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The opportunities and challenges of developing and implementing local climate adaptation targets

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Abstract

Climate adaptation policies have been developed at global, national and local levels, however, significant implementation gaps persist. Adaptation targets – achieved through metrics to assess the effectiveness of an adaptation action or policy – offer a potential solution to improve implementation. If adaptation actions can be compared and tracked, it should be possible to identify which actions are most effective, where more support is needed, the extent to which vulnerabilities are addressed, and evidence what progress is made. Despite this potential, the development and delivery of adaptation targets has been challenging because: (1) adaptation is context-specific - a target in one place may not be suitable in another; and (2) there is often a lack of clarity over how metrics should be designed. We aim to stimulate debate in this area through development of guiding principles for creating climate adaptation targets. These principles aim to increase the robustness of targets through the lens of equity and vulnerability as well as highlighting some key challenges and limitations in the development and implementation of adaptation targets at the local level.

Introduction

The use of globally defined targets to drive climate change mitigation action, to reduce greenhouse gas emissions, was established by the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, whilst the

2015 Paris Agreement focused the world's attention on keeping global warming well below 2°C. However, as current warming records and future projections show, there are still substantial gaps in the implementation of international mitigation targets [1]. The Intergovernmental Panel on Climate Change define climate adaptation as a process of adjustment to actual or expected climate and its effects. Current climate adaptation research has highlighted the need to accelerate action that better prepares the world to the impacts of climate change and to finance such action. Still, global, national, and local progress has been slow, with tracking adaptation action and climate risk reduction being seen as urgent research areas [2]. More recently, adaptation targets have received increased policy attention through the UN's Global Goal on Adaptation (GGA), the UAE Framework for Global Climate Resilience (UAE Framework) and the UK Climate Adaptation Research and Innovation Framework. This framework underscores the importance of setting coherent adaptation goals, identifying it as both a key challenge and a critical area for future research [3].

Despite global frameworks, such as the GGA, creating a framework for tailoring national adaptation actions through thematic, quantitative targets, a local operationalisation deficit remains. Hallegatte [4] has provided guidance for developing flexible, no-regrets strategies. For example, the use of "no-regret" measures that bring external benefits such as reducing leaks in water distribution systems. While this action has a climate benefit, by ensuring water is available during periods of drought, it also has a cost benefit associated with it. Dilling et al. have challenged conventional notions of adaptation success through the lens of how we measure adaptation, suggesting alternative outcome-oriented and capacity-building metrics that better capture localised adaptation and resilience [5]. In Scotland, the Adaptation Scotland programme provides an example of an approach focused on building adaptation capabilities as opposed to working towards predetermined quantified targets. The capabilities include: understanding the challenge posed by climate change, building organisation culture and resources, creating strategy, implementation and monitoring mechanisms and working collaboratively [6]. Similarly, Eriksen et al. argues how measuring adaptation has to be contextualized within broader scalar governance and justice issues [7]. Hence, in their current guise, adaptation targets only remain useful if national actors have effective governance systems in place to tailor them to local scales of implementation [8], and if not, they can block or create disjointed adaptation aims and outcomes across different scales [9,10]. This is because adaptation is context-specific, dependent on local priorities.

We define 'local' broadly as a neighbourhood, community, town, rural area or city with unique characteristics. This commentary invites debate on the use and challenges of developing and implementing local adaptation targets. We provide a "principles-in-practice" framework for local adaptation targets to show what they might look like, how useful they might be, how they complement and support national and international adaptation agendas, and how they can be developed and applied in practice in diverse local contexts. Key questions remain for researchers and policymakers in establishing a local evidence-based framework for implementing robust adaptation targets (see Table 1 below).

Table 1. Key questions in establishing a local evidence-based framework for implementing robust adaptation targets.

Measurement: *Should local adaptation targets measure the amount of action taken or the levels of resilience achieved and how should progress be monitored?*
Specific vs. scalable: *How can local adaptation targets account for the context specificity of resilience needs while being applicable across different scales, sectors or organisations[5]?*
Addressing uncertainty: *How can local adaptation targets address the uncertainty in our climate and socio-economic futures while making sure the correct levels and types of adaptation policy are responsive to varied future risks?*
Inclusion and governance: *Who should be included in the process of creating local targets and who holds the responsibility for ensuring such targets are met?*

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These questions may help explain why adoption of local adaptation targets is currently limited and point to nascent areas of social and physical scientific research needed to pin down the effective use of adaptation targets to inform local policymaking. In response to this, we present a "principles in practice" framework developed from a meeting of experts from the research community, the public sector and policymaking in the UK to spark debate in this area and guide discussions on the development of adaptation targets, which are usable and can support the delivery of local policy aims to increase resilience and reduce vulnerability, while reducing the risk of maladaptation [11]. Additionally, we highlight challenges and limitations associated with the principles that may indicate why progress in developing adaptation targets remains stagnant.

