# Leadership for moving the climate change adaptation agenda from planning to action

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Current Opinion in Environmental Sustainability

# Leadership for moving the climate change adaptation agenda from planning to action

Raffaele Vignola[1], Gregoire Leclerc[1,2], Mariela Morales[1] and Julian Gonzalez[3]

An increasing number of initiatives for adaptation to climate change are occurring at multiple scales and decision focuses (*e.g.*, impact assessment, policy design, technology development, planning management and implementation of adaptation measures *etc.*) but concrete action is lagging. The complex problems (characterized by deep uncertainties, multiple interests and knowledge references) as well as correspondent solutions of many adaptation initiatives are often addressed through technical analysis (*e.g.*, observed and foreseen impacts of climate change) and a limited consideration of the importance of adopting an adequate leadership styles. Increasingly, authors and practitioners consider that for moving the adaptation agenda forward, leadership should be adapted to the socio-institutional context and informed by behavioral and process-design aspects. We find that different leadership styles might be needed to mobilize social action from one phase of the adaptation cycle to another.

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## Introduction

The need for adaptation to climate change[4] has gained attention worldwide given the evidences of increasing impacts of climate extremes and related societal costs [1,2]. Adaptation initiatives are occurring at multiple geographic scales and decision scopes (*e.g.*, impact assessment, policy design, use of technology and planning processes) [3]. However, concrete action is lagging behind for several reasons [4,5], for example, because of an overreliance on complex climate change impact models [5], scale assessment mismatches [6] or inadequate/insufficient consideration of uncertainties in the definition of concrete implementation responsibilities of stakeholders [7••]. In this respect, the inherent 'wicked' nature of adaptation responses [8••] demands a paradigm shift, from a large reliance on technical knowledge and solutions towards a more comprehensive approach paying more attention to behavioral challenges [9–15]. Successful adaptation rely on the proper grasp of the cultural, economic and institutional contexts and on the leadership that is needed to mobilize resources for concrete action [6,8••,16]. Several authors [5,16,18,21–24] state that leadership is key in moving the adaptation agenda forward at all scales of operation, from the National policy-making level (*e.g.*, setting the enabling policy environment) to the local level (*e.g.*, concrete responses to reducing climatic stresses). Leadership, either within or among institutions, is influenced by values, beliefs and motives as well as goals, gender, collectivism, power distance, and performance orientation [17]. In some cases, coercive leadership with formal authority may be successful in implementing a solution (*e.g.*, regulations, fines *etc.*). On the other hand, a context that requires building trust among stakeholders to collectively define the problem and generate possible solutions might require a more inspiring and engaging leadership style.

In this respect, adopting the adequate leadership style can help promote concerted efforts, priority setting and creative thinking (which may include paradigm change) to, for example, identify targets for geographic intervention, possible institutional arrangements [18] and stakeholders' engagement in multi-scale processes of continual action, learning and adaptive management [19,20]. We will first review leadership styles for climate change adaptation, from the lens of the management sciences, environmental governance and social psychology. We then address specific leadership challenges within the adaptation cycle, from planning to implementation of concrete actions.

[4] For sake of conciseness the term 'adaptation' will be used in reference to 'adaptation to climate change'.

**Table 1**

**Leadership styles based on Ref. [29]**

| Table 2: Leadership challenges at various stages and subip types (adapted from | Coercive | Authorative | Affiliative | Democratic | Pacesetting | Coaching |
|---|---|---|---|---|---|---|
| The leader's modus operandi | Demands immediate compliance | Mobilizes people toward a vision | Creates harmony and builds trust | Forges consensus through participation | Sets high standards for performance | Develops people for the future |
| The style in a phrase | Do what I tell you! | Come with me | People come first | What do you think? | Do as I do, now | Try this |
| When the style works best | To force mobilization in times of crisis, to enforce rules | To innovate on problem perspective or clarify direction | To heal conflicts or to motivate people during stressful circumstances | To build buy-in or consensus, or to get input from key actors | To get quick results from a highly motivated and competent team | To help actors improve performance or develop long-term capacities |
| Overall impact on interaction climate[a] | Negative | Most strongly positive | Positive | Positive | Negative | Positive |

[a] Interaction climate is determined by stakeholders' motivations to collaborate and to proactively assume compromise.

