FNI Report 4/2015

The state of technology transfer obligations in global environmental governance and law: biodiversity conservation and sustainable use

Christian Prip, G. Kristin Rosendal and Morten Walløe Tvedt

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

CEBPOL
Centre for Biodiversity Policy and Law

The state of technology transfer obligations in global environmental governance and law: biodiversity conservation and sustainable use

Christian Prip
cp@fni.no

G. Kristin Rosendal
kristin.rosendal@fni.no

Morten Walløe Tvedt
mwt@fni.no

Report in cooperation with the Center for Biodiversity Policy and Law (CEBPOL), NBA, Chennai, India

December 2015

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

NORWEGIAN EMBASSY

NORWEGIAN ENVIRONMENT AGENCY

CEBPOL
Centre for Biodiversity Policy and Law

Title

The state of technology transfer obligations in global environmental governance and law: biodiversity conservation and sustainable use.

Publication Type and Number

FNI Report 4/2015

Pages

18

Authors

Christian Prip, G. Kristin Rosendal and Morten Walløe Tvedt

ISBN 978-82-7613-697-5

ISSN 1893-5486

Abstract

Technology transfer (TT) is of high importance for India and also in global environmental governance. This is reflected in horizontal UN goals and instruments as well as in various multilateral environmental agreements. This report addresses the conditions for and the state of technology transfer, with a focus on conservation and sustainable use of biodiversity. It also debates how technology needs in this field are similar to or differ from the needs in other fields of global environmental governance such as climate change and chemicals.

Key Words

Technology transfer, conservation and sustainable use of biodiversity, international envrionmental governance

Foreword / Preface

This report is a contribution to the Centre for Biodiversity Policy and Law (CEBPOL), India. The Centre has been established in the National Biodiversity Authority (NBA), Chennai, a statutory autonomous body of the Ministry of Environment, Forests and Climate Change, responsible for implementing the Biological Diversity Act of 2002. CEBPOL is a joint project on technical and institutional cooperation between the Government of Norway and the Government of India as part of the Indian–Norwegian dialogue under the Joint Working Group on Environment.

This report constitutes the second report on technology transfer of which the report Dhillion, S. 2014. *Technology transfer in India: CBD, institutions, actors, typologies and perceptions* (FNI Report 2/2014. Lysaker) constitutes the first. The first part focuses on TT in India and deals with technology transfer primarily in relation to utilization of genetic resources, biotechnology and the Access and Benefit Sharing (ABS) regime of the CBD.

Contents

1 Introduction

Technology transfer (TT or Tech Trans) is of high importance for India and also in global environmental governance. This is reflected in horizontal UN goals and instruments as well as in various multilateral environmental agreements.

This report addresses the conditions for and the state of technology transfer, with a focus on conservation and sustainable use of biodiversity. It also debates how technology needs in this field are similar to or differ from the needs in other fields of global environmental governance.

As environmental problem-solving often involves the application of specific technologies that originate in developed countries, facilitating the transfer of such technologies to developing countries constitutes a central goal in many international environmental agreements. Technology transfer *between* developing countries is also on the rise, with a potential for altering the preconditions of global TT negotiations (Lewis, 2014). While this cross-sectoral theme constitutes a key aim of most global environmental treaties, as well as in the Global Environment Facility (GEF) work and project portfolio, TT has received relatively limited scholarly attention as regards its implementation and operationalization.

A core structural challenge concerning technology transfer as part of global environmental law is that, in international law, obligations are directed at states, whereas the *owners of* technology are often private companies or private persons. This means that the duty subject (the state) is not the entity that is obliged to transfer the technology. As such, this is not different from other aspects of international environmental obligations, which often require the enactment of domestic legislation in order for the treaty party (the state) to comply with its obligations. The special circumstance of ownership is, however, a largely neglected aspect in relation to TT obligations.

Agenda 21, Chapter 34, concerns the transfer of environmentally sound technology, cooperation and capacity-building. Similarly, the Open Working Group of the General Assembly on Sustainable Development Goals has included in its proposal a Goal 17.7: to promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries. This shows how TT in global environmental governance is not only about technologies in general: the technology must also be environmentally sound. In this report we examine how the concept is formulated in multilateral environmental agreements, with a focus on the Convention on Biological Diversity (CBD), drawing also on possible lessons from the climate change regime (UNFCCC) and the Montreal Protocol of the Vienna Convention for the Protection of the Ozone Layer. We include the ozone regime because it is known to have relatively advanced TT and the UNFCCC because it constitutes a global environmental problem of similar magnitude and threat as the loss of biodiversity. The objectives of these treaties and the technologies involved vary considerably: there is no common framework for TT internationally (Lewis, 2014). Nevertheless, we deem it pertinent to compare how TT has been understood and undertaken in these areas of international environmental cooperation. We assume the probability of common barriers and options involved in the implementation of TT, but also that technology and TT in relation to biodiversity have distinctive points compared to the other areas.

