INDICATORS AND INFORMATION SYSTEMS FOR BIODIVERSITY AND DEVELOPMENT – GUIDANCE FROM THE PAN EUROPEAN REGION

UNEP

Published December 2016

The United Nations Environment's World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of the UN Environment, the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

Written by

Philip Bubb, Sarah Ivory and Andy Arnell (United Nations Environment's World Conservation Monitoring Centre).

Acknowledgements

The authors would like to thank the national project partners in the Pan European region for their contributions to the project workshops and materials, Thierry Lucas and Maria Morgado (UN Environment – Europe Office) and Oksana Lipka (WWF Russia) for their partnership and delivery of the project "Strengthening MEA synergies and indicators in NBSAPs for the Pan-European region", and "Support for the Revision of National Biodiversity Strategies and Action Plans in Central Asian Countries", and Fiona Danks (UNEP-WCMC), Sarah Darrah (UNEP-WCMC), Nina Bhola (UNEP-WCMC) and Brian MacSharry (UNEP-WCMC) for valuable review and input to this document.

Citation

UNEP-WCMC. 2016. Indicators and Information Systems for biodiversity and development - guidance from the Pan European region. UNEP-WCMC, Cambridge, UK.

Layout: Ralph Design Ltd. (www.ralphdesign.co.uk).

UNEP WCMC

UNEP World Conservation Monitoring Centre
(UNEP-WCMC)
219 Huntingdon Road,
Cambridge CB3 0DL, UK
Tel: +44 1223 277314
www.unep-wcmc.org
Email: info@unep-wcmc.org

Contents

LIST OF FIGURES, TABLES AND BOXES

Figures

Tables

Boxes

Executive Summary

This document aims to help government staff responsible for biodiversity and sustainable development to have effective indicators and information systems for their work. It presents lessons from the projects "Strengthening Multilateral Environmental Agreements (MEA) synergies and indicators in National Biodiversity Strategies and Action Plans (NBSAPs) for the Pan-European region", and "Support for the Revision of National Biodiversity Strategies and Action Plans in Central Asian Countries", and provides guidance to support the production of biodiversity information for national biodiversity management and actions towards the Sustainable Development Goals (SDGs). The project was implemented by the UN Environment Europe Office and the UN Environment's World Conservation Monitoring Centre from 2014 to 2016, with funding by the European Commission's Thematic Programme for Environment and Sustainable Management of Natural Resources including Energy fund (ENRTP), China Trust Fund, and contributions from UN Environment (Environment Fund).

The first section of this document is an overview of the results and some lessons from the project's regional capacity development workshops, which explored developing common sub-regional indicators. The project found that although there are potential benefits for having common national scale biodiversity indicators for within a sub-region, the demand for such indicators was not sufficient to stimulate ongoing activities for this purpose. The project then adapted to include dialogue about and support for the development of biodiversity information systems, and this document presents preliminary guidance developed for this.

The second section illustrates how indicators developed for revised National Biodiversity Strategies and Action Plans can be relevant for Sustainable Development Goals, as well as for mainstreaming biodiversity into development strategies. It then addresses the ways in which information systems are needed for decision-making on the environment, to provide information on the status and trends of biodiversity, ecosystem functioning, and the supply and importance of ecosystem services.

The third section presents a framework to support the design of a national biodiversity information system, linking data production and management to information analysis and communication. Such a system may include all aspects of biodiversity, or focus on selected topics such as protected areas or threatened species.

The design of an information system should start with the definition of users' needs and the key questions that the system will help to address, along with conceptual frameworks to guide the analysis of data. This will inform the design of information products such as indicators, assessments, models and reports. The information system also needs to make available the data required for these products, which involves first the collection of appropriate observations and measurements of biodiversity, and then their adequate management. Guidance is provided on each of these information system components.

A successful information system will require responsible institutions, funding and skilled people for each of its components, which often necessitates co-operation between government agencies, non-government organisations and academia. The design and operation of an information system is therefore as much an institutional and network development task as it is a scientific or technical one. A template for an assessment of capacity needs for an information system is provided, as well as a discussion of drivers of success.

At the core of an information system are the data it makes available, and this document suggests some foundation information subjects for use in planning for biodiversity and sustainable development. The development of available data could follow a progression from land cover and species information to ecosystem services and priority locations for action, depending on the demand for information on these subjects and as resources and capacity permit.

Résumé

Ce document présente les leçons tirées du projet «Renforcement des synergies et des indicateurs des accords multilatéraux sur l'environnement dans les stratégies et plans d'action nationaux pour la biodiversité dans la région paneuropéenne» et fournit des conseils afin de soutenir la production d'informations sur la biodiversité pour soutenir la gestion de la biodiversité et les actions en faveur des objectifs de développement durable (SDG). Le projet a été mis en œuvre par le Bureau européen de l'ONU Environnement et le Centre mondial de surveillance de la conservation de la nature de l'ONU Environnement de 2014 à 2016, grâce au financement du programme thématique pour l'environnement et la gestion durable des ressources naturelles (ENRTP) ainsi que des contributions de l'ONU Environnement (Fonds pour l'environnement).

La première section de ce document donne un aperçu des résultats et des leçons tirées des ateliers régionaux de renforcement des capacités du projet qui ont exploré l'élaboration d'indicateurs sous-régionaux communs. Le projet a constaté que, même s'il existe des avantages potentiels dans le développement des indicateurs communs de biodiversité à l'échelle nationale dans une sous-région, la demande pour de tels indicateurs n'était pas suffisante pour entraîner des activités continues à cette fin. Le projet a ensuite été élargi pour inclure le soutien au développement des systèmes d'information, et ce document présente les lignes directrices préliminaires élaborées à cet effet.

La deuxième section illustre comment les indicateurs élaborés pour les Stratégies et plans d'action nationaux sur la biodiversité révisés peuvent être pertinents pour les Objectifs de développement durable et donc pour intégrer la diversité biologique dans les stratégies de développement. Elle considère ensuite l'importance des systèmes d'information pour la prise de décisions sur l'environnement, et pour l'approvisionnement des informations sur l'état et les tendances de la biodiversité, le fonctionnement des écosystèmes et l'approvisionnement et l'importance des services écosystémiques.

La troisième section présente un cadre pour soutenir la conception d'un système national d'information sur la biodiversité, en reliant la production et la gestion des données à l'analyse et à la communication des informations. Un tel système pourrait traiter tous les aspects de la biodiversité, ou également pourrait se concentrer sur des sujets choisis tels que les aires protégées ou les espèces menacées.

La conception d'un système d'informations devrait commencer par la définition des besoins des utilisateurs et des questions clés que le système aidera à aborder, ainsi que des cadres conceptuels pour guider l'analyse des données. Cela permettra de concevoir des produits d'information tels que des indicateurs, des évaluations, des modèles et des rapports. Le système d'informations doit également mettre à disposition les données requises pour ces produits, ce qui implique d'abord la collecte des observations et mesures appropriées de la biodiversité, et leur gestion adéquate. Des conseils sont fournis sur chacun de ces composants du système d'information.

Un système d'informations efficace nécessite des institutions responsables, du financement et des personnes qualifiées pour chacune de ses composantes, ce qui requiert souvent une coopération entre les organismes gouvernementaux, les organisations non gouvernementales et les milieux universitaires. La conception et la mise en œuvre d'un système d'informations est donc une tâche institutionnelle et de développement de réseau tout autant que scientifique ou technique. Un modèle d'évaluation des besoins en capacité d'un système d'informations est fourni, ainsi qu'une discussion sur les facteurs de réussite.

Au cœur d'un système d'informations se trouvent les données qu'il met à disposition, et ce document propose des sujets d'information fondamentale pour la planification de la biodiversité et le développement durable. Le développement des données disponibles pourrait suivre une évolution des informations sur la couverture terrestre et sur les espèces aux informations sur les services écosystémiques et sur les lieux d'action prioritaires, selon la demande d'information sur ces sujets et selon les ressources et la capacité.

Resumen ejecutivo

Este documento presenta lecciones del proyecto "Fortalecimiento de las sinergias y los indicadores de los Acuerdos Ambientales Multilaterales (MEA) en las Estrategias y Planes de Acción Nacionales sobre Biodiversidad para la región Pan Europea", y proporciona orientación para apoyar la producción de información sobre biodiversidad para la gestión nacional de la biodiversidad y acciones hacia los Objetivos de Desarrollo Sostenible (ODS). El proyecto fue ejecutado de 2014 a 2016 por la Oficina Europea de las Naciones Unidas para el Medio Ambiente y el Centro Mundial de Vigilancia de la Conservación de las Naciones Unidas para el Medio Ambiente, y financiado por el Programa Temático para el Medio Ambiente y la Gestión Sostenible de los Recursos Naturales (ENRTP) de la Comisión Europea, y de la ONU medio ambiente (Fondo para el Medio Ambiente).

La primera sección de este documento es una visión general de los resultados y algunas lecciones de los talleres regionales de desarrollo de capacidades del proyecto, que exploraron el desarrollo de indicadores comunes subregionales. El proyecto encontró que aunque existen beneficios potenciales para tener indicadores comunes de biodiversidad a escala nacional dentro de una subregión, la demanda de tales indicadores no fue suficiente para provocar actividades continuas para este propósito. El proyecto se amplió para incluir el apoyo al desarrollo de sistemas de información, y este documento presenta la guía preliminar desarrollada para esto.

La segunda sección ilustra cómo los indicadores desarrollados para las Estrategias y Planes de Acción Nacional de Biodiversidad revisados pueden ser relevantes para los Objetivos de Desarrollo Sostenible, así como para integrar la biodiversidad en las estrategias de desarrollo. A continuación se abordan las formas en que los sistemas de información son necesarios para la toma de decisiones sobre el medio ambiente, para proporcionar información sobre la situación y las tendencias de la diversidad biológica, el funcionamiento de los ecosistemas y el suministro e importancia de los servicios ecosistémicos.

La tercera sección presenta un marco para apoyar el diseño de un sistema nacional de información sobre biodiversidad, vinculando la producción y gestión de datos con el análisis y la comunicación de la información. Tal sistema puede incluir todos los aspectos de la biodiversidad, o enfocarse en temas seleccionados como áreas protegidas o especies amenazadas.

El diseño de un sistema de información debe comenzar con la definición de las necesidades de los usuarios y las preguntas clave que el sistema ayudará a abordar, junto con los marcos conceptuales para guiar el análisis de los datos. Esto informará al diseño de productos de información tales como indicadores, evaluaciones, modelos e informes. El sistema de información también debe poner a disposición los datos requeridos para estos productos, lo que implica primero la recolección de observaciones y medidas apropiadas de la biodiversidad, y luego su manejo adecuado. Se proporciona orientación sobre cada uno de estos componentes del sistema de información.

Un sistema de información exitoso requerirá instituciones responsables, financiamiento y personal calificado para cada uno de sus componentes, lo que a menudo requiere la cooperación entre agencias gubernamentales, organizaciones no gubernamentales y el mundo académico. Por lo tanto, el diseño y el funcionamiento de un sistema de información es tanto una tarea institucional y de desarrollo de una red como una tarea científica o técnica. Se proporciona una plantilla para una evaluación de las necesidades de capacidad para un sistema de información, así como una discusión de los impulsores del éxito.

En el núcleo de un sistema de información están los datos que pone a disposición, y este documento sugiere algunos temas de información fundamentales para su uso en la planificación de la biodiversidad y el desarrollo sostenible. El desarrollo de los datos disponibles podría seguir una evolución desde la cobertura de la tierra y la información sobre las especies hasta los servicios de los ecosistemas y los lugares prioritarios para la acción, dependiendo de la demanda de información sobre estos temas y según los recursos y la capacidad disponibles.

Резюме

В настоящем документе представлены уроки, извлеченные при осуществлении проекта «Повышение синергетического эффекта многосторонних природоохранных соглашений (МПС) и роли показателей национальных стратегий и планов действий по сохранению биоразнообразия (НСПДСБ) в странах общеевропейского региона», и приведены методические рекомендации в поддержку получения информации для осуществления НСПДСБ и для национальных действий по достижению Целей устойчивого развития (ЦУР). Проект осуществлялся Европейским отделением Программы Организации Объединенных Наций по окружающей среде (ЮНЕП) и Всемирным центром мониторинга охраны природы ЮНЕП в 2014–2016 годах, а финансировался Европейской комиссией за счет средств Тематической программы по окружающей среде и рациональному использованию природных ресурсов, в том числе фонда «Энергия» (ENRTP), при участии Программы Организации Объединенных Наций по окружающей среде (Фонд окружающей среды).

Первый раздел настоящего документа представляет собой общий обзор результатов и некоторых уроков, полученных при проведении в рамках проекта семинаров-практикумов по развитию регионального потенциала, в ходе которых изучались вопросы разработки общих субрегиональных показателей. При осуществлении проекта было установлено, что, несмотря на наличие потенциальных выгод от использования общих показателей для реализации НСПДСБ в пределах субрегиона, спрос на такие показатели был недостаточен для того, чтобы стимулировать продолжающуюся деятельность в этом направлении. Затем проект был адаптирован путем включения в него диалога о разработке информационных систем по биоразнообразию и поддержки такой разработки, В настоящем документе представлены предварительные методические рекомендации в этом отношении.