Principles in practice for adaptation targets

Adaptation targets have the potential to increase funding and financing, enhance and support business cases to advance adaptive action, and drive new services, markets, skills and jobs, which can feed into other non-environmental policy areas. On a practical level, targets can also facilitate greater knowledge mobilisation, best practice, and collaborative engagement between national-local governments and other private and third sector parties, particularly if they are developed through coproduction. We present five key interrelated principles to frame the design of effective and robust local adaptation targets (see Fig 1). Adopting these principles should lead to adaptation targets that are relevant at the local scale and to associated actions that are more climatically and socially just in terms of the distribution and ownership of risks.

Envisioning an equitable, "well-adapted" society

National governments often require quantified adaptation targets [12], however different localities may have differing visions of a "well-adapted" society. Targets will therefore need to be flexible, however all targets should prioritise equitable distribution of risk ownership to ensure that local regions adapt in a fair and equitable manner. Projected regional climate futures will vary and will change over the coming decades, and a vision will also need to address the co-benefits, trade-offs [13] and losses which will arise as adaptation resources are prioritised, whilst also accounting for climate variability. Nevertheless, a vision that supports equity, wellbeing, and security, particularly for those most vulnerable to climate change impacts under future climate and socio-economic scenarios, would be a significant step forward in aligning adaptation targets with specific policy needs. Methods such as creative futures storytelling used in a workshop-setting with communities could help to create such visions of an equitable and "well-adapted" society, supporting adaptation planning at the local scale. This could also allow trade-offs to be discussed and co-benefits to be realised. Targets could then be collaboratively created, aiming to realise that shared vision [14].

Reducing vulnerability

Reducing vulnerability should be a key aim of adaptation action. Adaptation actions must avoid worsening existing social inequalities and injustices, including in relation to racial, class, social or gender injustices [15,16]. To monitor this, our

