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Earth Surface Dynamics Discussions

Interactive comment on "Mātauranga Māori in geomorphology: existing frameworks, case studies and recommendations for Earth scientists" *by* Clare Wilkinson et al.

Anonymous Referee #2

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General Comments

This paper is a very useful review and analysis of bicultural research, with recommendations on how to better incorporate Indigenous knowledge (Matauranga Maori) in the science of geomorphology or in describing geomorphic processes. The paper should be accepted for publication, but with careful consideration of the following issues or suggestions for a moderate revision.

The title of the paper refers to "Matauranga Maori in geomorphology" or in other words the Knowledge held by Maori in the science of geomorphology or geomorphic processes. The second part of the title is confusing, and could be reworded to "Matau-

ranga Maori in Geomorphology: existing frameworks, case studies and recommendations for incorporating Indigenous Knowledge in earth science". The other interpretation of the first part of the title, which first drew me in, was the thought that the paper would review actual Matauranga Maori knowledge of geomorphic processes and phenomenon as local people. This knowledge is likely significant, as current occupiers and managers of landscapes, beyond just oral stories of past events or creation stories. The introduction of the paper could better differentiate these two versions of Matauranga Maori in geomorphology, and emphasise that the goal of the paper is to review the frameworks for knowledge incorporation in western science, rather than review the Indigenous geomorphic knowledge itself (but the brief review up front is helpful and insightful).

This in an important article needed to better inform geomorphologists of how to incorporate Indigenous knowledge in their research, or conversely, how to incorporate the science of geomorphology in education and the practical management of land by Indigenous people like the Maori . The latter could also be emphasised to an equal degree for balanced bicultural research, with suggestions on bidirectional education in contemporary Indigenous cultures that adapt to change.

All too often geomorphologists (and other scientists) ignore engagement with Indigenous communities and their traditional ownership of historic estates. They disrespect Indigenous rights to know of, control or guide, and/or participate in research on their traditional land, irrespective of current ownership or tenure or laws requiring it. This is a science version of continued colonisation and suppression. It should be emphasised to the reader that no matter if or how scientists involve Indigenous Knowledge in their proper research, they have an obligation at a minimum to engage with Indigenous people and custodians while conducting research on their traditional land, and most specifically ask permission to conduct the research on traditional land according to local protocols.

At a minimum this will help prevent geomorphologists from damaging cultural sites

during research, disrupting cultural norms or taboos, and widening the divide between scientific elites and local people. Asking research permission on traditional land is the first prerequisite, with adding Indigenous community members (or guides) to the team secondary, and gaining the use of Indigenous knowledge then tertiary.

The issue of Intellectual Property of Indigenous Knowledge also needs to be reviewed more in the paper. Often Indigenous knowledge is owned by the collective of multiple-generations (community), past, present and future. Having one or several Indigenous community members or leaders on a research group or board (paid or unpaid) does not automatically give permission to use or include collective Indigenous knowledge for scientific purposes, even if held in the mind and agreed to be shared by one person. Agreement from the collective is often needed, through a Memorandum of Understanding or Intellectual Property agreement with a Council of Elders, Tribal Council, or Indigenous Corporation, or others. This can become a sticky issue, and partially why some scientists often ignore the development of IP agreements. Regardless, this should become an official part of business by researchers around the world as required by funding agreements (Human Ethics even if not studying humans!), and national, regional, local and Indigenous governments. It would be great if the authors could convey some of these issues to readers, many of which are naïve to the issues.

Specific Comments

Overall, the paper is fairly long, with many sub-headings, and is easy to get lost within. It is written more like a PhD thesis chapter and review, and not a concise paper for journal publication and easy education. Please condense and remove any extraneous word, sentences, sections, or references, where possible? Avoid repeating references or ideas unless critical. Every word counts or distracts the reader. So sentence intros like “As discussed earlier” or “As previously mentioned” do not help, as one of many examples. As another of many examples Line 390 should be reduced “He Poutama Whakamana follows a kaupapa Maori research approach,. Kaupapa Maori , described in depth by Smith (2012), can be understood as research that is “culturally safe” and

that takes place within a Maori worldview (Irwin, 1994 as cited in Smith, 2012). Keep the sentences simple and straight forward and non-redundant.

