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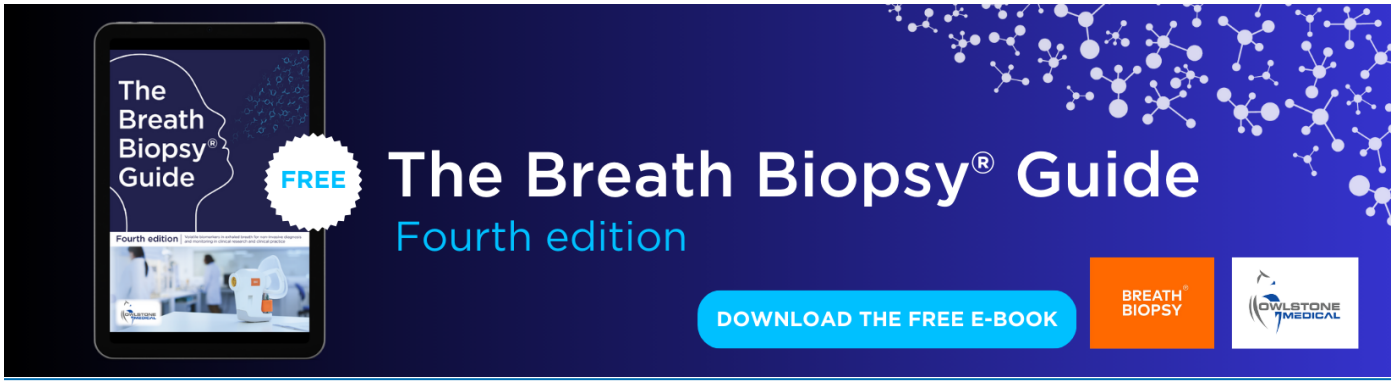

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Transformational capacity and the influence of place and identity

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Abstract
Climate change is altering the productivity of natural resources with far-reaching implications for those who depend on them. Resource-dependent industries and communities need the capacity to adapt to a range of climate risks if they are to remain viable. In some instances, the scale and nature of the likely impacts means that transformations of function or structure will be required. Transformations represent a switch to a distinct new system where a different suite of factors become important in the design and implementation of response strategies. There is a critical gap in knowledge on understanding transformational capacity and its influences. On the basis of current knowledge on adaptive capacity we propose four foundations for measuring transformational capacity: (1) how risks and uncertainty are managed, (2) the extent of skills in planning, learning and reorganizing, (3) the level of financial and psychological flexibility to undertake change and (4) the willingness to undertake change. We test the influence of place attachment and occupational identity on transformational capacity using the Australian peanut industry, which is presently assessing significant structural change in response to predicted climatic changes. Survey data from 88% of peanut farmers in Queensland show a strong negative correlation between transformational capacity and both place attachment and occupational attachment, suggesting that whilst these factors may be important positive influences on the capacity to adapt to incremental change, they act as barriers to transformational change.

Keywords: adaptive capacity, barriers to change, agriculture, natural resource management, social resilience, socio-ecological systems, resource dependence, climate change

1. Introduction

Past emissions of greenhouse gases have already committed the planet to climate change [1]. Current estimates suggest a significant increase in global temperature in the coming decades with even the most drastic mitigation efforts unlikely to prevent substantial climatic changes later this century. Changes in key climatic variables such as temperature and rainfall will act to push natural resource systems towards their thresholds of change, in some cases threatening the future of those industries and communities dependent on them [2, 3]. Preparing and restructuring sensitive resource-dependent industries for the changing climate is becoming urgent, especially given how long such social processes can take.

Globally, economic sectors such as agriculture, forestry and fisheries are already investing heavily in research on whether to take pre-emptive action to reduce the impacts of climate change or to respond reactively after impacts are realized [4–6].

The specific challenge for primary resource industries and the enterprises that comprise them is to build productivity and profitability without depleting the resources on which they depend. Increasingly, however, current observations of climate shifts suggest that implementing incremental changes may be insufficient; primary industries and enterprises may need to undergo transformations that include changes in function or structure if they are to remain viable [7–9]. Farmers, fishers, foresters, graziers and the industries that define them may need to consider innovative strategies for generating income or translocating to where conditions are more amenable to making a living [10, 11]. There is also a significant likelihood of demand for planned resettlement of communities. We focus on these situations: when the social, economic or ecological conditions under which resource systems in particular are expected to adapt become untenable and transformations need to be planned [12, 13].

