Journal of Teaching and Learning for Graduate Employability

# Implementing the threshold learning outcomes for agriculture at two Australian universities

Tina Botwright Acuña[1], Glenn McDonald[2], Jo-Anne Kelder[3], Amanda J Able[2]

Tina.Acuña@utas.edu.au; Jo.Kelder@utas.edu.au; glenn.mcdonald@adelaide.edu.au; amanda.able@adelaide.edu.au;

[1]School of Land and Food, University of Tasmania, Hobart, Australia

[2]School of Agriculture Food and Wine, University of Adelaide Waite Campus, Australia

[3]Faculty of Health Science, University of Tasmania, Hobart, Australia

## Abstract

The national Learning and Teaching Academics Standards Statement for Agriculture (AgLTAS) defines the nature and extent of the discipline and provides a set of Threshold Learning Outcome statements (TLOs) that define what a graduate should know, understand and be able to do on graduation. The Australian Council of Deans of Agriculture have endorsed the AgLTAS document: it can be used to communicate to potential and current students the minimum standards of their degree, and also inform curriculum design. While the AgLTAS document provides explanatory notes to assist educators to further understand the intent of the TLOs there are no exemplars on how the AgLTAS can be implemented. This paper presents two case studies of how academics at the University of Tasmania and the University of Adelaide used the AgLTAS to map their respective agriculture curricula. Curriculum mapping was used to evaluate the links between the curriculum and the target learning outcomes, and to identify gaps and areas for improvement. Results include the curriculum maps but also a survey of academic staff and their reactions to the TLOs, plus a reflective commentary on what we believe are the next steps and implications of the AgLTAS for curriculum development, industry engagement and graduate employability in the agriculture discipline.

Keywords: curriculum mapping, learning and teaching academic standards for agriculture, AgLTAS

## Context: Learning and teaching academic standards

Internationally, the quality assurance agenda in higher education has led to the development of Academic Standards Statements for a range of disciplines, through regulatory bodies and projects such as the Quality Assurance Agency in the United Kingdom (QAA, 2008) and the European Union's Tuning Project (Tuning, 2015). The latter approach has been adopted outside the European Union in regions such as Latin America and parts of the United States of America. Similarly, an increased emphasis on quality assurance in higher education by the Australian Government has been articulated through the Higher Education Standards Framework (HESF) (Australian Government, 2015).

The Australian Government commissioned the then Australian Learning and Teaching Council to develop the Learning and Teaching Academic Standards component of the HESF from 2009 to 2011. As was the case internationally, the approach was designed to ensure that discipline communities would define and take responsibility for implementing academic standards. Threshold learning outcomes (TLOs) were defined in terms of minimum discipline knowledge, and articulate the expectations of a graduate from a program of study at university in terms of what they know, understand and are able to do. The process took account of existing award-level descriptors defined in the Australian Qualifications Framework (AQF) (Australian Qualifications Framework, 2013) and involved the participation of professional and accreditation bodies, employers and graduates as well as academic institutions and teachers. Learning and Teaching Academic Standards were developed using this process for ten fields of education, such as accounting, education, law and science. The Learning and Teaching Academic Standards are acknowledged in the HESF as reference points that higher education providers can use to describe how they meet requirements related to learning outcomes and assessment (Australian Government, 2015).

In the agriculture discipline, there was a need to build capacity via skilled graduates to meet Australia's objectives for innovation and sustainable agricultural production into the future (Cowan, 2010; Parliament of Victoria, 2012; NSW Government, 2012; Pratley, 2013; Australian Government, 2012) in the context of declining enrolments (Australian Council of Deans of Agriculture, 2009; Pratley & Botwright Acuña, 2015). This provided the impetus to develop the LTAS Statement for Agriculture (AgLTAS) (Botwright Acuña, Able et al., 2014).

Developed using a consensus approach (Botwright Acuña, Kelder, Lane, & Hannan, 2014), the AgLTAS Statement is a formal document that articulates the collective views of agriculture discipline stakeholders, including academics, industry and students. In particular, the involvement of industry in the development of the standards ensures that the learning and teaching academic standards of agriculture graduates meet their needs. This, in turn, can improve the employability of graduates and build capacity. Employability can be defined as a set of achievements – skills, understandings and personal attributes – that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy (Yorke, 2006).

The preparation of the AgLTAS Statement by the project team and a reference group was informed by 21 national workshops and two online surveys. This approach was based on approaches and achievements of prior projects and used already developed resources. Specifically, the project built on the framework for engagement used in the ALTC-funded project to develop the Learning and Teaching Academic Standards for Science (Jones, Yates, & Kelder, 2011); resources to assist discipline communities to define TLOs (ALTC, 2011); a pilot project on developing TLOs for Agriculture at UTAS that involved consultation with the University of Adelaide and Charles Sturt University (Botwright Acuña et al., 2012); the process outlined by Dowling and Hadgraft (2012) used to develop practitioner-authenticated sets of graduate capabilities for Engineering via the Define Your Discipline project; the UTAS project that has mapped the UTAS Bachelor of Science against the LTAS Science TLOs using an online tool (Jones & Holmes, 2013), and; the application of standards outlined by (Brawley et al., 2011) for History in the *After Standards* project.

The Learning and Teaching Academic Standards Statement for Agriculture thus includes a definition on the nature and extent of the discipline, threshold learning outcome statements (TLOs) that define what a graduate should know, understand and be able to do at graduation and associated explanatory notes. The five Agriculture TLOs broadly follow the Science LTAS (Jones, Yates, & Kelder, 2011) and include: Knowledge; Understanding; Inquiry and Problem Solving; Communication; and Personal and Professional Responsibility. However, each Agriculture TLO embeds components that are strongly contextualised to the highly

multidisciplinary nature of agriculture capturing diverse elements such as business and social contexts, adoption and the value chain (Botwright Acuña, Able et al., 2014). Alignment of the TLOs in agriculture with national and international comparators is explored in more detail in Botwright Acuña, Able et al. (2014).

The AgLTAS Statement, endorsed by the Australian Council of Deans of Agriculture, can be used to communicate to potential and current students what the minimum standards of their degree are, and can also be used to inform curriculum design. While the AgLTAS document provides explanatory notes to assist educators to further understand the intent of the TLOs there are no exemplars on how the AgLTAS can be implemented. This paper presents two case studies of how academics at the University of Tasmania (UTAS) and the University of Adelaide (UA) used the AgLTAS to map their respective agriculture curricula. Curriculum mapping is used to evaluate the links between the curriculum and the target learning outcomes (Lam & Tsui, 2013; Uchiyama & Radin, 2009; Plaza, Draugalis, Slack, Skrepnek, & Sauer, 2007), and to identify gaps and areas for improvement (Sumsion & Goodfellow, 2004). Curriculum mapping exercises such as the one reported here, are successful and sustainable when the implementation process is adopted to provide ongoing feedback to students and academics (Lawson et al., 2015). Furthermore, allowing academics to take ownership of assessment and how it aligns to TLOs encourages implementation of graduate attributes (or TLOs) (Lawson et al., 2015). We provide details of the curriculum maps developed using an online tool; the external benchmarking of assessment items aligned to the TLOs; a survey of academic staff and their reactions to the TLOs; plus a reflective commentary on what we believe are the next steps and implications of the AgLTAS for curriculum development, industry engagement and graduate employability in the agriculture discipline.

