UN-REDD
PROGRAMME

Safeguarding and enhancing the ecosystem-derived benefits of REDD+

UN-REDD PROGRAMME

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Multiple Benefits Series **2**

The UN-REDD Programme, a collaborative partnership between FAO, UNDP and UNEP, was created in response to, and in support of, the UNFCCC decision on REDD at COP 13 and the Bali Action Plan. The Programme supports countries to develop capacity to reduce emissions from deforestation and forest degradation and to implement a future REDD+ mechanism in a post-2012 climate regime. It builds on the convening power of its participating UN agencies, their diverse expertise and vast networks, and "delivers as One UN".

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. The centre has been in operation since 1989, combining scientific research with practical policy advice.

The United Nations has proclaimed 2010 to be the International Year of Biodiversity. People all over the world are working to safeguard this irreplaceable natural wealth and reduce biodiversity loss. This is vital for current and future human wellbeing. We need to do more. Now is the time to act.

Prepared by

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Abstract

A future UNFCCC decision on REDD+ is expected to specify certain 'safeguard' requirements aimed at ensuring positive outcomes for ecosystem services, biodiversity and local rights and livelihoods. Individual developing countries may choose to adopt more detailed and/or stringent requirements on these potential multiple benefits of REDD+.

As the ecosystem services and biodiversity present in a forest vary with its type, history and management, REDD+ implementation decisions will affect their quality and quantity. The non-carbon services and biodiversity provided by REDD+ forests can be thought of as the 'ecosystem-derived benefits' of REDD+. Biodiversity also has a role as an enabler of REDD+, as biodiverse forests are expected to be more resilient to climate change, and include areas with very high carbon stocks.

The overall positive and negative effects on multiple benefits will depend upon a sequence of decisions taken in REDD+ design and implementation. Considering these benefits at each stage is likely to significantly enhance their delivery. Planning at an early stage for positive outcomes for multiple benefits can avoid inadvertent commitment to a suboptimal or actively harmful course of action. Making use of appropriate tools and putting policies in place to safeguard and enhance ecosystem-derived benefits can also increase the benefits from REDD+, sometimes at little additional cost.

This issues paper considers options to safeguard and enhance these benefits under a national REDD+ programme. It assesses the opportunities for and risks to these benefits during REDD+ preparation, design and implementation, measuring, reporting and verification. It focuses on those approaches to REDD+ for which there is scope to safeguard and/or enhance ecosystem-derived benefits, and which are included within the existing national strategies of UN-REDD Programme partner countries. It considers various tools and measures that are available to increase the opportunities for and decrease the risks to these benefits, and suggests some of the likely trade-offs between carbon, ecosystem-derived benefits and cost. Trade-offs may involve exchanging short-term use of resources for long-term sustainable use, or may involve a long-term prioritisation of one benefit over another.

Consultation, engagement and buy-in of stakeholders, from national government to local communities, are critical both for the overall success of REDD+ and to ensure that different values attached to potential multiple benefits are understood. At the national level, it is useful to identify the potential value of ecosystem-derived benefits and the groups that place value on it. This will help to demonstrate that added value to funders, sometimes to facilitate complementary finance, and to enhance the benefits' value to the nation and its forest-dependent communities.

Sauvegarder et renforcer les bénéfices écosystémiques de la REDD+ : Résumé

Une décision future du CCNUCC portée sur la REDD+ spécifiera sûrement la mise en place de certaines mesures de sauvegardes pour garantir des conséquences positives pour les services écosystémiques, la biodiversité et les droits des communautés locales et leurs moyens d'existence. Certains pays en voie de développement pourraient également choisir de mettre en place des mesures plus détaillées, ou strictes, sur ces bénéfices multiples potentielles de la REDD+.

Étant donné que les services écosystémiques et la biodiversité d'une forêt varient selon sa caractéristique, son histoire et sa gestion, la mis en œuvre des décisions de la REDD+ aura une portée sur leurs qualités et quantités. Les services écosystémiques non-liées au carbone ainsi que la biodiversité provenant des forêts ciblées pour la REDD+ peuvent être considérés comme les bénéfices écosystémiques de la REDD+. La biodiversité est aussi une condition préalable nécessaire pour la REDD+, comme les forêts ayant plus de diversité biologique sont attendues à être plus résilientes face au changement climatique et contiennent souvent des stocks de carbone élevées.

Les effets globaux positifs et négatifs pour les bénéfices multiples seront déterminés par la séquence des décisions prises pendant la conception et la mise en œuvre de la REDD+. La prise en considération de ces bénéfices à chaque étape croîtrait sûrement leur livraison. Planifier pour obtenir des résultats positifs pour les bénéfices multiples tôt dans processus pourrait garantir qu'un moyen d'action sous optimal ou néfaste ne soit pas involontairement suivi. Les bénéfices multiples de la REDD+ pourraient aussi être augmentés, parfois à peu de frais, en utilisant des outils appropriés et en mettant en place des politiques pour sauvegarder et renforcer les bénéfices écosystémiques.

Ce document de synthèse détermine les options pour sauvegarder et renforcer ces bénéfices au sein d'un programme national de REDD+. Il détermine les opportunités ainsi que les risques pour ces bénéfices durant la préparation, la conception et la mise en œuvre de REDD+ ainsi qu'au sein du système de mesure, d'information et de vérification. Ce document se concentre sur les procédés de REDD+ pour lesquels il y a une opportunité pour sauvegarder et renforcer les bénéfices écosystémiques, et qui sont inclus dans les stratégies nationales existantes des pays pilotes et partenaires du Programme ONU-REDD. Il examine les divers outils et mesures qui existent et qui accroîtraient les opportunités et décroîtraient les risques pour les bénéfices écosystémiques et suggère quelques arbitrages entre le carbone, les bénéfices écosystémiques et les frais qui pourraient survenir. Les arbitrages pourraient être entre les décisions d'échanger l'utilisation à court terme avec l'utilisation durable des ressources, ou bien entre les décisions de donner priorité à un bénéfice au lieu d'un autre.

La consultation, l'engagement et le buy-in des parties prenantes, des gouvernements nationaux jusqu'aux communautés locales, sont indispensables pour le succès global de la REDD+ et pour assurer que les différentes valeurs attachées aux bénéfices multiples potentiels sont comprises. Au niveau national, il sera important d'établir les valeurs potentielles des bénéfices écosystémiques et pour quels groups ils sont importants. Ceci contribuera à montrer la valeur additionnelle aux bailleurs de fonds, à faciliter une finance complémentaire, et à renforcer les valeurs des bénéfices à la nation et aux communautés forestières.

Salvaguardando y reforzando los beneficios ecosistémicos de REDD+ : Resumen

Una decisión futura de la CMNUCC sobre REDD+ se espera que especifique ciertos requisitos de ´salvaguarda´ con el fin de asegurar resultados positivos para los servicios ecosistémicos, la biodiversidad y los derechos de las comunidades locales y su sustento. Ciertos países en vías de desarrollo podrían decidir adoptar requisitos más detallados y/o estrictos para estos beneficios múltiples potenciales de REDD+.

Dado que los servicios ecosistémicos y la biodiversidad presentes en un bosque varían dependiendo de sus características, historia y gestión, las decisiones de implementación de REDD+ les afectarán cualitativa y cuantitativamente. Los servicios no relacionados con el carbono y la biodiversidad provenientes de los bosques REDD+ pueden ser considerados como los ´beneficios ecosistémicos´ de REDD+. La biodiversidad también juega un papel como facilitadora de REDD+, ya que se considera que los bosques biodiversos son más resistentes al cambio climático, e incluyen áreas con grandes reservas de carbono.

Los efectos globales positivos y negativos para los beneficios múltiples dependerán de la secuencia de decisiones tomadas en el diseño y la implementación de REDD+. Es probable que la consideración de estos beneficios en cada etapa contribuya a su consecución. La planificación temprana para conseguir resultados positivos para los beneficios múltiples puede evitar que se siga un curso de acción subóptimo o activamente dañino. El uso de herramientas apropiadas y el establecimiento de políticas para salvaguardar y reforzar los beneficios ecosistémicos también pueden incrementar los beneficios de REDD+, a veces con poco coste adicional.

Este documento de síntesis considera las opciones para salvaguardar y reforzar estos beneficios bajo un programa nacional REDD+. Evalúa las oportunidades y los riesgos de estos beneficios durante la preparación, el diseño y la implementación de REDD+, así como de su sistema de medición, información y verificación.

El documento se concentra en los procesos de REDD+ para los que es posible salvaguardar y/o reforzar los beneficios ecosistémicos, y que están incluidos en estrategias nacionales existentes de países socios del Programa ONU-REDD. Considera varias herramientas y medidas disponibles para aumentar las oportunidades y reducir los riesgos para estos beneficios, y sugiere algunas soluciones de compromiso entre el carbono, los beneficios ecosistémicos y los costes. Las soluciones de compromiso pueden consistir en el intercambio del uso de recursos a corto plazo por el uso sostenible a largo plazo, o en la priorización a largo plazo de un beneficio sobre otro.

La consulta, el compromiso y la aceptación de todos los interesados, desde gobiernos nacionales hasta las comunidades locales, son muy importantes tanto para el éxito global de REDD+ como para asegurar que se entiendan los distintos valores de los beneficios múltiples potenciales. A nivel nacional, resulta útil identificar el valor potencial de los beneficios ecosistémicos, así como para qué grupos son importantes. Esto ayudará a demostrar el valor añadido a los patrocinadores, tanto para facilitar la obtención de fondos complementarios como para reforzar el valor de los beneficios para la nación y para las comunidades que dependen de los bosques.

Perlindungan dan peningkatan manfaat-manfaat REDD+ yang diperoleh dari ekosistem : Abstrak

Keputusan UNFCCC di masa mendatang tentang REDD+ diharapkan akan menetapkan persyaratan-persyaratan tertentu bagi aspek ‘perlindungan’ yang bertujuan untuk mendorong hasil-hasil yang positif bagi jasa ekosistem, keanekaragaman hayati dan hak-hak serta mata pencaharian masyarakat lokal. Setiap negara berkembang dapat memilih untuk menerapkan persyaratan yang lebih terperinci dan/atau yang lebih ketat terkait dengan potensi multi-manfaat dari REDD+ ini.

Dikarenakan jasa-jasa lingkungan dan keanekaragaman hayati yang berada di hutan sangat beragam tipe, sejarah dan pengelolaannya, maka keputusan-keputusan yang berkenaan dengan implementasi REDD+ akan mempengaruhi kualitas dan kuantitasnya. Jasa-jasa non-karbon dan keanekaragaman hayati yang disediakan oleh hutan-hutan REDD+ dapat dianggap sebagai 'manfaat-manfaat REDD+ yang diperoleh dari ekosistem'. Keanekaragaman hayati juga mempunyai peran sebagai pendorong REDD+, dikarenakan hutan-hutan yang memiliki keanekaragaman hayati diharapkan akan lebih tahan terhadap perubahan iklim dan mencakup kawasan-kawasan dengan cadangan karbon yang sangat tinggi.

Semua pengaruh positif dan negatif pada multi-manfaat akan tergantung pada rangkaian keputusan yang diambil pada tahap desain dan implementasi REDD+. Dengan mempertimbangkan manfaat-manfaat tersebut pada setiap tahapannya dapat memberi peluang untuk meningkatkan hasil-hasilnya secara signifikan. Merencanakan hasil-hasil yang positif untuk multi-manfaat dari sejak awal dapat mencegah timbulnya komitmen yang tidak terencana, yang pada akhirnya dapat merugikan atau membuat pelaksanaannya menjadi kurang optimal. Penggunaan metode yang tepat dan pembuatan kebijakan-kebijakan yang terkait dengan perlindungan dan peningkatan manfaat yang diperoleh dari ekosistem, juga dapat meningkatkan manfaat REDD+ dan kadang-kadang cukup hanya dengan sedikit biaya tambahan.

Paper kali ini mempertimbangkan opsi-opsi untuk perlindungan dan peningkatan manfaat- manfaat tersebut di bawah program REDD+ nasional. Paper ini menguji berbagai peluang dan resiko terhadap manfaat-manfaat tersebut selama berlangsungnya tahap persiapan, desain dan implementasi REDD+, serta pada saat pengukuran, pelaporan dan verifikasi. Fokus dari paper ini adalah pendekatan-pendekatan terhadap REDD+ yang mana di dalamnya terdapat ruang bagi perlindungan dan/atau peningkatan manfaat-manfaat yang diperoleh dari ekosistem, dan yang digunakan di dalam strategi nasional di negara-negara mitra program PBB-REDD yang ada saat ini. Dalam paper ini juga dipertimbangkan berbagai metode dan upaya yang ada untuk dapat meningkatkan peluang-peluangnya dan menurunkan resiko-resiko terhadap manfaat tersebut, serta dikemukakan akan kemungkinan timbulnya pilihan-pilihan yang sulit (trade-offs) antara karbon, manfaat yang diperoleh dari ekosistem dan komponen biaya. Trade-offs itu sendiri mungkin akan melibatkan unsur pertukaran dari penggunaan sumberdaya dalam jangka pendek menjadi penggunaan jangka panjang yang berkelanjutan, atau dengan menetapkan prioritas jangka panjang bagi satu manfaat di atas manfaat lainnya.

Konsultasi, keterlibatan dan partisipasi para pemangku kepentingan, mulai dari pemerintah pusat sampai dengan masyarakat lokal, sangat penting bagi kesuksesan REDD+ secara keseluruhan dan juga untuk memastikan adanya pemahaman akan perbedaan nilai-nilai yang melekat pada potensi multi-manfaat. Pada tingkat nasional, akan sangat bermanfaat untuk mengidentifikasi nilai potensial dari manfaat-manfaat yang diperoleh dari ekosistem tersebut dan kelompok-kelompok yang menghargainya. Hal ini dapat membantu untuk memperlihatkan nilai tambahan tersebut kepada para penyandang dana, yang terkadang dapat memfasilitasi kucuran dana tambahan, dan untuk meningkatkan nilai dari manfaat-manfaat tersebut bagi negara dan masyarakatnya yang bergantung kehidupannya pada hutan.

Table of contents

1 Introduction

1.1 Aims, structure and definitions

This paper focuses on the key opportunities to safeguard and enhance ecosystem-derived benefits within REDD+[1], concentrating on the direct impacts on these benefits of decisions. Many of the decisions involved in REDD+ design and implementation will affect the various benefits to differing degrees, not least as a result of their effect on the overall success of REDD+. Only those approaches with direct potential benefits or risks for biodiversity and ecosystem services are considered here, together with possible tools and measures to safeguard and enhance ecosystem-derived benefits, and the potential trade-offs between carbon, additional benefits and costs.

The paper is structured according to the phases of national REDD+ design and implementation, and the activities that are envisaged under the UN Framework Convention on Climate Change (UNFCCC), so that the reader can easily identify the issues and possible tools relating to their own interests. We first discuss approaches to design and prepare for REDD+; then implementation approaches are presented by broad REDD+ activity (e.g. 'reducing deforestation'), with cross-cutting approaches treated separately; and finally there is a brief discussion of Measurement, Reporting and Verification (MRV) and monitoring issues relating to ecosystem-derived benefits.