Transformation is a process that involves crossing ecological or social thresholds [7]. It fundamentally changes some of the biophysical or socio-economic components of a system from one form, function, nature or location to another (but not necessarily irreversibly) [13]. Being able to identify and distinguish a transformational change is dependent on being explicit about scale. For example, in larger socio-economic or ecological systems, transformation is signified by change in core functions [14] and can involve institutional change and collective action, both coordinated and un-coordinated, by constituent members [15]. At an industry scale, radical changes in function and structure may come about due to a myriad of small changes made by individuals, resulting in an overall transformation. At the individual scale, transformation can be signified by a major change in livelihood, location or identity, influenced also by the process by which transformation takes place. Autonomy and choice, as well as coercion by circumstance or government action, for example, are central to how individuals perceive and undergo transformation [16, 17].

Like any response or adaptive action, transformations can lead to 'desirable' or 'undesirable' outcomes where 'desirable' transformations provide substantial and widely distributed benefits [18]. Agricultural transformations have often incorporated new technologies into their planning and practice, leading to higher productivity [19]. Other attempts at major transformations have been less successful or have even turned out to be maladaptive [20]; examples include the de-linking of community from government, or food crises during periods of political stagnation [21]. Whether resource systems will adapt, transform or collapse as the effects of climate change progress depends in part on balance between 'desirable' to 'undesirable' states and the trajectory of the system [22, 23].

Despite an increasing awareness of the importance of transformation as a response to climate change, knowledge of whether whole industry sectors, particularly those that are sensitive to climate risks, have the capacity to transform remains limited [9]. A key challenge for industries that choose to collectively transform in response to changing agro-climatic conditions, will be to ensure that sufficient capacity exists across scales and that transformations result in a 'desirable' outcome that benefits both society and ecosystems [24–26]. Recognizing the multi-scalar nature of decision-making, we focus on the individual actors critical to the process of climate adaptation [27] both to complement other research on governmental and organizational elements of change [28, 29] and because individual adaptation has spill-over effects to collective action and response [30]. The capacity of farmers, fishers, foresters and graziers to undergo transformation individually as a climate change response may be vital to the success of their respective industries: in most situations a critical mass of individuals will need to transform for industry-wide transformation to occur [31–33]. Yet, not all individuals will have the same capacity to transform; some individuals are likely to face considerable barriers that make embarking on their own too challenging, consequently reducing the capacity for industry-wide transformation.

How transformational capacity compares with adaptive capacity is potentially important for planning responses to predicted climate change impacts; particularly pertinent is whether strategies aimed at supporting incremental change will be sufficient for supporting transformational adaptation. Moser and Ekstrom [34], suggest that the distinction between adaptive and transformational capacity is mostly one across temporal, spatial and social scales, where transformational change occurs at the long-term end of the adaptation spectrum whilst coping measures occur in the short term [34]. In their analysis, they found that transformations typically require greater time and effort than shorter-term coping or adaptation measures [34]. Correspondingly, we propose foundations for measuring transformational capacity at the individual scale that are based on extending established measures of adaptive capacity.

Considerable research has provided techniques to assess adaptive capacity across scales [35]. Essentially, adaptive capacity is the potential to mobilize existing resources necessary for adapting to change [5, 32, 36]. Characteristics that have been found to contribute to adaptive capacity include: possessing creativity and innovation (for identifying solutions or adaptation options) [37]; testing and experimenting with options [38]; recognizing and responding to effective feedback mechanisms [6]; employing adaptive management approaches [7]; possessing flexibility [38]; being able to reorganize given novel information [39]; managing risk [16] and, having necessary resources at hand [13, 40]. At the individual scale, adaptive capacity has been more comprehensively assessed according to four measurable attributes reflecting an individual's skills, circumstances, perceptions and willingness to change [41–43]. Marshall *et al*'s dimensions for adaptive capacity were based on responses to generic change where responses were clustered into four relatively independent components using a principal components analysis. They included: (1) how risks and

uncertainty are managed, (2) the extent of skills in planning, learning and reorganizing, (3) the level of financial and psychological flexibility to undertake change; and (4) the anticipation of the need and willingness to contemplate and undertake change. We suggest that the capacity to undertake transformational change reflects similar dimensions but addressing changes that are longer term, that affect more fundamental system characteristics and in response to larger-scale change. That is, we hypothesise that the nature and magnitude of the change event are likely to become important for determining the capacity to change. These four dimensions can then be used as the basis from which we begin to examine the capacity to undertake change of a transformational nature.

