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Knowledge integration and model evaluation for cross-sectoral agricultural climate change modelling

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Abstract: Primary industries in NSW face one of the most variable climates in the world, and many of the commodities that they produce require narrow ranges of climatic conditions for optimal growth and development. The availability of research into these physiological requirements varies greatly across the sector, and the Climate Vulnerability Assessment (CVA) sought to address knowledge gaps in the research literature. This talk will describe the modelling methodology and knowledge integration approach and discuss how expert knowledge and experience were used to fill gaps in the research literature for a large-scale investigation into the effects of climate change on primary industries in NSW.

The CVA was designed to help policymakers, planners and industry bodies understand possible implications (risks and opportunities) of climate change on economically significant commodities by the middle of the century. It was also intended to address disparities in research efforts across the sector as identified by Darbyshire et al. (2022). Target audiences for the project's outcomes and reporting include industry bodies and planners and policymakers at all levels of government. The primary industries included ranged from broadacre cropping to horticulture and fisheries, and related biosecurity risks. Details and published reports are available on the project's web pages (https://www.dpi.nsw.gov.au/dpi/climate/climate-vulnerability-assessment).

To undertake this work, a modelling framework was adopted which facilitated model development and evaluation and allowed for the creation of comparable outputs across the sector. To address the dearth of research literature for certain commodities, the inclusion of expert knowledge was also required. Multi-criteria analysis (MCA), a tool commonly used in the decision-making arena to combine multiple factors together under a common overall objective, was chosen for its ability to incorporate a variety of sources of information in a transparent and easily understood manner (Caubel *et al*., 2015; Romeijn *et al*., 2016). The MCA model components represent an organism's lifecycle or production stages, making them readily interpretable by a variety of audiences, with observational and future projection climate data used as input. The model calculated the 'climate suitability' for the production of each commodity, or for the survival of each biosecurity risk.

The development and validation of the models included expert involvement at a number of steps. To elicit expert knowledge, a focus group was convened for each model, consisting of 4-6 experts drawn from a broad network of collaborators across government, academia, industry bodies and primary production. Published literature was used to inform a draft model, which was then updated and completed by the focus group. These changes incorporated the focus group participants' knowledge about optimal and sub-optimal climate conditions for the commodities, based on their experience and expertise.

The incorporation of expert input throughout the modelling process strengthened its empirical foundation, ensured it reflected real-world conditions and ensured that the models would produce actionable insights with long-term relevance for climate impact assessments.

REFERENCES

Caubel J, de Cortázar-Atauri I, Launay M, de Noblet-Ducoudré N, Huard F, Bertuzzi P and Graux A (2015) Broadening the scope for ecoclimatic indicators to assess crop climate suitability according to ecophysiological, technical and quality criteria. Agricultural and Forest Meteorology 207, 94–106

Darbyshire RO, Johnson SB, Anwar MR, Ataollahi F, Burch D, Champion C, Coleman MA, Lawson J, McDonald SE, Miller M, Mo J, Timms M, Sun D, Wang B and Pardoe J (2022) Climate change and Australia's primary industries: factors hampering an effective and coordinated response. International Journal of Biometeorology 66, 1045–1056

Romeijn H, Faggian R, Diogo V and Sposito V (2016) Evaluation of Deterministic and Complex Analytical Hierarchy Process Methods for Agricultural Land Suitability Analysis in a Changing Climate. International Journal of Geo-Information, 5, 99

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