We distinguish REDD+ activities (e.g. reducing deforestation, reducing forest degradation) from approaches (e.g. forest certification, planting non-native species) (Figure 1). Each approach may be carried out using different practices (e.g. intensive monoculture) and each practice may employ different techniques (e.g. use of herbicides to create fire breaks). We recognise that this choice of terms is fairly arbitrary, but aim for consistency in application.

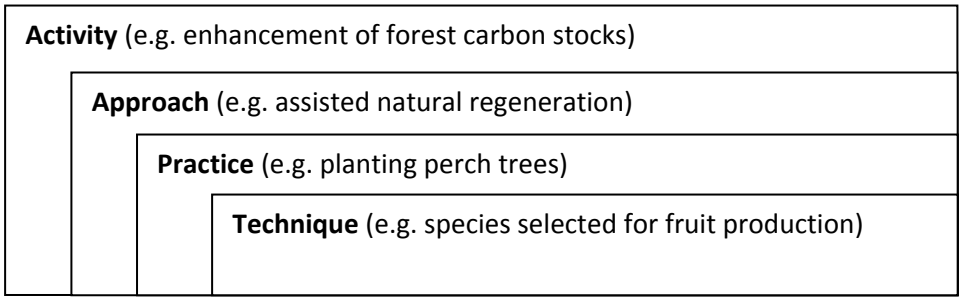

Figure 1: Hierarchy of terms used to describe REDD+ implementation

Whilst different approaches to REDD+ are discussed here individually, in practice some approaches (such as the design of policy frameworks) are prerequisites for the success of other approaches, others are co-dependent upon one another, and still others are relatively independent.

We draw on the National Joint Programmes prepared under the UN-REDD Programme, and other relevant literature, to identify approaches to REDD+, and highlight those that may influence the delivery of ecosystem services and biodiversity. We aim to summarise existing experience to inform the better integration of multiple benefits issues into programmes of work as they develop. This past experience includes lessons learnt from forestry, conservation planning, integrated conservation and

[1] REDD+ includes the reduction of emissions from deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks (UNFCCC 2009d).

development projects, community forest management, and protected area management (e.g. Coad *et al.* 2008, Brandon & Wells 2009, Blom *et al.* 2010, Burgess *et al*. 2010).

1.2 Why plan for multiple benefits?

The anticipated multiple benefits of REDD+ include ecosystem-derived benefits, and other social benefits. 'Ecosystem-derived benefits' are those that are direct side-effects of maintaining, increasing and enhancing forest carbon stocks through REDD+, i.e. **biodiversity[2] conservation and ecosystem services[3] other than carbon (**Table 1**)**.

Social benefits (such as improvements to quality of life enabled by REDD+ payments) arise from implementation of the REDD+ mechanism rather than from its effect on forest ecosystems, and are outside the scope of this paper; readers may wish to refer to http://www.redd-net.org/. We only consider social benefits insofar as they directly affect forest ecosystems, e.g. the positive and negative impacts of the commercialisation of non-timber forest products. Of course, delivering local livelihoods and satisfying local actors are prerequisites to the long-term success of REDD+, and thus to the delivery of ecosystem-derived benefits[4]. For more information about the definition of ecosystem-derived benefits, their meaning and value, see *Multiple Benefits Series **1*** (Dickson *et al.* 2010).

Early attention to ecosystem-derived benefits during the development of a REDD+ programme can:

i) identify the scope for REDD+ funds to help deliver or secure ecosystem-derived benefits,

ii) identify and plan for possible negative consequences of REDD+ on ecosystem services,

iii) minimise the additional costs of safeguarding and enhancing ecosystem-derived benefits

iv) help to ensure permanence of REDD+ efforts through maintaining forest ecosystem resilience (Guariguata *et al*. 2008, Thompson *et al.* 2009),

v) enable informed decisions on trade-offs between benefits[5] (since planning for one ecosystem service alone, i.e. carbon sequestration, can create unwanted declines in other services, Bennett *et al.* 2009), and

vi) help to ensure that an effective, coherent REDD+ system is put in place, which will not be undermined by unexpected consequences for other forest ecosystem services.

[2] Biodiversity is the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity 1992)

[3] Ecosystem services are the natural processes by which ecosystems, and the species which constitute them, sustain and fulfil human life (Daily 1997)

[4] Within the UN-REDD Programme, these social benefits are the focus of UNDP

[5] Trade-offs are the results of choices that lead to one ecosystem service increasing, whilst another decreases

Table 1: Forest ecosystem services (based on Millennium Ecosystem Assessment 2003); excluding global climate regulation, and adding biodiversity, these are the potential ecosystem-derived benefits of REDD+

Ecosystem services	Examples for forest ecosystems
Provisioning	**The goods or products obtained from ecosystems**
Food	Edible non−timber forest products (NTFPs) such as fruits, berries, and bush meat
Fresh water	Around 4.6 billion people depend on forests for all or some of their water supplies
Wood & fibre	Timber, and non-timber forest products such as silk, rubber, bamboo
Fuel	Fuel wood
Genetic resources	Wild species and genes used for animal and plant breeding and biotechnology
Biochemicals & natural medicines	Many commercial and traditional medicines are derived from forest species
Regulating	**The benefits obtained from an ecosystem's control of natural processes**
Climate regulation	The regulation of the global carbon cycle through carbon storage and sequestration, in addition to local and regional climate regulation (albedo effects, regional rainfall etc)
Flood regulation	The reduction and slow down of surface water run−off
Disease regulation	Intact forests reduce the occurrence of standing water, reducing the breeding area for some disease vectors and transmission of diseases such as malaria
Water regulation	Forest systems are associated with the regulation of 57% of total water runoff, and play a large role in the hydrological cycle
Pollination	Crops, such as coffee, that are close to forests receive more visits from pollinators
Cultural	**The non-material benefits obtained from ecosystems**
Aesthetic & inspirational	The scenery and landscapes provided by forest, both for their own beauty and as an inspiration for art
Spiritual & religious	Indigenous peoples and others attach spiritual significance to forests
Educational	Research, education and training in forests
Recreational	Ecotourism in forest areas
Cultural heritage & sense of place	Some cultures place high value on particular landscapes or species
Supporting	**The natural processes that maintain the other ecosystem services**
Nutrient cycling	Forests are extremely efficient at maintaining nutrient flows through atmosphere, plants and soils
Soil formation	Forests on slopes hold soil in place and can prevent degradation
Primary production	The total organic matter produced as a result of photosynthesis and nutrient uptake from the soil

1.3 Influence of REDD+ approaches on multiple benefits delivery

REDD+ will help to safeguard and enhance ecosystem services through its fundamental purpose of climate change mitigation, reducing the need for ecosystems and biodiversity to adapt to climate change. In addition, the maintenance of forests will inevitably protect many habitats and conserve their biodiversity and ecosystem services. One might conclude that any approach that increases the success of REDD+ will automatically increase the flow of ecosystem-derived benefits.

Biodiversity conservation can be seen as an enabler as well as a benefit of REDD+. There is some evidence that biodiversity underpins both the size and the resilience of forest carbon stocks. Old growth forests and large trees store significant amounts of carbon per hectare, and their continued

existence depends upon a functional natural ecosystem (pollinators, dispersers, soil microbes etc.). Diverse natural ecosystems are thought to be more resilient to a changing climate (Hooper *et al*. 2005, Thompson *et al*. 2009), although much of our knowledge comes from grasslands rather than forest. Models indicate that there is likely to be a threshold of climate change beyond which carbon stocks will be lost, but there is considerable uncertainty about both the threshold and size of this effect (Rummukainen *et al*. 2010). It is expected that degraded forests will be more vulnerable to climate change. Hence, intact natural forests are those most likely to deliver better long-term outcomes for carbon sequestration and storage. Certain natural forest sites will also deliver better outcomes for biodiversity conservation than others, in the sense of maintaining unique and threatened species and ecosystems.

The precise outcomes will depend on how REDD+ is planned for and implemented: there are potential risks to ecosystem services and biodiversity from REDD+, as well as opportunities to better maintain and enhance them. At a landscape scale, the distribution of REDD+ activities (such as reducing deforestation) will affect the range of benefits delivered; at any given location, the approach to REDD+ will affect the delivery of ecosystem-derived benefits.

At landscape-scale, wise, consensual decisions have the potential to ensure delivery of the whole range of desirable ecosystem-derived benefits in a region. There is an uneven distribution of ecosystem services across landscapes, and sites chosen on the basis of one service are not guaranteed to automatically deliver other services (Egoh *et al*. 2008). For example, forests important for regulating water flows and reducing flood risk may or may not also be of high value for biodiversity conservation, and forests vary in both the amount of carbon per hectare they store in their biomass and the carbon immobilised in the soil (FAO 2006).

Prioritising REDD+ action to those areas that also deliver other desired benefits is logical, but costs must be taken into account. Given the risk that land-use change pressures are displaced to areas not covered by REDD+, it may be more efficient to allocate other forestry and conservation funds to the most valued of these areas rather than to co-financing of REDD+ (Figure 2). Mapping the distribution of land values, different ecosystem-derived benefits and modelling the likely land-use outcomes of REDD+ decisions can all assist in setting spatial priorities (see Section 3.3.1, page 14).

At site-scale, management designed to enhance one ecosystem service, or aspect of biodiversity, will not necessarily safeguard or enhance all possible ecosystem-derived benefits. There are multiple and non-linear relationships amongst ecosystem services, so depending on which are prioritised, different management considerations will come into play. In general, regulating services (Table 1) are more likely to indicate changes in provisioning and cultural services than the other way round (Bennett *et al.* 2009). For example, over-harvesting of a given food species would be unlikely to affect a forest's climate regulation function; but the changes in structure required to damage climate or flood regulation services would be likely to also affect food supply.

Given our limited knowledge about ecosystem-derived benefits, monitoring could be particularly helpful in facilitating adaptive management to respond to any declines. Considerably more is known about the distribution, value, flows of and impacts of change on some services and aspects of biodiversity than others (Carpenter *et al*. 2006). Monitoring would both help to ensure the multiple

benefits of REDD+, and to improve our understanding of the impacts of management and interactions between ecosystem services.

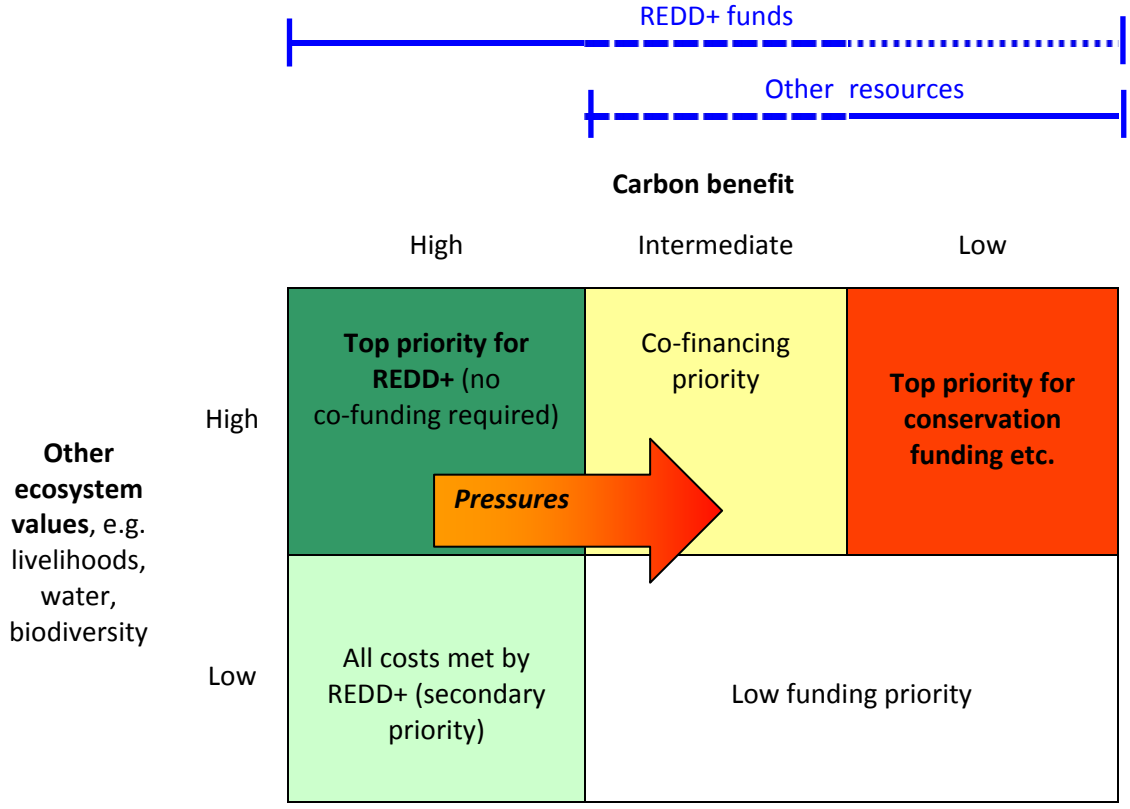

Figure 2: Value for different ecosystem services and biodiversity are distributed differently among tropical ecosystems. Therefore funding from REDD+ would protect only some additional values, and could increase pressures on other ecosystems. Funds for other purposes such as sustainable development and biodiversity conservation may be needed to fill the gap. The threshold for 'high' carbon benefit will depend on the site-specific costs of REDD+ implementation. (adapted from Miles & Kapos 2008)

2 International obligations and commitments on multiple benefits

2.1 International agreements

The UNFCCC negotiations on a post-Kyoto agreement have not yet resulted in a Decision on the form that an international REDD+ mechanism will take. For a functioning international REDD+ mechanism to emerge, both a new international agreement under UNFCCC, and a ready (in the sense of willing and prepared) set of REDD-eligible countries, will be needed. Widespread readiness to participate would make it possible for a large proportion of the world's tropical forest to be covered by the mechanism from the start, reducing opportunities for international displacement ("leakage") of emissions and increasing the likelihood that REDD+ will yield true benefits for the climate, and thus for vulnerable ecosystems and their services.

Greater progress was made on REDD+ at the 15th Conference of Parties (COP15) of the UNFCCC, hosted in Copenhagen, Denmark in December 2009, than on other parts of the overall negotiations. A decision on methodological issues relating to REDD+ was endorsed, which included pre-ambulatory texts '*recognising the importance of promoting sustainable management of forests and co-benefits including biodiversity, that may complement the aims and objectives of national forest programmes and relevant international conventions and agreements*', and '*the need for full and effective engagement of indigenous peoples and local communities in, and the potential contribution of their knowledge to, monitoring and reporting of activities*' (UNFCCC 2009c).

