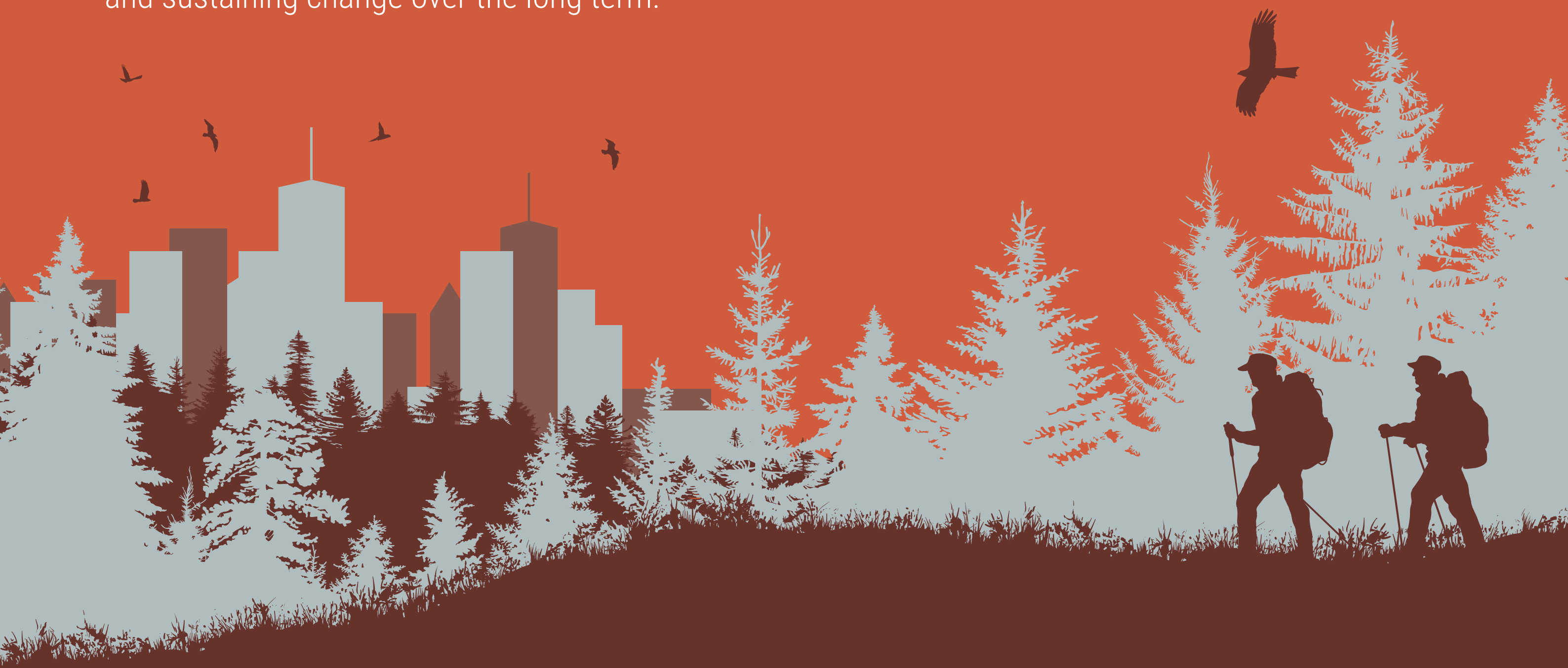
BRIEFING 2 NOTE

Navigating the adaptation challenge

Climate change adaptation is a multi-faceted challenge. Adaptation interventions need to both address current negative climate impacts and help people deal with future climate change in the long term. Adaptation also has to address many uncertainties: scientific uncertainty about projected changes and impacts, especially locally; technical uncertainty about the effectiveness of measures for addressing identified vulnerabilities now and in the future; socio-economic uncertainty about livelihood impacts and options, and capacities needed to adapt; political uncertainty about immediate and long-term structural and institutional changes needed; and financial uncertainty about funding and sustaining change over the long term.



It is both possible and necessary to move forward in meeting the adaptation challenge despite these uncertainties (Box 1). People's vulnerabilities to climate change are strongly linked to their dependency on ecosystems and their services – or the inability of ecosystems to provide these due to coupled climatic and non-climatic degradation processes (see Briefing Note 3). Therefore, most decisions on adaptation interventions represent a choice between measures that secure or build on ecosystem services (see Briefing Note 3) and those that mimic or supplement such functions with engineered and/or hybrid approaches (see Briefing Note 4). Ecosystem-based adaptation (EbA) therefore represents an appropriate strategy, alongside other approaches, to help meet the overall adaptation challenge.

