Briefing

Climate change

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Policy pointers

Familiar indicators of human wellbeing and development performance can be used to evaluate adaptation effectiveness, if they are interpreted in the context of climate information.

Over long timescales, planners can evaluate adaptation by asking whether wellbeing is stable or improving in the face of intensifying climate hazards.

Over shorter timescales, adaptation can be evaluated through comparisons with 'no-intervention' counterfactuals.

Using wellbeing indicators and climate information to assess adaptation effectiveness

Adaptation is increasingly heralded as the means to securing development in the face of climate change. But how can we be sure that it is effective? One option is to use a range of 'wellbeing indicators' alongside climate information to monitor and evaluate adaptation over the short and long term. Wellbeing indicators overlap to a large extent with standard development indicators. But they are influenced by variations and trends in climate and, if used alone, can paint a misleading picture of adaptation effectiveness. By combining them with climate information — data on how key climate variables and hazards change over time — evaluators can 'calibrate' wellbeing indicators to provide a more accurate assessment of adaptation activities.

Adaptation and wellbeing

The ultimate purpose of adaptation is to secure and improve human wellbeing — in line with national development priorities — in the face of climate change. So it makes sense to measure the effectiveness of adaptation — in terms of development success — using indicators of human wellbeing. These wellbeing indicators include common indicators of development performance that might be sensitive to climate, such as health, nutrition, water availability and livelihood-related indicators. But they also include indicators of the costs — to assets, livelihoods and lives — of the shocks and stresses associated with climate hazards.

Unlike resilience indicators, which are used to predict how people and systems will be affected by future shocks and stresses, wellbeing indicators are measured after the shock or stress has occurred, and so can paint a more reliable picture of their impact.

What is a climate hazard?

A climate hazard is a physical manifestation of climate variability or change to which populations and systems may be exposed. Hazards may be 'sudden onset' (for example, intense rainfall events) or 'slow onset' (for example, long-term declines in rainfall). They may be short lived (including storms, floods and droughts) or long lasting (for example, sea-level rise or shifts to more arid or humid climatic regimes). They may also be 'singular' and catastrophic (for example, glacial lake outbursts, or loss of land through large erosion events).

But wellbeing indicators will tell us little about adaptation if they are used in isolation. Any adaptation is unlikely to reduce the costs of climate stresses and shocks to zero, or completely eliminate the effects of climate on people's wellbeing. This means that wellbeing indicators will be influenced by variations and trends in climate, even if adaptation reduces the effects of climate hazards.

Monitoring wellbeing indicators over the long term may provide a good assessment of adaptation effectiveness

For a true picture of adaptation effectiveness, wellbeing indicators must be interpreted in the context of 'climate information' — quantitative and qualitative data on how climate hazards and variables are evolving (see 'Climate information', overleaf). Depending on the monitoring and evaluation task at hand, climate information can help contextualise or 'calibrate' wellbeing indicators in a variety of ways, over the long and short term.

Evaluating long-term adaptation

Development planners need to evaluate the extent and success of adaptation over long timescales at national, sectoral and local levels. They can do this by analysing long-term trends in wellbeing indicators — in the context of climate information, which shows whether hazards are getting worse, not changing at all or becoming less severe or less frequent. Three scenarios illustrate how climate information can alter the interpretation of trends in wellbeing indicators (see Table 1).

Scenario 1: Wellbeing indicators show clear improvement. The most likely interpretation of this scenario is that adaptation is occurring and is enabling people to improve their wellbeing despite climate change. But climate information is required to confirm this interpretation, as it is possible that hazards are not intensifying or they are reducing in frequency or severity.

Scenario 2: Wellbeing indicators show no significant change. This might be because adaptation has made little or no difference to people's wellbeing. But, if hazards are intensifying, adaptation is likely to have stabilised a development situation that would otherwise have deteriorated. Unless development planners understand how climate hazards are evolving, they will not be able to interpret such a scenario: they might mistakenly conclude that adaptation is not effective, and remove support that is preventing a decline in wellbeing.