The range of activities encompassed by any future Decision on REDD+ will shape the opportunities and risks for ecosystem-derived benefits. The negotiating text presented at the subsequent meeting of the Ad Hoc Working Group on Long-Term Cooperative Action (AWG-LCA) in Bonn, Germany in June 2010 proposes that the following range of activities be eligible under REDD+ (UNFCCC 2010):

a) *Reducing emissions from deforestation;*
b) *Reducing emissions from forest degradation;*
c) *Conservation of forest carbon stocks;*
d) *Sustainable management of forest;*
e) *Enhancement of forest carbon stocks.*

There is some confusion over whether '*enhancement of forest carbon stocks*' includes afforestation and reforestation (A/R) (IUCN 2009, RECOFTC 2009), or only refers to enhancement of stocks within existing forest (Angelsen 2009). A definition is not included in the text, and an AWG-LCA "non-paper" prepared in November 2009 includes options which could imply either definition (UNFCCC 2009a). In this paper, we assume that A/R activities are included. The main international funds for REDD+ readiness also make this assumption (Miles 2010).

The AWG-LCA draft also includes a list of environmental and other safeguards that should be promoted and supported (UNFCCC 2010). These are requirements that REDD+ activities: are consistent with the conservation of natural forests and biological diversity (avoid the conversion of natural forests; incentivise the protection and conservation of natural forests and their ecosystem services; enhance other social and environmental benefits), complement existing forest plans and other relevant Conventions, involve transparent and effective governance, respect the knowledge and rights of indigenous peoples and members of local communities, involve full and effective participation of these and other stakeholders, address the risk of removals and reduce displacement (leakage) of emissions (UNFCCC 2010).

Eligible countries or the funders of their developing REDD+ strategies may opt for more detailed or stringent conditions than are stipulated in the eventual UNFCCC guidance that emerges. For example, it may be useful to define safeguards for the five broad REDD+ activities separately.

There are many uncertainties about the final Decision and associated guidance which will influence the set of countries that eventually choose to participate in REDD+, the area and type of forest affected, and thus the multiple benefits and number of people affected (Miles 2007). Major areas still to be agreed upon include the mode of international finance, which could be market-based, fund-based or a mixture of the two, and the method of deciding the reference levels for forest

emissions against which success will be judged (e.g. negotiation, historical records or projections of business-as-usual trends). For further discussion of the potential biodiversity implications of different design options at the international level, see Karousakis (2009) and Harvey *et al.* (2010).

2.2 Finance in the pilot phase

The total finance available for REDD+ will set the upper limit on the area of forest (and therefore the number of forest-dependent people) that can benefit. At COP15, a subset of prominent countries agreed on a 'Copenhagen Accord', which they proposed for adoption under the Convention. However, this Accord was only 'noted' by the full COP (UNFCCC 2009b). The Accord is gradually being endorsed by countries, including major emitters of greenhouse gases such as the US, all EU countries, India and China (Gerholdt 2010). The Accord states that REDD+ activities will play a crucial role in tackling climate change, and anticipates a multibillion dollar 'Copenhagen Green Climate Fund' which would include finance for REDD+. It is not yet clear whether or how this fund will be established, and whether attention to multiple benefits will be a condition of support for REDD+.

A number of established funds are already supporting the first phase of REDD+ development and implementation. The UN-REDD Programme, Forest Carbon Partnership Facility (FCPF) housed at the World Bank and at least some bilateral funds expect that countries consider ecosystem-based and social benefits as part of establishing their REDD+ national programmes. However, there are no explicit requirements under the UN-REDD Programme or FCPF for delivering them.

Before a National Joint Programme (NJP) can be approved for implementation funding, the UN-REDD Programme requires pilot countries to assess the key environmental issues they face.

The FCPF supports projects on the basis of defined criteria including a 'focus on innovative and/or advanced concepts of monitoring, reporting and remote sensing of forest degradation, biodiversity protection and social benefits', and seeks to achieve poverty reduction and biodiversity conservation benefits as well as climate change mitigation (FCPF 2008). Interested countries submit a Readiness Plan Idea Note (R-PIN) to the FCPF. If accepted, countries produce a Readiness Preparation Proposal (R-PP): a plan, budget and schedule to develop a Readiness Package (R-Package). This in turn consists of a national REDD+ strategy, MRV system and reference baseline. The R-PIN format poses questions about ecosystem-derived benefits including: whether non-carbon benefits are expected to result from the REDD+ strategy, what these are, where they are and how much; whether biodiversity conservation is being monitored now and would be in the future, and if so, where and how.

3 National design of and preparation for REDD+

This section discusses options to safeguard and enhance ecosystem-derived benefits when preparing for REDD+. Preparation includes the building of institutional capacity and commitment, amendments to national legislation and policy, and design of a REDD+ strategy and programme.

Many preparatory actions are essential to enable more direct REDD+ interventions. These include the establishment of a policy framework, imposition of restrictions or establishment of incentives for different types of land use, ensuring effective governance measures, identification of and support to

institutions to manage REDD+ at national to local levels and involvement of stakeholders in strategy preparation.

To support positive outcomes for ecosystem-derived benefits, the preparation stage should include:

i) acquiring and sharing data needed to understand the current and potential distribution of biodiversity and ecosystem services and where possible, their flows and beneficiaries (page 14+)

ii) taking the likely impacts on biodiversity and ecosystem services into account when selecting approaches to REDD+ design (page 14+)

iii) defining goals for multiple benefits delivery (page 14+)

iv) identifying institutional responsibilities for these goals (page 8)

v) designing cost-effective monitoring systems to allow assessment of the goals (page 15)

vi) planning for adaptive management to address unwanted declines in biodiversity and ecosystem services (page 17).

vii) designing and learning from demonstration projects to trial these approaches (page 15)

Approaches for the design, preparation and implementation of REDD+ overlap to some extent. Their influence on ecosystem-derived benefits are either discussed here or in "National implementation", page 19+. Tools and measures for safeguarding and enhancing ecosystem-derived benefits are summarised in tables within each section.

3.1 Institutional arrangements and capacity building for REDD+

Readiness for REDD+ starts with *establishing the core team and responsible agencies that will:* collaborate on the *design of a national strategy and programme,* identify the *appropriate national planning and governance frameworks for REDD+*, work to ensure *high-level government commitment*, *South-South transfer of knowledge* and *coordination between agencies*, decide on a *consultation and engagement strategy* (including for this design phase of REDD+), develop or commission *technical and institutional guidance* and identify *capacity building needs for REDD+ implementation and MRV*.[6]

3.1.1 Which approaches affect multiple benefits (institutional arrangements & capacity building)?

Major factors that will influence the delivery of ecosystem-derived benefits are the experience and interests of the individuals and agencies responsible for the design of REDD+, the inclusion of people benefiting from forest ecosystem services at different scales (local to global), and the approach to planning for multiple benefits (integrated or separate).

The *core team* that collaborates on the design of a REDD+ programme convenes a national REDD+ committee or working group. The participation of people with expertise on ecosystem-derived

[6] **From this point on**, these italicised lists of approaches to REDD+ include all options expressed within the National Joint Programmes. Only those approaches that have a clear, direct influence on ecosystem-derived benefits are subsequently discussed.

benefits will improve the collective understanding of multiple benefits issues, and increase the impact of this understanding on the programme design.

The relative strength of the position of agencies responsible for ecosystem-derived benefits issues such as water supply and biodiversity will vary between countries and through time, and is likely to affect the extent of provisions for safeguarding ecosystem-derived benefits within the REDD+ programme.

A wider constituency must also be involved in the first stage of a *stakeholder consultation and engagement strategy*, generating a sense of ownership and buy-in to the programme at different levels and in different sectors, and starting to build local institutional and organisational capacity. Widely sharing clear communication materials on ecosystem-derived benefits in the run-up to consultations would help to ensure meaningful engagement.

3.1.2 Tools and measures to enhance multiple benefits (institutional arrangements & capacity building)

The following options for safeguarding or enhancing ecosystem-derived benefits in the initial phases of REDD-readiness are summarised in Table 2.

Whatever agencies are responsible for REDD+, assessment and subsequent *building of institutional capacity on multiple benefits issues* will need to be included early in the REDD+ programme. A basic grounding in how and which forests provide biodiversity and ecosystem services, who benefits from them and how different REDD+ activities and approaches can sustain or undermine these ecosystem-derived benefits would help decision-makers to understand the potential impacts of their plans.

To ensure that ecosystem-derived benefits issues are adequately covered in the REDD+ design phase, the strategy could aim to identify how communities value specific ecosystem services or aspects of biodiversity provided by forests, and ensure that those people most dependent on these services (typically women, and the poorer members of communities (Coad *et al*. 2008)) are engaged in REDD+ discussions.

A technical expert group on promoting ecosystem-derived benefits in REDD+ could be created to identify when more specific expertise will be useful in REDD+ planning and implementation, what national expertise exists, and what capacity building needs there are. Including representatives from local communities and indigenous peoples would help to incorporate traditional knowledge and expertise. This group could be asked to review the developing REDD+ programme, and to establish best-practice guidance and principles for promoting ecosystem-derived benefits, for example on indicators and monitoring for ecosystem service delivery, spatial priority-setting, and/or adaptive management for ecosystem services and biodiversity. This guidance would contribute to capacity-building for REDD+ implementation amongst government staff and local communities. Another option would be to create an international expert group to offer such guidance (Karousakis 2009) rather than national groups; the advantage could be a reduction in duplication of effort, and the disadvantage a loss of fit to national circumstances. A combination of national and international groups may be the most sensible option.

Transfer of knowledge between and within REDD+ pilot countries is essential for safeguarding and enhancing ecosystem-derived benefits. Experiences from different groups can be drawn on, altered and improved to apply in other contexts, so that efforts are not replicated unnecessarily. A network that facilitates the flow of information and expertise will enable countries to better address ecosystem-derived benefits as they develop and implement REDD+.

Table 2: Ecosystem-derived benefits tools and measures – institutional arrangements and capacity building

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Capacity building on ecosystem-derived benefits basics	Increased understanding of ecosystem-derived benefits issues amongst decision-makers: **Any selected benefits**	Relatively low cost
Inclusion of ecosystem-derived benefits issues, and stakeholders dependent on forest services, in consultation and engagement strategy	Most likely to result in positive impacts for easily perceived provisioning benefits: **food, freshwater, wood/fibre, fuel, culture & biodiversity**	Value of less easily perceived benefits may not be captured
Expert group on ecosystem-derived benefits	Help to ensure ecosystem-derived benefits are addressed in developing REDD+ programmes. Best-practice guidelines and principles for promotion of: **any selected benefits.** Short-term investment here may increase long-term resilience of forest ecosystems.	Costs of participation; contribute to later capacity-building efforts Those services that are best understood are most likely to benefit.
REDD+ multiple benefits network	**All ecosystem-derived benefits**	Low start up costs, overheads to maintain and share information

3.2 Design of national legislation and policy

REDD+ requires transformational change in land use policy, but policy-making is normally incremental (Angelsen 2009). This conflict between business-as-usual and the urgent needs of a REDD+ programme for a *strengthened legislative framework to allow REDD+ implementation* will play out on a country-specific basis. The design of a new framework may be supported by *assessment of drivers of deforestation and degradation* and subsequent *policy analysis* to identify nationally-appropriate means to address these drivers. New or amended regulations and policies may aim to *remove incentives for deforestation*, *realise forest value*, and *tackle corruption;* place *restrictions on land use*, or include *cross-sectoral initiatives* aimed at tackling land-use change such as *import tariffs on agricultural products*.

3.2.1 Which approaches affect multiple benefits (design of legislation & policy)?

A cross-sectoral *policy analysis* could identify likely outcomes for (some) ecosystem-derived benefits of this list of potential new policies or regulations. Ecosystem services of direct economic importance

such as timber are most likely to be included. It would make sense to repeat such an analysis if it was suspected that REDD+ measures were proving ineffectual, perhaps because of changes in the fundamental drivers of deforestation.

The overall drivers of forest carbon loss vary substantially between regions (Table 3), and so do their impacts on ecosystem-derived benefits, as a result of their spatial distribution, the types of ecosystems affected, and the extent of damage. Drivers may involve major industries such as agriculture, energy, infrastructure development, logging and mining (FCPF 2008). National policies that limit conversion, increase the value of standing forest or remove incentives for clearing are likely to be generally positive for biodiversity and ecosystem services, but the specific outcomes will vary between drivers.

Table 3: Regional patterns of forest-cover change and their driving forces (Rudel 2005: 159)

Region	Forest cover change	Driving forces
Central America and the Caribbean	Small forests: slowing but still rapid decline; slowing attributable to afforestation	Growing urban markets drive forest decline; emigration and tourism promote afforestation
South America	Large forests: moderate rates of deforestation, but amounts of forest lost are large	Passive protection erodes; logging, agriculture, and fires expand; resource partitioning occurs.
West Africa	Small forests: continued rapid deforestation	Growing urban markets; continuing agricultural exports; debt
Central Africa	Large forests: little deforestation; peri-urban forest losses and peripheral forest gains	Passive protection: inaccessibility; mining economy suppresses farming
East Africa	Dry forests with little biomass: net losses; peri-urban forest gains and peripheral forest losses	Charcoal production; domestic market expansion; rural population increase
South Asia	Small forests: net afforestation	Charcoal production; control over forests ceded in part to villages
Southeast Asia	Large forests: rapid decline in lowlands; some recovery in highlands	Large-scale logging, agriculture and fires without regulation

For example, the adoption of *low import tariffs on agricultural products in forest-rich countries* for imports of staple foods would reduce the economic incentives for farmers to expand production of staples at the expense of old-growth forest and thus the opportunity costs of participating in REDD+ programmes (Rudel 2009). However, this strategy risks simply exporting the land-use change problem, whilst adding carbon emissions associated with the international transport of food.

The national forest definitions adopted within a *strengthened legislative framework* are critically important to successful REDD+ implementation. If there is little distinction between natural and planted forest, or between timber and agricultural plantations, then there is an increased risk of REDD+ support for non-forest land uses or conversion of native forest. The safeguard against conversion of natural forest in the REDD+ negotiating text (UNFCCC 2010), when translated into national policy, should prevent the most extreme losses of ecosystem-derived benefits on REDD+ lands.

3.2.2 Tools and measures to enhance multiple benefits (design of legislation & policy)

Inclusion of ecosystem-derived benefits issues in a cross-sectoral analysis of potential new REDD+ policies should help to ensure that the positive and negative impacts of policy changes on biodiversity and ecosystem services are identified at an early stage. A formal process to consider the environmental externalities of national policies and land-use decisions could help to mainstream ecosystem services thinking, including on carbon emissions.

Clear forest definitions that distinguish between intact, secondary, restored and planted forests will enable policies that aim to safeguard and enhance ecosystem-derived benefits by prioritising activities that conserve intact forest, and ensure that REDD+ monitoring produces relevant results. This approach assumes that most ecosystem services are provided most effectively and with greatest resilience by intact native forests (Thompson *et al*. 2009, Table 4).