This Briefing Note introduces how resilience thinking, which considers interactions within a coupled social-ecological system, can help to navigate the adaptation challenge and explores the use of ecosystems as part of the solution to the overall challenge. It also discusses a number of challenges inherent to EbA itself and how to move forward in addressing them.

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Using a resilience perspective to understand the adaptation challenge

The concept of resilience, which originated in ecology in the 1970s,[1] refers to the capacity of a system to absorb disturbances and still retain the same structure and function, or to 'bounce back'. Resilience thinking has since broadened[2] and been applied widely in the context of sustainability, including climate change adaptation. Recognising that humans are part of nature, it is typically discussed in the context of a coupled social-ecological system in order to avoid arbitrary boundaries and give both components equal weight.[3] Resilience is fundamentally about change processes and long-term trajectories[4] that can be non-linear and even transformative.

Although resilience is often interpreted as inherently good and therefore a desirable goal, it is not a normative concept – systems deemed undesirable by a particular group can be very resilient.[5] Resilience should therefore be used as a framework to describe dynamic systems in relation to change, and stakeholder groups within the system must decide whether the current state is desirable or not and choose a course of action accordingly.

The resilience perspective is therefore useful in deciding how to address climate change: it provides a framework to assess actions in a complex, interconnected system and encourages thinking beyond traditional solutions to meet adaptation objectives. Its consideration of thresholds ("boundaries around a system state, which if crossed represent a transition to a new system with a new set of components and relationships"[6]) can help determine whether it is feasible or desirable to keep the system in its current form.

How close a system is to a threshold will depend in part on the sensitivities of its components to climate-related stresses, shocks and extreme events as well as interactions among other pressures on the system.[7] The system's response will also depend on its adaptive capacity (i.e. capacity to learn, cope, innovate and adapt), which in turn is determined by the amount and diversity of social, economic, physical and natural capital, as well as social networks, institutions and entitlements to the distribution and use of such capital.[8] The IPCC[9] captures the interaction of sensitivity, adaptive capacity and susceptibility to harm in the concept of vulnerability, which together with exposure and hazards determine the level of climate risk. Furthermore, system response will also be influenced by changes occurring at other spatial and temporal scales.[10]

The Adaptation Challenge =
determining risks of climate change at different timescales
+ taking account of a range of uncertainties
+ choosing and implementing measures that are themselves resilient to climate change and appropriate to local circumstances

Depending on the interaction of such processes and drivers, a system (or some of its components) can either persist through resilience, undergo an unintended transformation to an undesirable state or be actively transformed to a new desirable state (Figure 1). If the system is characterised by strong stabilising feedbacks and high adaptive capacity, its components are likely to be resilient, persist and remain within the system's threshold. Otherwise, the system is likely to cross a threshold, moving to a new state that is often characterised by degradation and deemed undesirable. Where the current state of the system is not viewed as desirable and adaptive capacity is high, transformation to a new and potentially more beneficial state can be actively navigated.

Transformative change can require radically reorganising systems, which can be challenging and run into political and social resistance. Increasing transformative action may be required as climatic and non-climatic drivers of change (see Briefing Note 3) can push systems closer to their tipping points. For example, with shifting climatic zones, many traditional crops will simply no longer grow in certain areas. This may require shifting the focus of the entire local economy to a completely new model, enhancing resilience through socio-economic transformation. Where a social-ecological system is assessed as able to persist in the face of climate change with continued provision of ecosystem services, adaptation efforts can focus on strengthening ecosystem function and improving livelihoods within the existing socio-economic context. Adaptation thereby becomes "the process of managing system resilience" by maintaining its function in ways that avoid loss of future options.[11]

Box 1. Tackling uncertainties

- **Uncertainty in climate projections:** use an ensemble of climate models to get a spread of results, which can be integrated into climate risk assessments
- **Uncertainty in impacts on bio-physical systems:** use analogues of past experiences and extrapolate to the range of possible climate change impacts
- **Technical and socio-economic uncertainty:** learn from experience in-country or borrow from analogous cultural settings – test interventions in new settings
- **Political uncertainty:** consider how proposed adaptation measures may affect public opinion and policy priorities – some strategies might require more stakeholder engagement and awareness-raising
- **Financial and economic uncertainty:** ensure that adaptation interventions are included in existing long-term financial planning and budgets at national and other scales; identify new funding sources to lengthen planning horizons; carry out economic valuation studies as inputs into cost-benefit analysis; calculate financial costs and returns from EbA