Scenario 3: Wellbeing indicators show a decline. A crude conclusion here is that adaptation has failed. But it is possible that adaptation has prevented an even greater decline in wellbeing. Planners must assess whether climate hazards have intensified, and whether they have done so to such an extent that adaptation activities are inadequate. In other words, has adaptation actually failed or is it delivering 'invisible' benefits? The answer to this

Table 1. Possible explanations for trends in wellbeing indicators

Trend in wellbeing indicators	Possible explanations
Wellbeing has improved	Climate hazards have intensified and adaptation has enhanced wellbeing by reducing risk despite more intense hazards
	Climate hazards have not changed but adaptation has delivered benefits to wellbeing
	Climate hazards have weakened in strength or frequency to some extent, but adaptation has amplified the resulting benefits
	Climate hazards have weakened in strength or frequency significantly, and adaptation has contributed little to improved wellbeing
Wellbeing has remained more-or-less stable	Climate hazards have intensified but adaptation has prevented a decline in wellbeing ('invisible' benefits)
	Climate hazards have not changed and adaptation has not delivered benefits to wellbeing
	Climate hazards have weakened in strength or frequency but adaptation has been counterproductive or irrelevant in the face of other drivers
Wellbeing has declined	Climate hazards have intensified and adaptation has not been effective
	Climate hazards have intensified but adaptation has prevented an even greater decline in wellbeing
	Climate hazards have not intensified and adaptation has been counterproductive or irrelevant in the face of other drivers

question will enable planners to make informed decisions on abandoning or augmenting their adaptation activities.

Implicit in all these scenarios is the idea of a 'counterfactual' — a hypothetical scenario or narrative in which the same hazards occurred but there were no adaptation activities. By comparing these counterfactuals with reality, planners can better understand the true impact of adaptation.

In the counterfactuals for scenarios 1 and 2, climate change prevents development from improving wellbeing, or results in a decline in wellbeing. If hazards are intensifying but wellbeing is stable or improving, planners can conclude that adaptation is happening without the need to construct a counterfactual.

Scenario 3 is more complicated, as it involves comparing different degrees of decline in wellbeing. Here, it is important to build a counterfactual that describes how much wellbeing would have declined without adaptation.

Evaluating adaptation in the short term

Monitoring wellbeing indicators over the long term may provide government planners with a good assessment of adaptation effectiveness. But it is not always feasible or appropriate for evaluators of individual projects and programmes, which often last only a few years. Nonetheless, wellbeing indicators can still be defined at the impact level[1] and monitored over short time periods (a few years at most).

How this is done will depend on the availability of information, resources and expertise, as well as on the nature of the relationship between the relevant wellbeing indicators and climate variables. All methods still use climate information to put wellbeing indicators into context. Where they differ is in their approach to developing counterfactuals, and in their use of quantitative data.

Three options for assessing the impact of adaptation in the short term are outlined below.

1. Control groups. Changes in wellbeing indicators can be compared between beneficiaries of an intervention and a control group (those who have not benefited) through a randomised control trial (RCT) or 'difference in difference' (DiD) approach. RCTs require large sample sizes and will probably only work for a small proportion of projects or programmes. Conversely, DiD studies use small but representative groups of beneficiaries and non-beneficiaries and can be used to compare wellbeing indicators before and after the intervention. In either case, it is important to use climate information to confirm that both groups have been exposed to the same climate hazards. (Of course, the comparison groups should be as similar as possible in other respects too, to help rule out any other reasons for difference in wellbeing indicators.)

2. Event comparisons. Two or more similar hazards might occur shortly before, during, or soon after an adaptation intervention. If this is the case, it might be possible to compare the effects of these hazards and use participatory surveys and beneficiary narratives to investigate the reasons for any differences. Questions to ask here include: Have losses or other adverse impacts been reduced over time? Is the intervention responsible for these reductions (in whole or in part)? If so, to what extent did it contribute to them?