With its three objectives – conservation, sustainable use and equitable benefit sharing – the CBD draws up two TT tracks: for biotechnology, and for conservation and sustainable use. During the negotiations of the CBD, TT was seen very much in light of the emerging demand for biotechnology, which is also a basis for the CBD provisions on access to genetic resources and equitable sharing of the benefits from their use. Thus, TT and ABS are often viewed in combination; some mistakenly assume that TT obligations are merely a part of access and benefit sharing (ABS). As described in CBD Art. 16, technology transfer is a stand-alone mechanism aimed at contributing to conservation and sustainable use of biodiversity through environmentally sound technology. The second TT mechanism has received far more attention and is linked to access and benefit sharing. In ABS, technology transfer is part of the mutual contractual transactions where a country rich in genetic diversity can require, amongst other types of benefits, transfer of technology from the party that utilizes and draws benefits from the use of the genetic resources of the former. This second mechanism as a part of ABS is discussed in the context of India in a twin report to this report. Technology transfer as part of the legally binding ABS regime of the CBD has been discussed thoroughly in connection with efforts at further strengthening ABS through the Nagoya Protocol and in the Bonn Guidelines.

However, TT as a tool for conservation and sustainable use of biodiversity (CBD Art. 16) has not been explored or dealt with extensively by the CBD. Therefore, the present study focuses on the technology transfer obligation in Art. 16 of the CBD, comparing it against how technology transfer mechanisms have been formulated and applied in global environmental treaties dealing with climate change and chemicals. Here we identify technologies aimed directly at biodiversity conservation, rather than those which might treat biodiversity as at best a co-benefit and at worst are harmful to biodiversity. By also including a broad literature review of scholarly discussions of the state of TT, we seek to provide an updated view of the state of TT and whether there are lessons to be learned across environmental issue areas, with a focus on biodiversity conservation and sustainable use.

TT and IPRs

TT depends not only on the existence of the right technologies, but also on their availability. Intellectual property rights are typically applied to all areas of technologies, so the technology transfer for all kind of environmental agreements and the intellectual property are necessarily interlinked. The relationship between TT, intellectual property rights (IPR) and environmental obligations gives rise to several questions regarding the complex interaction between private and public actors, also as regards the government of the provider country (Clapp, 1998). These activities take place within a loosely regulated field, including multi- and bilateral trade agreements and predominantly voluntary measures for environmental standards. Seen against international environmental agreements, the patent system is an arrangement far more enforceable as a legal system (compared to any obligations tied to TT). Domestic patent law has been functioning well, and provides a legal system for creating and enforcing exclusive right to inventions and techniques. The TRIPS agreement of the WTO establishes standards with which all WTO members must make their patent systems compatible – also as regards making these systems available for protecting *all* technologies, including those relevant to the environment and biodiversity conservation.

In addition, technologies and TT relevant to the environment and to conservation are subject to voluntary codes of environmental conduct. Significant among these voluntary codes are the ISO 14000 environmental management standards, which are influenced by industry and industry advocacy associations, such as the International Chamber of Commerce (ICC) with its business charter for sustainable development (Clapp, 1998). The effects of intellectual property rights are disputed: some see costly and broadly defined patents as a growing barrier to TT and innovation in general, whereas others consider well-functioning IPR systems to be a prerequisite for foreign investments and TT. Strong patent protection of environmentally and biodiversity-friendly techniques places them within the exclusive rights of the inventors. In effect, the obligations in international environmental law to conduct technology transfer create a potential tension between two types of laws: environmental and patent legislation.

Before moving on to a comparison of the various TT obligations and their respective relationship to intellectual property rights, it is relevant to take a closer look at the different ways of dealing with technology transfer.

2 Conditions for successful technology transfer

For technology transfer to be a successful venture, there are at least three main conditions to be met. Each condition is necessary but not sufficient for successful application of TT.

The first condition is the *existence* of relevant technology to resolve a particular environmental problem. This may involve technologies for biodiversity conservation and sustainable use, for combating climate change, or any other environmental problem dealt with in international environmental law. Spurring environmentally friendly technology can be done by creating private economic incentives for developing new technologies through the use of the patent system and by making public funding available to produce technological solutions to the environmental problems. The alternatives of either private incentives or publicly funded technology-development often co-exist as a mixture of the two (as exemplified by the US Bayh-Doyle Act, which permits a university, small business, or non-profit institution to pursue the IPR of a publicly funded invention in preference to the government.

The second criterion is that the relevant technology is *disseminated* in a manner which makes it available to the countries and entities in need of the technology. This is a question of access to the technology and hence the rules regulating exclusive right to it. Here the rules on technology transfer are of core relevance.

The third criterion is that the technology is *applied* in a manner conducive to solving the problems it is meant to resolve. This concerns how the technology is applied at the ground level so as to yield the expected *ecological impact* on the environmental problem in question.

This report focuses on the second and, to some extent, the first criteria for successful technology transfer, although this is much too limited a study to resolve or answer the questions posed in any detail. The second criterion (access) may to a larger extent that the two others be addressed by international agreements / institutions on TT. The first and third criteria are more contingent on the specific domestic and ecological situation, which is beyond the scope of the present report.