Decentralisation of forest governance transfers responsibility for regulation from national to provincial levels, with the aim of making it easier to monitor and control what is happening in forests in each provincial area, ensuring local engagement in REDD+ decision-making and representing local needs in design, implementation and social and ecosystem benefit access. It may help to ensure support from the people on the ground, therefore generating higher likelihood of success. There are, however, risks: (i) decentralisation sometimes equates to transferring administrative duties but not actual control; (ii) where governance is lacking, local communities can be exploited and lose their access to ecosystem-derived benefits (for example, through the sale of community concessions to logging companies in Indonesia, Pope-Smith 2007).

A legislative requirement for social and environmental impact assessment (SEIA) for REDD+ policies or activities involving change of land use (e.g. 'Biodiversity-Inclusive Impact Assessments' (SCBD/NCEA 2006), Grainger *et al.* 2009, Harvey *et al*. 2010) would increase the likelihood that potential harm to ecosystem-derived benefits would be identified and avoided. The drawback is that any such detailed assessment can add time and cost to the process. Exemptions to the requirement for SEIA, or a facility to assess multiple cases together in a single 'bundle', may be appropriate for small initiatives.

A legislative requirement that REDD+ projects meet sustainability standards would incur similar trade-offs of time and cost for enhanced protection of ecosystem-derived benefits. A set of 'REDD+ Social and Environmental Standards' are currently under development (see Sustainable management of forests, page 26).

Table 4: Ecosystem-derived benefits tools and measures – design of legislation and policy

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Inclusion of ecosystem-derived benefits issues in policy analysis	Policy analysis could cover: **all ecosystem-derived benefits**, acknowledging gaps in knowledge on impacts. Helps to ensure cross-sectoral policy-making.	Relatively low cost
National forest definitions that distinguish intact / secondary / restored / planted forests	Enables incentives that value more natural forests more highly: **food, freshwater, climate regulation, disease regulation, culture & biodiversity, nutrient cycling** are most likely to benefit. These more natural forests are also likely to be more resilient to change. Distinguishing between specific forest ecosystem types (such as tropical dry forest) could facilitate spatial priority-setting	Low cost Incentives imply complex trade-offs with speed of carbon accumulation (outcome is context-dependent)
Decentralised forest governance	Local access to ecosystem-derived benefits is likely to be supported.	Mixed history of success
Social and environmental impact assessment (SEIA) for REDD+	Impact assessment could cover: **all ecosystem-derived benefits**, acknowledging gaps in knowledge on impacts	Where capacity needs to be built, this may delay REDD+ implementation Implementation costs – bundling may help Risk of corruption where SEIA is financed by proposer
Sustainability standards for REDD+	Criteria could cover: **any selected ecosystem-derived benefits**	May delay REDD+ implementation and increase costs at a project scale; analogous to SEIA above

3.3 Design of a REDD+ strategy and programme

The changes to legislation and policy discussed above may be formally included within a national REDD+ strategy, or provide context within which the programme is delivered. This section covers those strategic decisions that determine what, where and how REDD+ actions are undertaken. The following section (page 19+) discusses implementation of the programme.

Both the UN-REDD Programme and FCPF offer assistance in the preparation of national strategies, in the form of National Joint Programme (NJP) documents and Readiness Preparation Proposals (R-PPs) respectively. The design of a strategy may include continued *engagement with stakeholders*, planning *of REDD+ implementation* (tackling deforestation and forest degradation, conserving and

enhancing forest carbon stocks and other activities and approaches that contribute to sustainable management of forest), *designing a mechanism for channelling REDD+ finance*, and related *mechanisms to ensure participation and benefit-sharing*, analysis *of the risks of REDD+ strategy*, *establishment of an MRV system and reference emissions levels*, *analysis to support zoning or land-use planning*, and *identification of demonstration activities.*

3.3.1 Which approaches affect multiple benefits (design of strategy & programme)?

Some policies and approaches to REDD+ apply in a blanket fashion on a national scale, and some target specific situations or priority locations. 'Blanket' policies that tackle the drivers of deforestation include changes to agricultural incentives, a logging moratorium, and payments to 'suppliers' of carbon stocks. These are relatively unlikely to generate internal displacement of deforestation and degradation pressures.

Other approaches are implemented only in selected regions or sites, rather than universally, either because there is a high cost per unit area, or because the approaches are more appropriate to some areas than others. Examples include afforestation, or targeted law enforcement. Best practice for these approaches involves priority-setting *analysis to support zoning or land-use planning*, so that the total set of potential sites that could be subject to each approach is defined, and the most valuable sites are tackled first.

Priority-setting analysis can offer a focus for community engagement with REDD+, and can explicitly include ecosystem-derived benefits. Local strategy development clearly has a greater scope for broad participation, and thus for detailed understanding of ecosystem-derived benefits issues, than national-scale planning, but many of the principles apply at both scales.

Criteria (and data requirements) for the identification of priority areas could include:

- likelihood of cooperation from land-holder (may be more easily secured for state lands)
- value of present forest carbon stocks
- value of potential carbon stocks (based on potential for new forest cover)
- value of ecosystem-derived benefits (based on maps and models)
- cost of implementation of REDD+ (varies with approach)
- opportunity cost (i.e. value of existing or alternative land use; land price is an indicator)
- current and future risk to carbon stocks without REDD+ approach (linked to opportunity cost)

An analysis focused on maximising carbon savings for minimum costs may miss the opportunity for substantial ecosystem-derived benefits at little extra cost (Miles & Kapos 2008, Grainger *et al*. 2009). From a biodiversity perspective, an outcome that conserves or sequesters a given quantity of carbon by conserving or creating a greater mix of different forest types over a wider area is likely to deliver greater conservation gains (Miles 2007, Strassburg *et al*. 2009, Venter *et al*. 2009). Some areas of conservation concern will always be more costly to conserve than an average forest – for example, 'biodiversity hotspots' by definition experience a high level of threat and also hold a high number of endemic species (Myers *et al*. 2000).

Demonstration activities to pilot REDD+ give an opportunity to test some of the assumptions on the ecosystem-derived benefits in the strategy, and adapt it according to the results. As the costs and benefits of forest conservation accrue at different spatial scales, and the approaches implemented at different scales may interact in unanticipated ways, pilot projects that emphasise multiscale collaboration could be particularly valuable. Site-scale projects are less likely than a national policy-setting to generate a coherent integrated strategy for the realisation of ecosystem-derived benefits on a landscape to regional scale, but they can help to achieve equity (Blom *et al*. 2010), allow investors to target specific areas with high biodiversity or other selected ecosystem service value (Brown *et al*. 2008), be implemented quickly, and better accommodate in-country heterogeneity (Costenbader 2009).

A process for *establishment of MRV systems and calculation of reference emissions levels* will be included within the readiness plan (see page 38). It may be useful to use MRV systems to support policy analysis, to better understand processes of deforestation and degradation, and establish more effective interventions (Angelsen 2009). This could comprise analysis of the results of MRV, including monitoring for ecosystem-derived benefits, against the current understanding of the drivers of change, including the initial REDD+ activities undertaken.

Finally, the process of *engagement with stakeholders* will influence the understanding of the value of ecosystem-derived benefits, and the opportunities to capitalise on social and environmental factors. There is a likely strong overlap between the groups involved in REDD+ thinking and the groups benefiting from ecosystems. This may result from limited understanding of other groups' needs and dependencies on ecosystem services, rather than only intentional capture of resources. If REDD+ favours groups of people associated with certain forest types (e.g. indigenous people over more recent settlers), their preferred activities and locations to live/work will influence the ecosystem-derived benefits delivered.

3.3.2 Tools and measures to enhance multiple benefits (design of strategy & programme)

Important considerations here include: how to engage stakeholders on ecosystem-derived benefits; how to include these benefits in priority-setting; and what lessons can most usefully be learnt from demonstration activities?

The design stage is a good time to *engage on ecosystem-derived benefits issues* with local stakeholders or groups representing them. The importance of social and cultural factors, such as traditions and peer pressure, for incentivising conservation should not be overlooked in REDD+ design. Current consultations within REDD+ programmes appear to focus largely on revenue distribution: there could be scope to integrate ecosystem-derived benefits considerations.

It may help to pay attention to appropriate language in consultations (describing multiple benefits in terms familiar to users), and to include exercises such as ranking potential options for intervention or the importance of different specific services, or map-based workshops to think about the total effect of changes across a landscape. Identifying differences between social groups in the value placed on ecosystem services will indicate whether decisions risk favouring one group over another or will have specific impacts on ecosystem-derived benefits.

A *priority-setting toolkit* could be developed to support those land-use decisions that are not implemented universally. When not all forests will be protected, or some will be protected first or more effectively, there is a need to prioritise, and the use of transparent, simple tools in a workshop context can help here. Such a toolkit could include:

(a) Some guidance for priority-setting in the absence of spatial analysis, for example in selecting pilot projects. Rules of thumb may include: (i) prioritising the retention of threatened, biodiverse forests over activities such as reforestation or sustainable forest management will typically bring greater gains for both biodiversity, supporting and regulating services (Table 1) and carbon conservation; (ii) where carbon stocks and ecosystems are similar between forest areas, prioritising connectivity of forests will yield better results for biodiversity conservation (Harvey *et al*. 2010); (iii) forest landscape restoration (page 29) or agroforestry (page 20) principles can inform the placement of new trees in landscapes to best provide local services (e.g. erosion prevention, pollination, water regulation).

(b) Guidance and tools for *mapping the distribution of ecosystem-derived benefits and flows,* starting with existing maps (such as Key Biodiversity Areas, Important Bird Areas or species distribution data) and deciding where it is necessary to gather new data. Ecosystem service modelling tools could be used here (e.g. The Natural Capital Project partnership - Naidoo & Ricketts 2006).

Gap analyses for biodiversity conservation have been undertaken by several countries in the course of implementing the Convention on Biological Diversity programme of work on protected areas, and are underway in several more. These analyses and the datasets used could be drawn upon in deciding REDD+ priorities (SCBD 2009); in turn, analyses carried out for REDD+ could contribute to gap analyses where these have not yet been carried out.

The 'High Conservation Value' (HCV) framework represents one practice for mapping priority areas for multiple benefits (local ecosystem services and biodiversity conservation). It identifies all areas that meet one or more of six defined conservation values. Small-scale HCV assessments are widely used in certification for forest and palm oil, and have been undertaken in some places at a landscape scale. Plentiful materials may be found at http://www.hcvnetwork.org.

(c) Techniques to compare this ecosystem-derived benefits information with the distribution of carbon, opportunity costs and so on (see page 14)[7]. There are various multicriteria analysis and other analytical techniques that can be employed to understand the trade-offs between carbon, costs and ecosystem-derived benefits, and to provide initial 'solutions' for decision-makers to work from (e.g. Brown *et al*. 2001, Chan *et al*. 2006). Typically these involve identification of stakeholders' priorities in a workshop setting, and using software tools to map the distribution of multiple priorities to come up with possible balanced land-use solutions.

It must be recognised that these tools can only inform and support policy development, not prescribe it. Local knowledge of ecosystem-derived benefits and feasibility of different land uses is essential for ensuring that local needs are met.

[7] E.g. Venter *et al.* (2009) calculated what the value of REDD+ payments needed to prevent deforestation in Kalimantan, Borneo, if forest conservation targets areas where emissions reductions are cheapest, and found that this will help to conserve 40 threatened mammal species

Marxan is one multicriteria analysis tool, developed at the University of Queensland, Australia and freely available with manuals in English and Spanish from http://www.uq.edu.au/marxan/ (Game & Grantham 2008). Marxan can be used to design networks for carbon protection; or to balance carbon protection with other ecosystem service and biodiversity conservation goals (Chan *et al*. 2006). It is principally designed for systematic conservation planning: identifying coherent networks of sites for biodiversity conservation. It highlights land units that together satisfy a set of goals (e.g. protection of all species or 50% of all forest carbon) whilst occupying the minimum area possible.

One less obvious variable is the landscape context of the forest patches: their size, shape and the distance from old-growth forest all have an influence on the long-term persistence of the forests' biodiversity, especially in the face of climate change pressures (e.g. Newton 2007). Marxan includes modules to represent connectivity, and multiple land uses, but will not resolve all such questions.

(d) Tools for economic valuation of the benefits flowing to different groups of stakeholders, to further inform such an analysis and potentially the design of a scheme for incentive payments (Nelson *et al.* 2009). A UNEP manual for the economic valuation of regulating ecosystem services (Table 1) will shortly be available (Kumar *et al*. 2010).

(e) Tools for scenario and threat analysis, looking at the effect of different policy options on the economic and environmental drivers of change, and/or under multiple economic and social scenarios, would allow an assessment of the potential effects of the proposed priority areas for REDD+ (e.g. ten Brink *et al.* 2006, Blom *et al*. 2010). They can contribute to the analysis of the risk of REDD+ strategy for ecosystem-derived benefits, including leakage of land-use change to non-priority areas.

Limitations to readily available data, and the complexity of such a full analysis, mean that it is unlikely to be possible to include all the factors of interest at once. Aiming for a perfect understanding may slow decision-making and the implementation of REDD+. It may be better to start pilot projects based on an initial analysis, testing the methodologies developed, and to run a more detailed analysis in parallel to influence implementation of the next stage of REDD+.

Development of a *metadatabase* on existing national spatial data on ecosystem services and biodiversity would support such an analysis. Ideally this metadata (data about data) would include a description of the content of each dataset, its format, resolution and geographic reference system, its custodian (institution or individual), the date that it was compiled, the timespan that it represents, its proper citation and any restrictions on its sharing or use. Various metadata standards exist; one toolset for cataloguing data is supplied by FAO at http://www.fao.org/geonetwork.

Once demonstration projects are underway, monitoring the outcomes for ecosystem-derived benefits in demonstration activities will help to understand the impacts of different REDD+ approaches and practices on ecosystem-derived benefits. Demonstration projects also offer the opportunity to trial adaptive management based on the results of monitoring.

Table 5: Ecosystem-derived benefits tools and measures – design of a REDD+ strategy and programme

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Continued engagement with local stakeholders – e.g. identify uses of forest by different groups; integrate ecosystem-derived benefits issues into consultations	**All ecosystem-derived benefits**, but especially those delivered at a local level	Less value is likely to be placed on ecosystem-derived benefits flowing to national and international levels
Priority-setting toolkit: - rules of thumb - guidance for mapping ecosystem-derived benefits - multicriteria analysis techniques - economic valuation tools - scenario analysis tools	**Any selected ecosystem-derived benefits**, but especially those with existing spatial data	Any complex analysis requiring new data may slow decisions.
Metadatabase development	**Any selected ecosystem-derived benefits**: highlights those for which existing spatial data is available, and those for which further research is required	Adherence to formal data standards requires training or existing competence, but simple databases can still be useful.
Analysis of the risks of REDD+ strategy for ecosystem-derived benefits	**All ecosystem-derived benefits**	Relatively minor cost if supporting information is available
Monitoring of the outcomes for ecosystem-derived benefits in demonstration activities, and adaptive management	**Any selected ecosystem-derived benefits,** to allow for more effective intervention. Identification of what works well in each unique national circumstance and in different ecosystem types	See MRV section, page 38

4 National implementation

This section discusses options to safeguard and enhance ecosystem-derived benefits when implementing REDD+ activities. A range of approaches for implementing REDD+ and potential tools and policies to support ecosystem-derived benefits are covered. The approaches have been identified through a survey of the available existing National Joint Programmes and other literature. They are categorised by the UNFCCC list of activities (reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forest; enhancement of forest carbon stocks; UNFCCC 2010), as well as a number of cross-cutting activities, such as promotion of alternative livelihoods. Those REDD+ approaches and multiple benefits tools that are relevant to more than one activity are only discussed once.