## Method

In June 2014, workshops with academic staff were undertaken at the University of Tasmania and The University of Adelaide to map curricula in two degrees against the TLOs for agriculture using an online Curriculum Mapping Tool (CMT). The two institutions selected for this study were lead and partner universities, respectively, in the development of the national Learning and Teaching Academic Standards Statement for Agriculture who were undertaking a periodic review of their respective curricula. Note that here ‘degree’ refers to a programme of study comprised of ‘units’ leading to a Bachelor’s qualification. Furthermore, ‘unit’ may be alternatively described as a course or subject at some universities.

A CMT user guide (Acuña et al., 2014) and the tool can be downloaded from www.agltas.edu.au. The CMT was further developed during the AgLTAS project from a pilot tool developed by the University of Tasmania to map the Science TLOs in the Bachelor of Science majors (Jones & Holmes, 2013). The CMT enables the mapping of curriculum against a set of user-defined statements, designated ‘criterion statements’ in the tool, which represent the set of standards against which the curriculum is to be evaluated. The tool is designed so that users can set up an instance of the tool to map a grouping of Units comprising a Degree against a set of Criterion Statements. The Agriculture TLOs were subdivided into criterion statements. The TLOs for agriculture are provided in Table 1 for reference and are referred to by their respective numbers in the curriculum maps provided in Plates 2 and 3 (see Appendix). A brief commentary on the process of curriculum mapping follows Table 1.

## *Table 1. Threshold Learning Outcomes for Agriculture**

| |
|---|
| **TLO 1 Understanding agriculture** |
| Demonstrate an integrative understanding of agriculture by: |
| 1.1 Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society. |
| 1.2 Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change. |
| 1.3 Understanding how information is adopted and the context within which producers, processors and consumers make decisions. |
| **TLO 2 Knowledge of agriculture** |
| Exhibit depth and breadth of knowledge of agriculture by: |
| 2.1 Demonstrating knowledge of the core sciences in the context of agriculture. |
| 2.2 Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area. |
| 2.3 Understanding how knowledge from different sub-disciplines is integrated and applied into practice. |
| 2.4 Demonstrating a basic knowledge of economics, business and social science as they apply to agriculture. |
| **TLO 3 Inquiry and problem solving** |
| Critically analyse and address dynamic complex problems in agriculture by: |
| 3.1 Identifying contemporary issues and opportunities in agriculture. |
| 3.2 Gathering, synthesising and critically evaluating information from a range of relevant sources and disciplines. |
| 3.3 Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation. |
| 3.4 Collecting, accurately recording, analysing, interpreting and reporting data. |
| **TLO 4 Communication** |
| Be effective communicators by: |
| 4.1 Understanding methods of effective two-way written and verbal communication with different audiences. |
| 4.2 Communicating with a range of audiences in an agricultural context using a variety of modes. |
| **TLO 5 Personal and professional responsibility** |
| Be accountable for their own learning and professional work by: |
| 5.1 Being independent and self-directed learners. |
| 5.2 Working effectively, responsibly and safely in an individual and team context. |
| 5.3 Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture. |
| 5.4 Practising ethical conduct. |

**Extracted from Botwright Acuña, Able, et al. (2014).*

Using the CMT, the unit coordinator self-assessed the extent to which the unit met each criterion statement, answering the questions: 'is it taught?', 'is it assessed?', 'if assessed, to what level is it taught?' and 'how is it assessed?' The coordinator indicated the level of taught and assessed, selecting from options of introductory, intermediate or meets graduate level achievement. Options of partial at graduate level (meaning part of the criterion standard was met, but not all components) and exceeds graduate level (meaning a pass graduate student

will be at a higher level of achievement than the TLO statement) are also available. The Report function of the CMT produced a 'traffic light' report or heat map that provides a visual representation for each group of Units, indicating the extent to which standards are reached.

Both degrees consist of 20 core units and four elective units, with electives chosen in either first or second year (UTAS) or third year (UA) (Plates 1 to 4). These two degrees could broadly be regarded as representative of the agriculture discipline in Australia and internationally. They include foundation units in the physical and natural sciences followed by specialisation in a range of sub-disciplines related to crop and livestock production, farming systems and agribusiness that are contextualised locally, nationally and internationally. The degree reports for both institutions were generated from the CMT using the 20 core and the most popular combination of electives that students select.

The process of curriculum mapping, which academics engaged in collaboratively, raised several questions that were addressed through peer discussion in the workshops. Partial attainment of a TLO was taken to occur when only a specific part of a TLO was met. Likewise, meeting the graduate level was taken to represent a student with a passing grade, whereas exceeding the graduate TLO occurred when the expectation of what students do is greater than this level.

Workshop participants completed pre and post-workshop questionnaires to evaluate the benefits of mapping the curriculum for the respective degrees against the AgLTAS TLOs (n=13 at UTAS and n=12 at UA). Data were collected using a mix of quantitative and qualitative methods (Creswell, 2003). The pre-workshop questionnaire collected demographic data about the participants and their knowledge about the agriculture TLOs, degree and the Australian Qualifications Framework. Participants were asked to rate their knowledge of the degree being mapped using Likert-scaled options, where 1=none, while 5=an integrated knowledge of all units and how they contribute to the curriculum outcomes for the degree. The post-workshop questionnaire established perceived changes in each participant's awareness, knowledge, connection with the teaching team and curriculum. It was also used to inform the development of the explanatory notes section in the AgLTAS statement (Botwright Acuña, Able et al., 2014). In addition, four units from each University were chosen randomly for external benchmarking. For UA, the units chosen were: the compulsory second year unit *Crop and Pasture Production*; the compulsory third year units *Agricultural and Resource Management* and *Agricultural Economics and Policy*; and the elective unit *Soil and Plant Nutrition* (which 90% of students choose). For UTAS, the units chosen were: the first year core unit *Sustainable Resource Management*, the second year compulsory unit *Crop Production*, the third year compulsory unit *Agricultural Landscape Systems*; and; the third year elective *Agronomy*. Members of the degree teaching team with limited knowledge of the units or members of the AgLTAS project blindly evaluated the unit handbook and details for all assessment items and provided feedback on whether the tasks addressed the AgLTAS TLOs or not. Assessors were not asked to what extent tasks expected students to perform (introductory, intermediate, partially meets or meets TLO). The results of this evaluation were then compared with the output for individual units as provided by unit coordinators for the CMT.

Ethics approval for data collection was gained from the UTAS Social Sciences Human Ethics Research Committee (HREC 13526) and the UA Human Research Ethics Committee (H-2013-092).

## Results

The TLOs for agriculture, which were developed through a national consultation of academics, students and industry and endorsed by the Australian Council of Deans of Agriculture, met the needs of the universities in this study. Thus, the AgLTAS Statement can act as a mechanism for change and review of undergraduate degrees in agriculture and related disciplines (such

as horticulture, viticulture and agribusiness). Results are presented for the pre and post-workshop questionnaires, the output of the curriculum mapping and external benchmarking. The majority of academics participating in the workshops had tenured position, although employment status was not specified by some respondents. The academics taught introductory through to advanced level units.