3 TT in multilateral environmental agreements

Gillespie (2005) traces the emergence of TT in global negotiations back to the 1963 UN Conference on Science and Technology for the benefit of the Least Developed Countries. He notes that it has also figured significantly in UN environmental conferences, from the 1972 Stockholm Conference on the Human Environment, to the World Summit in Johannesburg in 2002. While TT constitutes a central principle of several environmental treaties, it has remained largely unspecified, without resolving many of the initial debates concerning a New International Economic Order, including North/South disputes over common but differentiated obligations and funding of environmental initiatives and policy measures (Gillespie, 2005).

A broad review of the literature shows that there has been substantial writing on TT within the fields of climate change, energy and pollution control, a bit on TT and genetic resources/biotechnology, and very little on TT and conservation issues. Hwang and Lee (2011) discuss i.a. the potential for transferring abatement technology; Forsyth (2007) analyses how private–public partnerships can enhance climate and energy technology transfer; and Saikawa and Urpelainen (2014) examine how developing countries may employ environmental standards – using emission standards as a case – as a lever to instigate technology transfer in the transport sector. Haites et al. (2006) find that about one third of the projects under the Clean Development Mechanism (CDM) of the UNFCCC involve technology transfer, in the form of equipment or knowledge. Drawing attention to the importance of accessing the necessary technology, Chuffart-Finterwald (2014) points to the simplification and the creation of an environmental patent pool for enhancing transfer of technologies that can lower emissions, mitigate and help adaptation to climate change. Suzuki (2013) cites the absence of an enabling environment in developing countries as the main barrier to successful technology transfer in the energy sector.

Before moving on to the CBD and specific conservation-related technologies, let us examine the obligations linked to TT in the Ozone/Montreal Protocol and the UNFCCC.

3.1 The Ozone Regime and its Montreal Protocol

The Montreal Protocol stipulates that the Parties shall take steps to ensure that the best available, environmentally friendly substitutes to ozone-depleting substances and related technologies are expeditiously transferred to developing countries, and that these transfers occur under fair and most favourable conditions (Art. 10A).

The ozone regime is widely regarded as the most successful treaty also in terms of technology transfer. In this case, the aim was to assist developing countries in phasing out ozone-depleting substances (ODS). Since 1991, more than USD 3 billion has been disbursed from the Montreal Fund, with industrial conversion, technical assistance, training and capacity-building as central elements (Lewis, 2014). The Montreal Protocol had the added strength of an Implementation Committee and a Multilateral Fund. Ozone had the added benefit of offering a clear focal point – the development of substitutes for ozone-reducing emissions. That the chemicals industry sector soon saw the potential involved in producing substitutes for ozone-depleting substances is seen as a major factor in the relatively swift success of the ozone regime (Næss, 2004).

The ozone regime's strong emphasis on technological innovation and also technological diffusion through technology transfer reflected the interests of both developed and developing countries, and contributed to effectively phasing out the use of ozone-depleting substances (ODS) (Andersen et al., 2007: 293). Part of the success is attributed to the financial assistance, but also to the 'ability of the regime to identify and remove barriers to TT, including through national law and voluntary coders' (ibid.: 294). The Multilateral Fund covers the incremental costs of TT, and a significant part of TT proceeds through voluntary measures. This is where the ozone regime differs from other global environmental problem areas, which largely depend on the increasingly strained Global Environment Facility (GEF) for covering the incremental costs of complying with treaty obligations but is not directly geared towards TT. Domestic law is crucial for TT, and the Parties to the Montreal Protocol have largely followed suit in introducing financial incentives to spur TT – as through substantial taxes on ODS, making the transition to ODS substitutes quicker and spending revenues from these taxes on TT (ibid.: 316). Moreover, most of the technologies needed were already in the public domain, and could be obtained at reasonable prices and terms, reducing the barriers created by IPR (ibid.: 318). In the remaining cases, compulsory licensing was available but rarely necessary: TT gradually became attractive as competing alternatives to ODS were rapidly being developed. This was possible as technologies protected by IPR were transferred through the 'fair and favourable conditions' negotiated under the GEF and the Multilateral Fund (ibid.: 256).

3.2 TT within the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the International Panel on Climate Change (IPCC)

According to UNFCCC Article 4.5, developed countries 'shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention.' The Article further prescribes that developed countries shall support the development and enhancement of endogenous capacities and technologies of developing countries.

The Kyoto Protocol includes a more general obligation of country parties to cooperate in the promotion of effective modalities for the development, application and diffusion of the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries. This includes 'the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector, to promote and enhance the transfer of, and access to, environmentally sound technologies (Art. 10C).

A key entity established with the 2010 meeting in Cancun is the Climate Technology Centre and Network (CTNT).

While the CBD does not have its own definition of TT (IBN, 2004), the concept of technology transfer in the climate change concept is defined by the Intergovernmental Panel on Climate Change (IPCC) – Methodological and Technological Issues in Technology Transfer, IPCC 2000 – and is embodied in the UNFCCC technology transfer framework. Technology transfer is defined as:

> ….a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions…
>
> … the broad and inclusive term 'transfer' encompasses diffusion of technologies and technology cooperation across and within countries. It covers technology transfer processes between developed countries, developing countries, and countries with economies in transition. It comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose and adapt to local conditions and integrate it with indigenous technologies.

