

Correspondence

Concern grows for Turkey's academics

We strongly urge the Turkish government to stop prosecuting academics, to abide by international human-rights values and to respect civil liberties — including freedom of speech (see *Nature* <http://doi.org/bbxj>; 2016).

In a petition to the government this month, more than 2,000 academics from Turkey and thousands of international scholars have called for an end to the curfews and violence against people in Kurdish provinces. This prompted Turkey's President Recep Tayyip Erdoğan to order the Higher Education Board to take action against those academics he described as committing “treason”. Istanbul's Chief Public Prosecutor launched a criminal investigation based on Article 301 of the Turkish Penal Code, which prosecutes those who insult the state.

We are deeply concerned about this escalating crisis. We hope that the international academic community will join us in condemning these attacks against our colleagues in Turkey.

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Synthesize evidence to steer decisions

Using evidence mapping to display and categorize environmental studies cannot replace ‘evidence synthesis’ in guiding decision-making (M. C. McKinnon *et al.* *Nature* **528**, 185–187; 2015). There are no shortcuts to evidence-based practice.

The results of investigations need to be synthesized to allow conclusions to be drawn from contradicting data (L. V. Dicks *et al.* *Trends Ecol. Evol.* **29**,

607–613; 2014). Studies can be assigned a ‘level of evidence’ indicator of design and quality, which is derived from evidence hierarchies (see, for example, A.-C. Mupepele *et al.* *Ecol. Appl.* <http://dx.doi.org/10.1890/15-0595.1>; 2016). This indicator reflects the confidence with which the reported outcome can be causally attributed to the investigated driver.

Practitioners' questions are rarely answered directly by an existing set of studies. Evidence-based medicine tackles this problem by developing clinical guidelines on the basis of collated scientific results and clinical experience, and by using systematic reviews of research results and evidence assessments that are supported by hierarchies.

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Hold atmosphere in trust for all

We, the undersigned, call on the V20 — the 20 countries that are most vulnerable to the effects of climate change — to take the lead in creating an ‘atmospheric trust’ that establishes community property rights over the atmospheric commons (www.claimthesky.org). The V20 could use this trust as a legal instrument to address the climate crisis and to help to implement last month's Paris agreement to keep warming well below 2 °C.

Under public-trust doctrine, certain natural resources such as soil and water must be held in trust to serve the public good. It is every government's responsibility as a trustee to protect these assets as natural capital and to maintain them for the public's use, not give them away or sell them to private parties. The global atmosphere is one such asset.

An atmospheric trust would act as an independent agency and trustee. It could collect

claims for damages to the atmosphere and invest funds in mitigation, adaptation and compensation, and in resources for the most affected populations. Because only 90 enterprises (mainly extractive industries) are responsible for two-thirds of global carbon emissions (R. Heede *Clim. Change* **122**, 229–241; 2014), damage claims could target a relatively small number of entities.

All governments would eventually be co-trustees in the atmospheric commons, with a fiduciary responsibility to protect it from catastrophic releases of greenhouse gases.

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What stops women getting more grants?

Women make up 33% of the applicants who are eligible for programmes funded by the UK Biotechnology and Biological Sciences Research Council (BBSRC), but they lead only 21% of grant applications. The percentage receiving large grants of more than £2 million (US\$2.8 million) remains stubbornly low: in 2014, women had a success rate of 17% compared with 44% for men. To investigate this, we informally surveyed focus groups from seven BBSRC-funded universities (see go.nature.com/wqrfz3).

All groups cited society's expectations of professional women and (unconscious) biases against them. They also specified the way in which science as a profession organizes itself and how esteem is rewarded; and dominant behaviours by full-time researchers (primarily men) that seem to attract support at the expense of more-junior, part-time or flexitime researchers (primarily women). There were perceived inconsistencies

in the grant-award process, including in the quality and tone of reviewer comments and committee feedback, and concerns about gender imbalance in the reviewer pool.

The BBSRC is working with its research communities to address these issues. We welcome suggestions that could help us to achieve a more diverse and inclusive research community (see also M. Urry *Nature* **528**, 471–473; 2015).

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Solar energy needs focus

The high cost of solar photovoltaic installations prevents them from providing more than about 1% of the world's electricity requirement. A solution would be to incorporate an optical concentrator in the solar photovoltaic module that would save on expensive materials without compromising electrical output.

Optical concentrators focus solar energy on a small area attached to a photovoltaic cell (P. Gleckman *et al.* *Nature* **339**, 198–200; 1989). However, this technology has been held back by its complex manufacturing and assembly processes, its modest electrical-conversion efficiency and a lack of government funding and policy.

Researchers, industries and governments must work together to resolve the technical issues associated with this promising technology and come up with a practical, industry-ready design to revive the solar energy market.

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JESSICA SCRANTON



The impact of sustainability measures such as Mexico's Encrucijada Biosphere Reserve can be assessed by aggregating existing reviews and impact evaluations.

Map the evidence

Too many studies go unread. Collate them to enable synthesis and guide decision-making in sustainability, urge **Madeleine C. McKinnon** and colleagues.