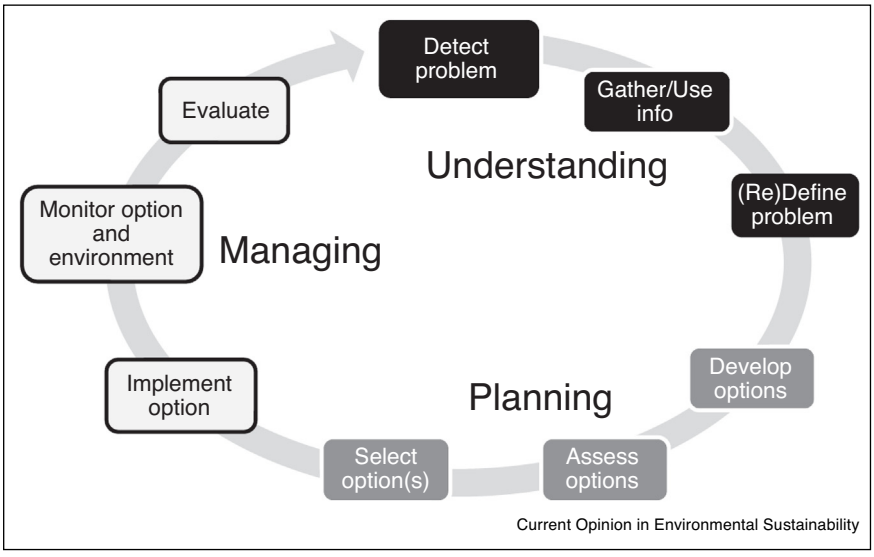
## Leadership for adaptation

Commonly, leadership is referred to the capacity of an individual to convince others to accept/follow his decisions and/or the associated underlying paradigm (the leader-followers paradigm). However, scholars from the management and political science have identified a range of leadership styles needed in facing complex problems that require transformational approaches [23,25,26] (Table 1). Style is defined by the way an agent directs an assessment (*e.g.*, gathering and using information), makes decisions (*e.g.*, through large open consultations or through small-group), and manages change and crises, and has a significant effect on the climate of interaction among stakeholders [29]. One or more of these leadership styles may be more successful than others to encourage the interaction of a variety of individual, organizational and inter-organizational processes towards a common adaptation goal [27–29].

Considering adequate leadership style can help an agent (individual, group, organization or coalition) identify ways to promote the proactive engagement of social forces in the identification and mobilization of resources (financial, human, information, institutional enforcement *etc.*) to plan and implement adaptation measures [30,31]. In these social undertakings, parties involved face 'wicked problems' [32] characterized by inherent and irreducible uncertainties [33], power asymmetry, conflicting interests, involvement of multiple agents across-scales from different knowledge and value domains [34].

In these contexts, agents aiming at mobilizing social action need to promote a long-term perspective and stakeholders' commitment over time for identifying and promoting collaborative opportunities and achieving agreements on technically and socially desired solutions and concrete action [16,18,22,33,35]. Proper leadership style will distinguish the technical aspects of an adaptation problem [36] from the value-laden ones which require an adaptive lens to adjust to the social context procedures, language, process design and so on [37]. For example, for well-defined technical problems and solutions (*e.g.*, build a water dam as drought mitigation measure (provided there is popular backstopping), a State agency (with formal authority) or an engineering firm (with technical legitimacy) are well positioned to lead towards the desired outcome). In effect, these are routine-types of problems for which society has already identified, experimented, and developed successful well-defined solutions. However, given the wicked nature of many global change problems, several and diverse stakeholders (*e.g.*, civil society, State, academics *etc.*) are often required to work closely to diagnose the problem and identify technically and socially robust solutions that can realistically be implemented [37].

**Figure 1**




Phases (Understanding the problem, Planning adaptation actions and Managing their implementation) and subprocesses (boxes) in the adaptation process. Source: Fazey *et al.* [15].

## Leadership in the adaptation cycle

Contextual and structural social factors determine agents' credibility and legitimacy to lead in each phase of the adaptation cycle (Figure 1), (*e.g.*, who is better entitled to facilitate the identification of vulnerable population (Understanding phase), who can design an adaptation measure that is technically and socially robust (Planning phase) or who can better implement and evaluate adaptation actions (Managing phase)).