The IPCC describes three major dimensions necessary to ensure effective technology transfer: capacity-building, enabling environments, and mechanisms for technology transfer.

The GEF applies the same TT definition as does the IPCC. Within the GEF project portfolio, 11 approved national and seven regional/global projects aim directly at TT, 14 of which are within the focal area of climate change and the remaining four are multifocal.[1] A search 'technology transfer' as keyword coupled with 'biodiversity' and/or 'land degradation' as focal areas in the GEF project portfolio yielded no hits. This would seem to substantiate how biodiversity (which, along with climate, constitutes about 80 per cent, and the second main bulk, of GEF funding) does not attract funding for TT, and that loss of biodiversity is less readily seen as amenable to technological solutions.

Interestingly, measures to facilitate access to finance and technologies in the climate regime have also been depicted as a form of benefit sharing. With reference to (and co-evolving with) the CBD, the framing of the underlying equity questions in terms of benefit sharing is seen to draw attention to the advantages derived from environmental protection also in the climate-change regime (Morgera, 2014: 3). Central here are the Clean Development Mechanism (CDM) and REDD+, both aimed at the transfer of monetary benefits as well as non-monetary ones, including technology transfer. As yet, the effectiveness of these mechanisms in providing the latter has been inconclusive, due to lack of evidence and indicators (ibid.: 9). A fairly solid conclusion would seem to be that these transfers only marginally reach or aim at the least developed countries (ibid.: 9).

This is of interest also as regards a main finding of Rosendal and Andresen (2012) in their study of GEF projects for biodiversity and climate change: that when it comes to strengthening capacity-building in the poorest developing countries, the GEF is of more critical importance in the biodiversity area than in the area of climate change. We return to this aspect in part 4.

TT projects aimed at climate change are certainly not irrelevant for biodiversity conservation. Climate change poses a threat to biodiversity, mainly by exacerbating the other main drivers of biodiversity loss – habitat destruction and degradation, pollution, and invasive alien species. On the other hand, there is also a risk that technologies aimed at climate-change mitigation and adaptation may themselves constitute threats to biodiversity, as seen with certain types of biofuels and plantations. Often established as part of REDD+ projects or the CDM, they may endanger natural ecosystems, such as virgin forests (Gardner et al., 2012;

---

[1] http://www.thegef.org/gef/project_list?keyword=technology+transfer&countryCode=&focalAreaCode=all&agencyCode=all&projectType=all&fundingSource=all&approvalFYFrom=all&approvalFYTo=all&ltgt=lt&ltgtAmt=&op=Search&form_build_id=form-Gted8BDXF7p0WnAEKkN4Oi_BxsQGu8TZ-3lDcCI8bKY&form_id=prjsearch_searchfrm Accessed 3rd December 2014.

McDermott et al., 2012; O'Connor, 2008). There is a direct link between forest protection, carbon storage and biodiversity conservation; however, evolving carbon markets have largely failed to value biodiversity, because carbon sequestration in plantations is a more attractive economic proposition (UNEP, 2009).

3.3 TT within the Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD), Article 16.1 on Access to and Transfer of technology states:

> Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.

For developing countries 'the access and transfer of technology shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms' according to Article 16.2, which also stipulates that, in the case of technology subject to patents and other IPR, access and transfer shall be provided on terms that recognize and are consistent with the adequate and effective protection of intellectual property rights.

Article 16.3 addresses TT as a means of benefit sharing for access to genetic resources, while Article 16.4 requires States to take legislative, administrative or policy measures so that the private sector can facilitate access to, joint development of and transfer of technology for the benefit of the governmental institutions and the private sector in developing countries. Finally, Article 16.5 calls on States to cooperate and ensure that IPRs are supportive of and do not run counter to the objectives of the Convention.

Several other CBD provisions are relevant to TT. These include Article 12 on training and research, Article 17 on information exchange, Article 18 on technical and scientific cooperation, Article 19 on biotechnology, and Article 15 on access to genetic resources and benefit sharing.

The concept of technology as generally understood under the Convention includes both 'hard' and 'soft' technology. The former refers to the actual machinery and other physical hardware that is transferred, whereas the latter refers to technological information or know-how. Such 'soft' technology is often transferred within long-term scientific and technological cooperation, including though joint research and innovation which move ideas from invention to new products, processes and services.[2]

Technology Transfer was one of the most contentious issues of the CBD negotiations, reflecting the North–South debate in other international fora over the issue and the fact that it was linked to the ABS and IPR discourses. The tough negotiations, with major divides between developing and developed countries, resulted in the rather ambiguous Article 16 whose imprecise text reflects the complexity of the political debate and subsequent compromise reached during the negotiations (Glowka et al., 1994).

The prominent status of TT during the negotiations of the Convention stands in stark contrast to the limited attention that Article 16 and TT (in particular as a stand-alone issue) have received by the CBD after its entry force. One explanation, as mentioned above, is that TT has been viewed as an ABS sub-issue and thus been dealt with (when at all) in that context alone. Another explanation is that technology and TT in the context of biodiversity is viewed as a rather abstract, less tangible concept compared to TT in the context of e.g. climate change, ozone depletion and the handling of hazardous waste.