“What if someone had already figured out the answers to the world’s most pressing policy problems, but those solutions were buried deep in a PDF, somewhere nobody will ever read them?” asked a *Washington Post* blog last year.

It was on to something. Many of the tens of thousands of documents that are produced every year to assess the impacts of sustainability policies and programmes are never read¹. In 2014, the World Bank²

found that almost one-third of its archived policy reports — documenting the impacts of its numerous projects, from dam construction to microcrediting — has never been downloaded.

It doesn’t have to be this way. Experts in evidence synthesis, a field that involves the use of various tools and methods to locate and combine many sources of data, are starting to produce evidence maps for wayfaring researchers and policymakers. These pull together and categorize systematic reviews,

impact evaluations and other primary-research studies in a particular area (such as agriculture or education), and visually distil the scope and effects of interventions that have been implemented³.

Evidence maps can show at a glance which areas or relationships have been studied most — whether it be the impact of ecotourism on local economies or of education on reducing harmful fishing practices. They can also highlight key gaps in the evidence base, and so guide the prioritization of research. ▶

► We are an interdisciplinary working group supported by the Science for Nature and People (SNAP) Partnership that aims to understand how protecting nature can enhance human well-being (see go.nature.com/fdsj4v). We contend that evidence mapping should be applied to sustainable development much more broadly. To aid decision-making at the intersection of development and conservation, we have produced an interactive map that categorizes more than 1,000 studies documenting links between conservation efforts and human well-being. We urge policymakers and researchers working in sustainability to develop similar tools to enable researchers, donors and practitioners to rapidly find and assess the information relevant to them.

MIND THE GAPS

Failure to evaluate the existing evidence can result in unnecessary harm. For example, conducting a systematic review in the 1960s of the available data on cot death (instead of waiting until the 1990s) could have led to earlier recognition of risk factors associated with infant sleeping positions and prevented an estimated 10,000 infant deaths in the United Kingdom alone⁴.

Another consequence may be overlooking the relative costs and benefits of different interventions. Development projects designed to prevent diarrhoeal disease, for instance, continue to emphasize the importance of providing people with access to clean water. Yet a 2012 synthesis⁵ of different sanitation interventions indicates that prioritizing certain behavioural changes, such as hand-washing, can bring equivalent health and other benefits, and cost much less than introducing a new water supply.

Often people assume that there is evidence to justify a particular intervention, or they act on the basis of what is familiar rather than what is proven. Establishing and maintaining national parks and other protected areas is one of the more prevalent conservation approaches used by governments and non-governmental organizations. Yet a 2013 systematic review⁶ of qualitative and quantitative assessments of protected areas worldwide shows that many of the broad assumptions that underlie their creation — that protected areas have positive social impacts, say, or provide economic benefits through tourism — are not reliably supported.

Systematic reviews of multiple studies, such as the three just described, enable researchers to assess the quality of the available evidence and to make predictions about the effectiveness of a programme more broadly. Yet because documents are often inaccessible — hidden behind paywalls, or buried in hard drives and filing cabinets in field offices — obtaining the relevant publications and reports to conduct such reviews

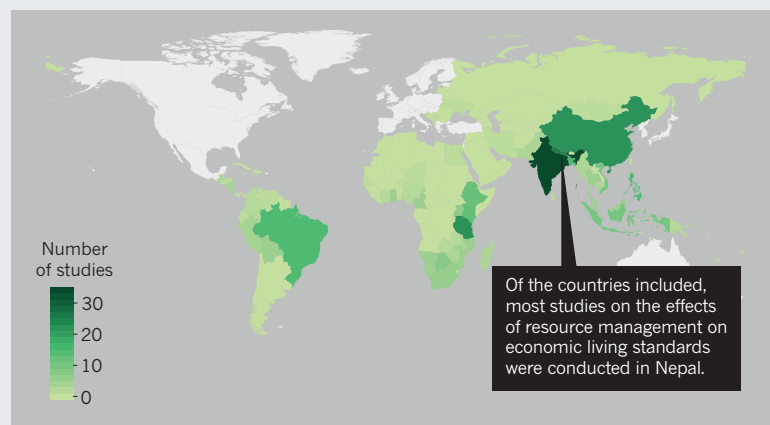
NAVIGATING WHAT'S KNOWN

An evidence map is produced by collecting and categorizing studies that probe the link between conservation efforts and human well-being. It reveals where data are available to establish causal pathways, and where there are gaps in the knowledge.

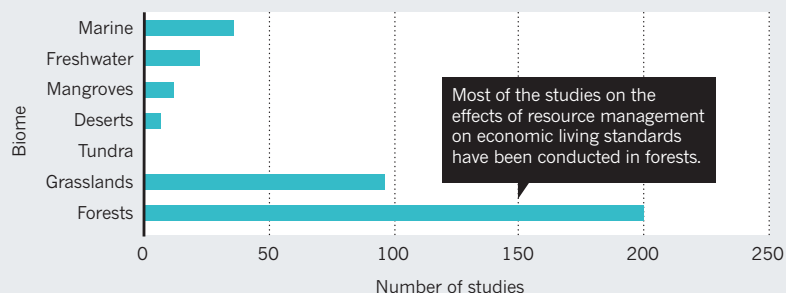
More than 1,000 studies were included in the evidence map on the basis of systematically designed selection criteria.