Climate information is again important to ensure that the hazards being compared are sufficiently alike. For example, daily pressure, rainfall and

Climate information

Climate information includes a variety of quantitative and qualitative data that describe how key climate variables and hazards have changed over time.

Some of these data can be obtained from national meteorological and hydrological services, and national and international research and monitoring organisations.

When these sources cannot provide appropriate data, evaluators can consult local people or organisations about the frequency and relative severity of climate hazards. Did a community experience drought in a given year? If so, was it moderate or severe? How many storms or floods occurred? Did rain arrive early or late? If monitoring systems don't already exist, they might be set up to monitor the relevant hazards.

Whatever the source, climate data must represent phenomena that clearly affect relevant aspects of wellbeing if they are to be useful in interpreting wellbeing indicators. Measures such as rainfall onset dates, duration of dry episodes during growing seasons, maximum daily rainfall intensity, and storm frequency and intensity are likely to be much more useful than average temperature or absolute rainfall amounts.

Once it has been collected, climate information can be used to interpret changes in wellbeing in a variety of ways. Most fundamentally, it can be used to reveal the general direction of change (if any) in key aspects of climate: have climate hazards become less severe or more severe, or have they exhibited no significant change? This provides a context for the development of adaptation narratives.

More sophisticated uses of climate information include the combination of climate data with wellbeing indicators to create indices such as costs per hazard event of/above a certain magnitude; and the use of climate data to model expected costs or effects, providing a counterfactual that can be compared with reality (see main text).

maximum wind speed data can be used to characterise storms and identify events of similar magnitude occurring in the same district. But it is also important to ensure that non-climatic factors that affect people's vulnerability to the hazards in question are sufficiently similar. For example, price rises in key commodities might mean that people have less to invest in reconstruction after a disaster. These price rises might be driven by changes in the global economy, national policies, or climate disasters in exporting countries.

3.Statistical models. Some wellbeing indicators are historically strongly correlated with climate variables. For example, annual growth in gross domestic product in sub-Saharan Africa is closely related to rainfall over certain periods.[2] Famine in northern Nigeria has been associated with deficits in rainfall above a certain magnitude.[3] And increases in mortality in urban centres across the world occur when temperature and humidity indices rise above certain thresholds.[4]

Such historical relationships can be used to model variations in wellbeing indicators, over time periods that include— and extend beyond — an adaptation intervention. The difference between these modelled changes to wellbeing and the actual changes measured on the ground can then be attributed to the adaptation intervention — assuming that other explanations can be discounted. Of course, approaches based on statistical modelling require both wellbeing indicator data and relevant climate data to be available over long periods (preferably several decades or more). And they are only applicable where clear relationships exist between relevant variables.

All three of the 'short-term' approaches — control groups, event comparisons and statistical models — can also be used to monitor the effectiveness of adaptation outside individual project and programme contexts, over both the short and long term. For example, they might be used to assess the effectiveness of adaptation that arises from changes in policies and governance; or they might be used to assess the cumulative impact of multiple adaptation projects or programmes.

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Knowledge Products

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Notes

[1] For example, indicators relating to mortality and declines in nutritional status resulting from climate extremes and disasters are defined at the impact level in DFID's BRACED programme. / [2] Petherick, A (2012) Enumerating adaptation. *Nature Climate Change* 2, 228-229; Richardson, CJ (2007) How much did droughts matter? Linking rainfall and GDP growth in Zimbabwe. *African Affairs* 106, 463-478; Barrios, S et al. (2010) Trends in rainfall and economic growth in Africa: A neglected cause of the African growth tragedy. *Review of Economics and Statistics* 92, 350-366 / [3] Tarhule, A and Woo, M-K (1997) Towards an interpretation of historical droughts in northern Nigeria. *Climatic Change* 37, 601-616 / [4] Conti, S et al. (2005) Epidemiologic study of mortality during the Summer 2003 heat wave in Italy. *Environmental Research* 98, 390–399; McMichael, AJ et al. (2008) International study of temperature, heat and urban mortality: the 'ISOTHURM' project. *International Journal of Epidemiology* 37, 1121–1131