The capacity to implement transformative adaptation is likely to be influenced by a range of factors. For example, other studies have shown that the extent to which individuals are socially and economically dependent on a natural resource is an important influence [44, 45]. An aim of this paper is to explore factors that might influence transformational capacity and be important in supporting or inhibiting transformational change within a primary resource industry in Australia. One critical factor likely to influence transformational capacity is the attachment that resource users have with their place [31, 44, 46]. 'Attachment to place' is a concept that describes the level of connection that people have with their physical community or 'place', including the strong friendships and networks that exist within it [47]. In general, it represents continuity and order, rootedness, self-identity, attachment, comfort, security and refuge [48]. Attachment to place may enhance the capacity of resource users to adapt to a change in the region where their attachment acts to motivate individuals to identify novel solutions and create a sustainable future [49]. However, in cases where the change event may require people to relocate, the level of attachment to place may negatively influence the capacity of resource users to undergo transformations of place and adapt [50].

The level of attachment that individuals have to their occupation might also act to influence transformational capacity [44]. 'Attachment to occupation' (or 'occupational identity') is a related concept that describes the identity that is created as a result of working in a particular occupation. Resource users such as farmers, fishers and graziers can become very attached to their occupation [51]. The more firmly attached a person becomes to their occupation, the more traumatic and disorienting a change in their occupation becomes [47]. Like place attachment, the attachment that individuals have to their occupation is thus likely to be an important influence on transformational processes, especially when the nature of the change event is likely to impact on people's livelihoods or the identity that they have created around their occupation. These two concepts are significantly under-represented in climate-change decision-making [33, 48], yet they are potentially important influences that need to be considered before successful transformation strategies can be planned. People with high levels of place or occupational attachments may be less likely to be willing to contemplate or undertake change that involves moving or changing occupation.

2. Measuring transformational capacity in the Australian peanut industry

We examined the influence of place and occupational attachments on the capacity of individuals to transform using the example of the peanut industry in Queensland, Australia (see figure 1). Peanuts are particularly sensitive to water stress: too little water can cause a toxic fungus *(Aspergillus flavus)* to grow in the inner shell such that the peanut becomes unsuitable for human consumption [53]. Lower than average rainfall over the past 25 years in south-east Queensland, the traditional home of growing peanuts, has significantly affected the quality and quantity of peanuts produced (by about 30% in value) [54]. In response to the threat of reduced peanut production, the largest company in the industry collectively (represented by a board) decided to transform its structure by translocating to what was perceived as a more agro-climatically amenable region for growing peanuts presently, and into the future because of their great supply of irrigation water. In 2007, company representatives purchased a property of 11 700 ha near Katherine in the Northern Territory, some 3000 km from south-east Queensland, where conditions for growing peanuts were projected to be more suitable over the longer term due to climate changes (www.pca.com.au). One considered option for the company was to encourage farmers from Queensland to translocate to Katherine as a planned collective response to anticipated change. However, for this strategy to be feasible, it would be important to keep building and supporting the capacity of peanut farmers to relocate to Katherine and continue growing peanuts. In this context, we explore the likelihood that peanut growers in Queensland would relocate to Katherine to continue growing peanuts, thus supporting a transformation across scales. Through a structured survey, conducted May to July 2010, we quantitatively assessed the capacity of growers to transform, and examined the relationship between transformational capacity and attachment to place and occupation, respectively. As it turned out, in 2011 the strategy to relocate to Katherine was abandoned.

