED field, and dark grey cells indicate less than the expected number ( $p < 0.001$ ).

\* Natural and physical science includes Biology, Physics, Astronomy, Chemistry and Earth Sciences.

In summary, overall these results indicate a small but statistically significant tendency for rural/regional students in this study to have taken Biology at Year 12 and not Physics (or Advanced Maths) in relation to their metropolitan counterparts. In addition, rural and regional students are also more likely than their city peers to be studying Agriculture, Environmental and Related studies in their first year at university. Of the students enrolled in Agriculture, Environmental and Related studies, the vast majority of these were in Environmental Studies.

## DISCUSSION

These results relate coherently to what we would expect from pertinent literature, and highlight some important issues around education, employment and equity in the regions.

In terms of aspiration and motivation explored in research question 1, this study has sampled students who *have* university aspirations and who are the survivors; those students who have aspired to university STEM education and made it to nearly the end of their first year at university. From this sample, regional and rural students report similar levels of aspiration, motivation and expectations of success as the metropolitan students near the end of their first year. This is an unsurprising result as regional/ rural school leavers with different educational aspirations referred to in the literature would have either opted or dropped out of University further education in favour of alternatives such as Vocational and Educational Training (VET), employment or other options prior to this study being conducted. This result has implications for academic support and First Year Transition issues that are beyond the scope of this paper to discuss. Importantly it does not conflict with or contradict the real and persistent problems of access, participation rates and attrition that have for so long been experienced by students from the ‘remote’ equity group (James, Krause, & Jennings, 2010). However more recent initiatives including removing caps on university enrolments and the Demand Driven University Funding Model have apparently enhanced Higher Education participation and opportunities for low SES and Indigenous students (Kemp & Norton, 2014).

In relation to research question two, we know that there are persistent shortages of appropriately qualified teachers in secondary science, (especially physics), and mathematics in Australia, and that

this problem is particularly acute in rural and regional areas (Australian Government Productivity Commission, 2012; Lyons, et al., 2006). We also know that teachers have a very strong influence on their students' decisions about science subject choices in senior secondary school (Lyons & Quinn, 2010). From this perspective it is therefore not surprising that rural and regional students in this study were less well represented in the harder-to-staff areas of maths and physics at school. This may highlight an effective limitation to real subject choice opportunities for rural and regional students who may be inclined towards maths and physical sciences, but who lack the advantages accorded by appropriately qualified and experienced teachers in these fields.

However this result may also relate to intended career choices for these students, who had greater representation in Agriculture, Environmental and Related studies at University (Figure 2). Year 12 Biology may have been favoured over other sciences because of its perceived utility value in future plans for Agriculture, Environmental and Related tertiary studies. However the converse may also play a role: the greater representation of rural and regional students in Agriculture, Environmental and Related studies may well relate in part to their stronger biological background at school.

In terms of research question three, the greater representation of rural and regional students in Agriculture, Environmental and Related studies at university is also not surprising, given that many of these students will have come from farming families and farming communities, and given that agriculture is so characteristic of, and such an important source of employment in rural and regional Australia. This is consistent with data from the Australian Government Department of Industry Innovation Science Research and Tertiary Education (2012) and previous years that non-metropolitan applicants to university are more likely than their metropolitan counterparts to apply for courses in Education, Nursing, and Agriculture, Environmental and Related studies.

However, there are some broader issues worth discussing regarding this apparent relationship between rurality and Agriculture, Environmental and Related studies at University, particularly around employment. As has recently been pointed out (Australian Council of Deans of Agriculture, 2014) there is a lack of clarity about employment in this area, in part because the ASCED category used to present much of the data aggregates Agriculture with Environmental Science, which blurs some important distinctions between these disciplinary categories.

Taking a broad retrospective look at agriculture specifically over the past 30 years, employment in the area of agriculture forestry and fishing has declined from 401,600 in 1984 to 320,600 in February 2014, but with an increase over the past year from a low point of 292,700 in May 2013 (Australian Bureau of Statistics, 2014). The proportion of Australians employed in agriculture has nearly halved from 4.8 per cent to 2.5 per cent from 1992 to 2012 (Australian Bureau of Statistics, 2012) and the number of farmers in Australia has declined from 246,000 in 1996–97 to 192,600 in 2010–11 (Australian Bureau of Statistics, 2012).

However, within the context of this long term overall decline, the latest reports point to a recent and current serious shortage of skilled workers with higher education degrees in the agriculture sector, especially in agribusiness (Australian Council of Deans of Agriculture, 2014; Carey, 2014; The Allen Consulting Group, 2012), and have highlighted the importance of filling these shortages as a matter of some urgency. In a positive sign, enrolments in Agriculture at Australian universities have shown a recent marked upturn (Australian Council of Deans of Agriculture, 2014), as have enrolments in all other science disciplines (Kemp & Norton, 2014). This is good news for meeting the labour shortages and enhancing the agricultural industry in general, but what is not so clear is where the skilled shortages are located and how this will pan out across the metropolitan/rural-regional divide. It remains to be seen to what extent either directly or indirectly it will ameliorate declines in unskilled on-farm work, farmers, and people employed in associated service industries in rural and regional towns.