An early CBD COP decision from 1996 (COP3 Decision III/16 endorsing SBSTTA recommendation II/3) calls for an integrated approach to TT, acknowledging that the concept cannot be seen in isolation from the range of issues covered by the Convention and its thematic areas (which the CBD might decide to address further and which have later been expressed in the form of CBD work programmes). In fact, this approach has been followed to some extent, since CBD thematic work programmes – explicitly or implicitly – often include issues related to technology and TT. This is an aspect that is sometimes overlooked in criticisms of how marginally the CBD has dealt with TT. One example is the CBD Programme of Work on Protected Areas from 2004, which includes Goal 3.3, 'To develop, apply and transfer appropriate technologies for protected areas'.[3]

This sector- and issue-based approach to TT became superseded by the cross-cutting and conceptual programme of work on TT and technological and scientific cooperation from 2004 (COP/DEC/VII/29). As stated in the CBD cross-cutting programme on TT: 'Both access to and transfer of technology among contracting Parties are essential elements for attaining the objectives of the Convention. Contracting Parties undertake to provide and/or facilitate access and transfer to other Contracting Parties of technologies that are relevant to the conservation

[2] CBD Strategy for Practical Implementation of the Programme of Work on Technology Transfer and Scientific and Technological Cooperation, at: https://www.cbd.int/tech-transfer/ahtegtechnologycooperation.shtml

[3] http://www.cbd.int/programmes/pa/pow-goals-alone.pdf

and sustainable use of biological diversity or make use of genetic resources and do not cause significant damage to the environment.'[4]

COP 10 Decision X/15, 1(b) adds that the Clearing House Mechanism of the CBD includes TT on the list of priority activities.[5]

4 Technologies for biodiversity conservation and sustainable use

Given this rather vague picture of what biodiversity-related technology actually is, what does the academic literature have to say about technology for biodiversity conservation in general? Lomborg (2001) argues that technological progress may reconcile economic growth with biodiversity conservation. A more mainstream argument see steady-state economy as a more likely prerequisite for biodiversity conservation, regardless of technological developments, as R&D is closely linked to economic growth (Czech, 2000, 2003). However, the academic literature on this topic is relatively scarce.

The CBD database on *Scientific and technological cooperation and TT* lists 23 cases of TT, the majority of which concern climate-change projects, energy efficiency and production.[6] At the top of the list is a GEF report on ten cases aimed at the energy sector and climate change; none of these deal with biodiversity conservation (GEF, 2000). Another CBD-listed report concerns the potential of agricultural technologies to reduce pressures on scarce land. More than 40% of the world's surface is used for agriculture; hence, sustainable intensification of agriculture on already cultivated land is an aspect of biodiversity protection. These technologies are disputed, as they often involve integrated crop management, including the increased use of herbicides, pesticides and costly input factors.

Further, the CBD database provides one hit when seeking for technology cooperation and sustainable use: The Equator Initiative. Seeking for technology cooperation and obstacles to TT in the database gave nine results, most of them dating from 2001 to 2004. In a note by the secretariat of the United Nations Forum on Forests it was concluded that TT for sustainable forest management is broadly hindered by lack of funding and limited technical capabilities in developing countries (E/CN.18/AC.2/2003/3) and similar conclusions are drawn in notes from the WTO, OECD, UNCTAD and the CBD. Technologies relating to sustainable forest management include assessment and monitoring technologies, integrated information management systems, sustainable forest management practices, harvesting and processing technologies, recycling of wood, fuel wood energy technologies, and sound techno-

[4] http://www.cbd.int/programmes/pa/pow-goals-alone.pdf
[5] 1(b):'Analyse and disseminate concrete and practical information as well as best practices on ongoing activities that support, facilitate, or promote technology transfer as well as scientific and technological cooperation'.
http://www.cbd.int/decision/cop/default.shtml?id=12281#cop-10-dec-15-ax-g1 Accessed 5 May 2015.

logies for secondary wood products (E/CN.18/AC.2/2003/3). Searching for technology cooperation and all activities in the CBD database provided 11 documents, including on low-pressure irrigation systems, reclaiming and rehabilitation of nature reserves and degraded areas, domestication of indigenous fruit trees, non-chemical insect control and a couple of studies on water management.

A central document in the database is that from the German Institute for Biodiversity – Network (IBN), which has compiled a report on '40 shades of TT' (2004). This report includes biotechnologies, bio-resources technologies, and bionics, all of which are related to the use of genetic resources (the ABS-related track). Of closer relevance to conservation, the report lists various ecosystem technologies (agrobiodiversity, forest, mountain, marine water and inland water) and technologies for monitoring biodiversity.