3. Method

3.1. Survey development

Survey questions were developed to quantify a peanut grower's level of attachment to place and occupation and capacity to transform. Questions were chosen as representative of other similar studies in the literature and were aggregated accordingly [42, 44, 45]. Most questions were designed to elicit an attitude, opinion, or stance. For example, one statement was 'I like being a peanut producer'. Respondents were asked to rate how strongly they agreed with each statement using a 5-point rating scale (1 = strongly disagree, 2 = disagree, 3 = unsure or neutral, 4 = agree, 5 = strongly agree). Respondents were instructed to leave a response blank if they so wanted. An initial version of the survey was pilot-tested with five farmers in their homes to ensure that the questions were readable and unambiguous. A copy of the survey can be obtained by contacting the primary author.

Figure 1. A map of northern Australia showing Kingaroy in south-east Queensland and Katherine in the Northern Territory (map developed from Google Earth).

3.2. Survey administration

An intensive media campaign was undertaken to introduce the research to the region. Names, addresses and telephone numbers of peanut farmers were provided by the industry under strict conditions of ethical conduct. All peanut growing families received a personal letter informing them of the research and inviting them to participate. Of the 90 names on the list, nine farmers were not interested in participating in the research, ten were retired and two were unable to be contacted (and assumed to have left the industry). The survey was completed by 69 people giving a response rate of 90% and a representation of 88% of the industry. We asked if we could speak to the main 'decision-maker' within the family business. Interviews were conducted between June and October 2010 and took between 45 and 90 min to complete.

3.3. Data analysis

Responses to structured questions or statements were analysed using standard statistical techniques. Transformational capacity and resource dependency were quantified by obtaining the F-scores or weighted means for each set of relevant statements (e.g. there were several statements describing attachment to occupation, etc). The relationship between transformational capacity and resource dependency was quantified using Pearson correlations.

4. Results

We propose that transformational capacity comprises four dimensions. Descriptive statistics for each of the four dimensions in this study are presented in table 1. In general, peanut farmers generally perceived the risks associated with transformational change as manageable, although they did not tend to agree that there were opportunities associated with climate change. They perceived that they had sufficient skills in planning, learning and reorganizing their enterprises. Peanut farmers appeared to have sufficient levels of financial and psychological flexibility. They were interested in new skills and learning about the effects of climate change, yet they also thought that the effects of climate change were unlikely to manifest in their region for some time.

Peanut farmers were highly attached to their place. Farmers responded to three survey questions about their willingness to move (table 2), and responded to a specific question about their likelihood of moving elsewhere (figure 2). Their responses suggest that peanut farmers are highly unlikely to move elsewhere such as Katherine to continue growing peanuts, even if favourable conditions could be found. Peanut farmers are also highly attached to their occupation as suggested in table 3, but many farmers would consider an alternative occupation such as growing other crops if conditions for growing peanuts became economically unviable (figure 3). Occupations that were far removed from being a peanut farmer were unattractive and unlikely to be pursued.

Given a situation in which environmental conditions become too difficult to profitably grow peanuts, peanut farmers were more likely to change their land use practices or crop type, or even change to grazing cattle, rather than change location (table 4). Of the issues associated with changing occupation or place, peanut farmers ranked 'needing advice on how to implement change' as their most important issue, but they also suggested that, 'there is no urgency ... to change', as well as, '... the local climate will (not) change much', as more important than, 'it is too hard for me to change' and, 'I am not convinced that changing will be more profitable' (table 5).

Place attachment and occupational attachment were significant influences on one dimension of the capacity of

Table 1. Dimensions of transformational capacity of peanut farmers in SE Queensland ($n = 69$).

	Mean (scale 1–5[a])	S.E.	Mode	Range
A. Perceptions of the risks associated with transformational change				
Q. If the climate changes, there is much I can do to respond to the opportunities	3.4	0.13	4	5
Q. Climate change brings great opportunities	2.45	0.15	2	5
Q. I have many options available to me other than being a farmer	3.17	0.15	4	5
Q. The important thing for me is to minimize my losses during bad seasons	4.02	0.13	4	5
B. The level of skills in planning, learning and reorganizing livelihood activities				
Q. If there is a drought, I just hope for the best[b]	2.42	0.16	1	5
Q. Current approaches for dealing with present climate challenges will be sufficient for dealing with future climate challenges[b]	2.86	0.27	4	4
Q. I do not really believe in long-term planning—things are too uncertain[b]	2.72	0.17	2	5
Q. I like to experiment with new ways to farm	4.01	0.141	4	5
C. The level of financial and emotional flexibility				
Q. Regardless of what happens, we have made sure that we are financially secure	3.41	0.15	4	5
Q. I am less likely to survive drought compared to other farmers I know[b]	2.04	0.11	2	4
Q. If needed, I am prepared to completely change the way I manage my property in order to survive as a farmer	3.73	0.14	4	5
D. The level of interest in undertaking transformational change				
Q. Climate impacts are unlikely to manifest in this region for some time[b]	2.91	0.15	4	5
Q. I am interested in learning about climate change and its impacts on the peanut and farming industry	3.39	0.14	4	5
Q. I am interested in learning new skills	3.86	0.14	4	5