The potential risks and opportunities for ecosystem-derived benefits of REDD+ vary between the REDD+ *activities* (e.g. for biodiversity, Figure 3). For any one activity, the *approach* taken, and the *practices* employed in the course of implementing that approach, will strongly influence the extent to which these benefits are realised (see page 1 for definitions of italicised words).

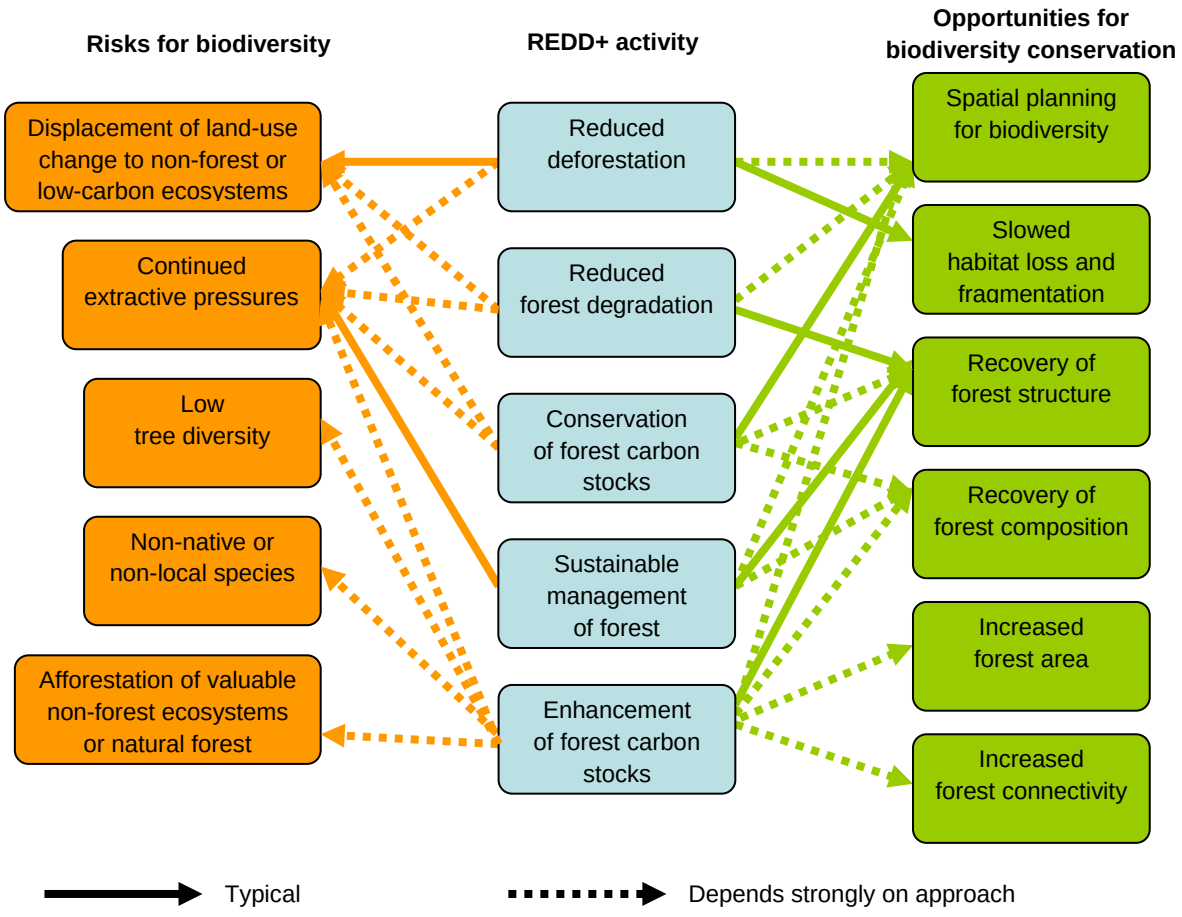

Figure 3: Major opportunities and risks for biodiversity benefits of REDD+ resulting from the five REDD+ activities proposed in the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) negotiating text of May 2010 (adapted from Miles & Dickson, in press)

To support positive outcomes for ecosystem-derived benefits, the implementation stage could include:

i) attention to ecosystem service issues when deciding how to implement the readiness plan

ii) participatory planning with local stakeholders to ensure that local ecosystem-derived benefit values are understood and taken into account

iii) communication to all stakeholders of the potential impacts of selected approaches on ecosystem-derived benefits (discussed below), and likely trade-offs between cost, carbon and multiple benefits

iv) putting policies in place and/or employing appropriate tools at both landscape and site scale, to maintain or enhance the delivery of ecosystem-derived benefits

v) a process to absorb lessons from the demonstration phase and ensure adaptive management for ecosystem-derived benefits as REDD+ progresses.

4.1 REDD+ activities: opportunities to safeguard and enhance multiple benefits

4.1.1 Reducing deforestation

REDD+ approaches are likely to reduce access to new land for cultivation or limit the suitability of the land available (UNEP-WCMC 2007), as change in land use from forest to agriculture is the major historical driver of tropical deforestation (Millennium Ecosystem Assessment 2005). Potential approaches to reducing deforestation whilst maintaining a food supply and farm livelihoods include *conservation/sustainable agriculture, agricultural intensification, agroforestry*[8]*, land swaps* (i.e. change in zoning)*,* or *preferential interest rates for those using sustainable agricultural production techniques*. These variously work by increasing the productivity of existing land under agriculture to reduce the area required, increasing the long-term sustainability of agriculture to increase the time that land may be used for agriculture, or increasing the use of trees within agricultural landscapes. Targeting these forms of assistance to growers in productive areas close to areas of high population density (*place-specific agriculture*) will especially help to shift pressure away from forests (Angelsen 2009, Rudel 2009).

Reforestation of agricultural land is discussed in 'Carbon stock enhancement', below.

4.1.1.1 Which approaches affect multiple benefits (reducing deforestation)?

Taking action to conserve natural forests will always yield significant ecosystem-derived benefits: reducing deforestation can reduce river discharge, erosion and sediment fluxes; protect soil resources which contain essential nutrients for plant growth, purify water and provide a habitat for flora, fauna and microbial communities (Stickler *et al.* 2009). Which benefits are delivered depends on the forest in question – in particular, the influence of forests on watersheds is more complex than their effect on soil stability. On balance, forests regulate flow and purify water, but do not

[8] "The integration of trees into agriculturally productive landscapes, for the realisation of multiple purposes" (World Agroforestry Centre 2010)

necessarily increase total water outputs. Trees take up water and return it to the atmosphere, and slow the passage of rainfall to ground level, both of which can increase the retention of water in the local ecosystem and decrease both the total run-off and the likelihood of flooding. Some montane forests also increase the amount of precipitation as a result of their surface characteristics (Cayuela *et al*. 2006).

Where deterioration in crop yields from degraded agricultural land is a driver of deforestation, *conservation/sustainable agriculture* can enable longer-term land use. It does so by enhancing erosion control as well as improving yields, thus benefiting food provisioning services and soil conservation as well as limiting emissions from soil carbon. These benefits are achieved through practices such as conservation tillage, permanent crop rotations, terracing and increased use of manure and crop residues. Further information may be found at http://www.conserveagri.org and http://www.fao.org/ag/ca.

The direct impacts of more conventional a*gricultural intensification* (obtaining greater yield per area through increased inputs) on ecosystem services are largely negative: increases in use of machinery and chemicals may damage soil and water quality, flood regulation and nutrient cycling. However, intensification can help to meet rising demands for food whilst minimising the additional land needed for agriculture (Balmford *et al*. 2005, Stickler *et al.* 2009). The consequent increases in energy use and in nitrogenous fertilisers will themselves contribute to climate change.

The effects of agroforestry depend on the starting point: it can increase the total carbon stored in a conventional agricultural landscape (including in soils), improve biodiversity, and increase the resilience of both the agricultural ecosystem and the livelihoods of the local community. However, converting natural forest systems to agroforestry systems is likely to result in losses of some species and population densities, and moderate increases in surface water run-off (Sajwaj *et al.* 2008). Agroforestry can involve a multiplicity of practices depending on the context and aims (for example, growth of perennial tree crops, boundary planting, hedgerow cropping, home gardens or shelter belts), each with different implications for biodiversity and ecosystem services. More information on agroforestry can be found at http://www.worldagroforestry.org.

4.1.1.2 Tools and measures to enhance multiple benefits (reducing deforestation)

The ecological costs and benefits of different agricultural options aimed at reducing deforestation are closely dependent on the status of existing landscapes and agricultural practices.

(i) *Conservation agriculture* generally yields more ecosystem services than intensive agriculture, but there is a possible trade-off with land demand depending on local conditions. Existing local capacity-building efforts may be more suited to one approach or the other.

(ii) *Agroforestry schemes* involving fruiting trees may be more successful when near to intact forests and their pollinating services. Forest biodiversity may benefit from increased connectivity to other intact forest and access to some resources of the agroforestry area.

(iii) Depending upon the crops favoured locally, there may be an existing *'round table' on sustainable practices*, with a defined or developing set of standards for certification. Criteria vary, but tend to cover social issues, restrictions on the type of land that may be converted, care for soil, water and biodiversity on site, restrictions on chemical use and environmental impact assessment

requirements (e.g. RSPO 2007). Sustainability initiatives exist for soy (http://responsiblesoy.org), palm oil (http://www.rspo.org), cocoa (http://roundtablecocoa.org), sugar cane (http://www.bettersugarcane.org), cotton (http://www.bettercotton.org), and tea (http://www.ethicalteapartnership.org). Some roundtables have adopted HCV definitions (page 16).

Table 6: Ecosystem-derived benefits tools and measures – reducing deforestation

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Promote conservation agriculture	**Soil formation, nutrient cycling, freshwater**	Local agricultural extension may be designed to support conventional agriculture
Encourage agroforestry near natural forest	**Biodiversity**	Restricts choice of location; increased human activity may generate risks to forest as well as benefits
Adopt agricultural certification standards	**Biodiversity, soil formation, freshwater**	Relatively costly to implement; premium for certified goods may compensate costs

4.1.2 Reducing degradation

Common causes of degradation of forest carbon stocks include logging, fire, forest wetland drainage and extreme weather events such as hurricane damage or drought. Only anthropogenic causes of degradation are strictly relevant to REDD+, according to the aims of UNFCCC.

Logging relies on the ecosystem service of timber production, which is only a 'service' if eventually exploited. However, timber extraction results directly and inevitably in degradation of forest structure and therefore forest carbon stocks in the short term, so there are trade-offs between exploitation of this service and carbon storage. The extent of damage caused to forest by logging varies with the approach taken. Clear-cutting releases large amounts of carbon from biomass, causes declines in species diversity and population size (including of species important for provisioning services), increases abundance of exotic species, increases hunting pressure on large vertebrates by allowing increased access, and increases surface run-off (which contributes to declines in soil carbon storage) (Sajwaj *et al.* 2008). Conventional selective logging can have similar but less dramatic effects. Besides removing trees for timber, logging also involves carbon losses through damage to non-target trees (loss of branches or mortality), access road construction, and often subsequent access to forest by third parties. The resulting degraded forest is often at greater risk of deforestation through land-use change (Asner *et al*. 2006).

Where logging is unregulated and/or illegal, there is less incentive to manage the forest for long-term sustainability, and a greater risk of changes in species composition, and a decline in forest

structure and carbon stocks. Logging and forest regulations intended to increase the sustainability of this industry may include *logging bans or moratoria*, *improved monitoring and regulation of illegal logging*, establishment of *regulated logging concessions*, and *improvements in governance and law enforcement related to timber extraction* (which may include approaches such as *decentralisation*, *improved monitoring of activities* or *establishment of a redress mechanism for non-performance*, and *engagement in international Forest Law Enforcement and Governance* processes). Best practice approaches to management for timber production are covered in the section "Sustainable management of forests", page 26.

Wildfire can be a natural part of some dry forest ecosystems, but where fire frequency is increased as a result of human activity, carbon stocks and many ecosystem services are degraded over the long term. *Early alert and fire control systems*, as well *as controls on the use of fire for land clearance*, can help to tackle this problem.

Reversing the drainage of wetland forest ecosystems can be a relatively simple engineering task, involving blocking drainage channels with locally available material.

4.1.2.1 Which approaches affect multiple benefits (reducing degradation)?

A *logging moratorium* involves a time-limited ban that allows the country time to plan its REDD+ Programme, including measures for more sustainable extraction of timber resources, and can often be put in place rapidly. If effective, it has the advantage of preventing a rush to exploit a weakly-protected resource that sometimes results from the anticipation that stricter regulation will be forthcoming (Infield & Namara 2001, Xu & Melick 2007).

Where logging is damaging forest carbon stocks, an adequately enforced and monitored *logging ban or moratorium* is likely to have positive effects on all ecosystem services except the provision of wood, fibre and fuel. The trade-offs with provisioning services may affect local people, or more powerful commercial interests, depending on previous restrictions on access. Provisos for continuing to allow local use would allay the former impact.

There are several ways in which displacement of logging may result from a moratorium:

i) If a moratorium is only applied to particular forest areas (e.g. according to their carbon stock density), pressures may be displaced to low-carbon forests and other ecosystems, leading to geographical trade-offs in supply of ecosystem services.

ii) If a blanket moratorium is poorly enforced and monitored, logging might be displaced to more remote or otherwise poorly policed areas.

iii) Even with adequate enforcement, there are risks of international leakage, with potentially negative implications for biodiversity and ecosystem services in other countries (Miles & Kapos 2008).

Whether or not a moratorium is imposed, *improvements in governance and law enforcement related to timber extraction* may take a number of forms. *Regulated logging concessions* can protect some ecosystem services and biodiversity values whilst realising some timber values (Chomitz *et al*. 2006).

In most forest landscapes, control of fire would benefit biodiversity and the provisioning, regulating, cultural and supporting services that it underpins. Much fire is associated with agriculture, so change

to fire-free practices should help to reduce forest degradation (Aragao *et al*. 2010). *Early alert and fire control systems* can help where fire is still prevalent.