Dealing with long-term climate related problems in local contexts might conflict with day-to-day priorities of the populations [38–40] so that the leading agents need to adapt their approach to consider stakeholders' multiple interests, different understanding and values as well as perceptions of urgency along the adaptive cycle. At different stages or subprocesses of the cycle, actors and challenges can change due to the variability in the nature of the task demanded and decisions that need to be made [41] (Table 2).

For each stage and subprocess of the adaptation cycle leading agents might need the support of a formal authority (*e.g.*, public institutions) to enforce measures, legitimize the process and/or guarantee sustained resource flow while maintaining legitimacy and stakeholders' participation. Since challenges will vary across the cycle, agents will have to adapt their leadership style or relay leadership to other agents depending on the task (*e.g.*, some will have better legitimacy and credibility to lead large consultations, convoke stakeholders for hybrid forums [43] or smooth out conflicts and facilitate learning).

When there are no formal mandates (*e.g.*, authorities or policies to initiate the cycle), agents with informal authority (*e.g.*, an NGO, a community organization, a team from a research and development project) might be in position to provide the affiliative, democratic or coaching type of leadership to convene communities on problem identification [18]. However, many developing countries' stakeholders engaging in complex adaptation planning exercises face power asymmetries, weak institutions and latent conflicts over natural resources [44–47]. Often, those agents are external and adopt pre-established assessment frameworks to urge commitment and action [48,5] that might not resonate with local urgency and perceived priorities and eventually lead to conflicts (*e.g.*, selection of most vulnerable areas to intervene). In these cases backstopping by local leaders may be needed to, for instance, recognize the day-to-day priorities of communities and mobilize them to get involved [48,49] or to open the technical criteria for popular scrutiny [37]).

In the planning stage, large stakeholders' consultations (demanding a democratic type of leadership) might be needed to complement technical and legal experts' opinions to design adaptation measures (*e.g.*, regarding their feasibility). Power asymmetries (*e.g.*, related to technical knowledge), distrust and vested interests or conflicts can arise in this process especially when large investments are at stake, so that leading agents will need to ensure a transparent and trust-building process. Considering the

**Table 2**

**Leadership challenges and styles at various stages and subprocesses of the adaptation cycle and examples**

| Stage and subprocess of adaptation cycle | Leadership challenges | Leadership styles and examples |
|---|---|---|
| Understanding | | |
| Detect problems | Raise awareness and urgency to act, facilitate, and interact between policy-makers, communities and experts to guarantee transparency and trust-building for an effective engagement of interested parties (especially potentially-affected communities) in identification of priorities | Often this comes from the informal authority of a legitimate and credible agent (*e.g.*, an NGO well-recognized in a landscape and/or a credible action-research oriented institution) promoting affiliative, democratic or coaching types of leadership |
| Gather/use information | Motivating and facilitating engagement of communities in information-gathering, and building trust and transparency in information management and use | Authorative and/or affiliative leadership types to build trust and/or guide actors based on a common and legitimate vision (*e.g.*, a municipality partnering with a community's association to recompile data and evidences) |
| (Re)define the problem | Facilitate/mediate between experts' and local communities' framing of the problem in light of evidences and transparent communication of uncertainties without diminishing urgency to act, distinguish technical from adaptive aspects of the problem (*e.g.*, revealing values driving behaviors), and diagnosing the political landscape | To ensure inclusion of diverse perspectives of the problem, democratic and/or affiliative leadership types might be needed (*e.g.*, NGO extension services ensuring adequate language and mutual understanding of relevant actors from different knowledge domains) |
| Planning | | |
| Develop options | Facilitate engagement of communities and experts in identification of alternatives along with experts' knowledge of existing options, ensuring a values-based approach is used to generate new options [42]. As well, it is important to allow for conflictual points of views to emerge as it can enrich the development of solutions | Democratic, affiliative and/or coaching leadership types might be needed to build trust and capacities to effectively share and use diverse knowledge sources (*e.g.*, legitimate NGO outreach ensuring adequate language and mutual understanding of relevant actors from different knowledge domains) and gather relevant experts and stakeholders |
| Assess options | Ensure technical expertise, as well as, value-based judgement of interested communities and local knowledge are considered in identifying performance indicators and evaluating options | |
| Select option(s) | Facilitate a transparent use of options' selection method, ensure relevant participants' preferences are accounted for | |
| Managing | | |
| Implement options | Build and sustain alliances, pace implementation to allow for learning and adjustment of values that might be needed as part of the adaptive problem, develop leadership capacity in the social system to distribute responsibility | Authorative and/or coercive leadership types might be needed to ensure long-term compromise to allocate resources to sustain action (*e.g.*, a public administration ensuring a budget line to sustain adaptation action over time or institutional enforcement through fines, regulations, incentives *etc.*). In solutions that require coordinate action across a range of stakeholders affiliative and/or coaching leadership types are likely needed |
| Monitor outcomes | Facilitate processes to identify monitoring goals, indicators and responsibilities for follow up and reporting of advances and barriers | To engage actors in monitoring efforts, boost learning mechanisms and promote trust and transparency authorative, affiliative and/or coaching leadership types might be needed (*e.g.*, a legitimate NGO engage a rural community association in monitoring efforts to provide data to a municipal monitoring system) |
| Evaluate effectiveness of option | Facilitate process to identify performance indicators acceptable to all involved parties and ensure the information is adequately gathered, systematized and used to inform eventual adjustments needed in implementation | Democratic, affiliative and/or coaching leadership types might be needed to ensure that a diversity of interests and perspectives are included |