[a] 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

[b] Please note that responses to these negative questions were reversed prior to analysis.

Table 2. Survey responses on attachment to place of peanut farmers ($n = 69$).

Survey items	Mean (scale 1–5[a])	S.E.	Mode	Range
We would be willing to move elsewhere if things became too tough here[b]	2.55	0.15	2	5
I would never want to move from this region	3.69	0.14	4	5
I am unlikely to move elsewhere to farm if conditions become unsuitable here	3.20	0.75	4	5

[a] 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

[b] Please note that responses to this negative question was reversed prior to analysis.

Table 3. Survey responses on attachment to occupation of peanut farmers ($n = 69$).

Survey responses	Mean (scale 1–5[a])	S.E.	Mode	Range
Farming is what I know best	4.11	0.12	4	5
Being a farmer is a lifestyle—it is not just my job	3.71	0.16	4	5
I would happily consider another occupation if the need arose[b]	2.84	0.15	4	5

[a] 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

[b] Please note that responses to this negative question was reversed prior to analysis.

Table 4. Ranking of occupational versus place attachment given an untenable situation.

Survey item in response to: faced with a situation in which conditions become too difficult to remain profitable, are you more likely to change your occupation, change your location or change the way you manage your farming business?	Mean (scale 1–5[a])	S.E.	Mode	Sum[b]
Continue growing peanuts by growing different varieties or using different approaches	1.57	0.13	1	107.00
Change to another crop type	1.75	0.09	2	119.00
Change to grazing cattle	2.59	0.18	3	176.00
Change my location (and remain growing peanuts)	3.42	0.20	4	232.50
Change my location and occupation	3.64	0.21	5	247.50

[a] 1 = most important, 2 = important, 3 = neutral, 4 = unlikely to be important, 5 = least important.

[b] Lesser values were ranked as more likely.

Table 5. Ranking of the risks associated with changing either occupation or place.

Survey item in response to: when considering options for the future, could you please tell me how important each of the following factors might be (scale 1–4, where 1 = not at all important and 4 = very important)	Mean (scale 1–5[a])	S.E.	Mode	Sum[b]
I need advice on how to implement change	2.25	0.18	3	153.50
There is no urgency for me to change	2.18	0.18	3	148.00
I do not think that the local climate will change much	2.16	0.18	3	147.00
The relevant rules and regulations are incompatible with my aspirations	1.91	0.17	3	130.00
There is too much risk in changing for better seasons	1.62	0.16	2	110.00
My family would not be supportive of the change	1.56	0.14	2	104.50
Any change would limit me in other areas	1.43	0.16	1	96.00
It is too hard for me to change	1.36	0.14	1	93.00
I am not convinced that changing will be more profitable	0.79	0.16	1	53.00

[a] 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

[b] Higher values were rated as more important.

Table 6. The influence of occupational attachment and place attachment on transformational capacity.

Dimension	(1) Risk perception	(2) Planning	(3) Coping	(4) Interest
Identity	0.057	−0.208	0.199	−0.270[a]
Place attachment	−0.042	−0.190	0.226	−0.252[a]

[a] Indicates a significant influence where $p < 0.05$.