However, some plant and animal species in fire-adapted ecosystems, such as tropical woodlands and savannas do depend on periodic burning (Stickler *et al.* 2009). Fire is used in some management strategies to reduce invasive non-native species, or to facilitate natural regeneration. This approach can benefit biodiversity and most ecosystem services, except possibly carbon storage and some provisioning services supplied by non-native species.

4.1.2.2 Tools and measures to enhance multiple benefits (reducing degradation)

Prioritising efforts to tackle *illegal logging* so that areas most valuable for ecosystem-derived benefits were more highly protected from degradation would be beneficial. Any effective tackling of illegal logging would have positive consequences for most ecosystem-derived benefits. One method of safeguarding valuable areas is to assign a special task force, such as Indonesia's SPORC (rapid response forest guard), to their protection from logging.

In peatland areas subject to drainage, *restoration of the water table* will slow carbon emissions from peat decomposition and reduce the likelihood of underground fire, as well as being a first step towards restoring forest ecosystems (Parish *et al*. 2008).

Table 7: Ecosystem-derived benefits tools and measures – reducing degradation

Tools	**Positive effects on ecosystem-derived benefits**	**Costs and trade-offs**
Spatial priority setting for action on illegal logging	See "Priority setting toolkit..." in Table 5, page 18	
Restoring water table in drained peat swamp forests	**All ecosystem-derived benefits**; speed of recovery will depend on extent of damage to forest.	Major carbon benefits possible for minimal costs

4.1.3 Conservation of forest carbon stocks

Financial support for conservation of carbon stocks in intact forests could be particularly important to REDD-eligible countries with high forest carbon stocks and low current deforestation rates. If forest conservation initiatives are not undertaken, the risk of international leakage to these countries would threaten the global success of REDD+ in climate mitigation. Other countries may also choose to include forest carbon conservation amongst their REDD+ activities.

Whilst conservation of forest carbon stocks has a different primary aim to conservation of forest biological diversity, many of the same approaches may apply. These include increasing the number or enhancing the management of *protected areas, community-conserved areas* and *forest reserves* (including some production forests). *Community-based natural resource management* and *integrated conservation and development projects,* which aim to simultaneously meet conservation and development objectives, are discussed under "Promoting livelihood changes", page 31.

4.1.3.1 Which approaches affect multiple benefits (conservation of forest carbon stocks)?

Increasing the number and enhancing the management of *protected areas* would help to adequately protect primary forests and thus the ecosystem-derived benefits they provide. Whilst strict protection may reduce provisioning and cultural services for local people; community-conserved areas may enhance and preserve access to these services (Coad *et al*. 2008). Protected areas are demonstrably able to withstand agricultural expansion and logging pressures, especially when sufficiently funded and managed with the consent of local communities (Clark *et al*. 2008).

There has been some concern that protected areas will not be eligible for REDD+, if it were assumed that their carbon was already formally protected. The prospect of future REDD+ payments may create a perverse incentive to de-gazette protected areas, case their forests are excluded from REDD+ funding (Miles 2007, Karousakis 2009). The issue is still to be decided, but the inclusion of forest conservation within the list of REDD+ activities makes the exclusion of protected areas from REDD+ schemes seem less likely. Investments in protected areas and improvements to their management are certainly included within some countries' pilot programmes for REDD+.

4.1.3.2 Tools and measures to enhance multiple benefits (conservation of forest carbon stocks)

Prioritisation for any new designations that are supported by REDD+ funds should be given to areas that are high in both carbon and in biodiversity and ecosystem services (e.g. Miles *et al.* 2009).

Frameworks and tools for *assessment of protected area management effectiveness* can help to identify when protected areas are successful in meeting their goals. Extra *training for protected area staff* on the use of these and other tools in managing for and monitoring ecosystem-derived benefits would help to ensure they are a priority. The same applies to stakeholders in community-conserved areas – see http://www.iccaforum.org/ for resources on this topic.

Table 8: Ecosystem-derived benefits tools and measures – conservation of forest carbon stocks

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Systematic conservation planning tools (see page 16) – employed at local scale	**Any selected ecosystem-derived benefits** for which spatial data are available and goals are regional rather than local in nature. But tools are most developed for biodiversity conservation.	A complex analysis requiring new data may slow decisions.
Frameworks and tools for assessment of protected area management effectiveness	**Any selected benefits**, but especially **biodiversity** conservation given that this is the primary goal of protected areas	Any programme targeted at particular benefits may inadvertently have negative impacts on those that are not planned for or monitored
Capacity building on ecosystem-derived benefits for protected area staff and stakeholders in community-conserved areas and forest reserves		

4.1.4 Sustainable management of forests

The term *sustainable management of forests* (SMF) is used in the UNFCCC Decisions in place of the more common term Sustainable Forest Management (SFM). In its original conception, SFM describes a management strategy following the Agenda 21 principles that "*Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generation […] for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs, and for other forest products*" (UNGA 1992, Scialabba & Williamson 2004). However, it is argued by some (e.g. Greenpeace 2009) to have legitimised continued unsustainable use of forests, without eliminating the negative effects on their quality and quantity that may degrade ecosystem services and biodiversity.

This section focuses on the sustainable management of forest (SMF) for timber production, whilst recognising that a full definition of SMF would include many of the REDD+ activities described in other sections. Approaches include *reduced impact logging*, *enhanced regulation of logging,* and *certification standards*.

4.1.4.1 Which approaches affect multiple benefits (SMF)?

The term *sustainable management of forests* is intended to refer back to the original description of SFM. If implemented successfully, SMF could allow continued productive use of and access to forests, at levels that avoid excessive degradation or harm to biodiversity and regulating, cultural and supporting ecosystem services.

In intact forests that have not previously been managed for timber production, any logging regime will negatively affect carbon stocks and provision of many ecosystem-derived benefits, but conventional selective logging is more harmful than RIL.

Reduced impact logging (RIL) implies a faster recovery of forest structure after logging, supporting primary production and biodiversity conservation. Efforts are made to reduce tree mortality, limit damage to soils and reduce wood waste by use of pre-harvest inventory, low-extraction intensity, reduced-impact harvest techniques (such as directional felling) and reduced-impact extraction techniques (such as extraction along planned paths), and use of post-harvest damage assessments to inform improvements to practice (Putz *et al*. 2008, Sajwaj *et al*. 2008). RIL may include the protection of streamside reserves and biodiversity reserves, and the retention of live trees for re-seeding if areas of clear-cutting are included (exceptional for RIL). Carbon losses for RIL can be halved in comparison to the more common approach of 'selective' logging by untrained and unsupervised crews (Sasaki & Putz 2009).

4.1.4.2 Tools and measures to enhance multiple benefits (SMF)

SMF can involve planning for and monitoring the delivery of ecosystem-derived benefits other than timber from production forests. Making use of the *Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests* produced by ITTO and IUCN[9] would help to ensure that ecosystem-derived benefits are safeguarded. Recommendations include training forestry workers in RIL techniques.

[9] http://www.itto.int/direct/topics/topics_pdf_download/topics_id=1918&no=0

The term *ecoforestry* describes an ecosystem approach to SMF, which is sometimes combined with *community forest management* (see page 31). Ecoforestry aims to minimise the losses of ecosystem-derived benefits. It is "a low-impact approach to forest management that maintains a fully functioning forest within the natural historic range of spatial and temporal variability" (Scialabba & Williamson 2004). It aims to ensure long-term sustainable timber stocks, with no deterioration of ecosystem services, and has an even greater emphasis on conserving the forest structure than RIL. Principles include "observing the structure, function, composition and natural changes of forest ecosystems, learning from these and using management practices that mimic them". More information may be found at http://www.ecoforestry.org.pg/

Ecoforestry, RIL and other SMF techniques require better training for forest managers and workers, but deliver substantially greater ecosystem-derived benefits in comparison with conventional selective logging techniques. The main trade-offs are between the immediate volume of timber harvested, and the long-term availability of timber supplies. REDD+ funds could provide an opportunity to transform the forestry sector to meet these goals.

Certification standards can provide criteria and indicators to identify whether good practice is in place, and recommendations for improvements. They can be used to demonstrate the delivery of biodiversity conservation and other ecosystem services, including for the implementation of Payments for Ecosystem Services (PES) schemes (see page 33). The evaluation and selection of a certification scheme is therefore critical to ensuring that its criteria and indicators are appropriate for the ecosystem(s) in question, and will help to deliver the desired ecosystem-derived benefits. Considerable experience exists for forestry standards, and there is a premium market for some of the products of certified areas. Standards designed for the carbon market include the CCB Standards (http://www.climate-standards.org/) and CarbonFix (http://www.carbonfix.info/). These and other standards such as that of the Forestry Stewardship Council (FSC) or the developing standards for REDD+ (Social & Environmental Standards – http://www.climate-standards.org/REDD+/index.html) and biofuel sustainability, include some criteria for ecosystem-derived benefits that have to be met in order to receive certification. Including regular *assessments* to monitor biodiversity and forest ecosystem health as part of a REDD+ standard, would help to ensure that activities are sustainable and the goal of maintaining biodiversity and ecosystem services is always kept in mind. Standards will be most influential if applied consistently over the whole area subject to REDD+ measures, rather than on a voluntary site-by-site basis (Karousakis 2009).

The disadvantages are that verification by external certifiers may be disproportionately costly for small producers (Scheyvens 2006), that not all ecosystem-derived benefits are tackled by all standards, and that in some cases, the criteria and indicators on ecosystem-derived benefits are loosely worded.

Finally, there is a need to reduce the possibility that expected changes in climate will degrade forest carbon stocks and ecosystem functions. Where forests are managed for timber production, this means identifying an appropriate form of *adaptive management for climate change resilience*. The extent and direction of climate change will vary depending on the forest location, but the general recommendations are to foster forests' ability to adapt to an uncertain future by maintaining a higher diversity of species and genotypes for natural selection to work upon, maintaining a high number of seeds (i.e. reproductive trees) and juveniles. Many of the practices proposed are

compatible with SMF aims and especially favourable for biodiversity conservation. Detailed recommendations for both natural and plantation forest are found in Guariguata *et al*. 2008.

Table 9: Ecosystem-derived benefits tools and measures – sustainable management of forest

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Promotion of, and capacity building in, reduced impact logging techniques	Decreased tree mortality and damage, and retention of mature seed trees leads to faster recovery of forest structure and decreased fire risk: **all services** Decreased soil compaction: **soil formation** Protection of streamside forest and biodiversity reserves: **freshwater, flood regulation, culture & biodiversity**	**Wood/fibre:** timber yields spread over longer timescale than for conventional selective logging or clear-cutting **All other services**: RIL still has an impact on forest structure in the short term Need for training of forest managers and workers – but cost-effective in comparison with carbon gains (Putz & Nasi 2010)
Ecoforestry	As for 'Promotion of reduced impact logging', plus closer retention of natural forest structure: **all services**	**Wood/fibre:** timber yields spread over longer timescale than for other forms of logging Need for training of forest managers and workers
Certification standards/schemes	Choice of standard, criteria and indicators will influence which ecosystem-derived benefits form part of the targets	Cost of verification by external certifiers
Adaptive management for climate resilience	Increases likelihood of long-term provision of benefits: **all services** Increases genetic diversity: **culture & biodiversity**	Need for training of forest managers and workers

4.1.5 Carbon stock enhancement

Carbon stock enhancement could involve restoring carbon stocks in degraded forests, or creating forests where none currently exist. The approaches used and the locations where forests are created or restored, will determine the effects on ecosystem-derived benefits. Approaches may include *afforestation*[10]*, reforestation, restoration (through natural regeneration, assisted natural regeneration or planting)*[11], *rehabilitation*[12], or *forest landscape restoration*[13], supported through REDD+ projects, *grants or preferential interest rates*.

4.1.5.1 Which approaches affect multiple benefits (carbon stock enhancement)?

The impacts of carbon stock enhancement depend upon the state of the existing ecosystem, and the degree of naturalness of the new forest ecosystem. *Forest landscape restoration* (FLR) is a conceptual framework for thinking about the appropriate location of new forest and trees in landscapes to meet local goals. Its implications for ecosystem-derived benefits depend on these local priorities.

In deforested landscapes, almost any new forest can have multiple benefits, such as attracting seed dispersal agents to help regenerate plant and animal communities and reducing flood risk and streamflowa by restoring high evapotranspiration rates (Stickler *et al.* 2009). However, in some circumstances, high evapotranspiration will reduce the total water supply emerging from the forest (Fahey & Jackson 1997; Engel *et al.* 2005).

Reforestation actions focused on one service such as carbon sequestration, timber production, or water regulation, may not be designed to provide others. In some situations, each could be achieved using monoculture plantations with intensive management practices that facilitate the growth of specific fast-growing species at the expense of an understory, which are likely to do little to deliver biodiversity or other regulating and provisioning services (Putz & Redford 2009). Monoculture plantations usually support fewer native plant and animal species than the native ecosystems they replace (Barlow *et al.* 2007), and may require heavy machinery for establishment and management, with negative effects on soil formation and water quality (though use of fertilisers and pesticides) (Schwarzenbach *et al.* 2006). There are particular risks to biodiversity if invasive species are used, as these can replace native species over large areas; in addition, certain non-native species such as *Eucalyptus* (often used in plantations) are toxic to many other species.

Forest restoration and *rehabilitation* place a greater emphasis on healthy ecosystem functioning, whilst also increasing the eventual amount of carbon stored relative to more intensively managed

[10] Under UNFCCC's Kyoto Protocol, forest restoration or creation in areas that have not been forested in the last 50 years is known as 'afforestation' – otherwise, it is 'reforestation'.

[11] Not defined under UNFCCC. A common definition is: "to re-establish the presumed structure, productivity and species diversity of the forest originally present at a site. In time, the ecological processes and functions of the restored forest will closely match those of the original forest" (Gilmour *et al*. 2000).

[12] "To re-establish the productivity and some, but not necessarily all, of the plant and animal species thought to be originally present at a site. (For ecological or economic reasons the new forest might also include species not originally present at the site). In time, the protective function and many of the ecological services of the original forest may be re-established" (Gilmour *et al*. 2000).

[13] "Bringing people together to identify, negotiate and implement practices that restore an agreed optimal balance of the ecological, social and economic benefits of forests and trees within a broader pattern of land uses" (GPFLR no date).

forests (Sajwaj *et al.* 2008). Water quality and biodiversity are particularly likely to improve with more natural forest structure and composition. There is a trade-off with the speed of carbon accumulation, which may be slower than that in intensively managed forest.

4.1.5.2 Tools and measures to enhance multiple benefits (carbon stock enhancement)

To safeguard and enhance ecosystem-derived benefits from forest creation or restoration, it is necessary to consider: what ecosystem is being created; where it will be created, what is already there, the site's connectivity to other forest, and the likely speed of forest response.

One approach to spatial priority setting would be to invest in rehabilitation efforts in degraded forest before creating new forest areas, as ecosystem services will be restored here more rapidly (Palmer & Filoso 2009).