Второй раздел иллюстрирует, каким образом показатели, разработанные для пересмотренных НСПДСБ, могут являться актуальными для ЦУР, а также для включения НСПДСБ в стратегии развития. Далее в нем рассматриваются причины, по которым информационные системы необходимы для принятия решений по окружающей среде, чтобы обеспечить информацией о состоянии и тенденциях изменения биоразнообразия, функционирования экосистем, а также предоставлении и важности экосистемных услуг.

В третьем разделе представлены рамочные основы в поддержку проектирования национальной информационной системы по биоразнообразию, связь генерирования данных и управления ими с анализом информации и ее доведением до сведения заинтересованных сторон. Такая система может включать в себя все аспекты биоразнообразия или концентрироваться на выбранных темах, таких как охраняемые природные территории или угрожаемые виды.

Проектирование информационной системы должно начинаться с определения потребностей пользователей и ключевых вопросов, которые система будет помогать решать, наряду с концептуальными основами, задающими направление анализа данных. Это обеспечит информационную основу для проектирования итоговых информационных материалов, таких как показатели, оценки, модели и доклады. Кроме того, в рамках информационной системы необходимо обеспечить доступность данных, требуемых для указанных итоговых материалов, что предполагает сначала сбор данных по соответствующим наблюдениям и результатов количественных измерений биоразнообразия, а затем надлежащее управление ими. По каждому из указанных компонентов информационной системы приводятся методические рекомендации.

Для успешной работы информационной системы потребуются ответственные учреждения, финансирование и квалифицированные специалисты для каждого из ее компонентов, что часто влечет за собой необходимость сотрудничества между правительственными ведомствами, НПО и научными кругами. Таким образом, проектирование и эксплуатация информационной системы представляют собой задачу развития общественных институтов и сетей взаимодействия в той же мере, в какой они являются научно-технической задачей. Приводится матрица для оценки потребностей в потенциале применительно к информационной системе, а также рассматриваются движущие силы успеха.

Центральным элементом информационной системы являются предоставляемые ею данные, и в настоящем документе предлагаются некоторые определения базовых объектов информационной системы для использования при планировании мероприятий по сохранению биоразнообразия и обеспечению устойчивого развития. Разработка имеющихся данных может идти от информации о почвенно-растительном покрове и биологических видах к экосистемным услугам и приоритетным территориям для принятия необходимых мер, в зависимости от спроса на информацию об этих объектах, а также наличия ресурсов и потенциала.

执行摘要

本报告总结了基于项目“加强泛欧洲地区多边环境协定（MEA）间协同增效和国家生物多样性战略行动方案（NBSAPs）的指标”的经验，并提供了为支持国家生物多样性管理和行动，进而推进可持续发展目标（SDG）的实现而开发有关生物多样性信息的指南。该项目由联合国环境规划署的欧洲办公室及其世界保护监测中心于2014年至2016年期间共同执行。项目经费由欧洲委员会环境和包含能源的自然资源可持续管理主题司（ENRTP）提供，联合国环境规划署（环境基金）也提供部分支持。

本报告的第一部分提供了该项目为探索开发次区域尺度通用指标而开展的区域能力建设研讨会的结果及经验教训的总览。我们发现尽管开发可在次区域尺度通用的国家生物多样性指标有其潜在价值，但目前针对此类指标的需求不高且不足以鼓励相关活动的开展。我们对项目进行了一定的扩展，以涵盖对信息系统开发进行支持的内容，本报告提供了相关的初步指南。

第二部分针对如何将为更新国家生物多样性战略行动方案而开发的指标同可持续发展目标相关联，以及如何将生物多样性主流化入发展战略中进行了综述。随后，该部分总结了环境决策制定过程中对于信息系统的不同需求方式，从而为生物多样性、生态系统功能和生态系统服务的供给和重要性提供状态以及趋势信息。

第三部分提供了一个支持设计国家生物多样性信息系统的框架，将数据开发和管理同信息分析和交流链接起来。这样的系统可用以容纳生物多样性相关的各个方面信息，也可重点关注选定的话题如保护区或濒危物种等。

一个信息系统的设计应该从用户需求以及系统应支撑的关键问题的定义和指引数据分析的概念框架开始。这将为如指标、评估、建模和报告等信息产品的设计提供依据。信息系统应能够提供这些产品所需要的数据，这就涵盖了生物多样性观察和测量数据的收集以及针对这些数据的完善管理。我们针对每一个信息系统模块都提供了相应的指南。

一个成功的信息系统的各个模块都将需要相应的业务机构、资金和专业人员的支持，这就使得政府部门、非政府组织和科研机构间的协调成为必要。一个信息系统的设计和运营不仅仅是一个有关科学或技术的任务，它同时也是一个机构和网络发展的任务。本报告提供了评估一个信息系统相关能力需求的模版以及有关成功因素的综述。

信息系统的核心就是它可以提供的数据，因此本报告推荐了一系列可用于生物多样性和可持续发展规划的基础信息类型。数据的开发可依据针对这些信息类型的需求以及可获取的资源和能力，从地表覆盖和物种信息到生态系统服务和行动优先区域循序渐进地展开。

وينبغي أن يبدأ تصميم نظام المعلومات بتعريف احتياجات المستخدمين والمسائل الرئيسية التي سيساعد النظام في تناولها، جنبا إلى جنب مع الأطر المفاهيمية لتوجيه تحليل البيانات. وهذا من شأنه أن ينير تصميم منتجات المعلومات مثل المؤشرات، والتقييمات والنماذج والتقارير. كما يحتاج نظام المعلومات أيضا إلى توفير البيانات اللازمة لهذه المنتجات، التي تنطوي أولا على مجموعة من الملاحظات والقياسات المناسبة للتنوع البيولوجي، ومن ثم إدارتها بصورة كافية. ويتم توفير التوجيه بشأن كل من مكونات نظام المعلومات هذه.

ويتطلب أي نظام معلومات ناجح وجود المؤسسات المسؤولة، والتمويل وأشخاص من ذوي المهارات لكل من مكوناته، والذي غالبا ما يتطلب التعاون بين الوكالات الحكومية والمنظمات غير الحكومية والأوساط الأكاديمية. ومن ثم يكون تصميم وتشغيل نظام المعلومات مثل مهمة التطوير الشبكي والمؤسسي حيث أنه يعد نظاما علميا أو تقني. ويتم توفير نموذج لتقييم الاحتياجات من القدرات لنظام المعلومات، فضلا عن مناقشة العوامل التي تؤدي إلى النجاح.

وتعد البيانات بمثابة الأساس الذي يقوم عليه أي نظام للمعلومات، وتشير هذه الوثيقة إلى بعض الموضوعات المتعلقة بالمعلومات الأساسية لاستخدامها في تخطيط التنوع البيولوجي والتنمية المستدامة. ويمكن لتطوير البيانات المتاحة أن يتتبع التقدم المحرز بدءا من الغطاء النباتي وأنواع المعلومات وصولا إلى خدمات النظام الإيكولوجي، والمناطق ذات الأولوية، وهذا يتوقف على الطلب للحصول على معلومات حول هذه الموضوعات وحسبما تسمح الموارد والقدرات المتوفرة.

ويحتوي القسم الأول من هذه الوثيقة على لمحة عامة عن النتائج وبعض الدروس المستفادة من ورش العمل المعنية بتنمية القدرات الإقليمية للمشروع، والذي بحث وضع مؤشرات دون إقليمية مشتركة. ووجد المشروع أنه على الرغم من أن هناك فوائد محتملة لوجود مؤشرات تنوع بيولوجي على نطاق وطني مشترك داخل منطقة دون إقليمية، إلا أن الطلب على هذه المؤشرات لم يكن كافيا لإحداث أنشطة جارية لهذا الغرض. ثم توسع المشروع ليشمل الدعم لتطوير نظم المعلومات، وتقدم هذه الوثيقة إرشادات أولية وضعت لهذا الغرض.

ويوضح القسم الثاني من هذه الوثيقة كيف يمكن للمؤشرات التي توضع للاستراتيجية وخطة العمل الوطنيتان لحفظ التنوع البيولوجي المنقحة أن تكون ذات صلة بتحقيق أهداف التنمية المستدامة، وكذلك صلتها بتعميم التنوع البيولوجي في استراتيجيات التنمية. ثم يتناول القسم الثاني السبل التي تحتاجها نظم المعلومات لاتخاذ القرارات بشأن البيئة، لتوفير معلومات عن حالة واتجاهات التنوع البيولوجي وعمل النظام الإيكولوجي، وإتاحة خدمات النظام الإيكولوجي وأهميته.

ويقدم القسم الثالث إطارا لدعم تصميم نظام وطني للمعلومات المتعلقة بالتنوع البيولوجي، وربط إنتاج وإدارة البيانات بتحليل المعلومات والاتصالات. وقد يشمل هذا النظام جميع جوانب التنوع البيولوجي، أو يركز على موضوعات مختارة مثل المناطق المحمية أو الأنواع المهددة بالانقراض.

موجز تنفيذي

تقدم هذه الوثيقة الدروس المستفادة من مشروع " تعزيز الاتفاقات البيئية المتعددة الأطراف، والتآزر والمؤشرات في استراتيجية وخطة العمل الوطنيتان لحفظ التنوع البيولوجي لمنطقة أوروبا ثالشاملة"، كما تقدم هذه الوثيقة إرشادات لدعم إنتاج معلومات عن التنوع البيولوجي للإدارة الوطنية للتنوع البيولوجي والعمل نحو تحقيق أهداف التنمية المستدامة. وقد تم تنفيذ هذا المشروع من قِبل المكتب الإقليمي للأمم المتحدة للبيئة لمنطقة أوروبا والمركز العالمي لرصد حفظ الطبيعة التابع للأمم المتحدة للبيئة في الفترة ما بين 2014 إلى 2016، بتمويل من البرنامج المواضيعي للبيئة والإدارة المستدامة للموارد الطبيعية التابع للمفوضية الأوروبية بما في ذلك صندوق الطاقة، وإسهامات من الأمم المتحدة للبيئة (الصندوق البيئي).

Section 1 – Lessons on developing common indicators from UN Environment support in the Pan-European region

The project "Strengthening Multi-lateral Environmental Agreements synergies and indicators in National Biodiversity Strategies and Action Plans for the Pan-European region", and "Support for the Revision of National Biodiversity Strategies and Action Plans in Central Asian Countries" was implemented by the UN Environment Europe Office and the UN Environment's World Conservation Monitoring Centre from 2014 to 2016, and aimed to develop capacity and examples of effective indicators to monitor progress in implementing National Biodiversity Strategies and Action Plans, including exploration of opportunities to develop common indicators between neighbouring countries. For this aim the project held three workshops for government Ministries, national environmental agencies and research centres responsible for the production and use of biodiversity information:

1) South eastern Europe project workshop, April 2015, in Belgrade, Serbia, with 13 delegates from Albania, Bosnia and Herzegovina, Croatia, Montenegro, Slovenia and Serbia.

2) Eastern Europe, southern Caucasus, and central Asia project workshop, September 2015, in Issyk-Kul, Kyrgyzstan, with 26 delegates from Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Ukraine and Uzbekistan, as well as representatives of United Nations Development Programme, Secretariat of Convention on Biological Diversity and WWF.

3) Central Asia, eastern Europe, south eastern Europe and southern Caucasus project workshop, March 2016, in Podgorica, Montenegro, with 18 delegates from Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Slovenia, Serbia, Tajikistan and Uzbekistan, as well as representatives of United Nations Development Programme and WWF.

By 2015, most countries that participated in the project had completed the revision of their National Biodiversity Strategies and Action Plans in support of the Strategic Plan for Biodiversity 2011-2020 and its framework of 20 Aichi Biodiversity Targets. This meant that they had defined national targets and indicators. Therefore, the first two project workshops examined the potential for developing capacity for indicators for common subjects in the NBSAPs of each sub-region, and the results are summarised in Tables 1 and 2.

Table 1. Conclusions from the south eastern Europe project workshop on the potential for indicators on common subjects within the region and limitations, considerations and challenges.