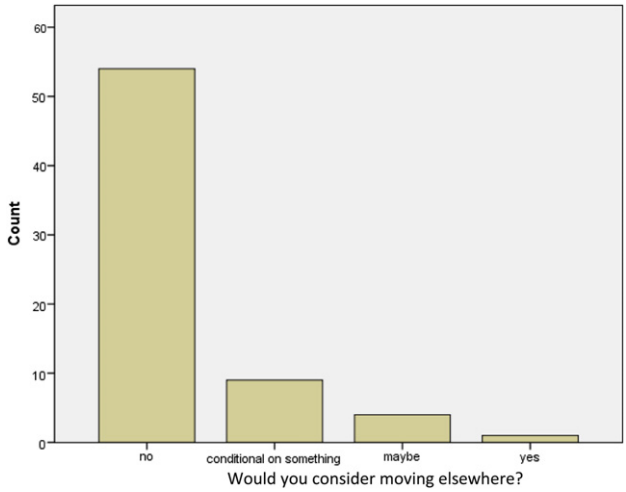

Figure 2. The likelihood of moving place: would you consider moving elsewhere—such as Katherine—so as to continue growing peanuts if favourable conditions elsewhere could be found?

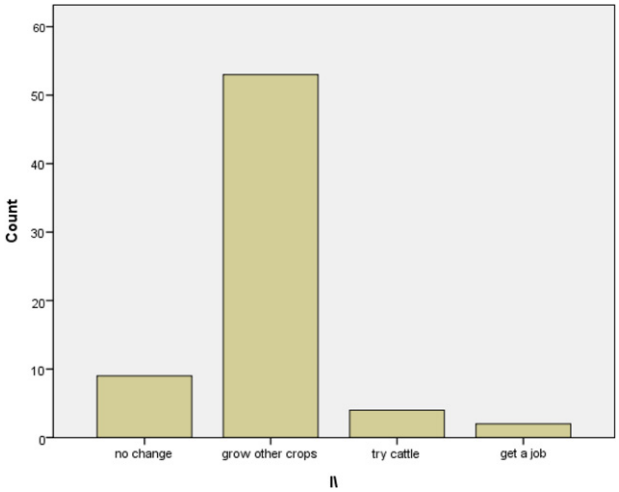

Figure 3. The likelihood of changing identity: what other options do you have available or are you considering if you can no longer grow peanuts in the region (e.g. if conditions change too much)?

peanut farmers to transform: having an interest in adapting to the future ('interest', dimension four). Place attachment and occupational attachment did not appear to influence how peanut farmers perceived the risks associated with transforming, their strategic skills, or their capacity to cope psychologically or financially (table 6).

5. Discussion

Peanut farmers with higher levels of attachment to place or occupation were assessed as having a lower capacity to change on one dimension. Of the four important components of adaptive capacity, we find that only the willingness to contemplate and undertake change was significantly correlated with the levels of attachment to place and occupation. We interpret these responses to mean that these individuals are especially interested in adapting because to fail would mean that their ability to remain within their occupation or place would be threatened. These observations highlight the importance of the nature and magnitude of the change event and its influence across and within scales. At the individual scale, for example, our results suggest that since transformation involves the crossing of social (or other) thresholds, a transformation for one individual (and possibly for a community or region) might not be a transformation for another. Individuals that have higher levels of attachment to place or occupation are likely to experience changes in place or identity as transformational since they are crossing

individual thresholds. Other individuals with lesser levels of attachment to place, however, are unlikely to experience such adaptations as transformational. Cross-scale issues become important when we consider that transformations at the individual, family, industry, community and regional levels of interest may need to occur concurrently for a system-wide transformation to occur [7]. Individuals are embedded within a complex socio-institutional context, and whilst individuals will also be intrinsically affected by those scales above them, our results suggest that they will also fundamentally influence the extent to which some climate adaptations at higher scales will be successful.

Some individuals are more attached to their place or occupational identity than others. 'Attachment to place' is a concept that describes the level of connection that individuals have with their physical place or community [46, 47]. It allows us to understand comments such as, 'this is a farming town' where an identity is created around the township, a sense of pride is associated with belonging to the town and strong friendships and networks exist within it [58]. The concept provides insight into social well-being and quality of life, and there is strong evidence to suggest that control over changing places or changes to the place itself are important for psychological and emotional well-being [52]. The level of attachment that a person has to their place or occupation may be an indicator of their willingness and ability to search for employment elsewhere or to diversify locally [24]. Whilst other research has been unable to show that place attachment is a significant influence on adaptive capacity [44], our results suggest that attachment to place is likely to be a barrier to adaptations that involve changing place. That is, for change events that do not involve moving locations, place attachment is likely to be a positive influence on adaptation; place attachment brings resources such as networks, social capital, local knowledge and a sense of well-being into a region [55]. Individuals with particularly high levels of place attachment typically have reciprocal networks of community interactions and increased social trust that are directed towards mutual benefit [56]. These people are unlikely to be interested in adaptations involving relocations. Place attachment can thus contribute to the success of some climate adaptations [57, 58], whilst acting to impair others [24].