Looking further forward, the most up-to-date Jobs Outlook figures (Table 2) from the Department of Employment for the fields pertinent to this study still point to below average and low job

openings in agriculture specifically, with below average earnings, particularly for farmers, whose numbers are expected to decline further over the next five years. The situation for agricultural technicians is somewhat better. The skills shortages in Agriculture reported by recent literature, many of which are likely to be in off-farm occupations such as research and development and post-farm-gate areas (see Table 3.1, The Allen Consulting Group, 2012, p. 24) seem not to be reflected in these Jobs Outlook figures; it would be useful to know why and to explore alternative ways of more accurately communicating these employment prospects.

**Table 2: Selected Employment Data for Some Indicative Agricultural, Environmental and Engineering Careers (Source: Australian Government, 2012).**

Employment Field	Employment prediction to 2017	Number of job openings	Earnings
Mixed Crop & Livestock Farmers	decline	Low (<= 5000)	Below average (3 <sup>rd</sup> decile)
Agricultural Technicians	steady	Low (<= 5000)	Low (2 <sup>nd</sup> decile)
Environmental Scientists	relatively steady	below average (5,001-10,000)	Above average (7 <sup>th</sup> decile)
Civil Engineering Professionals	relatively steady	Average (10,001 - 25,000)	High (10 <sup>th</sup> decile)

An alternative commonly used source of information about employment prospects is that put out by Graduate Careers Australia, including the *GradStats*, *GradFiles* and *Where Grads Go* annual summary resources. These sources have to date aggregated Agriculture with the far more numerous Environmental Science enrolments, which as has been argued by the Australian Council of Deans of Agriculture (2014) is therefore skewed towards the employment situation for the far more numerous environmental science graduates in that category. According to the most recent information from this source (Graduate Careers Australia, 2014), Bachelor degree students graduating from Agriculture and Environmental Studies in 2013 earned a starting salary of \$51,000 (\$4,000 below the Bachelor Graduate average), 64 per cent were employed fulltime four months after graduating and, of these, 77 per cent were in areas strongly related to their undergraduate degrees. However figures specific to Agriculture compiled by the Australian Council of Deans of Agriculture (2014) suggest much better outlook for the agriculture graduates from this broader ASCED category, at almost 90 per cent employment.

The education/employment situation for Environmental Science is similarly difficult to define, in this case because environmental scientists work across such a wide range of industries and government organisations. Most recent available data and the five year predictions from the Australian Government (2012) summarised above in Table 2, forecast steady employment prospects, somewhat below average job openings and above average earnings. However if we take the Agriculture students out of the Graduate Careers Australia (2014) data for the Agriculture and Environmental Studies category in 2013 outlined above, this points to somewhat less than 64 per cent of Environmental Science graduates employed fulltime four months after graduating; relatively low in relation to many other disciplines, but not as low as Life Sciences.

Both Agriculture and Environmental Science, though, can be contrasted with the situation in engineering disciplines. Students graduating from Engineering in 2013 earned the highest starting salary of all fields at \$65,000 (\$14,000 higher than Agriculture and Environmental Studies), 83 per cent were employed fulltime four months after graduating, 91.6 per cent of these in areas strongly related to their undergraduate degrees (Graduate Careers Australia, 2014). Certainly there are differences across different engineering disciplines that could be further explored, but in relation to the focus of this paper, the STEM disciplines of engineering that are significantly more

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frequently selected by metropolitan students are more lucrative than Agriculture and Environmental Studies, appear to have more job openings and are easier to find employment.

So what does all this mean in the current policy and budgetary context of Higher Education in STEM? Compared to their counterparts in capital cities, regional and rural Australians are more likely to be from low SES backgrounds (Kemp & Norton, 2014) and their average family income is less (Australian Bureau of Statistics, 2013). The results of this study demonstrate that differences in university education choices, at least in the STEM context, may play some part in the broader network of reasons for these persistent inequities.

It also means that higher education students in general, and rural and regional students in particular, have to keep their eyes open and ensure that their Higher Education course choices are very well informed. This is much easier for some career pathways than others, given the way that some career and employment data are reported. The proposed policy and budgetary shifts may well deter some students from choosing particular STEM pathways such as Environmental Science that have less lucrative and secure employment prospects, particularly given the high youth unemployment in many rural areas and cuts to youth unemployment income support announced in the Budget. The changes to Higher Education funding rates for Agriculture and Environmental Science will put particular pressure on students taking these courses. Environmental Science fees in particular have been targeted, set to rise by one of the highest amounts of 112 per cent (Knott, 2014). A recent recommendation (The Allen Consulting Group, 2012, p. 31) to reduce university fees for Agriculture has clearly not found traction, with these fees scheduled to rise by 42 per cent (Knott, 2014). The combined proposed Higher Education changes would, if implemented, see students taking these courses incurring relatively large debts, at compounding and higher rates of interest than present, which will be serviced by below average starting salaries in the case of Environmental Science, even if the student is successful in obtaining a job in their chosen field. These impacts could be particularly severe for regional and rural students, who more often enrol in these courses, and who more often come from low SES backgrounds with less capacity to absorb fees and debt.