Making it easy to read for a wide range of international geomorphologist will be key to having the information use and cited. The Table of Maori terms and names is very useful. However for the non-New Zealand reader, it is very hard to read the text and Maori terms and constantly go back to the table. It would be helpful to conduct two things: 1) make all Maori terms italics or otherwise to highlight to the reader the difference between English and written Maori (similar to what has been done with PNG language in the paper), and 2) at the end of key Maori words to have the short definition in brackets, like Iwi (tribe). This could be done at the location of first usage (which has been done in some places). Repeating it again at several key locations in the paper would also be helpful where important terms are used again. The authors do this for Matauranga Maori (Maori Indigenous knowledge), but not others like tangata whenua. The authors in places due this with commas, but the sentences get too complex. . .. Line 237, For mana whenua, spiritual values of the Te Manahuna, the Mackenzie basin, are held as a priority to be conserved, which may be challenging to communicate to their partners. It would be easier to read as follows. For Mana whenua (people with with authority), spiritual values of the Te Manahuna (the Mackenzie basin) are held as a priority to be conserved, which may be challenging to communicate to their partners. Maori terms could also be capitalised, Iwi (tribe) to make stand out, if appropriate for written Maori ? Regardless, please make changes as if you were reading the paper as a German geomorphologist with basic English reading skills who wants to engage with African Indigenous Knowledge in her research.

Overall I had to read the paper twice to understand where it was all going and the big picture. The section titles and outline are key to improve upon. The sections headings are as follows with suggested additions and changes in italics to the titles below. Some headings could be deleted or combined.