*Pre-workshop questionnaire*

Participants' knowledge of the TLOs for agriculture before the workshop varied. Around half (n=7) of the participants indicated they had some knowledge of the TLOs and their origin. Other participants reported relatively good knowledge; for example, one participant from UA responded that the TLOs were *an initiative to develop TLOs specific for agriculture…based on those for science and biology*. In contrast, the remainder of participants from both universities were generally aware of the existence of the TLOs, but not their detail.

When participants were asked to rate their knowledge of the degree being mapped before the workshop, the average response was 2.5 ± SE 0.2 at UTAS and 2.6 ± SE 0.26 at UA, where 2=good knowledge of units I have taught; slight knowledge of some units in the degree, and 3=good knowledge of units I have taught; good knowledge of units related to units I teach. These observations are consistent with academics having a unit coordinator or lecturing role, which can result in limited knowledge of other units offered in a degree.

In an open-ended question, participants were asked what their unit contributed to teaching and assessing the Learning Outcomes for the degree. Responses were quite varied. Around 50 per cent of participants (n=7) at both universities used the key TLOs of understanding, knowledge, problem solving and communication to describe how their unit contributed to teaching and assessing core learning outcomes. Around 10 per cent of respondents framed their response to the question in terms of content knowledge specific to the unit that they taught, while the remainder were unsure.

While academics were aware of the Australian Qualification Framework (AQF), their knowledge about its role was minimal. Around 50 per cent of respondents (n=7) noted that the AQF had a role in quality assurance and the provision of basic degree information.

## *Curriculum mapping*

Overall, output from the CMT demonstrated that the degrees met or in some instances units exceeded the graduate level TLOs for agriculture (Plates 1 and 3). Electives were often viewed as an opportunity for students to demonstrate and integrate learning or skills already learnt in a specific sub-discipline and even extend themselves, thus exceeding the relevant TLO. They also provided specialisation, particularly with regards to TLO 2 (Knowledge) and TLO 3.3 (particularly in applying techniques and tools). Further detail at the unit-level is provided in Plates 2 and 4.

Regardless of degree, assessments within units provided excellent coverage of TLO 2 (Knowledge), TLO 3 (Inquiry and Problem Solving), and TLO 4 (Communication) with clear progression in the extent to which assessment met graduate TLO over the years of the degrees evident. Even though assessment of TLO 1 did not occur in all units, the TLO was usually met by those units focused on the extension of skills and knowledge to agriculture (especially the electives and those units with independent research projects). In those units where students were expected to undertake undergraduate research projects with a high level of independence, TLOs 2.1 (knowledge of core science in context of agriculture), 3 (Inquiry and Problem Solving) or 5.1 (being independent and self-directed learners) were sometimes exceeded.

On the other hand, there was a paucity of assessment linked with TLO 5.3 on knowledge of regulatory frameworks. However, those units teaching sub-disciplines that rely heavily on such frameworks met this TLO (such as *Crop Protection* at UTAS and *Agricultural Economics and Policy* and *Plant Health III* at UA) with others where the extent of knowledge required was cursory either met this TLO partially or at an intermediate level (such as *Agricultural Technology and Innovation* at UTAS and *Livestock Production* at UA). At UA, in general, there was consensus that where needed, the relevant frameworks were taught but this knowledge was often not assessed.

Only seven of the 24 units curriculum mapped at UA assessed TLO 2.4 (demonstrating an appreciation of economics, business and social science as they apply to agriculture). However, this TLO was met through units that specifically focus on this aspect (such as *Agribusiness II* and *Agricultural Economics and Policy III*). Although a higher proportion of units mapped TLO 2.4 at UTAS (10 of the 19 units mapped), the assessment was partially met across 4 of those units all in the third year. A number of partially met TLOs were also observed for TLO 4.2 (communication with a range of audiences in an agricultural context using a variety of modes), especially at UA, largely because assessment items were geared to one type of audience and/or one mode within each unit. However, we determined that the range of audiences and range of modes were captured across the degrees when these were evaluated more closely. Interestingly, TLO 5.2 (working effectively, responsibly and safely in an individual and team context), which also had multiple components that could be assessed individually was never mapped as being partially met. In most cases, academics felt that assessment of these components was implicit in task design (for example, working in groups to complete an experiment that was reported upon individually). Practising ethical conduct (TLO 5.4) was often taken to refer to plagiarism and collusion, which by third year was no longer necessarily taught, but instead an expectation and not explicitly assessed.

### *Post-workshop questionnaire*

A series of questions were asked of workshop participants at the completion of the curriculum mapping activity, to ascertain any changes in their understanding of TLOs and potential impacts on their own teaching and the student experience.

Participants reported a range of responses to the question 'What do you know now that you didn't know before the workshop?' At UA, responses were generally positive, with improved understanding of the TLOs and their link with assessment. For example, one participant noted *…I understand much more about TLOs and how to evaluate my [unit] with respect to assessment items and how well they achieve TLOs.* Similarly another participant indicated that they had new knowledge about *…definition of terms that I can probably tackle in my [units]*… At UTAS, around 50 per cent (n=13) of respondents reported similar observations to that at UA. On the other hand, several academics were concerned about a perceived ambiguity of the standards and that *the TLOs are quite open to interpretation*. Two participants expressed a preference for the TLOs to be accompanied by performance indicators or criteria, while a further two participants learnt *nothing*. The latter comment may be a reflection of the participant's level of knowledge about TLOs before the workshop, but this is not clear from the data.

The second question asked of participants was 'What do you think will be the benefits of this workshop mapping process for you in your teaching?' Several comments from academics at UA noted potential benefits to their teaching through improved unit design and assessment. For example, identifying gaps in learning outcomes in their units, unit structure and the intention to *…think more critically about how and what I assess*. At UTAS, several academics commented that the workshop would assist in the process of mapping the curricula in their own units. Others noted a *better holistic understanding of learning outcomes across the degree*. On

a similar theme, another academic reported that curriculum mapping was of benefit to their teaching if it *gets staff to communicate and understand what others teach to reduce overlap*.

Similar ideas from UTAS academics were reported in response to the third question 'What do you think will be the benefits of this workshop mapping process for the teaching team?' At both UTAS and UA, several comments related to potential benefits through improved coherence and better balance of TLOs across the degree. One academic went further and linked integration of the unit with assessment practice, seeing potential benefits to the teaching team through *having more strategically structured assessment*. On the other hand, one UTAS respondent questioned the process, noting that it was *too subjective for making any objective and quantifiable benchmarking*.

A fourth question asked was 'What do you think will be the benefits of this workshop for student learning experience?' Responses were generally positive at both universities and related to identifying gaps in the curriculum leading to improved and more relevant unit and degree learning outcomes for students. Some participants at UA furthermore noted that it would assist academics to *more clearly explain the goals of our unit in terms of graduate outcomes*. In turn, this can lead to *help clarify expectations of students*, although as one participant noted, it is important to *be specific about the TLOs with students so they can appreciate it*. A small proportion of UTAS staff could not perceive any potential benefit to the student experience.