When selecting the locations of new forest areas, giving greater weight to areas close to existing can help to meet conservation objectives, by increasing connectivity between forest patches, providing some resources for wildlife resident in natural forest, and providing buffers around natural forest to lessen human impact there (e.g. Bali *et al.* 2007). Even plantations can offer some support to biodiversity conservation in this way.

Putting regulations in place to prevent replacing native ecosystems with high conservation value (or high value for other ecosystem services) with plantations would help to prevent a loss of biodiversity and decline in ecosystem services (Stickler *et al.* 2009). The safeguard against conversion of natural forest would appear to prevent REDD+ funds from supporting such a change of use (UNFCCC 2010), but other valuable natural ecosystems are still vulnerable.

Forest restoration will often be more favourable than development of commercial plantations for the enhancement of water regulation and many other ecosystem-derived benefits. The approach to restoration will affect the speed and total supply of ecosystem-derived benefits. Natural regeneration and assisted natural regeneration are likely to lead to the most 'natural' forest in the long term, and are fairly low-cost, but also relatively slow (Miles *et al*. 2010). Where planting is favoured over natural regeneration, choosing multiple species that are native to the area and planting them in mixed stands will enhance ecosystem-derived benefits, as will a choice of site management practices that enhance biodiversity and ecosystem services (such as allowing undergrowth to grow rather than clearing it).

To enhance ecosystem-derived benefits as part of f*orest landscape restoration* (FLR), practices should be prioritised which are beneficial to the ecosystem services of greatest value to local actors. For example, planting native species and creating corridors on degraded land to increase habitat and allow species to move between fragmented patches of forest will help biodiversity, whilst planting on slopes will help prevent erosion and flooding (SCBD 2009). Producing guidance on measures to enhance different ecosystem services may be useful.

Table 10: Ecosystem-derived benefits tools and measures – carbon stock enhancement

Tools and measures	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Regulations to prevent clearing valuable native vegetation	**All ecosystem-derived benefits**	Minimal
Spatial priority setting for forest landscape restoration	**Any selected ecosystem-derived benefits**, depending upon priorities established	See Table 5, page 18
Forest restoration in existing forest	Depending on the restoration practices chosen: **food, wood/fibre, fuel, biodiversity, freshwater**	Minimal cost, but fairly slow
Favourable management practices within plantations	Forest structure is more natural (e.g. mixed age and mixed species stands, understory exists). **All ecosystem-derived benefits**	Slower at meeting carbon storage and sequestration aims, but more resilient in longer-term
Forest restoration rather than conventional planting		
FLR guidance on methods to enhance ecosystem services	**Selected ecosystem-derived benefits,** depending on practices chosen	

4.2 Cross-cutting approaches to REDD+: opportunities to safeguard and enhance multiple benefits

4.2.1 Promoting livelihood changes

Carefully implemented, REDD+ should maintain the supply and security of some local livelihoods (UNEP-WCMC 2007) and provide new income sources, although many communities are sceptical because of its potential to restrict customary access and extraction rights (IFIPCC 2007, CIFOR 2008). Millions of people, especially the rural poor and indigenous groups, are directly dependent upon the goods and ecosystem services provided by forests, and often have no available alternatives. Forests also serve the poor as vital safety nets to provide sustenance and income in the face of shocks (Campbell 2009), which will become increasingly necessary as climate change effects become more severe and widespread.

However, some livelihoods are dependent upon processes of deforestation and forest degradation. REDD+ should aim to secure and enhance the livelihoods of both groups of people, whilst increasing their sustainability. Through providing social benefits such as alternative livelihood development, REDD+ may offer scope for safeguarding and enhancing ecosystem-derived benefits.

Approaches to promoting more sustainable livelihoods may include *community forest management*, *incentives to increase off-farm wages*, *promotion of off-farm employment, promotion of community-based ecotourism*, increasing the *sale and use of non-timber forest products,* development of a

transfer and resource distribution system for REDD+ revenues, *fuel efficiency schemes* and – as covered in earlier sections – implementation of *conservation/sustainable agriculture* (page 20) and *ecoforestry* (page 26).

Changes in livelihoods may lead to changes in the value that local people place upon individual services, as well as displacement of pressures from one service to another. Livelihood changes may therefore lead to trade-offs between services (e.g. a change from shifting cultivation to ecotourism may decrease pressure on soils, but increase pressure on water supply).

4.2.1.1 Which approaches affect multiple benefits (changing livelihoods)?

The promotion of change to livelihoods can affect ecosystem-derived benefits through two major processes: collective rights and management responsibilities may be defined, or specific livelihoods may be supported (such as non-timber forest production commercialisation). The latter may form part of the former approach. Assigning local rights and responsibilities may mean that ecosystem-derived benefits valued by local people are better managed; and support to forest-dependent livelihoods, if well thought out, should encourage sustainable management of the biodiversity and ecosystem services underpinning those livelihoods.

Ecosystem-derived benefits can be more evident at a community-level than for any one individual (Angelsen 2009); communal management may be more likely to focus on sustainable use over time. Two broad approaches to involving local and indigenous people in land management and decision-making are *Community-Based Natural Resource Management (CBNRM)* (WWF 2006) and *Integrated Conservation and Development Projects (ICDPs)*. Both are conservation approaches with rural development components (Blom *et al.* 2010) that can help to ensure REDD+ funding is channelled to local levels, and can form project-scale or sub-national interventions as part of broader REDD+ architecture. Both have the potential to foster social and ecosystem-derived benefits relevant to local communities. They were the focus of international discourse before PES (Payments for Ecosystem Services) initiatives and REDD+ were developed, and can offer various lessons, most notably on: the use of adaptive management linked to hypothesis testing, establishment of strong, flexible local management, long-term funding, effective communication with local stakeholders and enabling real decision-making by local institutions (Angelsen 2009).

Community forest management is a type of CBNRM, which can generate additional incentives to maintain forests by ensuring that benefits are captured locally. In Tanzania, for example, participatory forest management formalises the role of local communities through elected Village Councils and Village Assemblies (Burgess *et al*. in press). It builds upon the country's legal framework for land tenure, which vests these village governance organs with responsibility for managing the 'village lands' within their boundaries. Joint Forest Management involves both forest-adjacent villages and government managers, whilst in Community-based Forest Management, local villagers are the sole forest manager of communally reserved forests on village lands.

Communities that are already engaged in sustainable management of forest may wish to participate in REDD+, but if these are not catered for by national REDD+ schemes, they may find it difficult to fund the associated costs.

Increasing the sale and use of non-timber forest products (NTFPs) may help to increase local to national recognition of the importance of forest ecosystem services. It can be very challenging to commercialise NTFPs beyond a local area, not least because it is difficult to acquire definitive information about the limits to sustainable harvest, and because of limited access to markets (Marshall *et al*. 2006).

Community-based ecotourism can realise the economic values of biodiversity and recreation services. Preconditions include a potential market, and a sufficiently attractive landscape or interesting biota. Careful management is required to limit pressures on the forest (Ogutu 2002). Disadvantages can include the impacts of associated infrastructure development, water use and sometimes wildlife disease (e.g. Adams *et al*. 2001) on ecosystem services.

Fuel efficiency schemes, including rural electrification and improved stoves, are proposed in some NJPs to reduce reliance on fuelwood and charcoal for energy. The aims are to reduce degradation of forest carbon stocks (and consequently other services dependent on forest structure), and to alleviate poverty (through improved health and reduced time devoted to fuel collection). Rural electrification is likely to increase the demand for energy and so risks a trade-off between reducing carbon emissions from forest degradation and from use of fossil fuels. Associated infrastructure development may also damage or destroy areas of forest. Developing low-carbon energy sources such as wind, hydroelectricity and solar power will avoid the emissions issue, and when developed on a small-scale may require less infrastructure.

Supply-side measures such as *fuelwood production and plantations* can also help, but will work best in addition to rather than instead of efficiency measures (Angelsen 2009).

4.2.1.2 Tools and measures to enhance multiple benefits (changing livelihoods)

Payment for Environmental Services (PES) incentive schemes transfer money from the recipients of an ecosystem service to those responsible for its maintenance or enhancement. At least in some countries, REDD+ itself may be implemented through a PES-type scheme, with performance-based payments compensating forest owners and users for forest carbon conservation. Where willing funders are available, or legislation compels payments by service-users, further payments may be made for non-carbon services of forests to produce "premium" REDD+ credits. This would have positive effects on those ecosystem services that are prioritised by a country and valued under such a scheme. To date, PES schemes tend to fund water provision, soil conservation and biodiversity conservation. Wunder (2007) provides a useful review.

A new approach to contracting landowners to supply ecosystem services is being tested in Australia (Australian Government 2006). Landowners are given the opportunity to bid for funding to maintain and restore the biodiversity of valued ecosystems. Landowners bid for a conservation contract ('agreement') in a 'reverse auction', which identifies a set of sites from the available bids that offers the greatest conservation value [14] for the least cost. When the auction round is complete, the remainder of those landowners who have made a bid are given a 'take it or leave it' offer, based on

[14] The conservation value is evaluated using a Conservation Value Index that includes the significance of the conservation feature (its size and quality), the long-term security of the commitment to protect it, and the service provided by the landowner (i.e. the management of the conservation asset). An analogous index could be formulated for REDD+, but rigorous testing is required to assess suitability for the desired outcomes.

the average value of the agreements for successful bids with an equivalent conservation value. Landowners commit to specific conservation actions, and to refrain from converting the native vegetation for a number of years or in perpetuity (by attaching a restrictive covenant to the land holding). Multiple auction rounds have been offered, enabling learning for both the government and landowners, and establishing a market price for the conservation agreements.

It may be worth assessing whether this type of model could be adapted for use in REDD+ eligible countries. It combines a market mechanism, working with individual landholders, with a nationally managed fund, and allows multiple criteria such as multiple benefits provision to be used to assess the quality of bids. Prerequisites include clarity of tenure, a regulatory system that allows long-term covenants to be placed on land, a monitoring system with redress for non-compliance, and excellent outreach to land holders.

With regard to specific livelihoods, community-based ecotourism may be promoted using guidance provided by WWF (2001). One solution to potential negative impacts on ecosystem-derived benefits is to apply zoning, encouraging tourists towards 'honeypot' areas through provision of interpretative trails, guided routes or other attractions, thus avoiding disturbance to other areas.

Including *NTFP production* within national strategies and action plans could help to ensure the conservation and sustainable use of these resources, by fostering national interest in ensuring sustainable, regulated harvesting (SCBD 2009). An alternative and complementary approach is to develop community-based monitoring of the resource, and enforcement of local regulation of harvests and quotas.

Table 11: Ecosystem-derived benefits tools and measures – promoting livelihood changes

Tools	**Positive effects on ecosystem-derived benefits**	**Costs and trade-offs**
PES for non-carbon ecosystem services	Most frequently implemented for: **culture & biodiversity, water and soil formation/conservation**	High establishment costs
Carbon and ecosystem-derived benefits conservation agreements (adapting Australian approach)	Most likely to be tractable for services that are easily monitored: **food, freshwater, wood/fibre, culture & biodiversity, primary production**	High establishment costs
Community-based ecotourism	**All ecosystem-derived benefits:** but especially **culture & biodiversity**	Negative impacts need to be managed
Include NTFP production within national strategies and action plans	Helps to recognise and support: **food, freshwater, wood/fibre, culture and biodiversity**	Information for appropriate decision making may be lacking
Locally based monitoring and management of NTFP production		Capacity building requirements

4.2.2 Land-use planning and tenure

Land-use planning and tenure reforms often go hand-in-hand, as uncertainty about tenure can severely hamper attempts to coordinate land use across a region. New income sources from REDD+ are likely to increase land contestations, so tackling such issues will be vital, particularly for the poorer, less powerful households (Campbell 2009). Relevant approaches may involve setting up an improved and more participatory *planning system* to reduce conflicting pressures on land, more stringent *coordination and assessment of infrastructure developments*, a *clearer definition and enforcement of property rights*, *resolution of land tenure issues*[15], *improved governance related to land tenure*, and *revisiting the ownership/management of government lands*.

Land-use decisions may be informed by a priority-setting toolkit, discussed in "Design of a REDD+ strategy and programme", page 13+.

4.2.2.1 Which approaches affect multiple benefits (land-use planning & tenure)?

A system to organise and implement *land-use planning* will have implications for ecosystem-derived benefits, depending on the location and quantity of land that is allocated for different functions (which may overlap) e.g. food production, forest protection for REDD+, timber production, and human settlement.

Any land-use planning system may have significant impacts on people currently using forest land, including through their access to ecosystem-derived benefits. Disputed or unrecognised rights can relate to indigenous territories, ancestral lands, extractive reserves, community forests, concessions and agroforestry-based communities as well as private land (Sunderlin *et al.* 2009). *Participatory planning for land management (*Chomitz *et al*. 2006) can maximise benefits and minimise harms to local people. It should pay particular attention to minority groups who may face discrimination in the delineation of land rights and to related issues of equity in access to ecosystem-derived benefits (Dkamela *et al.* 2009).

Where informal systems of land tenure have been working well, formalisation of property rights may disrupt access to ecosystem-derived benefits (especially provisioning services). Where multiple groups of people lay claim to an area of land set to benefit from REDD+, mediation may be required. Carbon rights may be different to tenure rights, which could complicate already contested arrangements. Even land holders with secure tenure may choose to deforest if the returns are high enough (Chomitz *et al*. 2006). Cotula & Mayers (2009) provide a useful summary table about different types of forest and land tenure, and the associated challenges for REDD+.

Promoting more stringent *coordination and assessment of infrastructure developments* would aim to give more consideration to the implications, both positive and negative, of a given development in the context of regional land use plans. This may help to ensure more effective, strategic planning that minimises tradeoffs between ecosystem service and social goals (Chomitz *et al*. 2006). Limiting infrastructure development in forest would minimise disturbance and access to market for hunters,

[15] Land tenure refers to the right, whether customary or statutory, that determines who can use forest lands and resources, for how long and under what conditions. Property rights are similar but focused on ownership (Sunderlin *et al.* 2009)

and therefore be beneficial to forest biodiversity by. Conversely, access to cultural and provisioning services can be enhanced by road construction (Bennett *et al.* 2009).

4.2.2.2 Tools and measures to enhance multiple benefits (land-use planning & tenure)

To safeguard and enhance ecosystem-derived benefits, the *land-use planning system* can help to:

(i) resolve conflicts and make trade-offs between ecosystem-derived benefits and carbon explicit

(ii) direct (non-REDD+) funding and efforts to the conservation of areas at risk from international or national leakage.

In some situations, 'land swaps' may be employed to switch the area destined for conversion to a different area with less ecosystem service value.

A clearer *definition of property rights* and *resolution of land tenure issues*, and a *conflict resolution mechanism* may positively or negatively impact on biodiversity and ecosystem services depending on context. Where ecosystems are overexploited, clarifying and resolving tenure issues may be the first step to putting an effective management system in place. Better land-use planning and clarification of property rights, or of historical use rights, are also necessary to ensure an effective REDD+ revenue-distribution mechanism. However, it is often difficult to determine the rightful beneficiaries; some people may be denied access to customary provisioning and cultural services. Gender and class inequalities in access to provisioning services could be entrenched or resolved during the shift from traditional to formalised definitions of tenure (Coad *et al*. 2008); identifying these inequalities through community consultation is the first step to resolving them.