importance of getting stakeholders to participate throughout the cycle and thus to avoid participation tiredness, leadership should ensure that momentum is maintained by balancing practical solution identification and implementation (*e.g.*, motivating with concrete solutions and actions) with the need for technical studies to enrich stakeholders perspectives. In the monitoring and evaluation subprocesses, leading agents should ensure that stakeholders are motivated to learn and adjust adaptation measures.

## Conclusions

The insights on the importance of tailoring leadership styles to the different stages of the adaptation cycle apply also to initiatives that aim at mobilizing societal efforts to address complex environmental degradation problems. For a successful implementation of these endeavors agents should, from the very start of the process, carefully diagnose and separate the technical aspects of the problem at hand from those that, along the cycle, require adjusting leadership style based on changes in the tasks and on behavioral and process-design considerations which depend on the social, cultural and problem-specific context.

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## References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- •• of outstanding interest

1. Farmer GT: **Overview of climate change science**. *Modern Climate Change Science*. Springer International Publishing; 2015:1-42.

2. Bulkeley H, Newell P: *Governing Climate Change*. Routledge; 2015.

3. Gorddard R, Colloff MJ, Wise RM, Ware D, Dunlop M: **Values, rules and knowledge: adaptation as change in the decision context**. *Environ. Sci. Policy* 2016, **57**:60-69.

4. Ford JD, Berrang-Ford L, Paterson J: **A systematic review of observed climate change adaptation in developed nations**. *Clim. Change* 2011, **106**:327-336.

5. Dupuis J, Knoepfel P: **The adaptation policy paradox: the implementation deficit of policies framed as climate change adaptation**. *Ecol. Soc.* 2013, **18**:31.

6. Cash DW, Moser SC: **Linking global and local scales: designing dynamic assessment and management processes**. *Glob. Environ. Change* 2000, **10**:109-120.

7. •• Woodruff SC, Stults M: **Numerous strategies but limited implementation guidance in US local adaptation plans**. *Nat. Clim. Change* 2016, **6**:796-802 http://dx.doi.org/10.1038/nclimate3007.
Adaptation planning offers a promising approach for identifying and devising solutions to address local climate change impacts. Yet there is little empirical understanding of the content and quality of these plans. We use content analysis to evaluate 44 local adaptation plans in the United States and multivariate regression to examine how plan quality varies across communities. We find that plans draw on multiple data sources to analyze future climate impacts and include a breadth of strategies. Most plans, however, fail to prioritize impacts and strategies or provide detailed implementation processes, raising concerns about whether adaptation plans will translate into on-the-ground reductions in vulnerability. Our analysis also finds that plans authored by the planning department and those that engaged elected officials in the planning process were of higher quality. The results provide important insights for practitioners, policymakers and scientists wanting to improve local climate adaptation planning and action.