Finally, participants were asked 'What changes do you expect will be made to the curriculum as a result of this workshop?' Categories were provided, including degree and unit learning outcomes, assessment and content, or none. Overall participants considered that changes to unit-level outcomes, assessment and content were more likely compared with the degree-level.

### *External benchmarking of curriculum mapping*

In general, the results of the external evaluation aligned well with the results from the CMT reports (Plates 5 and 6). However, in five of the eight units, the unit coordinators indicated that TLO 5.4 was addressed, while the external evaluator did not believe they were. This probably reflects the observations that academics took this TLO to be implicit in their assessment (particularly with regards to plagiarism and collusion) and that this TLO was not explicitly addressed in assessment details or rubrics. In a few instances, the external evaluator believed the assessment addressed a TLO but the unit coordinator did not. At UA, the coordinators of the units sampled for this exercise discussed the inconsistencies between external evaluation and their assessment using the CMT. In most cases, the difference in evaluation was related to differences in interpretation of the TLO. For example, external evaluation of the unit *Agricultural and Resource Management III* indicated that TLO 2.1 (knowledge of core sciences in the context of agriculture) was met in some of the assessment tasks (usually through how the questions were framed) but the coordinator did not believe the TLO had been addressed because they felt that TLO merely referred to a straight understanding of biology, chemistry and physics and felt they were asking students to perform at a higher level integrating more than core sciences. In some cases, issues with details (or lack of details) provided in the rubrics were identified. Coordinators indicated informally (personal communication) that they used this information to refine their assessment tasks, unit learning outcomes and rubrics.

## Discussion and recommendations

The AgLTAS Standards Statement was developed through a national consultation of academics, students and industry and endorsed by the ACDA (Botwright Acuña, Able et al., 2014). The focus on collaborative mapping of the TLOs using the CMT can act as a mechanism for change and review of degrees. Although the AgLTAS statement provides explanatory notes about the TLOs, no exemplars were provided to assist universities in using them as part of their curriculum review processes.

In this paper we have presented two case studies of how academics at the University of Tasmania and the University of Adelaide have used the AgLTAS to map their respective agriculture curricula. This has allowed us to document evidence that these degrees meet the TLOs and, together with AQF mapping (not shown), meet requirements related to learning outcomes and assessment as described in the HESF (Australian Government, 2015). In addition we explore how peer engagement with the standards has supported their local needs in curriculum review. What follows is a discussion on the challenges and benefits of this approach to degree designers and we offer our personal reflections on what changes we have experienced as a result of the project. Finally, we discuss the potential future role of AgLTAS beyond the publication of the standards document, with respect to education, capacity building and the development of shared understandings about agricultural education among stakeholders.

## *Case studies: Examples of how to use the AgLTAS statement*

In this study, the CMT was used to provide a simple, traffic light report or heat map that indicates to what level a TLO was met through assessment activities delivered across all units in a degree. Such tools aid in the mapping of curricula (Ervin, Carter, & Robinson, 2013) and many universities have developed mapping tools to assist with the recent requirement to demonstrate degree compliance with the AQF, with various levels of complexity (Veltri, Webb, Matveev, & Zapatero, 2011; Lawson et al., 2011). The advantage of the CMT used here is its simplicity and that it can provide a quick overview without requiring too much resourcing. Furthermore, the headings and subheadings are editable, which means that the tool can be used for other purposes e.g. some Schools at UTAS amended the tool for mapping AQF compliance of their degrees. With additional resources, the CMT could be further developed with functionality to show how each unit contributed to the overall degree. This was instead undertaken in the two case studies with an Excel spreadsheet.

Consistent with published literature, curriculum mapping relied on academics to assess their own unit content (Ervin, Carter, & Robinson, 2013). Undertaking curriculum mapping against TLOs requires a good understanding of their intended meaning. This was a barrier for some participants, particularly in the UTAS workshop, and has been reported elsewhere (Ervin, Carter, & Robinson, 2013; Sumsion & Goodfellow, 2004). Furthermore, some of the TLOs conflated several ideas, which led to 'partial' meeting of some TLOs. Splitting lengthier TLOs into sub-sections can assist in the curriculum mapping process, as shown when the Bachelor of Science majors were mapped against the Science LTAS (Jones & Holmes, 2013). Here, for example, for TLO 4.2, a number of coordinators indicated 'partial' because they did not assess students for their communication abilities across a wide range of audiences using a variety of modes. In this case, determination of which modes and which audiences were addressed during assessment in each unit may be essential for assurance of this TLO.

Determining the proficiency level of students can be an issue (Ervin, Carter, & Robinson, 2013), particularly when some learning outcomes are implicit. For example, TLO 1.1 (Explaining role and relevance of agriculture in society) is usually only taught explicitly at first year, which raises the issue of how this standard is met at graduate level through assessment if it is by then regarded as implicit knowledge. Similar observations have been made in the Science discipline for TLO 1 (Understanding Science) (Yucel, 2012). At times it was thus difficult to determine if a TLO had been achieved (Sumsion & Goodfellow, 2004). Several Australian universities are collaborating in the preparation of Good Practice Guides for the agriculture TLOs that provide academics with case studies of assessment and student learning outcomes that embed each TLO in the curriculum. The Guides are intended to facilitate the implementation of academic standards by the agriculture discipline community and inform curriculum design.

External benchmarking identified examples where assessment tasks did not appear to meet a graduate TLO, yet the coordinator believed the unit did. Benchmarking of assessment standards in teaching teams and across universities is considered as essential in the assurance of achievement standards (Sadler, 2013). The perceived requirements for each proficiency level may also be affected by the unit coordinator's own background and field of research. The interpretation of generic attributes and their level of attainment by students can differ significantly between disciplines and even between fields within those disciplines (Jones, 2009). Given the multidisciplinary nature of agriculture, the perceptions of academics about what is required to meet a graduate TLO means in practice can differ considerably. A combination of external review and curriculum mapping workshops involving the entire teaching team is therefore recommended when mapping degrees to TLOs.

The workshops had the additional benefit of providing a forum for academics to engage in peer-to-peer development. An increasing emphasis on degrees rather than units requires that academics function as a teaching team, which is somewhat at odds with the traditional, individualistic concept of 'academic freedom'. The process of curriculum mapping has been noted to contribute to collaboration and collegiality (Uchiyama & Radin, 2009; Plaza et al., 2007). A sense of collegiality needs, however to be underscored by the mapping process being undertaken in a mutually supportive atmosphere (Lam & Tsui, 2013; Sumsion & Goodfellow, 2004). This is to ensure the participants' assumptions and biases are made apparent and available for discussion in the mapping process such that a mutually acceptable understanding can be reached (Hogan, 2000).