Ensuring thorough *social and environmental assessments* are carried out prior to any infrastructure developments may help to expose trade-offs between different policy objectives, consider likely impacts and allow mitigation strategies to be put in place for ecosystem-derived benefits.

Table 12: Ecosystem-derived benefits tools and measures – land-use planning and tenure

Tools	**Positive effects on ecosystem-derived benefits**	**Costs and trade-offs**
Direct non-REDD+ funding at areas at risk from leakage	**All ecosystem-derived benefits**	Minimal
Land swaps	**All ecosystem-derived benefits**	Costs influenced by opportunity cost / land value of new area
Conflict resolution mechanism/process	Access to provisioning services: food, wood/fibre, fuel, culture & biodiversity	Minimal
Social and environmental assessments of infrastructure development	See Table 5, page 18	

4.2.3 Education, local capacity-building and awareness-raising

Education and awareness-raising are key to increasing public understanding of and support for REDD+, and to building capacity to enable participation in planning and implementation. Approaches may include *providing education/training to facilitate changes in land use techniques*, enabling of *the principle of free, prior and informed consent, increasing public concern for forest conservation,* or *marketing sustainably produced timber in consumer countries. Capacity building in government and research institutions* has already been discussed in Institutional arrangements and capacity building for REDD+, page 8.

4.2.3.1 Which approaches affect multiple benefits (education, capacity, awareness)?

As part of education and awareness-raising, a national consultation and engagement strategy (covered further in Section 3.1, page 8) will be a key part of initial institutional arrangements for REDD+, so that people can be engaged and consulted with effectively from the beginning. This should include information on the multiple benefits that REDD+ can provide to highlight their relevance and the need to plan for them.

To allow *free, prior and informed consent (FPIC)* of stakeholders living and working in forests, it is necessary that they are adequately informed (through traditional knowledge and communication of current scientific understanding) about how forest ecosystem services are provided, how they underpin one another and local livelihoods, and are consulted about the implementation of REDD+ on their land and its likely implications for access to/provision of the ecosystem-derived benefits (Brown *et al*. 2008). To some extent, the same principles apply to the general population and their consent for REDD+ policy as a whole.

In implementing REDD+, *training and education to facilitate changes in land-use techniques* will be required in a number of areas discussed elsewhere to ensure success, for example:

- providing training to forestry workforces in RIL techniques (page 26) will increase good forestry practices, improve worker safety, enhance the protection of biodiversity and maintain other ecosystem services (Putz & Nasi 2010);
- community forest management (page 31) can provide technical training and education in a number of activities beneficial to ecosystem-derived benefits including forest patrols, fire controls, assisted natural regeneration, fuel-efficient stoves, sustainable agricultural intensification, and livelihood strategies (Poffenberger & Smith-Hanssen 2009);
- training in locally-based monitoring of ecosystem-derived benefits as part of establishing MRV systems (page 38) can ensure that ecosystem-derived benefits are considered, monitored and safeguarded in a cost-effective way at the same time as raising awareness and ownership.

Marketing sustainably produced timber in consumer countries is vital to ensure demand, so that ecosystem-derived benefits are maintained and enhanced in response both to national legislation and requirements and because they are sought by global consumers. If consumption patterns do not change, SMF in production forests cannot be effective (Karsenty 2008, cited by Lovera 2008).

4.2.3.2 Tools and measures to enhance multiple benefits (education, capacity, awareness)

A national communication strategy on REDD+ should emphasise the role of ecosystem-derived benefits, in order to inform the general population about REDD+ strategy, and foster informed debate.

Supporting the *principle of free, prior and informed consent (FPIC),* where informed consent involves an explanation of what the likely implications for access to/provision of the ecosystem-derived benefits are, will also help stakeholders to understand how ecosystem-derived benefits, and their access to them, will be affected by REDD+.

Table 13: Ecosystem-derived benefits tools and measures – education, capacity building and awareness-raising

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Incorporation of REDD+ multiple benefits in national communication strategies	**Any selected ecosystem-derived benefits**	Minimal
Enable free, prior and informed consent, by providing education on ecosystem-derived benefits	**All ecosystem-derived benefits**	Relatively low cost; and REDD+ success much more likely with successful stakeholder engagement

5 Measuring, reporting, verification and monitoring

The activity known as *Measuring, Reporting and Verifying* (MRV) uses the form of a robust, quantitative framework to demonstrate changes in forest-related greenhouse gas (GHG) emissions. MRV may be undertaken by foresters and remote sensing experts, or may involve *locally-based monitoring*. 'Measuring' in this context refers to the estimation of the amount of carbon in any given land area at any given time, which when repeated (monitoring) allows changes over time to be established (Terrestrial Carbon Group Project 2009). These changes in carbon stocks can be estimated using a combination of remote-sensing and ground-based data on carbon density (e.g. forest inventories).

'Reporting' refers to the process of detailing the results of the measurements of carbon and changes in carbon stocks at pre-determined intervals. Under the UNFCCC, reporting of greenhouse gas (GHG) emissions and removals needs to be transparent, consistent, comparable, complete and accurate, so the MRV framework is designed to meet those conditions. Reporting is usually undertaken using GHG inventories (GOFC-GOLD 2009). 'Verifying' is the process of independent review of the GHG inventories and is guided by the same principles as for reporting (GOFC-GOLD 2009). Verification can be an internal process, implementing a quality assurance and quality control plan, and/or can be achieved through third party (external) verification using a set of defined criteria (Brown 2002).

The primary reason for monitoring ecosystem-derived benefits is to understand the effect of REDD+ activities upon them, and to adapt these activities if necessary. This process does not require any reporting to or verifying by a third party. It is unlikely that there will be a stringent requirement under UNFCCC to measure, report and verify the status of ecosystem-derived benefits, but some of the results of ecosystem-derived benefits monitoring may be valuable for reporting to the Convention on Biological Diversity. A direct requirement to undertake the whole MRV process for one or more ecosystem-derived benefits is most likely when a Payment for Ecosystem Services scheme is in place, or when premium REDD+ credits are being sold.

Detailed information on potential monitoring approaches for ecosystem-derived benefits is available in *Multiple Benefits Series **3*** (Teobaldelli *et al*. 2010).

5.1.1 Which approaches affect multiple benefits (MRV)?

There are possible synergies between MRV of forestry-related emissions by sources and removals by sinks resulting from REDD+ activities and monitoring of ecosystem-derived benefits (Teobaldelli *et al.* 2010). It has been suggested that there is an opportunity to incorporate ecosystem-derived benefits monitoring in the carbon MRV system, thus promoting and financially supporting this monitoring to enable performance assessment over time (Karousakis 2009). REDD+ monitoring will certainly increase access to technologies such as hand-held global positioning systems and remote-sensing analysis. The extent to which ecosystem-derived benefits monitoring adds an extra cost to the process depends upon the choice of indicators and their data needs.

Some of the information required for carbon MRV can certainly be used to derive ecosystem service or biodiversity information. For example, remote-sensing data can be analysed at little additional cost to infer forest productivity. Forest inventories often contain species- or genus-specific information on trees to help in estimating carbon density (Brown 2002). This could be used to infer tree biodiversity. However, additional data collection would be required to ensure complete coverage of ecosystem-derived benefits or to improve the resolution of the available information (Teobaldelli *et al*. 2010).

Monitoring and verifying the effect of REDD+ activities on carbon stocks may be needed beyond the time horizon of a demonstration project (Penman *et al*. 2003). This is also likely to be true of ecosystem-derived benefits, some of which may lag behind carbon in their response to change.

Experience of third-party verification of carbon stocks is limited (Moura-Costa *et al.*, 2000) and as such cannot inform any verification process for ecosystem-derived benefits. Any required verification is, therefore, likely to be a challenging process for ecosystem-derived benefits.

5.1.2 Tools and measures to enhance multiple benefits (MRV)

In terms of cost, it would make sense to incorporate monitoring of ecosystem-derived benefits within the carbon MRV system if the data and methodology permits. As costs will limit the scope for additional monitoring of ecosystem-derived benefits, it is crucial that REDD+ plans identify the most important ecosystem-derived benefits to monitor, rather than the easiest.

Monitoring is only useful when there is a clear purpose – it should not be undertaken for its own sake. It has been suggested that ecosystem-derived benefits need to be monitored in order to obtain

regular *feedback on the implementation and impacts of readiness activities* (Global Witness 2010). It has also been argued that if ecosystem-derived benefits are not measured, there is no way to ensure that REDD+ activities, such as forest restoration, are leading to the delivery of services (Palmer & Filoso 2009).

The *extent of the carbon pools monitored* has implications for specific ecosystem types. That is, if countries account for soil carbon, ecosystems with a high soil organic matter content such as peat swamp forests will appear considerably more valuable than other tropical forest. At present, IPCC guidance leaves it to the country to decide whether to include soil organic carbon in its MRV.

To verify that safeguards on conversion of natural forest had been complied with, it will be necessary to identify the original locations of natural forest, and to track whether it is persisting there. A *comprehensive land-based carbon accounting system* would enable such rigorous tracking of changes in land use, allowing changes from intact forest to other land uses to be identified (Harvey *et al*. 2010).

Monitoring can contribute to *adaptive management* strategies to ensure that the ecosystem-derived benefits valued most are maintained or enhanced. A monitoring system for ecosystem-derived benefits would thus be most useful where its results are assessed against clear goals for the delivery of ecosystem-derived benefits, and REDD+ activities adapted if these goals are not being met. Ideally, there would be a continuous interaction between project design, monitoring and management, ensuring that ecosystem-derived benefits are maintained and enhanced, and changing the REDD+ practices if not.

On a site scale, *locally-based monitoring*, either alongside community forest management, or involving local government staff such as forest rangers, may offer several advantages (Burgess *et al*. in press). Entrusting forest inventories and monitoring to communities and locally-based staff could improve transparency, highlight the value of community forest management and reduce costs (http://www.communitycarbonforestry.org/; Danielsen *et al*. 2005, 2008; van Laake *et al*. 2009, Angelsen 2009). Locally-based monitoring for ecosystem-derived benefits can help to engage communities in preparation of these management plans, in establishing the multiple benefits goals that should be monitored, and in acting when goals are not being met (Danielsen *et al*. 2008).

Under the Compliance and Voluntary Carbon Markets, numerous small or large-scale projects already include mandatory *monitoring, reporting and verification of ecosystem-derived benefits* (Kolmuss *et al*. 2008). This suggests that on a small scale at least, incorporating ecosystem-derived benefits in an MRV system can be feasible. Further, experience from the carbon markets suggests that promotion and supporting of social and environmental safeguards should be mandatory (Phelps *et al*. 2010).

Where *verification* of ecosystem-derived benefits is required, costs could be reduced by defining a set of eligibility criteria and acceptable confidence intervals associated with the multiple benefits goals (Penman *et al*. 2003). Local verification within a locally-based monitoring system is also attractive as it could identify rapidly and most cost-effectively whether the stated goals are met, although it does not necessarily ensure that verification is unbiased.

Table 14: Ecosystem-derived benefits tools and policies – measuring, reporting and verification

Tools	Positive effects on ecosystem-derived benefits	Costs and trade-offs
Analysis of carbon MRV results to identify changes from natural forest to other land uses	Monitor safeguard on conversion**: all ecosystem-derived benefits**	MRV system may be more comprehensive than required for basic REDD+ compliance
Inclusion of soil organic carbon (SOC) in MRV	Increase the relative value of peat-swamp forest above other forest types, perhaps attracting a large share of REDD+ finance (Miles 2007)	Ecosystem-derived benefits delivered by high SOC ecosystems will benefit; other ecosystems and their services may suffer
Interpreting carbon MRV data to derive ecosystem-derived benefits information	Remote-sensing data could be relevant for : **primary production, or any selected ecosystem-derived benefits (**if other data layers are available to aid interpretation**)** Tree species/genus data could be relevant for: **food**, **culture & biodiversity**	Additional analyses incur relatively small additional costs Data availability is likely to restrict the range of ecosystem-derived benefits that can be monitored, and the accuracy of the results
Ecosystem-derived benefits specific monitoring	Information is more directly relevant to and may be more accurate for ecosystem-derived benefits monitored: **any selected ecosystem-derived benefits**	Costs are greater as a result of more expertise being required in design and implementation
Locally-based monitoring	Monitoring is specific to ecosystem-derived benefits which are of interest locally. Local communities have greater buy-in and adherence to management plans. Adaptive management (below) is more likely and more rapid: **any selected ecosystem-derived benefits**	National to global scale ecosystem-derived benefits assume less importance than those relevant locally. Wider capacity-building required; verification more challenging
Use of monitoring results for adaptive management	Use of results to improve and enhance the safeguarding of **any selected ecosystem-derived benefits**	Limited experience means that this may be difficult to implement

6 Summary

Different approaches to REDD+ planning and implementation have different implications for forest biodiversity, ecosystem services and the people that depend on them. Planning at an early stage for positive outcomes for multiple benefits can avoid inadvertent commitment to a suboptimal or actively harmful course of action. Making use of appropriate tools and putting policies in place to safeguard and enhance ecosystem-derived benefits can also increase the benefits from REDD+, sometimes at little additional cost.

Biodiversity can also be seen as an enabler as well as a beneficiary from REDD+, underpinning both the size and the resilience of forest carbon stocks. It is expected that low-diversity plantations and degraded forests will be more vulnerable to climate change than intact natural forests.

The identity, magnitude and recipients of the benefits and harms associated with REDD+ will depend on the range, location and type of REDD+ activities, as well as on the tools and measures adopted to address specific biodiversity and ecosystem services issues. Consultation, engagement and buy-in of stakeholders, from national government to local communities, are critical both for the overall success of REDD+ and to ensure that different values attached to potential multiple benefits are understood.

At the national level, it is useful to identify the potential value of ecosystem-derived benefits and the identity of the groups that value them, so as to improve outcomes for the nation and its forest-dependent communities, to demonstrate added value to funders, and sometimes to facilitate complementary finance from conservation or other sources. Trade-offs may involve exchanging short-term use of resources for long-term sustainable use, or may involve a long-term prioritisation of one benefit over another.

Useful activities in the design phase therefore include identification of data requirements and tools for modelling ecosystem-derived benefits and capacity building in basic understanding of these benefits and in use of tools. Spatial priority-setting methodologies can be used to inform decision-making on what REDD+ activities will be undertaken in what locations, delivering what anticipated multiple benefits. The management plan for each activity would ideally include explicit goals for the delivery of those benefits that are most valued, a monitoring scheme to identify whether the goals are being met, and a commitment to adaptive management to reduce any negative impacts observed. Paying attention in this way to multiple benefits at each stage of REDD+ planning and implementation will be of great help in ensuring their delivery.

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