1 Introduction

2 Overview of International research at the interface of Indigenous knowledge and science

3 Mixed-method geoscience research in contemporary Aotearoa-NZ

3.1 Te Ao Maori (the Maori worldview)

3.1.1 Whakapapa and tikanga (Validity through ancestry)

3.1.2 Matauranga Maori (Indigenous Knowledge)

3.1.3 Kaitiakitanga (Well-being of people and environment)

3.2 Obligations of the Aotearoa New Zealand government to Maori

3.2.1 The Treaty of Waitangi (Maori and Crown as legal partners)

3.2.2 The Treaty in practice

3.2.2.1 Te Manahuna Aoraki Project (Government Consolation)

3.2.2.2 Te Awa Tupua (Rivers at Legal People)

3.3 Woven spacesâĂŤthe interface of Matauranga Maori and science

3.3.1 The relationship between Matauranga and science

3.3.1.1 Indigenous knowledge versus values

3.3.2 Mutual research needs and benefits (Indigenous Management Plans)

3.3.3 Potential challenges and risks of conducting research at the cultural interface

4. Frameworks and models for incorporating Matauranga Maori alongside in geomorphic research

4.1 Theoretical Frameworks (Matauranga Maori in geomorphic research)

4.1.1 He Poutama Whakamana (Mirror-images of knowledge and understanding)

4.1.2 IBRLA (initiation, benefits, representation, legitimation, accountability)

4.1.3 He Awa Whiria (A Braided Rivers Approach)

4.2 Models (Step-By-Step Guide of Including Maori values in geomorphic research)

4.2.1 Mauri model (Sustainability and Cultural Bonds to the Environment)

4.2.1.1 Transferability to geomorphology (Mauri model)

4.2.2 Cultural Flow Preference Study (Cultural Practices and River Flow)

4.2.2.1 Transferability to geomorphology (Cultural Flow)

4.2.3 Sustainability Assessment Method (Values Associated with Waterway Health)

4.2.3.1 Transferability to geomorphology (Sustainability Assessment)

5. Critical assessment of existing frameworks and models in different conditions

5.1 Knowledge versus values (Revisited)

5.2 Framework and Model recommendations for Geomorphology subdisciplines

5.3 Guiding resources for initiating projects in Aotearoa-NZ

6. Lessons for the international geomorphology community

6.1 Direct benefits to geomorphology

6.2 International application of Aotearoa-NZ bicultural research frameworks

6.3 The benefit of Indigenous Knowledge and Geomorphology Science in Society

7. Conclusions and recommendations to geomorphologists

Please better define the difference between a Framework and Model earlier on in the paper. Overall these uses are very confusing to a new reader. The authors cover the difference better in section 5.2, but this needs to happen earlier in the paper (intro-

duction) in a more concise and clear fashion. The authors mention 3 frameworks and models each, but there are lots of similarities and differences. In Table 2, a Framework is defined as a methodology, and Model is defined as a method. Theoretical vs actionable is key, but the Theoretical frameworks are actionable depending on the user and interpretation. Methodology as a general research strategy, and method as a tool to answer a question. In some place this use is even mixed up, such as Line 354 “The models proposed by Smith (1992, 2012) can be thought of as methodologies, or guiding principles. . ...”. In this case and usage the sentence should read “The framework proposed by Smith (1992, 2012) can be thought of as methodologies, or guiding principles. . ...”.Please educate the reader why they are labelled or grouped as is, both in the abstract, introduction, and also the main sections such as section 4 in paragraph Line 355 and 370, and in section 4.2. Section 5.2 does a better job at describing these differences.

In some locations the authors intermix geologic, geomorphic(ology) and earth science. Even in the title. And at times river science and health and ecology. The paper and journal focus is on geomorphology, perhaps leave it as that and omit the others. Geomorphology is pretty broad and inclusive. Just refer to the broader earth science when talking about wider applications, and the more specific sciences like river health and environmental flow where appropriate for the example reference.

Line 80. This sentence needs to be broken into two. We then introduce Te Ao Maori (the Maori world), discuss obligations of the New Zealand government to Maori , and present frameworks for conducting mixed-methods scientific research with iwi and hapu (tribes and family groupingsâĂŤthe principle political units with whom scientists engage) in Aotearoa-NZ in this space.

Line 84. This sentence is vague. We then provide case studies of framework development and recommendations for framework implementation in geomorphology research.

Line 287 paragraph is connected to the discussion in Line 300 paragraph in the next section. Repetitive and confusing to repeat. Please clarify and simplify or consolidate.

Figure 3. Make sure that this image is high enough resolution in print to be readable in a condensed format in a journal paper. Even in this full page format it is hard to read, and the journal may not print it as a full page.

Line 431 Knowledge of

Sections 5.1 Knowledge versus values (Revisited) and 5.2 Framework and Model recommendations for Geomorphology subdisciplines should be renamed, as the first really covers model application to capture values, while the second focuses on frameworks. Same with the Section 5 title, which focuses on both frameworks and models. It just gets confusing about what each paragraph or sub-section is referring to.

6.1 Direct benefits to geomorphology. Rather than just focusing on knowledge of physical events to benefit geomorphologist, the more common international benefit of working with Indigenous people is learning from their current intricate knowledge of the environment and physical and cultural and biological landscapes. If one wants to learn about all the springs in a catchment, who better to ask than local Indigenous people? Or locations of rock outcrops with valuable resources or tools? Or unique species isolated above geologic barriers? The paper missed out on a wealth of knowledge beyond past events.

Line 685 The key recommendation should be to encourage geomorphologists interested in working with Indigenous communities to consult directly with Indigenous communities and their self-governance institutions. There is a surprising level of diversity in governance capacity of Indigenous communities around the globe. Direct consultation is best, with support of other programs and experts of course where needed.

Overall, thank you for putting forward many ideas and recommendations to help scientists become better at engaging with Indigenous People.

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