At the start of the workshop, academics on average reported that they had good knowledge of units they had taught, with only slight to good knowledge of units related to theirs in the degree. This was unsurprising. Academics lead busy professional lives, with teaching, research and administrative commitments. Our observations that some TLOs were addressed more frequently than others suggest that academics had a tendency to design tasks at the unit level with limited consideration of other units. The process of curriculum mapping was shown to provide most academics with a more holistic view of how the degree meets the AgLTAS and has the potential to drive greater innovation in assessment design. Some academics noted that they could see potential benefits in understanding where there were gaps and overlaps in assessment that could be addressed through curriculum renewal. It also benefits the degree coordinator, to assist in recognising how unit learning outcomes align with the degree, which can then inform curriculum design (Lam & Tsui, 2013). Curriculum mapping also assisted academics by reinforcing their understanding of constructive alignment (Sadler, 2005) between assessment and learning outcomes at the unit, degree and the discipline threshold standards.

### *Tension between standards and curriculum*

There is tension between standards, which are stable, and the curriculum, which is by necessity, dynamic and stable only in the short to medium term. Contributing factors are the constant need to review for quality assurance, changes in pedagogy and teaching delivery, and responsiveness to the changing needs of industry and students. We will briefly explore these tensions by expanding on the case study through reflecting on the recent curriculum review of the Bachelor of Agriculture at UTAS. The degree was last reviewed in 2010. Resources used to inform the review included curriculum mapping, as outlined in this paper, enrolment and retention data (not shown) plus local input from academics, students and industry representatives. Curriculum mapping had shown good coverage of TLOs related to understanding agriculture, inquiry and problem solving and communication. On the other hand it could be argued, as noted by one academic, that there was overlap in some of these TLOs across the degree. The TLO related to knowledge, particularly in relation to adoption and value chains, was somewhat patchy but met overall.

Feedback from academics, students and industry noted a need to strengthen student understanding of business, social aspects and adoption of new knowledge to result in outcomes that are more commercially relevant. The convergence between curriculum mapping and stakeholder feedback has provided a strong basis for making recommendations for revitalising the curriculum of this degree. The AgLTAS thus acted as an important reference point in undertaking this process through peer engagement and also informed the redevelopment of degree learning outcomes to promote improved graduate employability. The AgLTAS is also being used by UA as a reference point for the current review of its Bachelor of Agricultural Sciences.

## Conclusion

The processes described in this paper have been used to evaluate the curriculum, provide feedback on necessary improvements, and consider strategic decisions related to staffing and other resources that may be needed to deliver the improved curriculum. On a personal note, a benefit to the project team has been the development of our holistic understanding of the relationship between unit learning outcomes, assessment, degree learning outcomes and the AgLTAS standards. This will assist us to address requirements for the AQF and HESF. While this benefits us, there is a question about how to extend this knowledge to other universities, while maintaining their autonomy in curriculum design. While journal articles such as this paper can help, peer-to-peer engagement is most effective. We plan to take the network of practice that begun with this project across the 14 universities that teach agriculture and continuing it as a discipline network. These networks have been successful in other disciplines such as accounting and biology.

## Acknowledgements

This work was supported by the Australian Government Office for Learning and Teaching under grant number ID13-2982. The views expressed in this paper do not necessarily reflect the views of the Australian Government Office for Learning and Teaching.

We would like to acknowledge Phoebe Bobbi for her excellent support during the project; Prof Elizabeth Johnson for helpful feedback in her role as our External Evaluator; and the members of our Reference Group, which included Profs Susan Jones (UTAS) and Roger Leigh (University of Adelaide), Dr Andrea Crampton (Charles Sturt University), Mr Geoff Thomas (Thomas Project Services), Mr Ian McLeod (Peracto) and Ms Nysha Munro (UTAS). Thanks to other members of the AgLTAS project team (Dr Yann Guisard, A/Prof Paul Wormell and Dr Richard Doyle) that have provided discussion about implementation of the TLOs.

## References


Acuña, T., Kelder, J., Bobbi, P., & Gray, T. (2014). A*gLTAS: Curriculum Mapping Tool User Guide.* University of Tasmania. Available at: http://www.agltas.edu.au/resources/curriculum-mapping-tool/.

ALTC (2011). *Resources to assist discipline communities to define threshold learning outcomes (TLOs)*. Sydney: Australian Learning and Teaching Council.

Australian Council of Deans of Agriculture (2009). *Capacity in Agriculture - a matter of national concern*. Submission to PMSEIC.

Australian Government. (2012). *Higher education and skills training to support agriculture and agribusiness in Australia.* Canberra: Senate Standing Committees on Education Employment and Workplace Relations.

Australian Government. (2015). *Higher Education Standards Framework (Theshold Standards) 2015.* Canberra: Department of Education and Training.

Australian Governament (2013). *The Australian Qualifications Framework*. Canberra: Department of Education and Training. Available at: www.aqf.edu.au.

Botwright Acuña, T., Kelder, J. A., Able, A. J., Guisard, Y., Bellotti, W. D., McDonald, G., Doyle, R., Wormell, P., & Meinke, H. (2014). Academic, industry and student perspectives on the inclusion of 'vocational knowledge' in a 'Learning and Teaching Academic Standards Statement' for agriculture. *Journal of Learning Design* 7 (2),1–15.

Botwright Acuña, T. L., Able, A. J., Kelder, J., Bobbi, P., Guisard, Y., Bellotti, W., McDonald, G., Doyle, R., Wormell, P., & Meinke, H. (2014). *Learning and Teaching Academic Standards Statement for Agriculture*. Sydney, Australia: Office for Learning and Teaching.

Botwright Acuña, T. L., Kelder, J., Lane, P., & Hannan, G. (2012). Aligning an Agricultural Science Curriculum with the national Science threshold learning outcomes. In *Australian Conference of Science and Mathematics University Educators*. University of Sydney, September 26–28.

Brawley, S., Clark, J., Dixon, C., Ford, L., Grolman, L., Ross, S., & Upton. S. (201). Applying standards to tertiary-level history: Policy, challenges and the After Standards project. *History Australia 8*, 177–94.

Cowan, H. (2010). *Review of post-secondary agricultural education in Western Australia.* WA Government. Available at: http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/3812579a453038438c668362482577a70001dba1/$file/tp2579.pdf.

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. 2nd ed. London: Thousand Oaks.

Dowling, D., & Hadgraft. R. (2012). *What should we teach? Defining your discipline to drive curriculum renewal: An environmental engineering case study*. Paper presented at the SEFI European Society for Engineering Education, Thessaloniki, Greece 23–26 September 2012.

Ervin, L., Carter, B., & Robinson, P. (2013). Curriculum mapping: Not as straightforward as it sounds. *Journal of Vocational Education and Training*, *65* (3), 309–18.

Hogan, P. (2000). Gadamer and the philosophy of education. In *Encyclopedia of Philosophy of Education 12*(01). Australia: Philosophy of Education Society of Australasia and the *Educational Philosophy and Theory* journal.

Jones, A. (2009). Rediscipliningeneric attributes: The disciplinary context in focus. *Studies in Higher Education, 34*, 85–100.

Jones, S., & Holmes, J. (2013). *Learning and Teaching Academic Standards at University of Tasmania. A guide to Course Learning Outcomes*. Hobart: University of Tasmania.