1.What could "common" indicators look like in South Eastern Europe?	2. How can "common" indicators within the south eastern Europe sub-region help you?	3.What are the limitations, considerations and challenges for "common indicators"?
• Some harmonised common indicators may be possible • The development of potential common indicators should start by identification of broad subjects of common importance • Start with common geographic regions • Should seek to have common methodologies for calculation and reporting • Currently there are different processes for obtaining and paying for data in each country, including with NGOs, so ideally they would have similar systems • It would be good to have expert group meetings for each subject area • It would be good to report together as a sub-region	• Common indicator methodologies may reduce the burden for biodiversity reporting by individual countries, and help to interpret the results • They would assist a common and more powerful communication to decision-makers and stakeholders • They would help global reporting for the sub-region • They may help the common management of resources • They could be useful for comparison of management outcomes e.g. for trans-boundary protected areas • They could help to change or adjust national priorities in a sub-regional context • They would enhance co-operation, exchange of lessons learned, and resource mobilisation for indicators and the subjects they address • Synergies – if the results from one indicator are common with another Convention it can help with analysis	• Lack of experts • Lack of human resources • Lack of data and baselines • Unreliability of some official data • Lack of common financial and human resources to do the job • Lack of political will – Ministers will listen to colleagues from different countries but not from within government – will has to come from outside • Public opinion – public still not aware of biodiversity • Communication to different Ministry departments – lengthy processes • Indicators are contextualised by other indicators within the country – if other countries are missing these 'contextual' indicators it could make interpretation difficult • Limited time to meet national targets • Different status of countries e.g. European Union versus non European Union • Poor collaboration with non-governmental organisations and costs • Different national priorities • Different legislative frameworks

Table 2. Conclusions from the eastern Europe, southern Caucasus, and central Asia project workshop on the potential for indicators on common subjects within the region and limitations, considerations and challenges.

1.What could "common" indicators look like in your sub-region?	2. How can "common" indicators within your sub-region help you?	3.What are the limitations, considerations and challenges for "common indicators"?
• They should be comparable, but not obligatorily the same • They would promote a common methodology for biodiversity monitoring, planning, assessments, etc. • Improved synergy between countries for achievement of common goals • Common indicators are important at all levels, but their value depends on the purposes of the indicators and regional specifics • Indicator topics at European to global level: number of species, climate change, protected areas • Indicator topics at sub-regional level: protection of migratory species, marine and mountain territories • Common indicators are more useful at lower geographical scales, because they are more concrete • They should take into account ongoing conservation projects	• They would help to promote objective assessments of biodiversity status at national, regional and global levels • They would assist objective assessments of transboundary ecosystems and species • They can help top build strong international (transboundary) cooperation • They can help cross-sectoral cooperation in development and implementation of projects	• Common indicators work better at a regional level • Management goals could be the same, but not always identical (e.g. better protected areas management) • Common indicators have to be adapted for countries

The workshop participants agreed that it was not desirable or feasible to seek "common" indicators to the level of having exactly the same methodology used for an indicator for all the countries in a sub-region. This was due to differing priorities between countries, and the difficulties of changing established methods and institutional arrangements. However, in some cases it may be feasible to move towards some harmonisation of indicators and methods, and that common subjects for actions in National Biodiversity Strategies and Action Plans could be a starting point for this. Table 3 presents the subjects identified in the first two workshops which could be of common importance within each sub-region for development of indicators. It should be noted that some of these subjects, such as ecosystem services, public awareness and protected areas management, directly involve people and data is encouraged to be disaggregated with a gender dimension.

Table 3. Prioritised National Biodiversity Strategies and Action Plans subjects for potential development of common indicators for central Asia, eastern Europe, southern Caucasus, and south eastern Europe.

Central Asia	Eastern Europe	Southern Caucasus	South eastern Europe
• Provision of information about ecosystem services to a wide audience • Adaptation of international methodologies of ecosystem services • Invasive species	• Protected areas • Threatened species	• Protected areas • Water Resources • Species of Special Concern • Public awareness of biodiversity • Capacity for biodiversity conservation	• River fragmentation • Forest extent • Protected areas extent • Protected areas management • Large carnivores • Public awareness of biodiversity

At the first two project workshops there was support from some of the participating countries for exploring common indicators between neighbouring countries, but some countries had difficulties in securing institutional support for this. After the first workshop in the south eastern Europe sub-region the project team worked with interested national partners, advising on the production of indicator fact sheets for the prioritised subjects. There were difficulties encountered to fulfil this task, which were reported as limited national institutional resources and data for the development of indicators to be used in a wider regional situation. This was particularly the case for countries with low levels of resources for the production of biodiversity data and analyses.

A conclusion from this experience is that whilst there are potential benefits of having indicators developed for common subjects, the demand or need for such indicators to be produced and used in a multi-national manner did not appear to be sufficient to stimulate ongoing activities for this purpose. Without the existence of a government-supported regional body with a mandate to promote co-operation and reporting on biodiversity issues there appeared to be insufficient demand for the investment by national bodies to develop or harmonise indicators for subject of shared concern.

In 2016 the project adapted its focus from common sub-regional indicators to include the development of biodiversity information systems, to support both National Biodiversity Strategies and Action Plans implementation and biodiversity-related actions for the newly-adopted Sustainable Development Goals. Since most countries had already defined their National Biodiversity Strategies and Action Plans indicators, it was considered beneficial to progress to supporting the need for accessible information and institutional mechanisms for indicators.

To support this aim, the third project workshop was designed to build capacity in the design of a national biodiversity information system. It introduced a framework for information systems developed by UN Environment's World Conservation Monitoring Centre, and used a mix of presentations, interactive group work and training exercises to examine the components of the framework. The exercises focused on developing data and indicators about protected areas extent and management, which had been identified across all sub-regions as a common indicator need. There was also a session on assessment of capacity needs for developing an information system. This framework and the exercises were warmly received by participants in the workshop, and so this document has been designed to develop this material as a resource for national agencies.

To set the context and need for indicators and information systems for National Biodiversity Strategies and Action Plans and the SDGs, Section 2 explains how indicators for revised National Biodiversity Strategies and Action Plans can also be indicators for relevant SDGs, as well as for mainstreaming biodiversity into development strategies. The need for national biodiversity information systems is then identified, to sustain the production of indicators for National Biodiversity Strategies and Action Plans and achievement of the Sustainable Development Goals.

Section 3 presents a framework to support the design of a national biodiversity information system, and illustrates this for the subject of protected areas. This is complemented by a sub-section on assessing capacity needs for information systems.

A list of the many guidance and reference materials produced by UN Environment's World Conservation Monitoring Centre that are relevant to National Biodiversity Strategies and Action Plans updating and information systems is provided in Annex 1. The subjects include information management as part of enhancing cooperation among the biodiversity-related Conventions, indicators and ecosystem services in National Biodiversity Strategies and Action Plans revision, accessing and using data and mapping of biodiversity and ecosystem services.

Section 2 – Indicators and Information System Needs for National Biodiversity Strategies and Action Plans and Sustainable Development Goals

2.1 UPDATED NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLANS INCLUDE TARGETS AND INDICATORS

Since 2011 most countries have revised and updated their National Biodiversity Strategies and Action Plans[3] as a principle means for implementing the Convention on Biological Diversity (CBD) Strategic Plan for Biodiversity 2011-2020[4], with its framework of 20 global Aichi Biodiversity Targets. A central part of this process has been the setting of national targets that contribute to achievement of the Aichi Biodiversity Targets, which for most countries has been a largely new policy making activity, as only three National Biodiversity Strategies and Action Plans prior to 2010 had such targets[6]. Equally, the inclusion of indicators to measure progress towards the targets has usually been a new National Biodiversity Strategies and Action Plans component.

[3] https://www.cbd.int/nbsap/
[4] https://www.cbd.int/sp/default.shtml
[5] Bubb et al. (2011) National Indicators, Monitoring and Reporting for Global Biodiversity Targets https://www.cbd.int/doc/meetings/ind/ahteg-sp-ind-01/information/ahteg-sp-ind-01-inf-02-en.pdf

To provide technical assistance to countries in the revision of their National Biodiversity Strategies and Action Plans, including the definition of targets and indicators, UN Environment's World Conservation Monitoring Centre has partnered with the Secretariat of the Convention on Biological Diversity, United Nations Development Programme, and UN Environment in the National Biodiversity Strategies and Action Plans Forum (www.nbsapforum.net). From this experience and the published National Biodiversity Strategies and Action Plans, it is evident that most countries have identified at least the names or titles of indicators for reporting on progress towards their national targets. Table 4 presents some examples from the Pan Europe region of National Biodiversity Strategies and Action Plans targets and indicators concerning protected areas.

It is also evident that many countries have indicators to track the implementation of National Biodiversity Strategies and Action Plans activities (e.g. conduct training, produce analysis, establish laws, etc.), but fewer countries have indicators to measure the impact of the National Biodiversity Strategies and Action Plans on the state of biodiversity or the behaviour of institutions, etc. In many cases it is likely that further definition of indicators will be required, as well as capacity development to produce and communicate the indicators as tools for National Biodiversity Strategies and Action Plans implementation and reporting.

Table 4. Examples of targets and indicators concerning protected areas in revised National Biodiversity Strategies and Action Plans from the Pan Europe region.

Targets	Indicators
Bosnia & Herzegovina Target 11: By 2020, map and urgently protect the specific biological diversity of Bosnia and Herzegovina (canyon, mountain, alpine and wetland ecosystems, karst fields and alluvial plains) in compliance with the applicable spatial planning documents.	• Percentage of each habitat under protection status.
Georgia National Target C.4. By 2020, at least 12% of the country's terrestrial and inland water areas and 2.5 % of marine areas are covered by protected areas; Areas of particular importance for ecosystem services are effectively and equitably managed via an ecologically representative system and other effective conservation measures; development of the protected areas network and its integration into the wider landscape and seascapes is ongoing.	• The existence of adopted relevant regulations • Existence of an approved plan of the national protected areas network • The total area of protected areas • The number of connected protected areas and ecological corridors • Number of agreements on transboundary cooperation in protected areas management • Existence of results from a protected areas management effectiveness assessment • Number of functioning consultation councils of protected areas

Targets	Indicators
Russian Federation Target: By 2020 there is an efficiently managed system of protected areas which composes no less than 13.5% of the Russian Federation. Target: By 2020 the total area of terrestrial and aquatic territories with regulated resource use policies and which play a key role in the provision of ecosystem services is increased to the point where it composes 17% of all terrestrial territories and 10% of all aquatic bodies under the jurisdiction of the Russian Federation.	a) The proportion (%) of the Russian Federation taken up by both regional and federal protected areas; b) The proportion of the territories of the Russian Federation that have regulating land-use policies aimed at the conservation of the environment, (aquatic and fishing reserves, protected areas, protected forests which have undergone voluntary certification and others); c) The proportion of flora and fauna species found in Russia (includes plants, mammals, birds, reptiles and amphibians) which are represented in federal protected areas; d) The proportion of higher plants and vertebrates (includes mammals, birds reptiles and amphibians) which are part of the IUCN Red List of Russia and which can be found in protected areas out of the total number of species of higher plants and vertebrates (includes mammals, birds reptiles and amphibians) which are part of the IUCN Red List of Russia; e) The proportion of protected areas which have been tested for efficient management practices out of the total number of protected areas divided by the proportion of protected areas with proven efficient management practices out of the total number of protected areas in Russia; f) Landscape and biodiversity representativeness of protected areas; g) The proportion of protected areas h) The proportion of entities of the Russian Federation which regulate protected areas found on their territory through appropriate legal frameworks

2.2 INDICATORS FOR MAINSTREAMING BIODIVERSITY

The Strategic Plan for Biodiversity 2011-2020 significantly expanded the scope of subjects to be addressed in National Biodiversity Strategies and Action Plans, and therefore the requirements for relevant information were greatly increased. National Biodiversity Strategies and Action Plans have always included direct actions to safeguard ecosystems, species and genetic diversity (Strategic Goal C), and to reduce the pressures on biodiversity, such as habitat loss and pollution (Strategic Goal B). National Biodiversity Strategies and Action Plans are now also expected to have targets and actions to, "*Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society*" (Strategic Goal A), and to, "*Enhance the benefits to all from biodiversity and ecosystem services*" (Strategic Goal D).

Actions for mainstreaming biodiversity into development policy and plans requires evidence on the roles and importance of biodiversity, ecosystems and ecosystem services in development sectors. This information needs to be relevant for sectors such as finance, tourism, agriculture, forestry, fisheries, health, energy, mining and infrastructure. To assist the mainstreaming of National Biodiversity Strategies and Action Plans into development sectors, a suite of guidance materials have been produced by UN Environment's World Conservation Monitoring Centre and International Institute for Environment and Development and are available at www.iied.org/mainstreaming-biodiversity-development.

2.3 INDICATORS FOR THE SUSTAINABLE DEVELOPMENT GOALS AND MULTI-LATERAL ENVIRONMENTAL AGREEMENTS

In 2015 the UN Sustainable Development Goals (SDGs)[6] were adopted, and these have become a major new driver for information on biodiversity, and for the mainstreaming of biodiversity. The set of 17 Sustainable Development Goals and 169 associated targets cover all aspects of sustainable development, and are intended to be viewed in an integrated manner. Whilst the following three Sustainable Development Goals directly address the environmental dimension of sustainable development, they contribute to and underpin the achievement of the other Sustainable Development Goals:

Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

These three environment-focused Sustainable Development Goals and their associated targets (listed in Annex 2) have been designed to encompass the Aichi Biodiversity Targets. This means that national progress towards the Strategic Plan for Biodiversity 2011-2020 is also an integral part of achieving the SDGs, at both the global and national scales. Equally, therefore, information needed for National Biodiversity Strategies and Action Plans can be used for relevant national Sustainable Development Goals plans, implementation and reporting. Harmonising the indicators used for National Biodiversity Strategies and Action Plans with the national indicators for the Sustainable Development Goals can help reduce costs and harness additional support for NBSAP indicators.