Similarly, occupational identity appeared to be important for change events that affect identity. Resource users can become especially attached to their occupation. People that build their lives around their work, have friends that are from the same occupation and have leisure interests and activities that are work-oriented are likely to develop a strong attachment to their occupation [51]. People form occupational communities if they are members of the same occupation, have some sort of common life together and are, to some extent, separate from the rest of society [48]. The identity that is created and reinforced around a person's occupation is based on a set of attitudes, beliefs and opinions held about themselves and they depend on the support, encouragement, recognition and acceptance of others (usually from the same occupation) for their psychological stability [51]. When a person with a strong occupational attachment is faced with the prospect that they are no longer able to continue in their current occupation, they not only lose a means of earning an income, they may lose an important part of their self-identity [42]. Our results suggest that peanut farmers in Queensland that have created a strong sense of occupational identity around their peanut producing occupation are unlikely to adopt a new occupation outside of farming, regardless of the tenability of their situation. Innovative solutions that match or support current identities will need to be identified and supported if farmers are to adapt. These might include livelihoods centring on other cropping products (such as wheat, corn, sorghum, etc).

Transformational adaptations represent a fundamental system change where a different set of factors, processes and triggers influence it [13]. The capacity to respond to a broad range of climate risks is likely to be reflected in the extent to which each of the four dimensions listed here exist within individuals. This capacity might be able to be influenced, depending on the nature of the change event. Planning for transformations in which all system elements cross their respective thresholds concurrently, however, will be challenging. Cross-scale surprises may occur when variables that operate at different scales and at different speeds interact [5]. Attachments to occupational identity and place are examples of slow changing variables that may influence the pace at which planned transformations progress. They are also descriptors of the thresholds that exist at the individual scale; our results suggest that these thresholds will be different for different individuals. Identifying thresholds and measuring the proximity of social systems to them is important for the successful design and implementation of climate adaptation strategies.

Successful climate adaptations within the peanut industry in Australia are unlikely to include those that involve farmers changing locations or identity. Conditions for growing peanuts in Queensland are historically variable and may become more tenuous. Creative incentives would have been necessary to encourage peanut farmers to support the move to Katherine. Factors such as place attachment and occupational identity, which are effectively unaccounted for in climate policy to date [8, 59], and are important potential barriers to climate adaptations which involve changing place or identity, are important considerations. Given that it will be difficult to change the levels of place attachment and occupational identities of individuals that have high levels of each, and that approaches for dealing with current climate challenges will be insufficient for dealing with future climate challenges, targeting investments to improve farmers' capacity to manage a broad range of climate risks, plan and develop an interest in a climate changed future might enhance the industry's capacity to transform [60]. Creating supportive policy environments that enable lower-risk change pathways and provide well-matched incentives for effective transformation are also likely to be important [61–63].

6. Conclusions

While planned transformation in advance of climate change can bring many benefits to an industry sector, there are

significant challenges that need to be confronted if such processes are to bring net benefits that are equitably distributed and effectively address probable climate change impacts. These challenges will be different to those requiring incremental adjustments. We find a strong negative correlation between transformational capacity and both place attachment and occupational attachment, suggesting that whilst these factors may be important positive influences on the capacity to adapt to incremental change, they may act as barriers to transformational change.

This research explores the importance of four dimensions of how individuals respond to change as a basis from which to understand constraints and opportunities for transformational change. Given the impetus for transformation in the face of future climate change, there is a significant likelihood of demand for planned resettlements and migration. Future research is needed to identify the thresholds describing when *in situ* adaptation becomes ineffective, and the social and ecological limits to adaptation are reached. The research presented here emphasizes the social and psychological elements of the capacity to undertake such change so as to minimize the social costs and maximize the autonomy and legitimacy of such processes. Regional planners could consider the social dimensions of transformation and provide the appropriate incentives and phasing of the transformation process to maintain fundamental human security if such transformation becomes necessary for the chosen adaptation pathway.

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