Jones, S.,Yates, B., & Kelder, J. (2011). *Learning and Teaching Academic Standards Statement for Science.* Sydney: Australian Learning and Teaching Council.

Lam, B., & Tsui, K. (2013). Examining the alignment of subject learning outcomes and course curricula through curriculum mapping. *Australian Journal of Teacher Education, 38* (12), 97–119.

Lawson, R., Taylor, T., Failshaw, E., French, E., Hall, C., Kinash, S., & Summers, J. (2011). *Hunters & gatherers: Strategies for curriculum mapping and data collection for assurance of learning.* Paper presented at the ATN Assessment Conference October 2011, Perth, Western Australia.

Lawson, R., Taylor, T., French, T., Fallshaw, E., Hall, C., Kinash, S., & Summers, J. (2015). Hunting and gathering: New imperatives in mapping and collecting student learning data to assure quality outcomes. *Higher Education Research and Development, 34*, 581–95.

NSW Government. (2012). *Review into Agricultural Education and Training in New South Wales - Issues Paper*. Sydney: NSW Government. http://www.dec.nsw.gov.au/about-us/statistics-and-research/public-reviews-and-enquiries/agricultural-education-review.

Parliament of Victoria. (2012). *Inquiry into agricultural education and training in Victoria. Parliamentary paper No. 196 Session 2010–2012.* Parliament of Victoria Education and Training Committee,. http://www.parliament.vic.gov.au/file_uploads/ETC_Inquiry_into_Ag_Education_Final_Report_c3r44B0Q.pdf.

Plaza, C., Draugalis, J., Slack, M., Skrepnek, G., & Sauer, K. (2007). Curriculum mapping in program assessment and evaluation. *American Journal of Pharmaceutical Education, 71*(2), 20. doi: 10.5688/aj710220.

Pratley, J. (2013). *Review into Agricultural Education and Training in New South Wales*. NSW Government.

Pratley, J., & Botwright Acuña, T. L. (2015). From adversity comes strength - repositioning education in agriculture. In *Proceedings of 17th Australian Agronomy Conference*, Sept 20–24 Hobart, Tasmania: Australian Society of Agronomy.

QAA. (2008). *Frameworks for Higher Education Qualifications in England Wales and Northern Ireland.* Available at: www.qaa.ac.uk.

Sadler, D. (2005). Interpretations of criteria-based assessment and grading in higher education. *Assessment and Evaluation in Higher Education, 30*, 175–94.

Saldler, D. (2013). Assuring academic achievement standards: From moderation to calibration. *Assessment in education: Principles, policy & practice, 20*, 5–19.

Sumsion, J., & Goodfellow, J. (2004). Identifying generic skills through curriculum mapping: A critical evaluation. *Higher Education Research & Development, 23* (3), 329–46. doi: 10.1080/0729436042000235436.

Tuning. (2015). Tuning education structures in Europe. *Tuning*. Accessed 20 July: http://www.unideusto.org/tuningeu/

Uchiyama, K., & Radin, J. (2009). Curriculum mapping in higher education: A vehicle for collaboration. *Innovative Higher Education, 33* (4), 271–80. doi: Retieved from: http://dx.doi.org/10.1007/s10755-008-9078-8.

Veltri, N., Webb, H., Matveev, A., & Zapatero, E. (2011). Curriculum mapping as a tool for continuous improvement of IS curriculum. *Journal of Information Systems Education, 22* (1), 31–42.

Yorke, M. (2006). Employability in higher education: What it is – what it is not. *Learning and Employability Series 1*. The Higher Education Academy.

Yucel, R. (2012). *Good Practice Guide (Science). Threshold Learning Outcome 1. Understanding Science.* Sydney: Australian Learning and Teaching Council.

