



## 2019 PhD Proposal – China Scholarships Council and New Zealand – China Water Research Centre Joint PhD Programme Application

Information to be published on NZ – China Water Centre website if proposal is selected	
<b>Project title</b>	Hydrological behavior of irrigated loess landscapes
<b>Supervisors titles and names</b>	Associate Professor Peter Almond, Dr Seth Laurenson, Dr Steve Thomas, Dr Sam Carrick
<b>Department</b>	Soil and Physical Sciences, Lincoln University in collaboration with Agresearch, Plant and Food Research, Landcare- Manaaki Whenua Research.
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<b>Link to Supervisor's research page</b>	<a href="http://www.lincoln.ac.nz/Lincoln-Home/About-Lincoln/Staff-Profiles/?StaffID=Almond+Peter">http://www.lincoln.ac.nz/Lincoln-Home/About-Lincoln/Staff-Profiles/?StaffID=Almond+Peter</a> <a href="http://www.cibr.org.nz/the-cibr-team/soil-science/">http://www.cibr.org.nz/the-cibr-team/soil-science/</a>
<b>Project outline</b> Please outline the PhD project in 300 words (approx)	Loess-derived soils are wide spread globally and are inherently fertile (Catt, 2001) making them some of the most important soils on the planet for sustaining food supply. The Chinese Loess Plateau and the eastern sides of both islands of New Zealand include areas of intensive agriculture based on loess soils. Agriculture in both areas occurs within subhumid to semi-arid climates and water availability limits agricultural production (Kang et al., 2002; Poulsen, 2013). In New Zealand loess landscapes are often rolling in nature and only recently has spray irrigation technology advanced to allow them to be irrigated practically. Recent studies suggest problems of slow infiltration and overland flow lead to some inefficiencies of water use with the potential for contaminant transport into receiving waters (Laurenson et al., 2018). In Canterbury on the eastern side of South Island where there is expansion of irrigation onto rolling loess downlands the local territorial authority (Environment Canterbury) has commissioned a multi-agency (NIWA National Institute of Water and Atmospheric Science), Agresearch, Plant and Food, Manaaki Whenua – Landcare Research) study of the hydrology of these landscapes with focus on groundwater recharge. The study is sited in a small zero-order drainage basin where loess (multiple loess sheets) overlies alluvial gravel. Soils formed in the loess (and paleosols in buried loess sheets) are Pallic soils, characterised by dense subsurface pans (fragipans).

	<p>The aim of the PhD is to characterise and quantify the flowpaths of rain and irrigation water in the drainage basin.</p> <p>The hypotheses are:</p> <ul style="list-style-type: none"> <li>• Overland flow is modulated by lateral throughflow above fragipans in the surface soil and in paleosols in buried loess sheets</li> <li>• Groundwater recharge is facilitated by transmission of water to the axis of the drainage basin where water percolates through a valley fill into underlying alluvial gravels.</li> </ul> <p>The PhD candidate would be operating within a multidisciplinary research project, and would have high levels of support for hydrological modelling, soil characterisation, meteorological measurement, and soil-geomorphology expertise from participating research organisations. Skills and knowledge would have good transferability to Chinese loess landscapes.</p>
<b>References for further reading</b> (optional)	<p>Catt, J.A., 2001. The agricultural importance of loess. <i>Earth-Science Reviews</i>, 54(1): (<a href="https://doi.org/10.1016/S0012-8252(01)00049-6">https://doi.org/10.1016/S0012-8252(01)00049-6</a>) 213-229.</p> <p>Kang, S., Zhang, L., Liang, Y., Hu, X., Cai, H. and Gu, B., 2002. Effects of limited irrigation on yield and water use efficiency of winter wheat in the Loess Plateau of China. <i>Agricultural water management</i>, 55(3): 203-216.</p> <p>Laurenson, S., Cichota, R., Reese, P. and Breneger, S., 2018. Irrigation runoff from a rolling landscape with slowly permeable subsoils in New Zealand. <i>Irrigation Science</i>, 36(2): (10.1007/s00271-018-0570-3) 121-131.</p> <p>Poulsen, D., 2013. <a href="http://www.lincoln.ac.nz/Lincoln-Home/About-Lincoln/Staff-Profiles/?StaffID=Almond+Peter">http://www.lincoln.ac.nz/Lincoln-Home/About-Lincoln/Staff-Profiles/?StaffID=Almond+Peter</a> Technical Report R13/60</p>
<b>Please indicate if research operational funding is available to support the project, and if so, the sources of funding.</b>	<p>The research operational funding is available from Manaaki Whenua Landcare Research, Environment Canterbury and Lincoln University.</p>