Two examples of how National Biodiversity Strategies and Action Plans indicators are relevant to global Sustainable Development Goals targets are given in Annex 3, for Bosnia and Herzegovina and for Georgia. For both countries their National Biodiversity Strategies and Action Plan indicators mapped to 10 of the 17 Sustainable Development Goals, and to 41 and 42 Sustainable Development Goal targets respectively.

[6] http://uneplive.unep.org/portal#sdgs

© Mircea Bezergheanu / shutterstock.com

To assist with linking biodiversity and Sustainable Development Goal indicators Annex 4 is a table of the global indicators under the Biodiversity Indicators Partnership mapped to both the Aichi Biodiversity Targets and the Sustainable Development Goals. This information is also available with a search facility on the website of the Biodiversity Indicators Partnership (www.bipindicators.net).

As well as NBSAP indicators being able to support national Sustainable Development Goal reporting, they can be used or adapted for reporting on other biodiversity-related Conventions or Multilateral Environmental Agreements (MEAs), such as the Ramsar Convention on Wetlands. The Biodiversity Indicators Partnership website search facility also enables identification of which global indicators for the Aichi Biodiversity Targets relate to the targets of other Multilateral Environmental Agreements.

2.4 THE IMPORTANCE OF BIODIVERSITY INFORMATION SYSTEMS

Many countries do not have a national biodiversity information agency or strategy, and so the production of data, indicators and analyses on biodiversity-related topics is often only on an *ad-hoc* basis, such as to meet reporting requirements for Multilateral Environmental Agreements. In such cases, some relevant data may be produced and managed by government agencies, academia and NGOs. However, these data may not be analysed and presented in the form of indicators suitable for NBSAP implementation.

A few countries, such as the Republic of Serbia, have included in their National Biodiversity Strategies and Action Plans a target to establish a national biodiversity information system, along with a monitoring system to collect the necessary data (Box 1). From the experience of UN Environment's World Conservation Monitoring Centre and its support for national indicator development as part of the Biodiversity Indicators Partnership, the existence of a biodiversity information system is a major step in having sufficient data, indicators and analyses for the design and implementation of a National Biodiversity Strategy and Action Plan and other biodiversity-related decision-making. This is also consistent with Aichi Biodiversity Target 19, "*By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied*."

Box 1. Targets and activities for Serbia's National Biodiversity Information System and Monitoring Programme.

Objective 4.6.1: National Biodiversity Information System

Collect, review and synthesize available data and information on biological diversity to provide a basis for assessing the status of, monitoring, conserving and sustainably using biological diversity.

Activities:

1) Design a comprehensive National Biodiversity Information System (NBIS) within SEPA, including: National set of indicators on biodiversity status; Standardized protocol for monitoring, reporting and updating.
2) Compile and review existing biodiversity data from collections, databases and geographic information systems in all sectors;
3) Populate NBIS with existing data from all sectors;
4) Develop and implement a plan for addressing NBIS deficiencies;
5) Inventory and map threatened and rare habitat types (as per annex 1 of Habitat Directive);
6) Using internationally-accepted methods and standards, classify, describe and map vegetation communities throughout the Republic of Serbia, starting with protected areas;
7) Develop a Geographic Information System (GIS) map of protected area boundaries, with vegetation community classification and other relevant geographic information (trails, buildings etc.);
8) Map habitats of key flora and fauna species (ecologically or economically important species, rare, vulnerable or threatened species).

Objective 4.6.2 Biodiversity Monitoring

Establish a national programme to identify and monitor priority species, habitats, and genetic components of biodiversity, as well as the effects of activities and processes that threaten biodiversity components and their causes.

Activities:

1) Develop a biodiversity monitoring programme to monitor biodiversity status and threats at genetic, species and ecosystem levels in coordination with all relevant sectors;
2) Establish a biodiversity clearinghouse mechanism with web portal;
3) Establish a biosafety clearinghouse mechanism with web portal;
4) Establish plans and teams to monitor the implementation of sectoral strategies relevant to biodiversity.

Source: Biodiversity Strategy of the Republic of Serbia for the period 2011 – 2018.

Figure 1 presents a positive scenario for societal decision-making on the environment when there is suitable information on biodiversity and ecosystem services. In this scenario, an improving or stable status of biodiversity and supply of ecosystem services contributes to, and depends on, having an environmentally sustainable economy and increasing human well-being. These desired outcomes can be considered as overall goals of an NBSAP or national development plan. To achieve this desired impact it is proposed that the decision-making of different sectors or actors of society needs to include the following positive conditions:

- High public awareness and support for biodiversity conservation and diverse ecosystem services.
- Strong government targets and policies for biodiversity conservation and management for ecosystem services.
- Managers and users of the environment effectively use information to consider their impacts and dependence on biodiversity, ecosystem functioning and services.

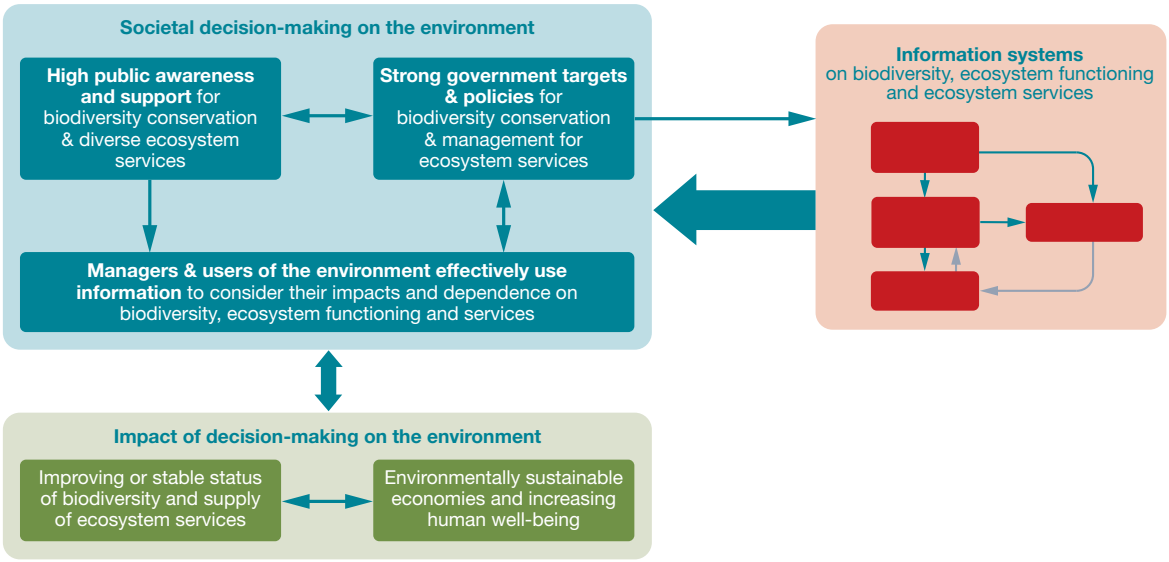


Figure 1. The roles of information on biodiversity and ecosystem services in societal decision-making on the environment - positive scenario. Source: UN Environment's World Conservation Monitoring Centre.

Managers and users of the environment include farmers, foresters, fishers, tourists, businesses that use or impact natural resources, and all levels of government. Such users and managers are only likely to consistently consider and adjust how they impact on the environment and depend on it (i.e. ecosystem services) if there are government targets and policies that promote this. However, it is difficult for governments to establish such policies if there is not sufficient public awareness and support for biodiversity conservation and ecosystem services. Many of the Aichi Biodiversity Targets and Targets of Sustainable Development Goal 14 and 15 address these policy framework needs.

To achieve positive societal decision-making on the environment there is a requirement for adequate information on the status and trends of biodiversity, ecosystem functioning, and the supply and importance of ecosystem services. This information should be disaggregated by gender where possible, to assist including gender perspectives in policies and projects. This information is needed as a key element for creating sufficient public understanding of the importance of biodiversity and ecosystem services, and so to have support for maintaining or improving its status. Government also needs this understanding and information to justify and design suitable targets, policies and investments. Managers and users of the environment need to have sufficient conceptual understanding and information on biodiversity, how they depend on ecosystem services, and how human management affects ecosystem functioning to supply desired ecosystem services.

For all of these information needs the existence of some form of information system is required, to gather the necessary data and to analyse and communicate it in the form of indicators and other communication products. Section 3 of this document presents a framework for the design of such a system.

Section 3 – Developing biodiversity information systems

3.1 DESIGN OF INFORMATION SYSTEMS

3.1.1 Overview of an information system framework

The capacity to consistently have available indicators and analyses for National Biodiversity Strategies and Action Plans and Sustainable Development Goal achievement requires the existence of some form of information system, as identified in Section 2. This third section presents a framework to support the design of an information system for a subject such as biodiversity or ecosystem services (Figure 2). Such a system may aim to include all the aspects of biodiversity, or be for selected topics such as protected areas or threatened species.

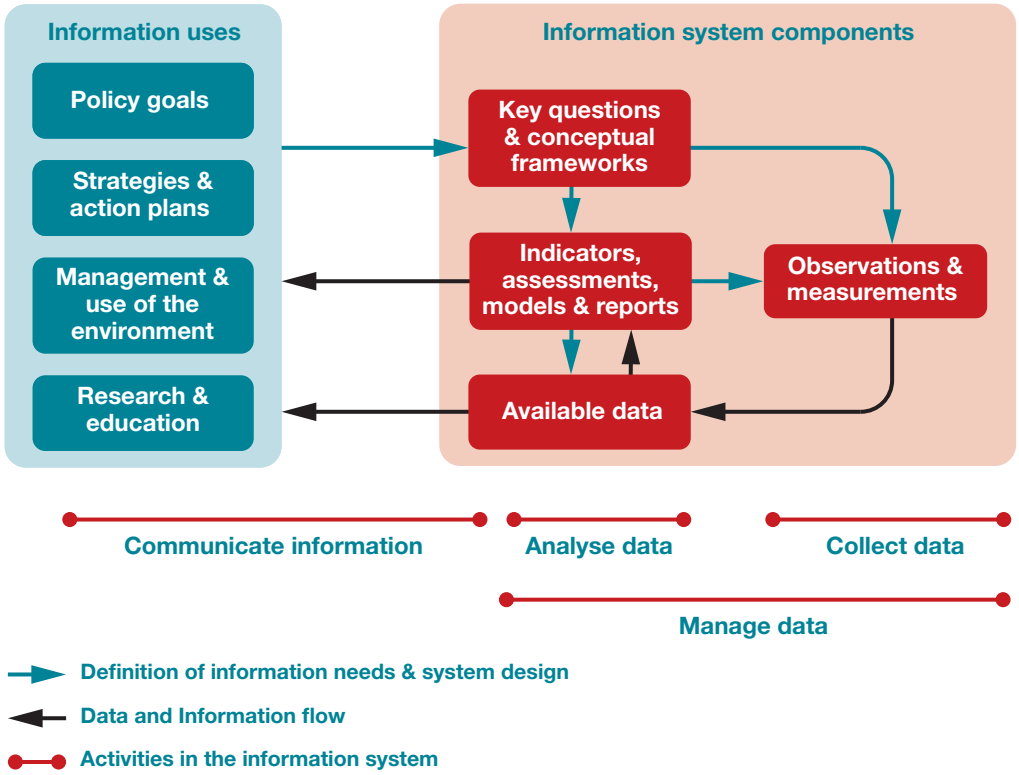


Figure 2. Framework for components and activities of an environmental information system.
Source: UN Environment's World Conservation Monitoring Centre.

The information system framework (Figure 2) includes the components, roles and activities to have suitable biodiversity information at the national or sub-national scales. It is intended to show all the major information components (red boxes) necessary to produce information for users, and then how these components inter-relate in the system. For the effective functioning of the system, the linkages between the components (arrows) are as important as the components (boxes). This whole system view helps to identify which components, roles and linkages may be weak or ineffective and so need more investment.

The framework is intended to be generic and is fairly scale independent, although it is primarily envisaged to support work at the national or sub-national scales. A country may choose to develop one national biodiversity information system, but this will actually consist of a network of sub-systems for different information subjects. The process of defining information needs should guide the choice of which information subjects are included, as well as build on existing research and monitoring capacity.

The information system framework is based on the premise that the design of a biodiversity information system and its products should start with the definition of the information needs of users. The blue arrows represent stages in the definition of information needs and system design, which involves the steps of:

1) identification of users' information needs, which lead to the definition of key questions and conceptual frameworks;

2) use of the key questions and conceptual frameworks to guide the selection and scoping of indicators, assessments, models and reports;

3) use of the results of steps 1) and 2) to define the needs for available information to conduct the analyses and produce the communication products;

4) use of the results of steps 2) and 3) to recommend the types of biodiversity observations and measurements that are required, and in what forms they should be available.

Table 5 is an example of the results of a simple information needs analysis for the subject of protected areas.