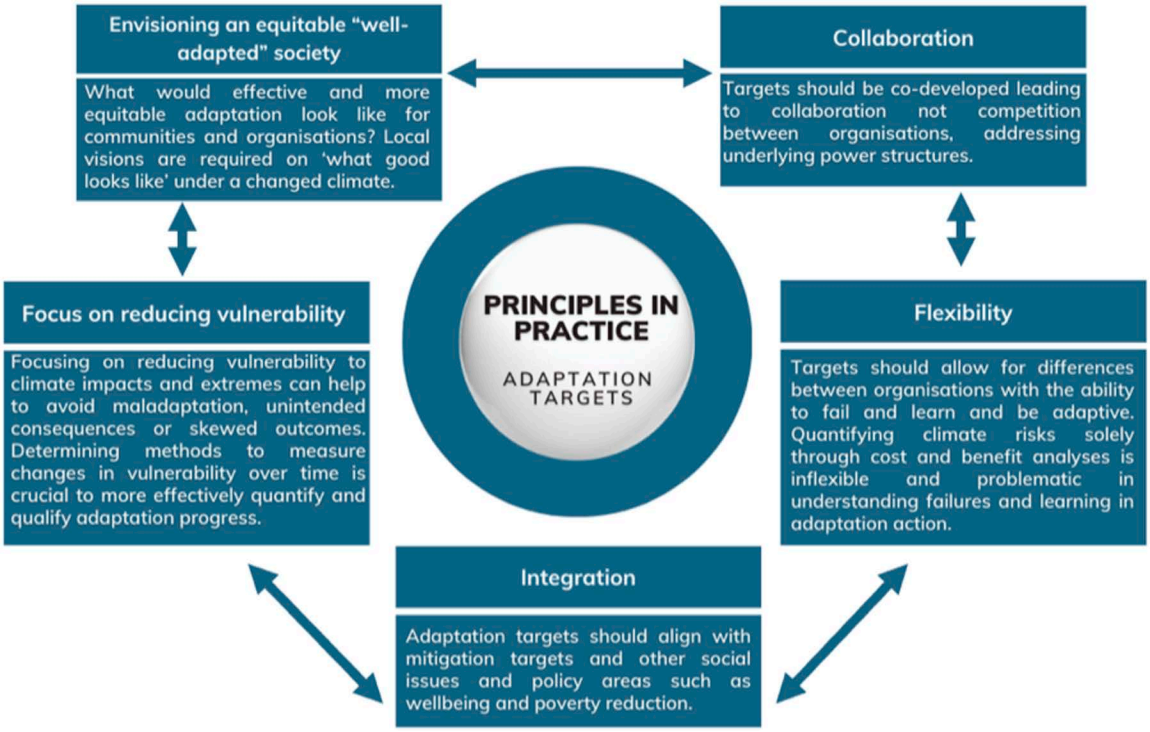

Fig 1. Key Principles in Practice for the development of local adaptation targets.

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understanding of who are currently and potentially vulnerable to climate risks, needs to be prioritised in any local adaptation planning, considering how vulnerabilities can shift and evolve depending on both exposure and vulnerability, and the climate hazard in question. This also requires considering how climate impacts and adaptation actions could reduce or exacerbate existing inequalities and injustices. Our five principles help ensure that outcome-focused targets achieve this aim, and reduce the potential for maladaptation [11]. For instance, a community may come to rely on a flood defence (the managed risk), rather than undertaking additional, but critical, measures such as household readiness, building community capacity, or changing upstream land management practices, thus increasing their vulnerability through exposure to residual, or unmanaged risk [17]. Further, the development of adaptation targets should not only account for socio-economic and biophysical contexts and their outcomes and drivers at different scales, but also be fully integrated in assessing and foresighting social and political place-based climate risks to reduce vulnerabilities [18] and to ensure more robust locally-contextualised adaptation policy. The likelihood of experiencing impacts from climate extremes, such as heat-stress, correlates with income level leading to social, economic and political inequalities, that could lead to failure in other policy domains [19]. By understanding who is currently most vulnerable to the impacts of climate change and why, and how this may change over time, local visions could provide effective ideas of how to build resilience. Also, with any associated target created, the question must be asked: does this target reduce risks to those who are most vulnerable to the impacts of climate change now *and* in the future? While this question warrants further consideration in measuring local adaptation response, in many cases it is not yet possible to quantify local vulnerability or resilience. But this does not mean adaptation actions cannot be taken [20]. To guide better local vulnerability reduction decisions, questions include: What are the worst case future climate scenarios or storylines? What actions can be taken to adapt and increase resilience? Who is responsible for financing this? Is that just?

Collaboration

To reduce maladaptation and to ensure adaptation targets motivate effective adaptation actions that reduce vulnerability, targets should be co-designed and co-delivered at the local level. Co-production of specific local adaptation knowledge that underpins targets to inform national and subnational policy is needed, resolving existing power imbalances as much as possible – or, at least, making them explicit. Individuals and community members worst affected by climate change are often excluded from discussions about how risks are managed: co-production is a method to support those voices and ensure those most vulnerable have increased decision-making power and agency. Adaptation targets that are place-based should be created and actioned in a collaborative manner with local businesses, councils and communities who need to come to an outcomes-based agreement (and outcomes in practice) that is qualified and directed by a shared vision of an equitable, "well-adapted" society that more fairly distributes risks. Since emergency responses to extreme weather events (including floods, extreme heat and wildfires) require collaboration and coordination of actions across groups, organisations, sectors and actors, adaptation targets should also actively embed collaboration while reducing the need for organisations to compete for resources.

Integration with other policies

Adaptation targets should be integrated with other policy areas like water, food and health and need to be more broadly aligned with climate mitigation efforts [13]. When considering what adaptation targets might look like, there is a need to co-design and foresight broader climate policy goals and benefits to ensure policy coherence between mitigation and adaptation at the national and local level [21]. For example, new housing fitted with solar panels to meet mitigation aims should also be designed to avoid overheating in preparation for more frequent and intense heatwaves (adaptation), whilst avoiding incurring additional energy use and emissions (e.g., from air conditioning) [22]. In many countries, there is considerable traction around "net zero" messaging which could be adapted to "resilient net zero" to better incorporate adaptation alongside ongoing mitigation efforts [23].