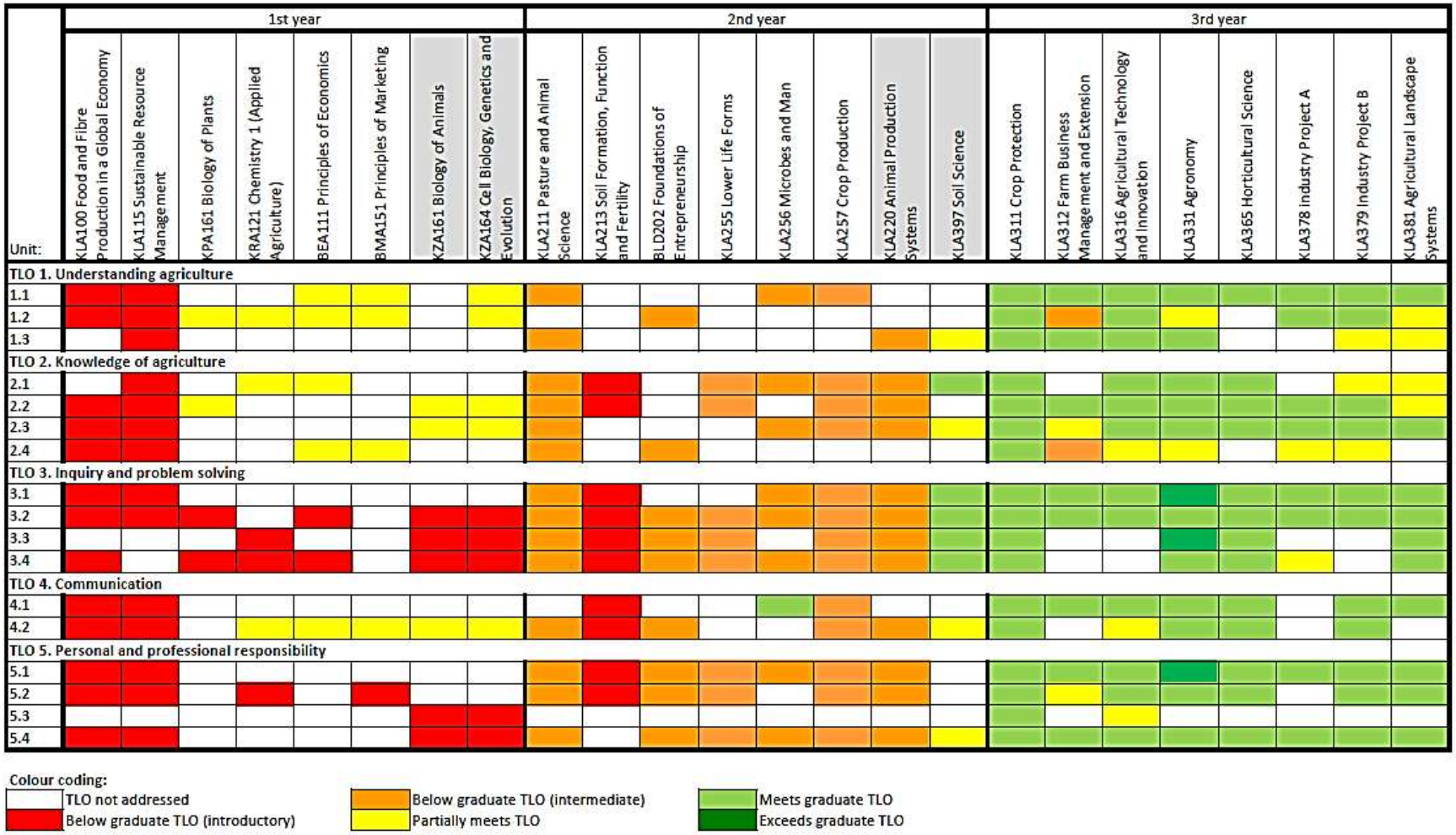
## Appendix

### *Plate 1: Degree report for the Bachelor of Agriculture at UTAS using the curriculum mapping tool.*

**Degree Report: Bachelor of Agriculture**

| Learning Outcomes | Students who complete this unit satisfactorily will: | Is Learning Outcome Taught | Is Learning Outcome Assessed | If assessed, then the student demonstrates standard |
|---|---|---|---|---|
| 1. Understanding agriculture. Demonstrate an integrative understanding of agriculture by: | Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society. | yes | yes | Meets graduate Learning Outcome: yes |
| | Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change. | yes | yes | Meets graduate Learning Outcome: yes |
| | Understanding how information is adopted and the context within which producers, processors and consumers, make decisions. | yes | yes | Meets graduate Learning Outcome: yes |
| 2. Knowledge of agriculture. Exhibit depth and breadth of knowledge of agriculture by: | Demonstrating knowledge of the core sciences in the context of agriculture. | yes | yes | Meets graduate Learning Outcome: yes |
| | Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area. | yes | yes | Meets graduate Learning Outcome: yes |
| | Understanding how knowledge is integrated and applied from different disciplines to agriculture. | yes | yes | Meets graduate Learning Outcome: yes |
| | Demonstrating an appreciation of economics, business and social science as they apply to agriculture. | yes | yes | Meets graduate Learning Outcome: yes |
| 3. Inquiry and problem solving. Critically analyse and address dynamic complex problems in agriculture by: | Identifying contemporary issues and opportunities in agriculture. | yes | yes | Exceeds graduate Learning Outcome: yes |
| | Gathering, synthesising and critically evaluating information from a range of relevant sources and disciplines. | yes | yes | Meets graduate Learning Outcome: yes |
| | Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation. | yes | yes | Exceeds graduate Learning Outcome: yes |
| | Collecting, accurately recording, analysing, interpreting and reporting data. | yes | yes | Meets graduate Learning Outcome: yes |
| 4. Communication. Be effective communicators by: | Understanding methods of effective two-way written and verbal communication with different audiences. | yes | yes | Meets graduate Learning Outcome: yes |
| | Communicating with a range of audiences in an agricultural context using a variety of modes. | yes | yes | Meets graduate Learning Outcome: yes |
| 5. Personal and professional responsibility. Be accountable for their own learning and professional work by: | Being independent and self-directed learners. | yes | yes | Exceeds graduate Learning Outcome: yes |
| | Working effectively, responsibly and safely in an individual and team context. | yes | yes | Meets graduate Learning Outcome: yes |
| | Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture. | yes | yes | Meets graduate Learning Outcome: yes |
| | Personally practising ethical conduct. | yes | yes | Meets graduate Learning Outcome: yes |

***Plate 2: Curriculum mapping of unit-level assessment against the AgLTAS TLOs for the Bachelor of Agriculture at UTAS.*** Numbers correspond to the TLOs shown in Table 1. Those units highlighted as grey are electives with these being the most common pathway for students (students choose 4). Units that are not highlighted



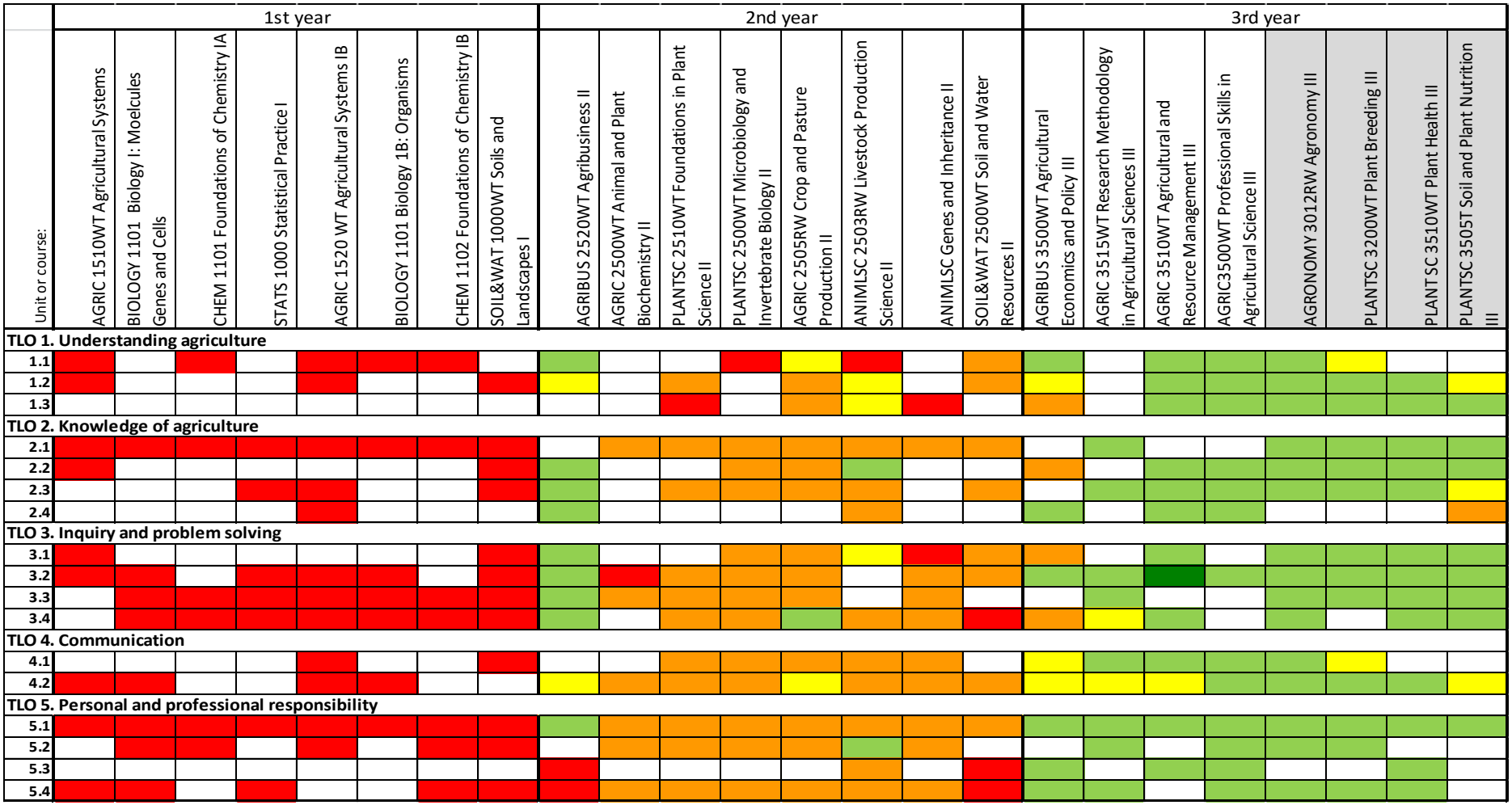

are compulsory/core.