Table 5. Example national protected area information users, use, key questions, indicators and data. Source: Regional workshop on strengthening synergies and indicators in NBSAPs for countries of central Asia, eastern Europe, south eastern Europe and southern Caucasus", held in March 2016 in Podgorica, Montenegro.

Information User	Information Use	Key Question	Indicator	Data
State Nature Protection Agency	Reporting	What is the extent of Protected Areas?	Coverage of Protected Areas by category	Extent of Protected Areas Categories of Protected Areas
Ministry for Agriculture and Water	Making action plans and taking measures	How many species of animal and plant are protected in the PA?	Number of species in Protected Areas	Results of surveys and species counts Protected area data
Local communities	To understand impacts of PAs on local communities	How do protected areas affect local communities' livelihoods including men and women?	Protected area extent and location by category	Protected area extent Protected area categories Local communities and village locations

The black arrows in the framework represent flows of data, or of information derived from the data. The functioning of these flows, or linkages, in an information system can be contributions or constraints to having suitable information for environmental decision-making. The principal flows of data and information are:

- biodiversity observations and measurements are gathered and managed so that they become available data;
- the production of indicators, assessments, models and reports uses the available data;
- indicators, assessments, models and reports are communicated to information users;
- available data are directly accessible to information users.

The framework also identifies four types of activities that are required for an information system to function: data collection, data management, data analysis, and communication of analyses. These activities form a chain or process from data production to the receipt of information by the users. A successful information system will have responsible institutions, funding and skilled people for each of these activities. The design and operation of an information system is therefore as much an institutional and network development task as it is a scientific or technical one.

The framework describes the components and activities in a biodiversity information system, but it does not identify which types of institutions or actors the system should be comprised of. Following the principle that 'form follows function', it is intended that the diagram will help institutions and networks that use and produce information to identify and assess their roles and relationships (functions) with other institutions and actors. They can then develop their capacity and actions (form) to fulfil these roles.

For a particular subject, such as protected areas, there may be one institution that has a national responsibility and function to carry out all four activities in the chain of information production, from data collection, management and analysis to the communication of analyses. Alternatively, there may be a network of different institutions or units within one organisation that carry out these activities, as represented in Figure 3.

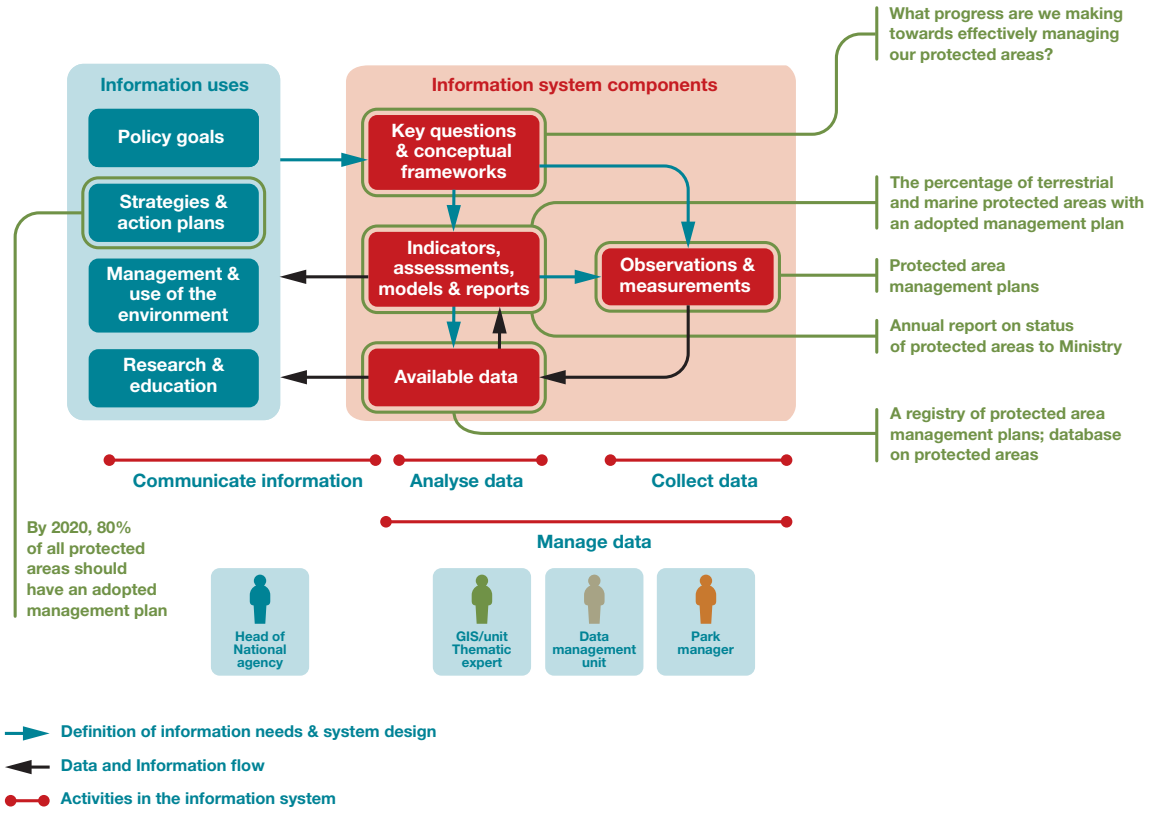


Figure 3. Illustration of the components and institutional roles for a national information system on protected areas. Source: UN Environment's World Conservation Monitoring Centre.

3.1.2 Guidance for developing the components of an information system

Information Uses

The aim of this section of the framework is to ensure that the information users are identified as the starting point for the design of the information system. The effectiveness and sustainability of the system will be increased if the whole system and its products are designed through dialogue and partnership with the users.

The framework diagram identifies four broad categories of biodiversity information uses. The formulation of policy goals by government and large-scale users of the environment should be guided by information on biodiversity and ecosystem services, and such information is used for measuring progress towards the goals. Similarly, the definition and implementation of strategies and action plans, such as National Biodiversity Strategies and Action Plans, should be based on sufficient information and analyses. As identified in Figure 1, all types of management and use of the environment should include consideration of the desired state of biodiversity, ecosystem functioning and services, and use information to guide management. And both research and education require data and information products.

Key Questions

A key question is a very useful way of summarising what a biodiversity information user wants to know. Key questions can be very general, such as, 'What is the status of threatened species in our country?', or quite specific, such as, 'Have we achieved our target of at least 10% of all ecosystems included in our protected areas system?' Key questions may be research orientated, such as, 'Which ecosystems are most vulnerable to climate change?', or they may have a management focus, such as, 'What are the sustainable harvest levels for this tree species?'

The defining of key questions with information users helps to clarify the purpose and scope of an information system. It is also recommended that information products and tools, such as indicators, assessments, models and reports are designed to help address key questions. The framework diagram (Figure 2) puts the definition of key questions at the core of a biodiversity information system, as these questions are a means to make a 'bridge' between the information users and the information providers. Box 2 presents some examples of key questions that information users may have concerning the development of a national biodiversity strategy and action plan (NBSAP) in support of the CBD Strategic Plan for Biodiversity 2011-2020.

Box 2. Some examples of key questions for national biodiversity strategy development, with their relevance to the Aichi Biodiversity Targets (T)

Key Species

- Which species are threatened with extinction? T12
- What is the distribution of species that are rare or threatened? T12
- Which areas are most important for species that are rare or threatened? T12
- Which species have a high economic and/or cultural value? T6, T14

Ecosystems and land use

- What is the distribution of the country's ecosystems or habitats? T5
- What land uses have replaced or altered the country's ecosystems or habitats? T5
- How fragmented are the country's ecosystems or habitats? T5, T15
- What is the protection status of the country's ecosystems or habitats (representativeness and effectiveness)? T11

Key biodiversity areas

- Where are the critical areas for preventing species extinctions? T12
- What is the protection status of the country's key biodiversity areas? T5, T11

Protected areas

- Where are the protected areas in the country? T11
- What is the management effectiveness of the country's protected areas? T11
- What are the priority areas for new area-based conservation measures? T5, T12, T14, T15

Ecosystem services

- What are the areas that supply important ecosystem services? T14
- What is the condition of areas that supply important ecosystem services? T14
- Which important areas for ecosystem services are threatened by land use change? T5
- Which important areas for ecosystem services are threatened by unsustainable use? T6, T7
- Which important areas for ecosystem services are threatened by climate change? T15
- Where do people that have a high dependence on ecosystem services live? T14
- What are the priority areas for restoration to increase the supply of ecosystem service? T15

Conceptual Frameworks

A conceptual framework is a diagram that identifies the main concepts and their relationships for an issue of concern. Conceptual frameworks and key questions are closely inter-linked and overlap in their usage. A conceptual framework diagram may be developed in response to a key question, such as, 'what is the importance of ecosystems to human well-being?' Equally a conceptual framework can support the identification of key questions, as it shows the key concepts and how they relate to each other.

One use of a conceptual framework is to assist discussions between information users and providers, helping to develop a common understanding of an issue or to identify and communicate important concepts, such as the categorisation by the Millennium Ecosystem Assessment of supporting, provisioning, regulating and cultural ecosystem services. As with key questions, having an agreed conceptual framework helps to define the scope and focus of a biodiversity information system, how the subjects and their analyses relate to each other, and how to design and communicate its products.

Conceptual frameworks can be very general in terms of the concepts they include, such as the Pressure-State-Benefits-Response (PSBR) Framework (Figure 4), which can be a starting point in the organisation of information subjects for a national biodiversity strategy. More detailed conceptual frameworks are likely to be needed for more specific topics and key questions. The basic process of producing a conceptual framework is to first identify the key concepts or terms that the subject of interest involves, and then to develop a graphical representation of how these concepts relate to each other.

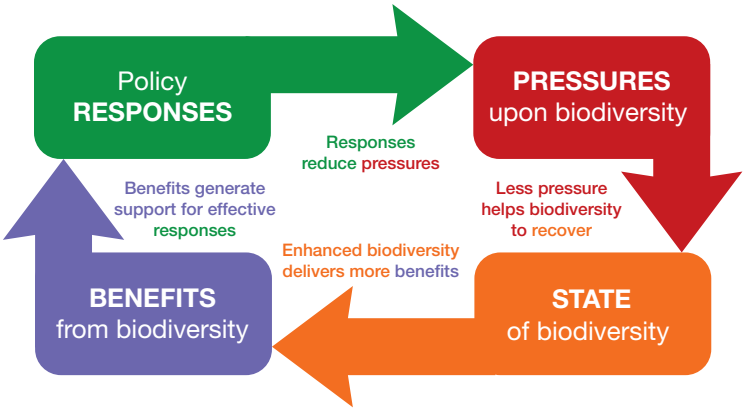


Figure 4. The Pressures, State, Benefits, Responses conceptual framework (Source: Sparks et al (2011) Linked indicator sets for addressing biodiversity loss, Oryx, 45(3): 411–419)

Indicators

Indicators are a central product of a biodiversity information system, and they may be produced as stand-alone products or as integral components of assessments, models and reports. A major use of indicators is to measure progress towards policy objectives, targets or management goals. They can also help to simplify and summarise information on complex subjects, and therefore support the analysis and understanding of a situation. Indicators are essentially a communication tool, and so can help to build stakeholder understanding and support for a situation. Indicators are often used to show change in an issue over time, and the data may be presented in the form of maps as well as graphs and charts.

UN Environment's World Conservation Monitoring Centre uses a definition of an indicator as, 'a measure based on verifiable data that conveys information about more than the subject of the data or measure'. The term 'biodiversity indicators' is used for more than direct measures of biodiversity itself, such as species populations and the extent of ecosystems. It can also include measures of actions to conserve and manage biodiversity, such as coverage of protected areas, or measures of pressures on biodiversity such as habitat loss.

As part of the Biodiversity Indicators Partnership (BIP) (www.bipindicators.net), UN Environment's World Conservation Monitoring Centre has been supporting national biodiversity indicator development alongside global indicator production since 2007. A key resource for this work is a widely-tested ten-step framework, or sequence, for successful biodiversity indicator development. Guidance materials in English, French, Spanish, Russian, and Arabic for using the framework and an e-learning module are available at www.bipindicators.net/nationalindicatordevelopment.

The Biodiversity Indicators Partnership website also provides information on the global indicators used for reporting on the Strategic Plan for Biodiversity, and how they link to relevant indicators for the Sustainable Development Goals and other multi-lateral environmental agreements.

Additional guidance materials on indicators produced by UN Environment's World Conservation Monitoring Centre are available at www.bipindicators.net and www.unep-wcmc.org and in Annex 1.

Assessments, Models and Reports

Along with indicators, assessments and reports are a principle means by which biodiversity data are interpreted and communicated to users. The analysis of data may also use computational models to understand biodiversity-related issues, and to develop scenarios of possible future change or management impacts. The definition of key questions and conceptual frameworks guides the scope, design and communication of assessments, models and reports. The success of these information products will depend not only on the availability of suitable data, but also on how the users view the salience, credibility and legitimacy of the information (Box 3).