A search of these 278 studies by country indicates where in the world they have been carried out.



Or these 278 studies can be searched by the biome in which they were conducted.



is costly and time consuming.

The resources currently allocated to monitoring and evaluation — on average, less than 5% of a conservation project's budget — do not come close to what is needed to satisfy the increasing demand from policymakers for more and higher-quality evidence on the impacts of conservation and development interventions¹.

INTERNATIONAL EFFORTS

Researchers and others need new ways to prioritize efforts, to ensure that funded evaluations and systematic reviews address relevant questions and to track progress in the generation of evidence.

Encouragingly, various organizations have begun to produce and fund systematic reviews and high-quality evaluations to assess the effects of conservation interventions. Among them is the International Initiative for Impact Evaluation (3ie), a non-governmental organization that promotes evidence-informed policies and programmes for development.

Standards, tools and practical guidance — for instance, on steps to reduce bias — have also begun to emerge. For instance, international research networks, such as the Collaboration for Environmental Evidence, are promoting the use of rigorous methodologies to assess the environmental, social and health impacts of specific interventions⁷, such as planting hedgerows or the use of genetically modified crops. The Evidence for Policy and Practice Information and Co-ordinating Centre at the UCL Institute of Education is developing various tools to help researchers to retrieve, characterize and extract data when doing evidence synthesis. We think that evidence maps should be added to this growing stock of synthesis tools.

Over the past five years, 3ie, and researchers funded by the organization, have generated five maps for a broad range of topics, from education to sanitation and hygiene. These maps identify well-studied areas, such as the effects of hand-washing and other sanitation measures on the incidence of diarrhoea. The maps also flag gaps in research. For instance, little is known about the impact of education-related interventions on household expenditure or child labour. As far as we know, no other evidence maps relevant to sustainable development have been created.

We have extended 3ie's effort by creating a map of the scope and amount of existing evidence on the impact of nature conservation on human well-being globally⁸. To do this, we mined online databases and websites and asked individuals who were well-positioned to alert us to studies. We narrowed our search to studies published since 1970 that had been conducted in developing countries. We then took systematic steps — based

on factors such as study design and type of conservation intervention — to winnow our collection. Following 3ie, we included systematic reviews and impact evaluations. We also categorized other primary research studies, such as non-comparative studies in which no control situation was available to compare the causal effect of the intervention.

Our map reveals that around 25% of the 1,014 studies we categorized measured the economic impacts of establishing and maintaining protected areas, whereas only 2% considered equally important measures of well-being, such as the health of local communities (unpublished work). More data, for instance, on the country and biome in which the study was conducted and on the study design, enable users to explore in more detail the distribution and robustness of the evidence base (see 'Navigating what's known'). For instance, we were surprised to learn that since 1970, almost half of all rigorous impact evaluations have been conducted in only six countries — including Tanzania, China and Thailand. Eight of the 90 such studies were carried out in Costa Rica, probably in part thanks to the country's strong governance in environmental issues and its well-established research community.

Our map also exposes areas where more data are needed. In Indonesia, for example, little is known about the relationship between conserving marine ecosystems and the sense of empowerment felt by local communities. And it illuminates which relationships are well-studied and ripe for analysts to explore trends and examine causal pathways through full systematic reviews — such as those between fisheries resource management and economic and material well-being.

GLOBAL CHALLENGES

Evidence maps are needed for a broad range of topics that are central to sustainable development, such as renewable energy, food security and disaster-risk management. As new evidence becomes available, such maps will need to be updated, ideally by a central curator, to enable researchers to track progress in plugging knowledge gaps. Publishers are well placed to catalyse the development of such shared map resources by enabling broader access to their journals and encouraging the use of standardized search terms and approaches in individual studies. Donors should make the placement of a study in an open evidence repository a condition of funding — such as public funding agencies, such as the US National

Institutes of Health, require grant recipients to make their research openly available to the public through PubMed Central.

The Sustainable Development Goals (or Global Goals) were launched in September by the United Nations. Among the 17 priorities for governments, businesses and others are addressing climate change, alleviating poverty and malnutrition and protecting the planet's natural resources. Information on what kinds of interventions are effective in helping the world to meet these and other challenges, and under what conditions, will be crucial to guiding policy and tracking progress⁹.

An evidence atlas for sustainable development, progressively updated and improved, could help to transform the work of addressing global challenges into a rigorous science. ■

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For a list of co-signatories to this article, see go.nature.com/qjuwlk.

CORRECTION

The Comment article 'Find asteroids to get to Mars' (R. P. Binzel *Nature* **514**, 559–561; 2014) omitted sources for the graphic 'Mission requirements'. The credit has been updated online at go.nature.com/6je8v3.