

## Vital Signs for Managing Climate Change

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Many quantities have been used to describe climate and its likely trajectory. Yet policy makers and the public hear mostly about only one of them - global surface temperature. The goals of climate policy are rarely expressed in terms other than global temperature and much of the public debate is around this single parameter. The 2C goal adopted by UNFCCC has been identified by IPCC as critical and has the merit of being simple and understandable.

But surface temperature is by no means the best or the most unequivocal tracer of climate change: less than 2% of global energy content goes into heating the atmosphere. There are also many other and possibly better indicators to communicate the rate and extent of climate change – sea level rise, ice extent, ocean acidification, and so on.

While many climate change metrics and indicators already exist, there is a need for an agreed set of planetary vital signs that replaces the sole use of temperature to focus policy analysis. The two-degree goal focused the work of the scientific and policy communities. Now attention is turning to how to make and measure progress in climate change mitigation and adaptation after COP21. This time, the policy community will need a basket of indicators to organize attention.

In addition to metrics that track changes in the physical climate, policy makers need risk indicators. Change metrics and risk indicators differ in the way they handle uncertainty. Climate change metrics track most probable outcomes and not outliers. On the other hand, the greatest risks are often associated with those outliers. Clearly, the methods used to develop climate metrics cannot be translated wholesale into those that produce risk indicators. Neither type suffices. Both are needed.

Risk can only be defined in relation to desired objectives. As an important example, in September 2015, the UN General Assembly endorsed a set of 17 sustainable development goals and 169 associated scientific and social indicators, of which at least 65 are directly related to spatially disaggregated descriptors of the physical Earth system.

An international effort convening natural and social scientists, policy experts, decision makers, and communicators should commence forthwith to design the initial vital signs. If initial vital signs are not in place at the entry into force of COP-21 commitments in 2020, it will be hard to infuse them into policy analyses later. The 2020 deadline would indicate a timeline something like:

Phase A (2016-2018): Nomination and vetting of initial vital signs

Phase B (2018-2020): Beta-testing (experimental production), development of certification and governance mechanisms, finalization of basket

Phase C (2020- ): Implementation