Flexibility to allow failure and learning through "adaptable" places

While any adaptation targets must aim to create a "well-adapted" place, there are many variables and uncertainties associated with our future, including variability in the climate system and resulting weather events, and uncertainty in future emissions pathways. Additional factors such as the state of the economy and other social pressures are also significant. This requires flexible targets that can be revisited and re-adjusted through time to align with societal and physical/climatic changes and as knowledge develops. It can therefore be more useful to think of framing targets as aiming to create "adaptable" places rather than "adapted" places. This is because targets, and processes to meet any target, must be iterative to take account of non-linear, uncertain and/or compounded physical and socio-political risks.

Any targets designed at the national scale need to be flexible enough to allow local decisions to be made more smoothly by relevant stakeholders. Often targets will be applied to complex, dynamic systems, such as ecosystems, and will need to have a degree of malleability as our knowledge changes, with a risk associated with overly reductive, fixed, single-measure targets. Additionally, our understanding of who is most vulnerable to climate change impacts may change, and adjustments might need to be made to ensure the most vulnerable are protected. Flexibility in targets could also allow for feedbacks between the local and national levels to occur through an iterative learning process. There is an administrative trade-off between multiple, more useful targets and the associated workload in measuring and reporting, and fewer highly aggregated targets which are less capable of measuring system resilience. Finally, targets must be flexible enough to allow a process of failure, evaluation and learning, whilst retaining an understanding of the common attributes of adaptation knowledge that can inform policymaking [24].

Limitations and suitability

This piece advances debates about local adaptation targets by offering principles on how those targets can be designed to ensure local adaptation planning is more equitable and fit for purpose. We recognise that similar principles have been developed in relation to adaptation implementation [25]. However, we aim to advance the debate on how such principles can be used in *target creation*. Many of the principles relate not only to the *outcome* of adaptation actions but to the *process* of creating adaptation knowledge and implementing actions. For example, the importance of collaboration and co-producing a shared vision of an equitable "well-adapted" society. While mitigation targets can be quantified by measuring greenhouse gas emissions, our principles demonstrate a need for qualitative adaptation targets – and current global climate policy is now dictating it through the Global Goal on Adaptation. This may mean that adaptation targets could align with mitigation through, for example, Just Transition policies that will also require a qualitative aspect of measurement. A preference for quantifiable adaptation targets should not devalue or circumscribe other meaningful yet qualitative measurements. For example, the "percentage of people with strong sense of belonging to local community" was an indicator presented in Canada's National Adaptation Strategy with the view that a sense of belonging can lead to resilience against shocks [26]. In Scotland's National Adaptation Plan Monitoring and Evaluation Framework [27], "the number of public bodies citing "work in partnership & collaborations" as a priority" in annual reporting is included, emphasising the importance of the *process* of adaptation implementation as well as highlighting the need for collaboration to ensure efficient implementation of adaptation actions.

Alignment between principles and subsequent targets remains a challenge. The principles are interdependent and should be used together to create adaptation targets that reduce vulnerability and share the ownership of risk collaboratively, as illustrated in Table 2. Here, a hypothetical tree planting case-study is used as an example of how the principles could create adaptation targets in practice that focus on reducing vulnerability, are community-driven and integrated into key policy areas. Key challenges will be to manage the power relations associated with the equitable ownership of risks that are unevenly distributed nation-wide, or for different groups and communities. This challenge requires that a diverse range of views are represented and respected in participatory processes for transformative change over business-as-usual. In addition, transparency of the actors that decide what actions or targets are pursued is critical here to highlight power imbalances, as transformative change will require adaptation actions that challenge existing power relations as opposed to reasserting them [7]. Furthermore, developing local adaptation targets will require an understanding of the barriers and enablers at play in the creation of such targets including budget and resource constraints for example [28]. The effectiveness of adaptation targets for building resilience in practice remains a complex challenge. Adaptation targets may, intentionally or otherwise, close-off some actions, and open others, which may increase or decrease resilience. It is, therefore, crucial that the proposed principles are instructive rather than prescriptive, to facilitate further debate and research in the adaptation community. Conversely, without adaptation targets that are not set within clear equity principles - and the vision that goes with them - the momentum for more robust evidenced-based research on this issue could ultimately hamper adaptation financing and delay policy action decisions.

Conclusion

The Global Goal on Adaptation and the UAE Framework for Global Climate Resilience cannot alone meet adaptation needs at the local level. Principles are needed to help nations translate adaptation targets *to the local scale*. We acknowledge the normativity of – and need for – globally-defined adaptation policymaking, particularly to release adaptation finance. Yet creating effective *local* adaptation targets, nested within national and global targets is highly challenging. Our five key principles help address this challenge, emphasising the need for targets to be usable and equitable. Targets need to be iteratively monitored and evaluated over time to address questions over governance, shared ownership, uncertainty, and equitable justice.