If these extremely powerful market signals lead to some choices that are advantageous to both individual students (by deterring them from enrolling in degrees with limited employment prospects) and to the nation's longer term best interests in relation to STEM this may have some advantages. But for individuals motivated and aspiring to careers in areas like Environmental Science there is a steep price to pay with uncertain pay-off. In addition, if these policy and budget settings perpetuate or exacerbate recent declines in national funding and employment in fields related to Life and Environmental Sciences, this is bad news for the ecological sustainability of our environmental systems on which we all depend. In fact, given the magnitude of recently announced Budget cuts to environment and science sectors, including major cuts to CSIRO, the abolition of the Australian Renewable Energy Agency, cuts to Cooperative Research Centres and positions at the Federal and State Environment Departments (Sturmer, Metherell, & McDonald, 2014), the current outlook for graduates from Environmental Science and some subdisciplines of Life Sciences is unlikely to improve any time soon.

If the predictions of such experienced Higher Education commentators as Simon Marginson (2014) play out, Australia will have a two-tiered Higher Education sector, with a few elite capital city universities from the Go8 (the explicit goal of the deregulation) and a range of at best 'struggling' middle level universities, many of whom will be regional, which already cost more per student to run than larger metropolitan institutions (Kemp & Norton, 2014). Regional universities, though, are important to the overall national interest, as they educate a large proportion of rural and regional students, who then tend to stay and work in regional areas, which enhances the skills and expertise of the regional workforce, and hence innovation, economic activity and regional sustainable development (Richardson & Friedman, 2010).



The broader educational implications of the skills shortages in agriculture have received recent attention: suggestions at the school level cluster around better and more outreach and engagement with schools, teacher professional development and more accurate careers information and advice. At the tertiary level attention is being paid to course marketing, structure and delivery modes (The Allen Consulting Group, 2012). The Pratley Report (2013) has included a raft of very specific recommendations to across all levels of education including VET that will not be repeated here, but in short, much work is underway and the way forward for education specifically in relation to agriculture has been charted.

In terms of Higher Education and regional education and employment, it is interesting that students graduating from Agriculture and Environmental Studies at regional universities have been reported as less likely than their metropolitan counterparts to undertake further study in these fields, with many proceeding to further studies in education (Richardson & Friedman, 2010, p. 11). This has clear implications for enhancing the number of secondary science teachers in rural and regional schools in agriculture and environmental/life science, but is unlikely to ameliorate the shortages of physical science and mathematics teachers. The question asked by Richardson and Friedman (2010) is particularly pertinent to the results and context of this study and the current secondary and Higher Education landscape and would be a fruitful area of further research from the perspective of both agricultural science and education:

*... if many of those who complete courses in agriculture and environment studies at regional HEIs go on to further studies in education, does this indicate particular attractions in the educational field in regional communities, particular limitations in the agricultural field or a combination of the two? (Richardson & Friedman, 2010, p. 105)*

In answering this question it would be useful to disentangle the Agriculture from Environmental Studies graduates, and follow career trajectories of these students and their relation to the attitudes, motivation and aspirations that drew these students to science in the first place – this is an area of research we are exploring further.

## CONCLUSION

This study has established that university STEM students from rural or regional areas were as engaged, aspirational and motivated towards the end of their first year as students from capital cities. However their subject choices tend to differ from metropolitan students both at school and university: they were less likely to have studied Physics or Advanced Mathematics at school, and more likely to have enrolled in an Agricultural or Environmental Science degree at university. This is, in part, somewhat problematic because Environmental Science in particular is less lucrative and has fewer employment prospects than Engineering that was more frequently favoured by metropolitan students, and will incur a relatively large increase in fees under the proposed changes to Higher Education fee structures. At the same time, the sustainability of Australia's regional and rural areas is facing serious challenges from climate change, food security, and changes in land and resource use, all of which need local agricultural and environmental expertise for solutions. Regional universities have a big part to play in facilitating this expertise, but it is unclear how regional institutions in general, and STEM disciplines in particular, will fare under the proposed deregulated university system and fee changes. This study has illustrated some of the dynamic and complex interactions between secondary and tertiary STEM education, employment and contemporary policy and budgetary settings impacting rural and regional Australia, and highlights the need for further research into some of these interrelationships.

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