In the field of biodiversity monitoring there are several technologies that can add value to conservation and sustainable use. Scientists using information and geospatial technologies can provide clearer and more complex data analysis of biodiversity information. Value may be added through geo-referencing and web-publishing collections, focusing on geospatial data. Remote sensing makes it possible to obtain information about the planet and human activities from a distance, revealing features, patterns, and relationships that may not be possible or readily accessible from ground level. Remote sensing makes it possible to obtain information about the planet and human activities from a distance, revealing features, patterns and relationships that may not be possible or readily accessible from ground level. Remote sensing can provide an overview of the interaction of our complex biosphere components and is especially useful in monitoring landscape change (Strand et al., 2007). Geographic Information System (GIS) technology is also an effective tool for managing, analysing, and mapping biodiversity data. For example, biodiversity technologies research at Oxford is focused on the use of established and newly emerging methodologies to record, value and map biodiversity, from individual species through to landscapes. The specific aim is to develop automated tools that enable ready identification of species and the assessment of important regions for biodiversity conservation beyond established nature reserves. Moreover, web-based tools are being developed that can map dynamic features of any landscape in the world, to provide information on the important ecosystem properties and functions that it supports.[7]

Technology transfer in the context of biodiversity also concerns knowledge, methods and technologies within the various economic sectors (like agriculture, forestry and fisheries) that may be essential to achieve the objectives of the CBD. Many institutions and forums beyond

[7] http://www.biodiversity.ox.ac.uk/researchthemes/biodiversity-technologies/ accessed 8 December 2014.

the CBD are involved in examining and sharing the scientific knowledge concerning biodiversity and related technology.

A central forum is DIVERSITAS, which has been a platform for such activities and a network for scientific exchange.[8] It is engaged in capacity building for three interlinked reasons: 1) Knowing what biodiversity there is on Earth, how it is changing and why, and designing ways to use biodiversity and ecosystem services sustainably are fundamental goals of conservation science and policy. Although tropical areas host the greatest terrestrial species diversity, as regards the vast majority of tropical organisms, their abundance and distribution remain virtually unknown. For species that are already known, there may be only limited knowledge of their geographical distributions, practically no information on their relative abundances, and even less data on their temporal dynamics and the underlying drivers of change, and the consequences for the delivery of ecosystem services. In addition, most studies have focused on the ecology of these systems: there is also a need to establish joint natural and social studies to respond to the needs of society. 2) In contrast to the immense natural wealth of the tropics, financial resources and adequately trained personnel for conservation science and policy are critically lacking. 3) These pressing resource imbalances must be tackled through a combination of immediate remedies and long-term strategies for data collection, effective biodiversity protection and management, and capacity building.

In 2014, projects under DIVERSITAS were transferred into the broader organization Future Earth, along with the International Geosphere-Biosphere Programme (IGBP), the (IHDP) and the World Climate Research Programme (WCRP).

The *Global Biodiversity Assessment* (Heywood, 1995) was the first comprehensive review of knowledge on biodiversity. It was produced by UNEP, following a recommendation of the Scientific Advisory Panel of the Global Environment Facility (GEF). Subsequently, the *Millennium Ecosystem Assessment* (MA), published in 2005, assessed the consequences of ecosystem change for human well-being. From 2001 to 2005, the MA involved the work of more than 1,360 experts worldwide. Their findings provided a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide, as well as the scientific basis for action for their conservation and sustainable use.

The Global Biodiversity Outlook (GBO) is the flagship publication of the Convention on Biological Diversity. GBO provides a summary of the status of biological diversity and an analysis of the steps taken by the global community to ensure that biodiversity is conserved and used sustainably, and that benefits arising from the use of genetic resources are

[8] In 2014, projects under DIVERSITAS were transferred into the broader organization Future Earth, along with the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP) and the World Climate Research Programme (WCRP).

shared equitably. Together with partners, the Secretariat of the CBD has produced three GBO reports, with a fourth forthcoming (GBO 4), assessing midterm progress towards the implementation of the Strategic Plan for Biodiversity 2011–2020, as well as the Aichi Biodiversity Targets.

Established in April 2012, the *Intergovernmental Platform on Biodiversity and Ecosystem Services* (IPBES) is an independent intergovernmental body open to all UN member-states. The members are committed to building IPBES as the leading intergovernmental body for assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide. IPBES provides a mechanism for synthesizing, reviewing, assessing and critically evaluating relevant information and knowledge generated by governments, academia, scientific organizations, non-governmental organizations and indigenous communities, through involving a recognized group of experts conducting assessments of such information and knowledge in a transparent way. IPBES also aims at addressing the needs of Multilateral Environmental Agreements related to biodiversity and ecosystem services, building on existing processes to ensure synergies and complementarities in work.[9]

Research, observations, assessments and policy-oriented knowledge production are clearly important facets of mapping the wide range of technological needs relating to biodiversity conservation and sustainable use.

5 Comparison and lessons learned

Generally, the needs of TT for biodiversity conservation and sustainable use are perceived as quite different from the TT involved in combating environmental problems like climate change, or hazardous chemicals and waste. While ozone was greatly helped by adequate funding and accessible as well as reasonably priced technologies, we have seen that the situation is largely the reverse for sustainable forest management and biodiversity conservation. Media attention and economically interesting investment opportunities are features that may have enhanced TT in the climate & energy sector compared to biodiversity.