Table 2. An example of outcomes using the guiding principles set out in this article for tree planting. Tree planting and/or the creation of green spaces is an objective within many nations' climate policies due to their coupled climate mitigation- adaptation co-benefit potential, e.g., as a carbon sink, providing shade during heatwaves and flood risk attenuation. Without such principles, a target could be created for a single benefit that is focused solely on the number of trees planted, raising the likelihood of maladaptation. With the guiding principles, a target for multiple benefits will also consider the variety of trees planted and how this can meet biodiversity, health, mitigation and adaptation goals; processes for how organisations and communities within a place could collaborate on the goal and consider the location of tree planting to reduce vulnerability and clarify the ownership of unevenly distributed risks.

Principle	With consideration of the principles
Envisioning an equitable "well-adapted" society	Tree species are used for multiple benefits to meet the community's vision of an equitable "well-adapted" society. This could include trees or shrubs that provide shade during heatwaves and/or reduce flooding risk through water retention. If the region's vision includes an increase in biodiversity this will also be a required consideration for the species and variety of trees selected. Decisions on the species and varieties planted are made at the local/community level to ensure alignment with the local vision of an equitable "well-adapted" place and to include local knowledge in the decision-making process.
Collaboration	Communities are central to decision-making, including choice of suitable species and location of planting/green spaces and their management for multiple benefits. Local knowledge is used and centred in decision-making. This also increases public awareness of the need to adapt to climate change impacts. Resources are distributed to encourage collaboration between local authorities ensuring that the location of tree planting/green spaces takes into account societal impact and biodiversity impact as opposed to administrative boundaries.
Flexibility	Different species of trees can be planted in different areas depending on the needs of the area and their local vision for multiple benefits. A target considers the number of trees but also the biodiversity of green spaces created and their societal impact including number of vulnerable community members who have with access to green space following planting.
Integration	Trees are selected on their potential for mitigation and adaptation purposes, not simply the species with the highest potential for CO_2 uptake. For example, for their ability to provide shade in densely populated areas or to reduce water run-off into populated areas, increasing resilience to multiple, cascading risks. Green spaces are created with health priorities in mind due to the impact of green spaces on physical and mental well-being. Green spaces are created that meet biodiversity goals. Trade-offs between competing purposes are reduced by aligning around a common purpose to simultaneously address net zero, climate risks and the state of water and ecosystems through all uses of the land.
Focus on reducing vulnerability	Green spaces are created with communities in areas where community members are most vulnerable to climate impacts. A whole-catchment approach is considered, including the ownership of unevenly distributed risks. Green spaces are created in low-income areas allowing more people to access free outdoor space that provides health benefits and can provide shade during heatwave events.

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Visions of an equitable "well-adapted" society are needed that reduces vulnerability, engenders collaboration, integrates mitigation and other policies, and is flexible and supportive of failure and learning at the local level. Exploring the application of these principles as a nascent frontier of adaptation targets research that allies global adaptation goals with local outcomes must be a focal point of future adaptation targets research. In addition, future adaptation targets research will require innovative and novel ways of policy collaboration and implementation with local end-users creating context-specific, relevant targets that align to the broader outcomes under global frameworks rather than prescriptive, one-size-fits-all global targets. Qualitative targets could play a key role here to ensure flexibility, equity and justice, and importantly also focusing on the process of adaptation implementation and not just the outcomes. This requires more participatory, deliberative, governance.

Our five principles offer thought leadership in the adaptation targets research space – new analytical and practical foregrounding – that will require a change in the adaptation knowledge-practice-policy landscape with adaptation planning and

target creation requiring heightened collaboration between communities, organisations and governments with those most vulnerable centred in decision-making processes. Ensuring adaptation plans and associated targets reduce vulnerability of those most vulnerable to climate impacts is key and requires the incorporation of a more holistic, transparent and tangible framework, like the one we present, for tracking and measuring adaptation at the local scale and ensuring more flexible transition across different scales of implementation. There is a need to test how local adaptation targets, developed using these principles, work in practice. Particularly, understanding the barriers and enablers to implementing adaptation targets at the local level. Future research can also concentrate on how adaptation targets are developed, implemented and iterative monitored.

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