***Plate 3: Degree report for the Bachelor of Agricultural Sciences at UA using the curriculum mapping tool.***

**Degree Report: Bachelor of Agricultural Sciences**

| Threshold Learning Outcomes | Students who complete this unit satisfactorily will: | Is Threshold Learning Outcome Taught | Is Threshold Learning Outcome Assessed | If assessed, then the student demonstrates standard: |
|---|---|---|---|---|
| 1. Demonstrate an integrative understanding of agriculture by: | Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Understanding how information is adopted and the context within which producers, processors and consumers, make decisions. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| 2. Exhibit depth and breadth of knowledge of agriculture by: | Demonstrating knowledge of the core sciences in the context of agriculture. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Understanding how knowledge is integrated and applied from different disciplines to agriculture. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Demonstrating an appreciation of economics, business and social science as they apply to agriculture. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| 3. Critically analyse and address dynamic complex problems in agriculture by: | Identifying contemporary issues and opportunities in agriculture. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Gathering, synthesising and critically evaluating information from a range of relevant sources and disciplines. | yes | yes | Exceeds graduate Threshold Learning Outcome: yes |
| | Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Collecting, accurately recording, analysing, interpreting and reporting data. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| 4. Be effective communicators by: | Understanding methods of effective two-way written and verbal communication with different audiences. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Communicating with a range of audiences in an agricultural context using a variety of modes. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| 5. Be accountable for their own learning and professional work by: | Being independent and self-directed learners. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Working effectively, responsibly and safely in an individual and team context. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture. | yes | yes | Meets graduate Threshold Learning Outcome: yes |
| | Personally practising ethical conduct. | yes | yes | Meets graduate Threshold Learning Outcome: yes |

***Plate 4. Curriculum mapping of unit-level assessment against the AgLTAS TLOs for the Bachelor of Agricultural Sciences at UA.***
Numbers correspond to the TLOs shown in Table 1. Colour codes are the same as in Plate 2. Those units highlighted as grey are electives with these being the most common pathway




for students (students choose 4 of 12). Units that are not highlighted are compulsory/core.

***Plate 5. External benchmarking of four units from the Bachelor of Agriculture at UTAS*.** Assessment tasks (and associated details) were evaluated externally for their alignment with the AgLTOs (indicated as dark grey if addressed). The results from the CMT are also shown for comparison where dark grey indicates unit was assessed at below graduate TLO (introductory, intermediate); meets graduate TLO; or; exceeds graduate TLO while light grey indicates unit was assessed as partially meets graduate TLO. * = assessment task is summative (contributing to the final grade).

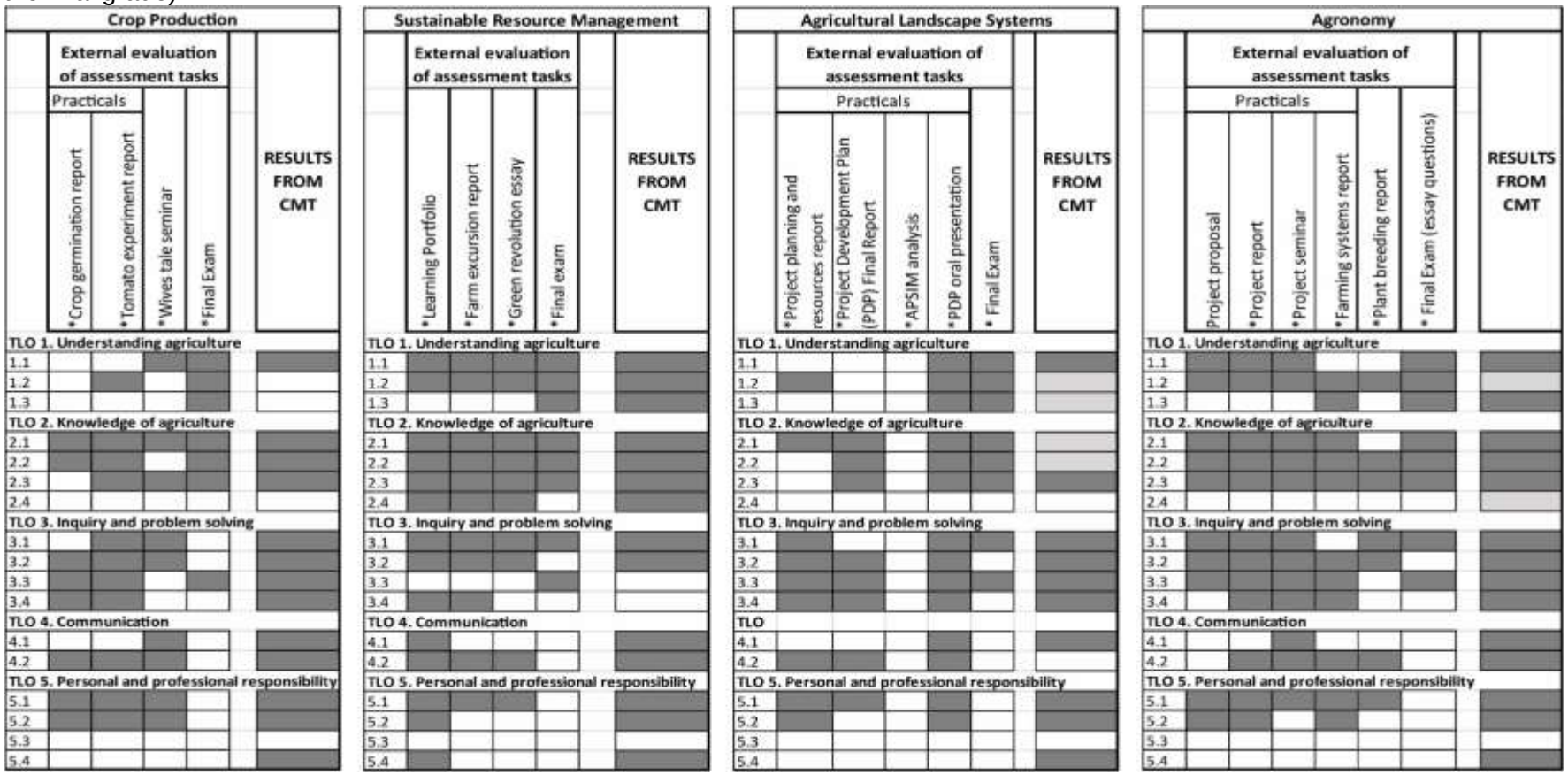


***Plate 6. External benchmarking of four units from the Bachelor of Agricultural Sciences at UA*.** Assessment tasks (and associated details) were evaluated externally for their alignment with the AgLTOs (indicated as dark grey if addressed). The results from the CMT are also shown for comparison where dark grey indicates unit was assessed at below graduate TLO (introductory, intermediate); meets graduate TLO; or; exceeds graduate TLO while light grey indicates unit was assessed as partially meets graduate TLO. * = assessment task is summative (contributing to the final grade).