Technology transfer is recognized as essential to mitigate greenhouse gas emissions and enable adaptation to climate change in developing countries. This involves a range of technologies, including low-emissions technology and energy-efficient technologies. It also involves high costs. The climate change regime has instituted a Technology Mechanism consisting of a Technology Executive Committee and a Climate Technology Center and Network. Various forms of pollution control technologies are central for the chemicals and hazardous waste regime;

[9] Other important assessments include UNESCO's World Water Assessment Programme and the International Coral Reef Initiative.

for the ozone regime, the technologies involved in developing substitutes have played a major role. Also, as noted, in the case of the ozone regime, it was an advantage that most of the technologies needed were already in the public domain as this reduced costs relating to IPR.

The problems of climate change attract considerable political and media attention, as well as business and associated technology interests. Compared to the reduction of greenhouse gas emissions and pollution control measures, the loss of biodiversity is less immediately amenable to technological solutions (Jänicke and Lindemann, 2010). Emissions reductions can be achieved not only through reduced economic activity, bans and phase-outs, but also through technological development of substitutes like alternative and renewable energy sources and more energy-efficient products. In contrast, the problem of biodiversity loss may be less attractive to investors because it appears less responsive to technological (and commercially interesting) solutions (Rosendal and Andresen, 2011). Measures like biodiversity off-sets, the establishment of nature parks and conservation areas basically mean restricting economic activity for most purposes other than ecotourism.

It has become axiomatic that, compared to other environmental problems 'biodiversity loss less easily lends itself to technological solutions' – but this may not necessarily be an inherent characteristic. True enough, awareness raising, increasing the flow of funding for conservation areas, and reducing and removing environmentally harmful subsidies are all measures that involve little or no technology and thus little scope for TT. However integrating biodiversity conservation strategies into all planning processes and/or taking the full economic value of ecosystem services into decision-making processes might be arenas for technological innovation and hence have a potential for TT. There is also a technological potential in developing more sustainable intensification of agriculture, aquaculture, etc.[10] Moreover, developments in information technology and monitoring, including remote sensing technology and Geographic Information Systems (GIS) technology, can prove important in identifying priority areas for conservation. In terms of capacity, funding and institutions, these technologies range from low-demanding to high; some may be suitable for transfer also to low-income countries, where the loss of biodiversity is often high. However, as shown by the GEF project portfolio, there has been no international interest in co-funding TT in these areas. Comparison of the GEF funds going to ozone, climate change and energy projects geared towards TT with those for biodiversity shows there is clearly an unused potential.

The axiom might end up as a self-fulfilling prophesy, in that the idea of TT to developing countries for conservation purposes blocks financial flows to investments in conservation technologies.

While considering lessons learned, a central aspect is where TT would make the most difference for biodiversity conservation. Monitoring and

---

[10] http://www.greenfacts.org/en/biodiversity/l-2/6-conserve-biodiversity.htm#7 accessed 3rd December 2014.

GIS technologies are already well established in some of the areas most prone to biodiversity loss – in the rapidly shrinking rainforests of Brazil's Amazon regions and in several other Latin American countries. TT might have the potential for more significant impact the world's second and third largest remaining rainforest areas, within the Congo Basin and in Indonesia. However, as DIVERSITAS has recognized, here the receiving capacity might necessitate more resources in order to function according to goals. Judging from the experience with the CDM of the UNFCCC, the scope for significant investments in TT seems smaller in the least developed countries – where, in fact, the threat to biodiversity may be greater.

Regarding agro-technologies, another avenue to explore for TT could be to transfer lessons from intensive food production (but also fodders, biofuels, and coffee and tobacco). The lessons could be applied in areas particularly exposed to rapidly expanding plantations and various types of agro- and aquaculture that entail destructive effects to local habitats and species, in order to halt expansion into pristine areas. The growing demand for food and fuels, and consumption goods in general, will need to be met by producing more of these in high-rise buildings or out at sea – and here the role of and scope for TT seem hardly to have been considered.

Within the Convention on Biological Diversity, the concept of 'technology transfer' has always been perceived as important – but also as highly general, difficult to grasp or translate into practical action. It is important to continue de-mystifying the concept by breaking it down into concrete, operational identification of the technologies relevant to successful implementation of the Convention and its goals and work programmes.

References

Andersen, S.O., K.M. Sarma and K.N. Taddonio. 2007. *Technology transfer for the ozone layer: Lessons for climate change.* London: Earthscan.

Chuffart-Finterwald, S. 2014. Environmental technology transfer and dissemination under the UNFCCC: Achievements and new perspectives. *Environmental Claims Journal* 26(3): 238–260.

Clapp, J. 1998. The privatization of global environmental governance: ISO 14000 and the developing world. *Global Governance* 4: 295–316.

Czech, B. 2000. Economic growth as the limiting factor for wildlife conservation. *Wildlife Society Bulletin* 28**:** 4–14.

Czech, B. 2003. Technological progress and biodiversity conservation: A dollar spent, a dollar burned. *Conservation Biology* 17(5): 1455–1457.

Dhillion, S. 2014. *Technology transfer in India: CBD, institutions, actors, typologies and perceptions*. FNI Report 2/2014. Lysaker, FNI.

Forsyth, T. 2007. Promoting the 'development dividend' of climate technology transfer: Can cross-sector partnerships help? *World Development* 35(10): 1684–1698.