8. •• Bisaro A, Hinkel J: **Governance of social dilemmas in climate change adaptation**. *Nat. Clim. Change* 2016, **6**:354-359.
The authors show that there is a significant opportunity to advance the understanding of adaptation governance by integrating insights that have been developed in the extensive commons literature on the institutions that work to overcome social conflicts or dilemmas. 'Realist-materialist' approaches to understanding such collective action are particularly valuable to adaptation governance research because they emphasize how biophysical conditions give rise to certain types of social dilemma. Climate change affects these biophysical conditions, and thus may alter dilemmas or create new ones.

9. Finger M: **From knowledge to action? Exploring the relationships between environmental experiences, learning, and behavior**. *J. Soc. Issues* 1994, **50**:141-160 http://dx.doi.org/10.1111/j.1540-4560.1994.tb02424.x.

10. Kollmuss A, Agyeman J: **Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?** *Environ. Educ. Res.* 2002, **8**:239-260 http://dx.doi.org/10.1080/13504620220145401.

11. Leiserowitz AA, Kates RW, Parris TM: **Do global attitudes and behaviors support sustainable development?** *Environ. Sci. Policy Sustain. Dev.* 2005, **47**:22-38.

12. McKenzie-Mohr Doug: *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing*. New Society Publishers; 2011.

13. Pfeffer Jeffrey, Sutton Robert I: *The Knowing-Doing Gap How Smart Companies Turn Knowledge into Action*. Boston, MA: Harvard Business School Press; 2000.

14. Simmons Bora, Volk Trudi: **Environmental educators a conversation with Harold Hungerford**. *J. Environ. Educ.* 2002, **34**:5.

15. Fazey I, Gamarra JG, Fischer J, Reed MS, Stringer LC, Christie M: **Adaptation strategies for reducing vulnerability to future environmental change**. *Front. Ecol. Environ.* 2009, **8**:414-422.

16. Termeer C, Dewulf A, van Rijswick H, van Buuren A, Huitema D, Meijerink S *et al.*: **The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements**. *Clim. Law* 2011, **2**:159-179.

17. Chhokar JS, Brodbeck FC, House RJ (Eds): *Culture and Leadership Across the World: The GLOBE Book of In-depth Studies of 25 Societies*. Routledge; 2013.

18. Moser SC, Ekstrom JA: **A framework to diagnose barriers to climate change adaptation**. *Proc. Natl. Acad. Sci. U. S. A.* 2010, **107**:22026-22031.

19. O'Brien K: **Global environmental change II: from adaptation to deliberate transformation**. *Progr. Hum. Geogr.* 2012, **36**:667-676 http://dx.doi.org/10.1177/0309132511425767.

20. Ostrom Elinor, Janssen Marco A, Anderies John M: **Going beyond panaceas**. *Proc. Natl. Acad. Sci. U. S. A.* 2007, **104**:15176-15178.

21. Black Simon A, Groombridge Jim J, Jones Carl G: **Leadership and conservation effectiveness: finding a better way to lead**. *Conserv. Lett.* 2011, **4**:329-339 http://dx.doi.org/10.1111/j.1755-263X.2011.00184.x.

22. Measham TG, Preston BL, Smith TF, Brooke C, Gorddard R, Withycombe G, Morrison C: **Adapting to climate change through local municipal planning: barriers and challenges**. *Mitig. Adapt. Strategies Glob. Change* 2011, **16**:889-909.

23. Kates RW, Travis WR, Wilbanks TJ: **Transformational adaptation when incremental adaptations to climate change are insufficient**. *Proc. Natl. Acad. Sci. U. S. A.* 2012, **109**:7156-7161.

24. Meijerink S, Stiller S: **What kind of leadership do we need for climate adaptation? A framework for analyzing leadership objectives, functions, and tasks in climate change adaptation**. *Environ. Plann. C: Govern. Policy* 2013, **31**:240-256.

25. Yukl Gary: **An evaluative essay on current conceptions of effective leadership**. *Eur. J. Work Org. Psychol.* 1999, **8**:33-48 http://dx.doi.org/10.1080/135943299398429.