Box 3. The importance of the salience, credibility and legitimacy of information

Salience, credibility and legitimacy of information

Cash et al. (2002) concluded that for science-based information to be useful in policy making it needs to have the attributes of salience, credibility, and legitimacy for both the information users and providers.

Salience refers to the relevance of the information for the user, in other words, are their key questions and decision-making needs being addressed.

Credibility refers to whether an actor perceives information as meeting standards of scientific plausibility and technical adequacy, and is therefore trustworthy and/or believable. This includes the credibility of the conceptual frameworks, data sources, analytical methods, and interpretations of the information.

Legitimacy refers to the trustworthiness of the process of producing the information. Users and providers of information judge its legitimacy based on who participated and who did not in its production, the processes for making those choices, and how information is produced, vetted, and disseminated.

Cash et al. (2002) and Cash et al. (2003) make recommendations on institutional mechanisms for effectively balancing the trade-offs between these attributes of information for science-based environmental management.

D.W. Cash, W.C. Clark, F. Alcock, N.M. Dickson, N. Eckley, J. Jäger (2002) Salience, credibility, legitimacy and boundaries: Linking research, assessment and decision making. John F. Kennedy School of Government, Harvard University, Cambridge, MA

D.W. Cash, W.C. Clark, F. Alcock, N.M. Dickson, N. Eckley, D.H. Guston, et al. (2003) Knowledge systems for sustainable development. Proceedings of the National Academy of Sciences of the United States of America, 100, pp. 8086–8091

National reports may be produced to meet international reporting obligations, such as for the Convention on Biological Diversity or other Multilateral Environmental Agreements. Similarly, there may be national requirements for reports on the implementation and impact of biodiversity and development policies and strategies.

International research, assessments and policy development can also stimulate the production of national or regional assessments and reports. For example, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES www.ipbes.net), and the Economics of Ecosystems and Biodiversity (TEEB www.teebweb.org) initiative have included national or sub-national assessments. The Sub-Global Assessment Network (SGAN www.ecosystemassessments.net) provides capacity development support to individuals and organisations involved in ecosystem assessments at regional, sub-regional, national and sub-national levels.

UN Environment's World Conservation Monitoring Centre has produced guidance materials to support many aspects of producing and using assessments, models and reports, which are available at www.unep-wcmc.org/resources-and-data

Available data

This component of the framework diagram covers the many forms in which biodiversity data are made available for use, including tools and systems such as databases and websites. It also includes the subjects of semantics and ontologies that guide the organisation and presentation of the data.

It is beyond the scope of this document to provide guidance on this subject, especially as it is rapidly evolving with developments in information technology and the Internet, but the capacity enhancement materials of the Global Biodiversity Information Facility (GBIF http://www.gbif.org/capacity-enhancement/summary) are a valuable resource for this purpose. The Global Biodiversity Information Facility is an international open data infrastructure, funded by governments, which allows anyone to access data about all types of life on Earth via the Internet. It encourages and helps institutions to publish data according to common standards, including as a network of nodes. The species occurrence data available through the Global Biodiversity Information Facility website is an example of how of data is increasingly available to all types of users, without it necessarily first being transformed into indicators, maps or reports.

Despite the growing on-line availability of data, there is a widely recognised problem that much of the data from observations and measurements of biodiversity is still not easily accessible for use in analyses, decision-making and reporting. In 2012 UN Environment's World Conservation Monitoring CentreC made recommendations for addressing this issue in the report, "A review of barriers to the sharing of biodiversity data and information, with recommendations for eliminating them".[7]

One of the challenges in developing an information system is to determine which types of data need to be available for which uses and users, and ideally the definition of available data needs should respond to an identification of indicator and analytical and reporting needs. Section 3.3.1 of this report suggests some foundation information subjects for biodiversity conservation and sustainable development.

Observations and Measurements

This component of an information system encompasses the direct observations and measurements of biodiversity, which may be made directly by people and on-site equipment, or by remote-sensing equipment. Ideally, the design of field observations and remote sensing considers the need to provide data for defined analyses, products and information uses.

A resource for facilitating the start-up or enhancement of national or regional biodiversity observation systems is the 'BON in a Box' online toolkit (http://geobon.org/bon-in-a-box/), which is being established by the Group on Earth Observations Biodiversity Observation Network (GEO BON). The toolkit will aid the selection of suitable and scientifically sound monitoring methods and guidelines, mapping software, and data management, analysis, discovery and reporting tools and platforms.

[7] https://www.cbd.int/doc/meetings/cop/cop-11/information/cop-11-inf-08-en.doc

3.2 DEVELOPING CAPACITY FOR A NATIONAL BIODIVERSITY INFORMATION SYSTEM

3.2.1 Assessment of capacity for an information system

The framework of an information system (Figure 2) can be used to guide a rapid assessment of the current functioning and capacity for producing information on a topic. Table 6 presents a list of outcomes or steps in the process of designing and implementing an information system. For each outcome a responsible or lead institution will be required, and a qualitative assessment can be made of the level of its achievement. The results of such an assessment can be used to identify institutional and technical weaknesses and capacity development priorities, considering the functioning of the whole system.

Table 6. Capacity assessment template for an information system.

Information Subject or Indicator Name:		
Definition of information needs	**Responsible institution for this activity**	**Level of achievement** Full, partial, zero
Information uses and users are clearly defined.		
Key questions are defined.		
Conceptual framework(s) are defined.		
Assessments, reports and/or models to be produced are defined.		
Indicators to be produced are defined.		
Available data requirements are defined.		
Observations and measurements required are defined.		

Production and flows of data and information	**Responsible institution for this activity**	**Level of achievement** Full, partial, zero
How observations and measurements are managed to become available data is defined.		
Observations & measurements (primary data) are produced.		
How data are made available for use in indicators, assessments, models, reports and direct access is defined.		
Data is available for indicators, assessments, models and reports.		
How indicators, assessments, models & reports are communicated to information users is defined.		
Indicators are produced and communicated to users.		
Assessments, models and reports are produced and communicated to users.		

3.2.2 Institutional roles and drivers for indicators

The experience of UN Environment's World Conservation Monitoring Centre in capacity development for national biodiversity indicators, and from technical reviews of National Biodiversity Strategies and Action Plans, has identified several institutional and capacity factors in the sustainable production of indicators, which are represented in Figure 5.

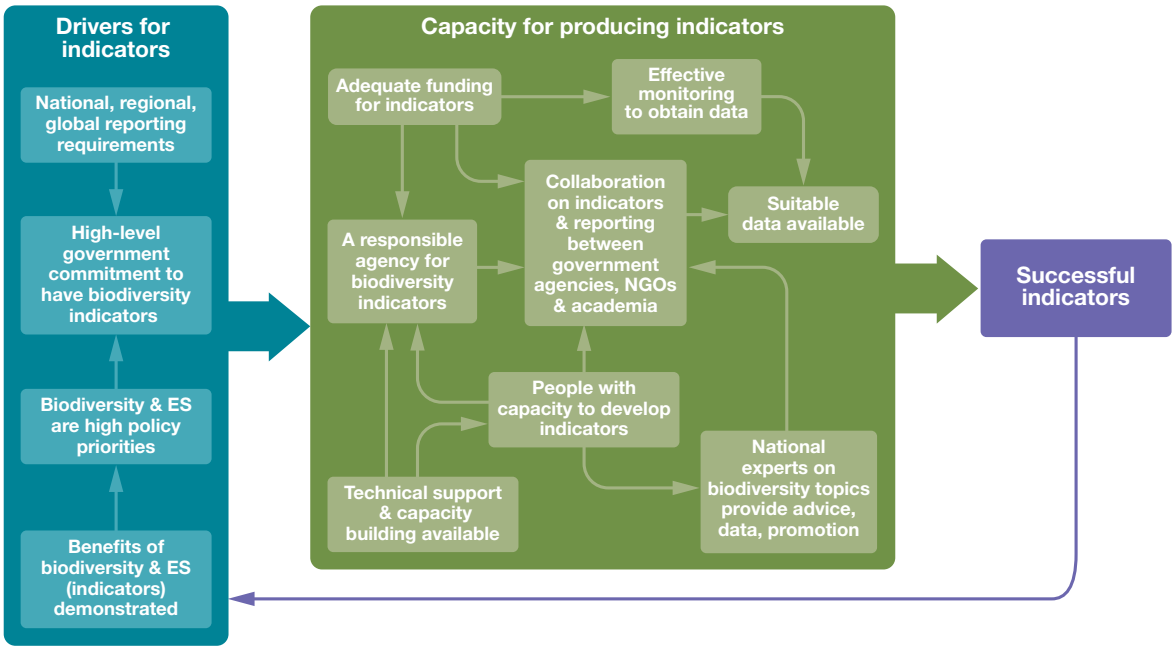


Figure 5. Drivers and capacity elements for producing successful national level biodiversity indicators. Source: UN Environment's World Conservation Monitoring Centre.

A key factor for the sustainable production of indicators is the existence of a responsible lead agency, or 'champion'. For the production indicators or a national information system there may be one institution with overall responsibility for this, but it is often the situation that co-operation is required between government agencies, non-governmental organisations and academia. For example, a Ministry of Environment may require indicators on the status of threatened species, but the field observations and outreach of the results on the status of these species may be conducted by non-governmental organisations and academia. Similarly, the management of this data and its processing in the form of indicators may be conducted by the same or other non-governmental organisations or academic groups, which may be operating with or without formal agreements to communicate the indicators for use by government agencies.

The level of investment in national biodiversity information and indicators is often a reflection of the level of government awareness of and commitment to biodiversity issues. This commitment can in turn be influenced the availability or not of information that demonstrates the benefits of biodiversity and ecosystem services, as presented in Figure 1. National and international reporting requirements and participation in multi-lateral environmental agreements can also be a significant driver for the production of biodiversity information.

National Statistics Offices (NSOs) can potentially have a very significant institutional role in biodiversity and ecosystem information systems. They may have a requirement for managing data and producing indicators on aspects of the natural environment for national government decision-making and reporting. They may also be responsible for reporting national indicators on sustainable development, which is often aggregated by the UN Statistics Division or other UN Agencies, as part of reporting on progress towards the Sustainable Development Goals. The expertise of National Statistics Offices in the collection, analysis and communication of data and information may be a useful capacity development resource for organisations involved in biodiversity information production and use.

There may also be a significant role in a biodiversity information system for the private or commercial sector, as they are users and producers of such information in sectors such as agriculture, forestry, fisheries, mining, infrastructure development, and tourism. Another increasingly important group of biodiversity information users and producers are ordinary citizens, such as through their use of smartphones to record, submit and access biodiversity data.

The "South Eastern Europe Workshop on Strengthening synergies and indicators in National Biodiversity Strategy and Action Plans (NBSAPs)", held in April 2015 in Belgrade, Serbia identified many of these challenges and some lessons and successes (Box 4).

Box 4. Challenges and lessons for biodiversity indicators from south eastern European countries.

Challenges relating to the production of indicators

- A lack of systematic data collected specifically for use in an indicator.
- Unsuitable formats of data for use in indicators can be an issue when data comes from outside of the country.
- Need for harmonisation of data and methodologies e.g. data on large carnivores from different countries
- Inadequate human resources
- Limited technical capacity for spatial analysis
- Funding – few countries have resource mobilisation plans for National Biodiversity Strategies and Action Plans or indicators, including for public and private sector funding. Maintaining a constant funding stream is difficult even when you prove successes
- Difficulties in communicating information to rural populations, less-educated people or those without access to the internet. Media involvement can also be a challenge, but media has a high influence in public opinion
- Low economic levels in the country lead to a lack of interest in biodiversity issues, compared to other priorities
- Low political will for biodiversity conservation, but if it exists it solves a lot of challenges
- Some indicator subjects are just a not high priority for government
- Weak inter-sectoral cooperation

Lessons learnt from previous experience

- European Union recommendations have a strong influence on national political will
- Establishment of a functional database
- Development of common methodologies
- Involvement of all stakeholders

Successes for indicators

- Serbia has been developing different types of indicators for protected areas extent
- Slovenia had a multi-sectorial consultation process during which the Ministry of Education proposed an indicator for public awareness and took ownership of it
- Albania – biodiversity is now in the national curriculum
- Trans-boundary communication has improved between biodiversity agencies

Source: South eastern Europe workshop on strengthening synergies and indicators in National Biodiversity Strategy and Action Plans (NBSAPs)", held in April 2015 in Belgrade, Serbia.

3.3 FOUNDATION INFORMATION SUBJECTS FOR BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT

3.3.1 A conceptual framework of foundation information subjects

The core of an information system is the data it makes available for use in analyses and information products. This section of the report suggests that there are some common information subjects for use in biodiversity and sustainable development decision-making, and that these foundation subjects can be combined and used for multiple purposes.

Figure 6 presents a conceptual framework of suggested information categories and their relationships to support national biodiversity and sustainable development decision-making. These categories have been identified from consideration of the subjects addressed by the Aichi Biodiversity Targets and Sustainable Development Goals 6, 14 and 15. The information subjects reflect the central need for spatial and land use considerations in biodiversity conservation and sustainable development planning. They also include the needs for an ecosystem approach to management and the importance of information on ecosystem services, as a bridge between biodiversity status and human well-being. The United Nations System of Environmental-Economic Accounting (SEEA) Experimental Ecosystem Accounting (EEA)[8] is also developing information categories for modelling and scaling of information on ecosystem services, ecosystem condition, and ecosystem capacity.