Gardner, T.A., N.D. Burgess, N. Aguilar-Amuchastegui, J. Barlow, E, Berenguer, T. Clements et al. 2012. A framework for integrating biodiversity concerns into national REDD+ programmes. *Biological Conservation* 154: 61–71.

GEF. 2000. *10 cases of technology transfer*. New York: GEF Secretariat.

Gillespie, A. 2005. *Climate change, ozone depletion and air pollution: Legal commentaries with policy and science considerations*. Leiden: Brill.

Glowka, L., et al. 1994. *A Guide to the Convention on Biological Diversity.* Gland and Cambridge: IUCN.

Haites, E., M. Duan and S. Seres. 2006. Technology transfer by CDM projects. *Climate Policy* 6(3): 327–344.

Heywood, V.H. (ed.). 1995. *Global biodiversity assessment,* UNEP (Cambridge: Cambridge University Press).

Hwang, U. and J. Lee. 2011. Cross-country technology transfer and politically driven international agreements for environmental standards. *Bulletin of Economic Research*. 63(4): 417–437.

IBN. 2004. German Institute for Biodiversity – Network (IBN) '40 shades of TT'. Presented at COP 7. https://www.cbd.int/doc/case-studies/tttc/tttc-00038-en.pdf

Jänicke, M. and S. Lindemann. 2010. Governing environmental innovations. *Environmental Politics.* 19(1): 127–141.

Lewis, J.I. 2014. Technology transfer, in J-F. Morin and A. Orsini (Eds) *Essential concepts of global environmental governance.* Abingdon: Routledge, pp. 207–209.

Lomborg, B. 2001. *The sceptical environmentalist: measuring the real state of the world.* Cambridge: Cambridge University Press.

McDermott, C.L., L. Coad, A. Helfgott and H. Schroeder. 2012. Operationalizing social safeguards in REDD+: actors, interests and ideas. *Environmental Science and Policy* 21: 63–72.

Morgera, E. 2014. Conceptualizing benefit-sharing: An emerging principle of equity in addressing global environmental challenges? BENELEX Project Working Paper 14/3 (Edinburgh Law School).

Næss, T. 2004. Ozone: A success story on all fronts? In J.B Skjærseth (ed.), *International regimes and Norway's environmental policy*. Aldershot: Ashgate.

O'Connor, D. 2008. Governing the global commons: Linking carbon sequestration and biodiversity conservation in tropical forests. *Global Environmental Change* 18: 368–374.

Rosendal, G.K. and S. Andresen. 2011. Institutional design for improved forest governance through REDD: Lessons from the Global Environment Facility. *Ecological Economics*, 70(11): 1908–1915.

Rosendal, G.K. and S. Andresen. 2012. *The Global Environmental Facility (GEF): The right mechanism for improved implementation?* FNI Report 4/2012. Lysaker: FNI.

Saikawa, E. and J. Urpelainen. 2014. Environmental standards as a strategy of international technology transfer. *Environmental Science and Policy* 38:192–206.

Strand, H., R. Höft, J. Strittholt, L. Miles, N. Horning, E. Fosnight and W. Turner, eds. 2007. *Sourcebook on remote sensing and biodiversity indicators.* Montreal: Secretariat of the Convention on Biological Diversity, Technical Series no. 32.

Suzuki, M. 2013. Addressing key issues in technology innovation and transfer of clean energy technologies: a focus on enhancing the enabling environment in the developing countries. *Environ Econ Policy Stud*. 16: 157–169.

UNEP. 2009. *The natural fix? The role of ecosystems in climate mitigation*. Cambridge: UNEP.

About CEBPOL

CEBPOL is a joint programme on technical and institutional cooperation between the Government of Norway and the Government of India as part of the Indian–Norwegian dialogue under the Joint Working Group on Environment.

CEBPOL is intended as a centre of excellence focused on biodiversity policy and law, catering to the needs of national and international rule-making and subsequent implementation on biodiversity issues. Its objectives are as follows:

1) to provide professional support, advice and expertise to the Governments of India and Norway on a sustained basis on matters relating to biodiversity policies and laws at the national level, as well as in international negotiations relating to biodiversity in multilateral forums;

2) to develop professional expertise in biodiversity-related policies and laws, *inter alia* by encouraging research, development and training in matters relating to the Convention on Biological Diversity, as well as its interface with other multilateral environment agreements and UN bodies;

3) to develop and implement an array of capacity-building programmes through multidisciplinary research and customized training programmes for a wide range of stakeholders, focusing on human resource development;

4) to facilitate interactive information sharing through web conferencing, web seminars and virtual meetings involving relevant research centers and environmental law associations in India, Norway and other countries where such expertise is available;

5) to help to develop India as a regional and international resource centre for biodiversity policy and law, through the provision of training and human resource development.

The Fridtjof Nansen Institute is a non-profit, independent research institute focusing on international environmental, energy, and resource management. The institute has a multi-disciplinary approach, with main emphasis on political science and international law. It collaborates extensively with other research institutions in Norway and abroad.

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

Fridtjof Nansens vei 17, P.O. Box 326, NO-1326 Lysaker, Norway
Phone: (47) 67 11 19 00 – Fax: (47) 67 11 19 10 – E-mail: post@fni.no
Website: www.fni.no