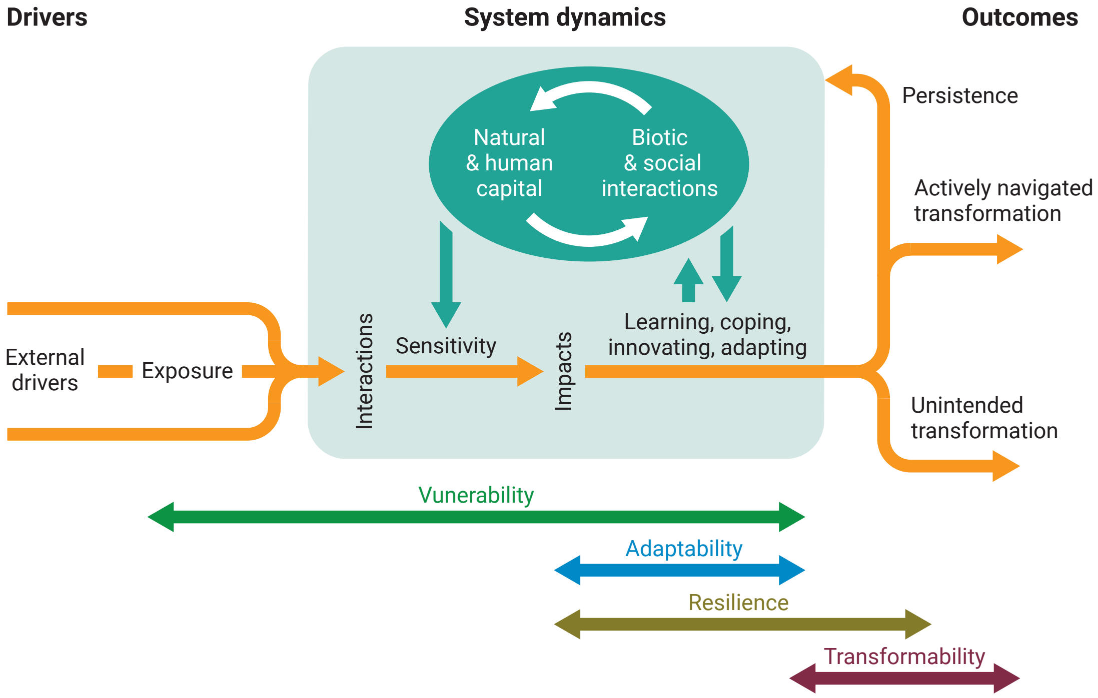

Figure 1. *A resilience framework for understanding change in a social-ecological system* (redrawn after Chapin et al. 2009).

The role of ecosystems in meeting the challenge

As highlighted by the Millennium Ecosystem Assessment, humans directly depend on ecosystems and their goods and services for their well-being. However, the abilities of ecosystems to supply these goods and services are being threatened by both climatic and non-climatic drivers of change (see Briefing Note 3). Therefore, measures aimed at restoring and/or building on provisioning, regulating, cultural and/or supporting services (Figure 2) to help people adapt to climate change (EbA) can contribute to their continued well-being by enhancing aspects such as security, basic material for a good life, health, and social and cultural relations.[12]

Adaptation benefits of working with ecosystems include:

- buffering communities from, or reducing the risk of, direct climate change impacts
- ensuring that ecosystem services on which communities depend persist and meet their needs despite climate change impacts
- supporting existing livelihoods and income-generation despite climate-related financial losses
- creating new livelihood options to replace those being threatened by climate change impacts