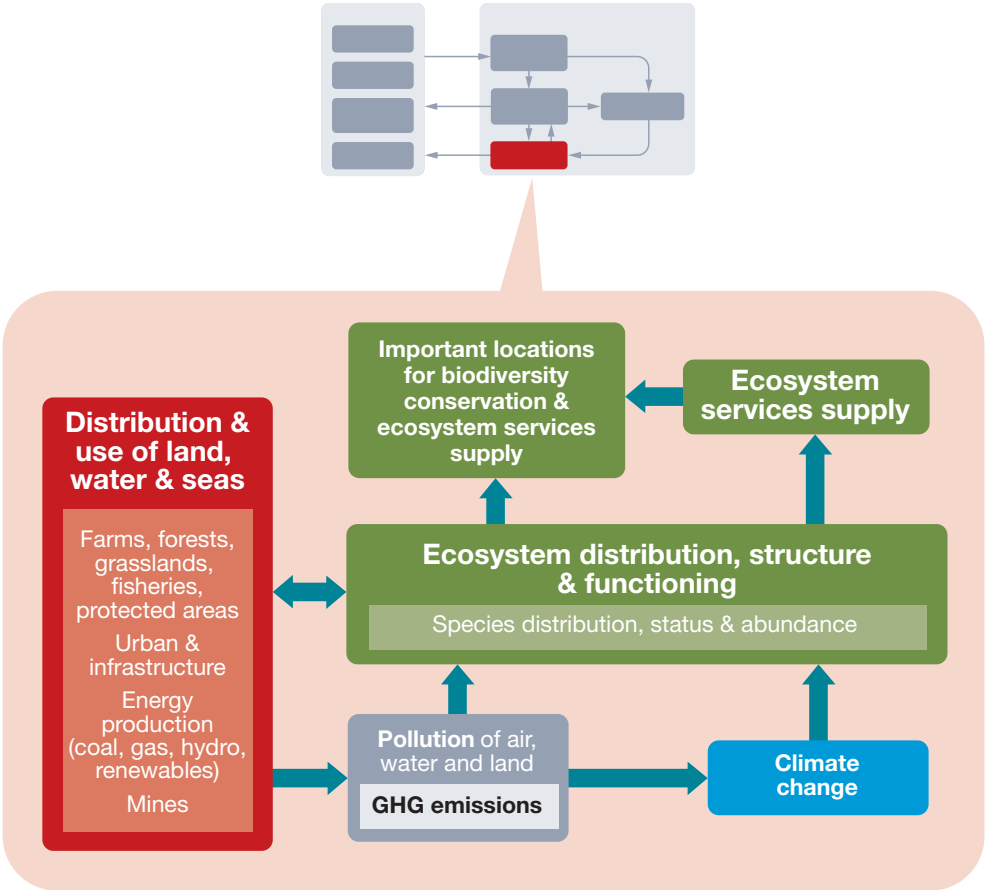


Figure 6. A framework of suggested data & derived information subjects to support environmental decision-making with an ecosystem approach. Source: UN Environment's World Conservation Monitoring Centre

[8] http://unstats.un.org/UNSD/envaccounting/eea_project/default.asp

The development of available data for all the subjects in Figure 6 could follow a progression, depending on the demand for information on newer subjects such as ecosystem services, and as resources and capacity permit. The most likely data set to be available is the distribution and use of land and water resources, including protected areas, as this is a basic data set for land use planning and management. From this data and other sources it is likely that information on the distribution of ecosystems or habitat types may be produced, following national or international classification schemes. This may include information on the fragmentation or connectivity of ecosystems, and of rates of change.

Information on ecosystem structure, at least in terms of vegetation structure and condition, may be derived from appropriate remote sensing data and ground surveys. This information may be further used to determine data on ecosystem functioning, such as the role of vegetation in water and mineral cycles across landscapes. Information on ecosystem distribution, structure and functioning forms the basis for deriving information on the supply of ecosystem services from an area.

The distribution, abundance and conservation status of species is also a basic data set for conservation and development planning. Much of this data will be produced from direct field observations and measurements, but some of it can be derived from modelling and assessments involving remote sensing data. Particularly for less developed and biodiverse tropical countries, there may be a lack of data for many species, but there is likely to be at least some data for species of high commercial or cultural value. Data on the use of natural resources, including ecosystem services, needs to be gender differentiated. Species information is required for not only the conservation and sustainable use of species, but as an input for producing information on ecosystem functioning and ecosystem services.

Information on ecosystems, species and ecosystem services supply can be combined to identify important areas for biodiversity conservation and ecosystem services supply. All these information categories can also be further developed through analysis with information on pollution and climate change, to assess their vulnerability to these pressures and identify response measures.

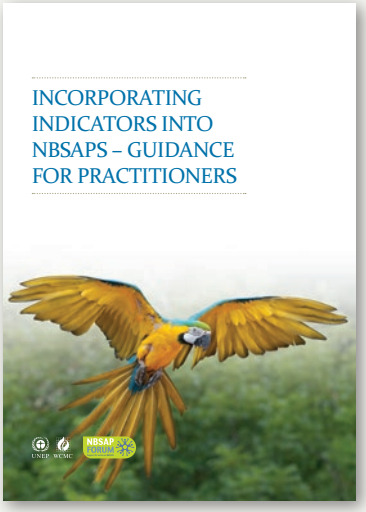
Annex 1 - Guidance and reference materials on biodiversity and ecosystem services produced by UN Environment's World Conservation Monitoring Centre

ENHANCING COOPERATION AMONG THE BIODIVERSITY-RELATED CONVENTIONS

A 'Sourcebook of Opportunities for Enhancing Cooperation among the Biodiversity-related Conventions at national and regional levels'
(http://wcmc.io/7aae)

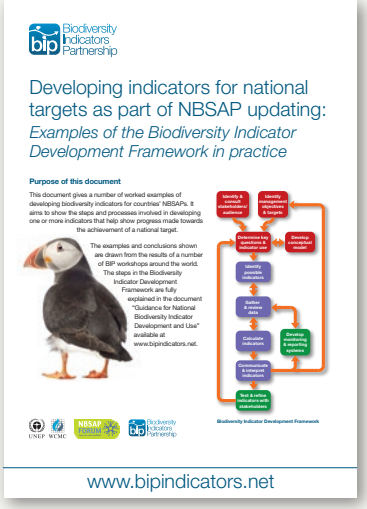
This includes a chapter on information management and reporting, with national examples of enhancing information management and reporting through cooperation, and overcoming challenges and barriers.

INDICATORS IN NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN REVISION

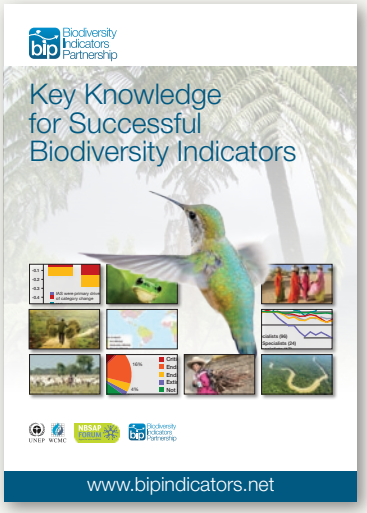


Incorporating Indicators into NBSAPs – Guidance for practitioners
(http://wcmc.io/6ffd)

INDICATORS IN NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN REVISION *continued*

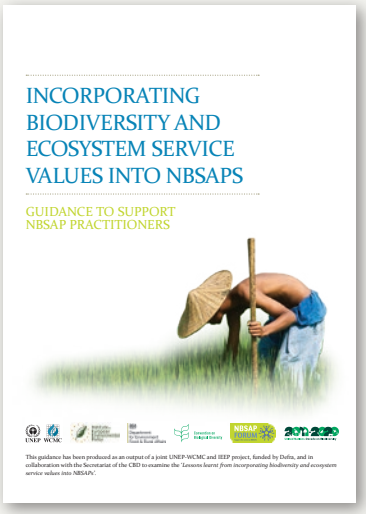


Developing indicators for national targets as part of NBSAP updating: Examples of the Biodiversity Indicator Development Framework in Practice
(http://wcmc.io/6ffd)



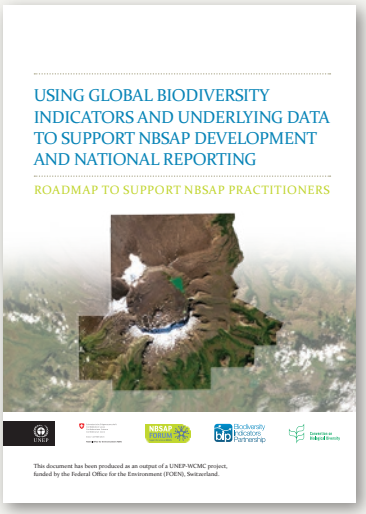
Key Knowledge for Successful Biodiversity Indicators
(http://wcmc.io/6ffd)

ECOSYSTEM SERVICES IN NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN REVISION



'Incorporating biodiversity and ecosystem service values into NBSAPs'
(http://wcmc.io/e35c)

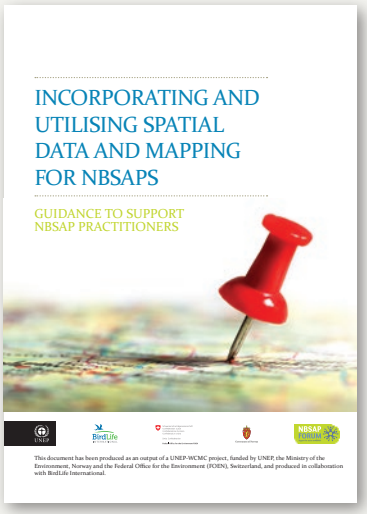
ACCESSING AND USING DATA IN NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN REVISION



Using global biodiversity indicators and underlying data to support NBSAP development and national reporting
(http://wcmc.io/c295)

Guidance on how global indicators or underlying data can be used in National Biodiversity Strategy and Action Plan updating and implementation and national reporting, and which global indicators are available for use at the national level.

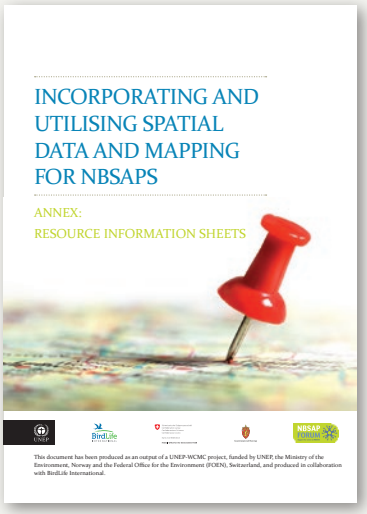
ACCESSING AND USING DATA IN NATIONAL BIODIVERSITY STRATEGY AND ACTION PLANS REVISION *continued*



Incorporating and using spatial data and mapping for NBSAPs

(http://wcmc.io/ec93)

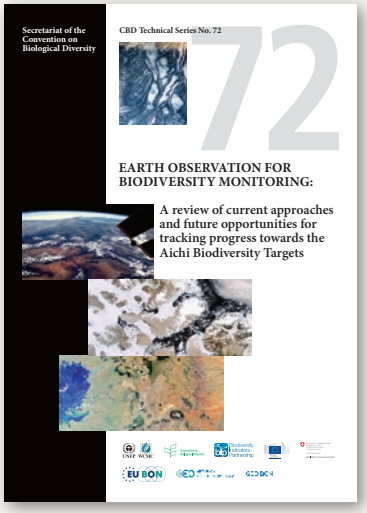
Guidance on steps and information sources for incorporating spatial data into National Biodiversity Strategy and Action Plans.



Incorporating and using spatial data and mapping for NBSAPs Annex

(http://wcmc.io/c3ab)

Resource information sheets on 25 biodiversity-relevant data sets and tools.

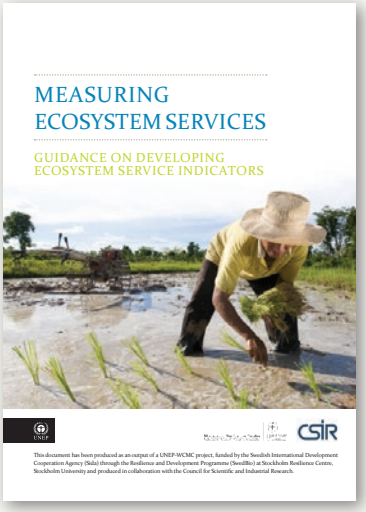


Earth Observation for Biodiversity Monitoring: A review of current approaches and future opportunities for tracking progress towards the Aichi Biodiversity Targets

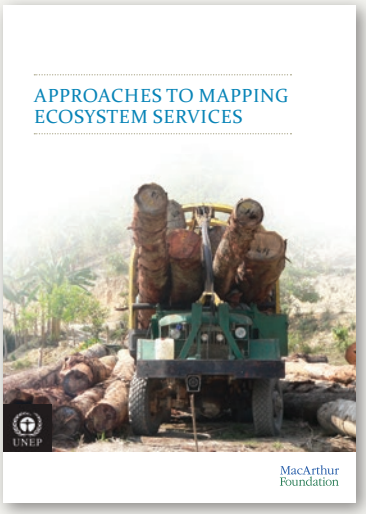
(https://www.cbd.int/doc/publications/cbd-ts-72-en.pdf)

The report includes a target by target assessment of the opportunities for remote sensing data to support biodiversity monitoring in the context of the Aichi Biodiversity Targets, and includes national experiences and lessons.