26. Rost J: *Leadership for the Twenty-First Century*. New York: Praeger; 1991.

27. Heifetz RA: **Leadership Without Easy Answers**. Harvard University Press; 1994.

28. Huxham C, Vangen S: **Leadership in the shaping and implementation of collaboration agendas: how things happen in a (not quite) joined-up world**. *Acad. Manage. J.* 2000, **43**:1159-1175.

29. Goleman D: **Leadership that gets results**. *Harv. Bus. Rev.* 2000, **78**:4-17.

30. Manolis Jim C, Chan Kai M, Finkelstein Myra E, Stephens Scott, Nelson Cara R, Grant Jacqualine B, Dombeck Michael P: **Leadership: a new frontier in conservation science**. *Conserv. Biol.* 2009, **23**:879-886 http://dx.doi.org/10.1111/j.1523-1739.2008.01150.x.

31. Lemos MC, Kirchhoff CJ, Ramprasad V: **Narrowing the climate information usability gap**. *Nat. Clim. Change* 2012, **2**:789-794.

32. Rittel HW, Webber MM: **Dilemmas in a general theory of planning**. *Policy Sci.* 1973, **4**:155-169.

33. Hulme PE: **Adapting to climate change: is there scope for ecological management in the face of a global threat?** *J. Appl. Ecol.* 2005, **42**:784-794.

34. Heifetz Ronald A, Grashow Alexander, Linsky Martin: *The Practice of Adaptive Leadership: Tools and Tactics for Changing Your Organization and the World*. Boston, MA: Harvard Business Press; 2009.

35. Ferdig MA: **Sustainability leadership: co-creating a sustainable future**. *J. Change Manage.* 2007, **7**:25-35.

36. Heifetz Ronald A: **Anchoring leadership in the work of adaptive progress**. In *The Leader of the Future 2: Visions, Strategies, and Practices for the New Era.* Edited by Frances Hesselbein, Marshall Goldsmith. John Wiley & Sons; 2011:73-84.

37. Heifetz Ronald, Grashow Alexander, Linsky Marty: **Leadership in a (permanent) crisis**. *Harv. Bus. Rev.* 2009, **87**:62-69.

38. Dietz T: **Bringing values and deliberation to science communication**. *Proc. Natl. Acad. Sci. U. S. A.* 2013, **110(Suppl. 3)**:14081-14087.

39. Stott C, Huq S: **Knowledge flows in climate change adaptation: exploring friction between scales**. *Clim. Dev.* 2014, **6**:382-387.

40. Prins Gwyn, Rayner Steve: **Time to ditch Kyoto**. *Nature* 2007, **449**:973-975 http://dx.doi.org/10.1038/449973a.

41. Van Buuren A, Driessen P, Teisman G, van Rijswick M: **Toward legitimate governance strategies for climate adaptation in the Netherlands: combining insights from a legal, planning, and network perspective**. *Reg. Environ. Change* 2014, **14**:1021-1033.

42. Gregory R, Failing L, Harstone M, Long G, McDaniels T, Ohlson D: *Structured Decision Making: A Practical Guide to Environmental Management Choices*. John Wiley & Sons; 2012.

43. Callon M: *Acting in an Uncertain World*. MIT Press; 2009.

44. Füssel HM: **Adaptation planning for climate change: concepts, assessment approaches, and key lessons**. *Sustain. Sci.* 2007, **2**:265-275.

45. Conway D, Mustelin J: **Strategies for improving adaptation practice in developing countries**. *Nat. Clim. Change* 2014, **4**:339-342.

46. Eisenack K, Moser SC, Hoffmann E, Klein RJ, Oberlack C, Pechan A *et al.*: **Explaining and overcoming barriers to climate change adaptation**. *Nat. Clim. Change* 2014, **4**:867-872.

47. Kollmuss Anja, Agyeman Julian: **Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?** *Environ. Educ. Res.* 2002, **8**:239-260 http://dx.doi.org/10.1080/13504620220145401.

48. Rauken T, Mydske PK, Winsvold M: **Mainstreaming climate change adaptation at the local level**. *Local Environ.* 2015, **20**:408-423.

49. Wise RM, Fazey I, Smith MS, Park SE, Eakin HC, Van Garderen EA, Campbell B: **Reconceptualising adaptation to climate change as part of pathways of change and response**. *Glob. Environ. Change* 2014, **28**:325-336.