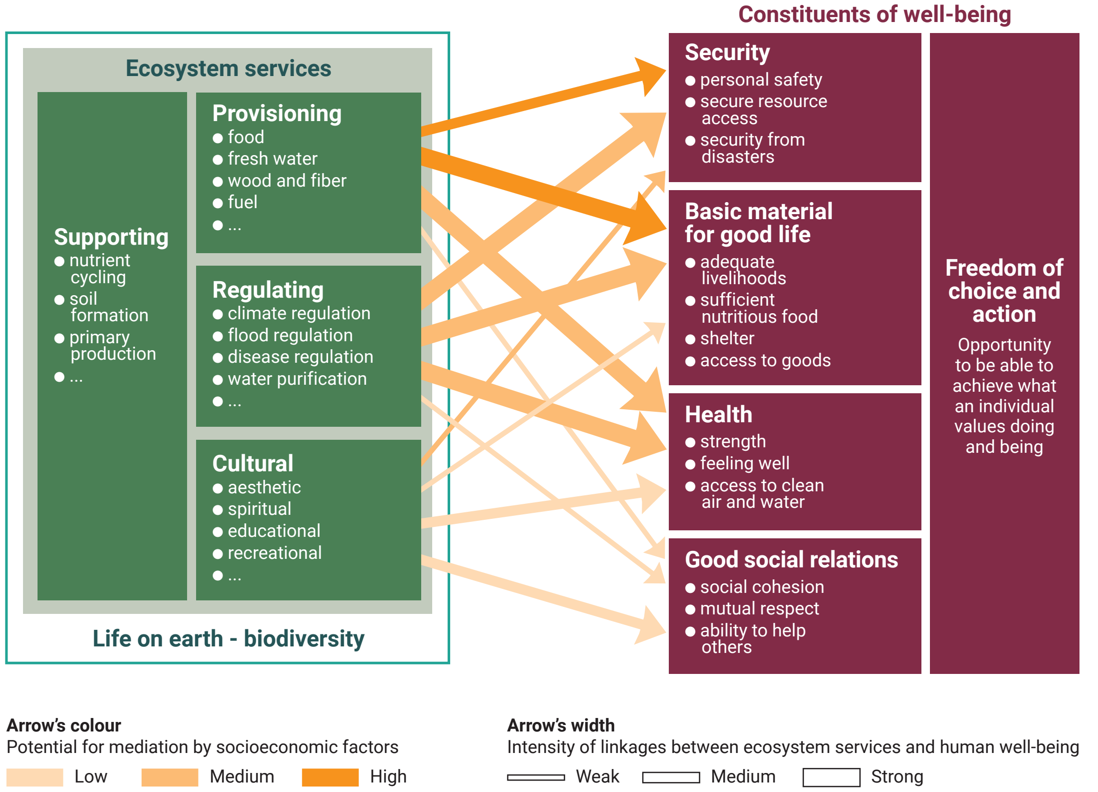

Figure 2. *Linkages between ecosystem services and human well-being* (source: Millennium Ecosystem Assessment).

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In designing EbA measures, it is important to determine how the ecosystem can support identified adaptation objectives (e.g. through protection, enhancement, transformation – see Briefing Note 4). This involves considering not only provisioning services, but also regulating and supporting services.

In order to work effectively with ecosystems to achieve desired adaptation goals, a number of uncertainties and challenges inherent to EbA need to be considered. These include uncertainties on how ecosystems themselves will respond to climate change impacts, particularly in the context of other anthropogenic pressures and drivers, and on the effectiveness and 'engineering tolerances' (permissible limits of variation in adaptation benefit) of EbA approaches. Further, EbA relies on ecological restoration processes that can take many years to provide evidence of tangible results. It can thus be unclear whether EbA produces benefits at a sufficiently fast rate to provide the necessary resilience vis-à-vis the rate of climate change and its impacts. Another challenge is incomplete knowledge on spatial trade-offs of costs and benefits in the wider landscape and potential losses or vulnerabilities in the social-ecological system resulting from EbA measures. For example, management of river flow to mitigate upstream drought and reduce flooding may reduce dry season water availability for downstream communities.

Applying the resilience framework can help navigate such challenges and uncertainties as it acknowledges that gains and losses are a necessary part of maintaining the resilience of an entire social-ecological system. Decisions about such issues must involve representatives of all affected stakeholders, acknowledging questions of equity and power relations,[13] enhancing capacity appropriately and providing compensatory measures where needed.

Resilience thinking and EbA are tools that, applied in tandem, can help understand and address the adaptation challenge through clarifying the adaptation objective, and identifying and implementing targeted adaptation actions. Once the adaptation objective has been identified, principles for promoting resilience in a social-ecological system (Box 2) can be used to guide EbA implementation.[14]

Box 2. Principles of resilience building

1. **Maintain diversity and redundancy**, allowing for some components of the social-ecological system to compensate for loss or failure of others.
2. **Manage connectivity and promote flexibility**, allowing for well-connected systems that more quickly overcome and recover from disturbances.
3. **Manage slow variables and feedbacks**, counteracting disturbance and change so that the social-ecological system recovers and keeps providing the same ecosystem services.
4. **Foster complex adaptive systems thinking**, acknowledging that social-ecological systems are based on a complex web of connections and interdependencies.
5. **Encourage learning**, ensuring that different types and sources of knowledge are valued and considered when developing solutions.
6. **Broaden participation**, actively engaging relevant stakeholders in order to build trust and expand knowledge needed in decision-making processes.
7. **Promote polycentric governance systems**, where multiple government bodies interact to achieve action in the face of disturbance and change.

Key action points

- Include investments to increase diversity and connectivity, and to enhance people's capacity to learn, innovate and adapt.
- Set an explicit adaptation objective and design a strategy for achieving it based on climate impact pathways and an understanding of non-climatic drivers.
- Invest in improving the flowing of all ecosystem services in order to enhance people's wellbeing.
- As a means of managing uncertainty, invest in monitoring and measuring ecosystem responses to change.

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