INDICATORS AND MAPPING OF ECOSYSTEM SERVICES

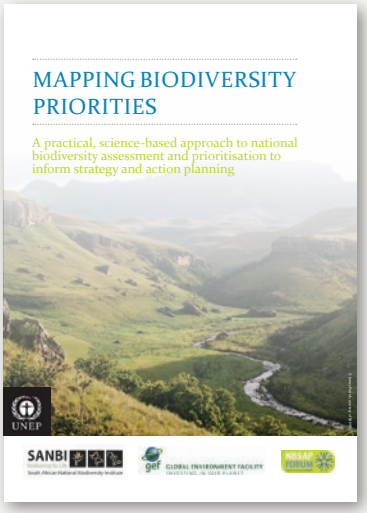


Measuring Ecosystem Services - Guidance on developing ecosystem service indicators
(http://wcmc.io/1322)



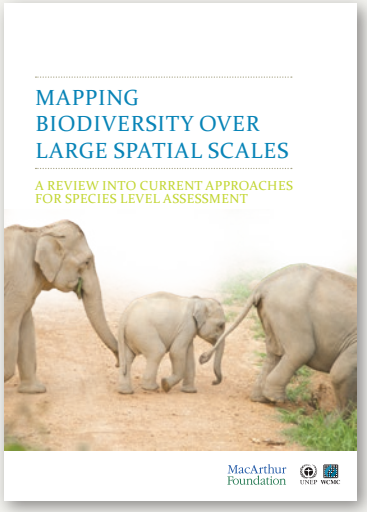
Approaches to mapping ecosystem services
(http://wcmc.io/2297)

MAPPING BIODIVERSITY



Mapping biodiversity priorities – a practical, science-based approach to national biodiversity assessment and prioritisation to inform strategy and action planning

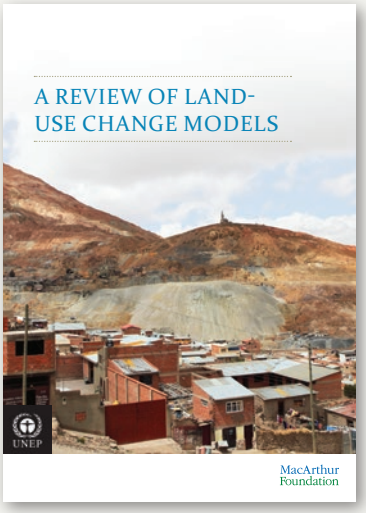
(http://wcmc.io/4acb)



Mapping biodiversity over large spatial scales – a review into current approaches for species level analysis

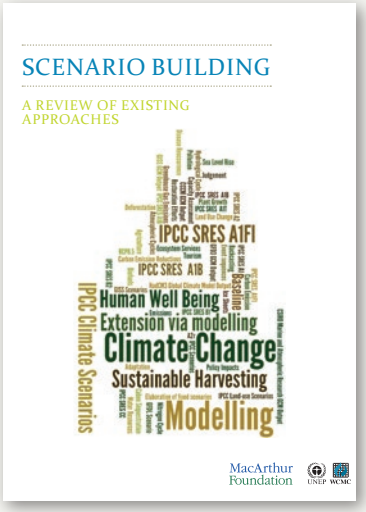
(http://wcmc.io/e16d)

MODELS AND SCENARIOS OF LAND USE AND AGRICULTURAL DEVELOPMENT IN RELATION TO BIODIVERSITY AND ECOSYSTEM SERVICES



A review of land use change models

(http://wcmc.io/29b1)

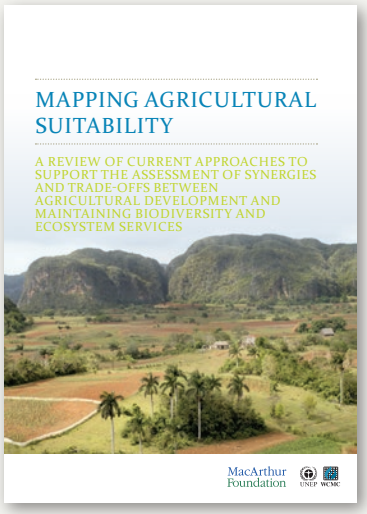


Scenario development

(http://wcmc.io/9b25)

A review of approaches in support of decision-making with consideration of synergies and trade-offs between agricultural or other natural resource-based development, whilst maintaining biodiversity and ecosystem service values.

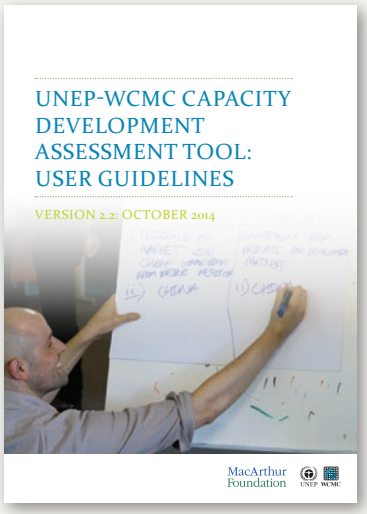
MODELS AND SCENARIOS OF LAND USE AND AGRICULTURAL DEVELOPMENT IN RELATION TO BIODIVERSITY AND ECOSYSTEM SERVICES *continued*



Mapping agricultural suitability
(http://wcmc.io/e731)

A review of approaches to support the assessment of synergies and trade-offs between agricultural development and ecosystem services.

CAPACITY ASSESSMENT



Capacity Development Assessment Tool (CDAT)
(http://wcmc.io/01af)

The CDAT is a suite of Microsoft Excel worksheets that guide the user to produce numerical scores for the current capacity to achieve a goal or task, and the feasibility of improving this capacity, and so assist in decision-making to design capacity development activities.

Annex 2 - Biodiversity-relevant targets under Sustainable Development Goals 6, 14 & 15

A list of all the SDGs, targets and indicators can be found at
http://uneplive.unep.org/portal#.WCnNZNWLTDc

Goal 6. Ensure availability and sustainable management of water and sanitation for all	
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
14.3	Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels
14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
14.5	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information
14.6	By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation
14.7	By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

Annex 3 - National Biodiversity Strategy and Action Plan indicators for Bosnia and Herzegovina and for Georgia and relevant global Sustainable Development Goal Targets which the indicators could be useful for

Assessment made by UNEP-WCMC.

A list of all the Sustainable Development Goals, targets and indicators can be found at http://uneplive.unep.org/portal#.WCnNZNWLTDc

Bosnia and Herzegovina NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance			
The number of projects related to protection of biological diversity	15.5			15.a			
A trend of reporting biological diversity notions in the media				12.8	13.3		
The number of strategic documents that have integrated biological diversity values into strategic plans	15.9			13.2			
The number and types of positive and negative incentives and subsidies for biological diversity	12.c	14.6		2.4			
The number of adopted sectoral plans for sustainable use of natural resources	12.2	15.1		6.4	14.7		
The number of passed laws and bylaws in the domain of biological diversity or other closely related domains	16.b	14.c	16.3				
Proportion of fishing waters with implemented sustainable management plans	14.4	14.6	14.7	14.b	2.3		
The trend of population density for indigenous, endemic and invasive fish species	14.4	15.5		14.6	14.7		
The trend of population density for commercially significant fish species in water courses	6.6	15.1	15.5				
Number of fish farms	14.7			2.3			
Areas of certified state-owned forests	15.2			15.b			
Areas under organic and integral production	2.4						
The quality and types of pesticides and fertilizers used	2.4			2.3			
The number of wastewater treatment systems installed	6.3			6.a	14.1	6.3	3.9

Bosnia and Herzegovina NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance			
Number of strategies implemented for invasive species	15.8						
Percentage of each habitat under protection status	14.5	6.6	15.1	11.4	15.5	14.2	
The number of species and ecosystems in the inventory	15.1	15.5					
The number of measures implemented for protection of endangered taxa	15.5						
The number of species under protection	15.5						
The number of local sorts and breeds and their wild relatives under ex situ and in situ protection	2.5	15.5					
Published reports of the benefits from forest, agricultural and water ecosystems	15.1			15.6	2.4		
Number of environmental permits and supervisory inspections	15.1	15.2	15.4	2.4			
The number of restored lakes	15.1						
Volume of forests by categories	15.2	15.1					
The size of urban green areas	11.3	11.6	11.a				
The number of legislative documents harmonized with the requirements of the Nagoya Protocol	15.6	2.5					
The number of scientific and expert references on traditional knowledge and practices	2.5			17.6	14.a		
A registry of scientific research and expert institutions, NGOs and media in the domain of biological diversity	9.5	17.17		12.a	14.3		
Earmarked financial resources (local and international) for protection and sustainable use of biological diversity	15.a	15.b		17.1	17.3		
The number of cross-border cooperation projects aimed at protection and sustained use of biological diversity	6.5	15.5	15.1	9.1	176		

Georgia NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance		
A.1- i1. Trends of awareness and attitudes of various target groups towards biodiversity (results of qualitative and quantitative studies incorporating the gender dimension)	12.8	13.3	15.5			
A.1- i2. Rate of media coverage of biodiversity issues (Published articles, radio and TV shows)	12.8	13.3	15.5			
A.1- i3. Number of supporting groups for communication, education and awareness-raising	12.8	13.3	15.5			
A.1- i4. Number of hits/clicks/visitors on the biodiversity web portal	12.8	13.3	15.5			
A.2- i1. Percentage of draft policy, strategic and legal documents related to biodiversity and biosafety made accessible for public consultation and the number and composition of consultation meetings	12.8	13.3	15.5	16.6		
A2 –i2. Existence of new amendments to the legislation aimed at improving public participation in decision making processes	16.7			6.b		
A.2- i3. Number of NGOs, including women's organizations and other stakeholders (especially representatives of local communities taking into account the gender balance), participating in public consultations on development projects and natural resource management plans	16.7	5.5	11.3	6.b		
A.3 – i1. Existence of newly enacted policies, laws, regulations and institutional changes that ensure compliance with the Convention on Biological Diversity and other biodiversity-related international commitments	16.b	14.c	16.3			
A.3- i2. Number of economic tools and instruments (including TEEB) ensuring biodiversity conservation and ecosystem services that are applied in decisionmaking	15.9					
A.3 – i3. Statistical information placed on www.geostat.ge and biodiversity monitoring reports/ calculated biodiversity indicators placed on www.biomonitoring.gov.ge	16.6	17.18	17.19			
A.4 –i1. Existence of newly enacted legislation on biosafety	15.5	15.8				
A.4 –i2. Existence of clearly defined functions of the state agencies in the field of management, monitoring and control of LMOs reflected in their statutes	15.5					
A.4 –i3. Existence of fully functional infrastructure for the management, monitoring and control of LMOs, including accredited laboratories	15.5					
A.4 –i4. Number of trained specialists (considering the gender dimension), with appropriate qualification in the assessment, monitoring, management and control of LMOs	15.5					

Georgia NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance		
B.1-i1. Percentage of natural habitats that are managed according to their respective management plans	15.2	15.5	15.4	15.3		
B.1-i2. Existence of a relevant legal base providing for (i) the integration of biodiversity conservation requirements into the EIA process and (ii) monitoring and enforcement of environmental impact permits (EIP) and licences	15.9	14.c				
B.1- i3. Rate of loss of forested areas	15.2	15.1	15.5	15.b		
B.1 -i4. Area of degraded forest	15.2	15.1	15.5	15.b		
B.1 - i5. Scale of grazing in the forest	15.2	15.1	15.5	15.b		
B.1 - i6. Area affected by forest fire	15.2	15.1	15.5	15.b		
B.1- i7. Area of forest affected by pests and diseases	15.2	15.1	15.5	15.b		
B.2- i1. Existence of a strategic document for the management of alien invasive species and for the prevention of their introduction and establishment	15.8			15.5		
B.2-i2. Number and distribution of invasive species	15.8			15.5		
B.3 -i1. Main anthropogenic sources of the eutrophication of the Black Sea identified; measures aimed at their eradication underway	14.1	6.3				
B.3-i2. Enacted legislation regulating environmental pollution	14.1	6.3	2.4	3.9		
B.3-i3. Existence of reports on the control of environmental pollution	14.1	6.3	2.4	3.9		
B.4 - i1. Relevant changes introduced in the legislation	15.1	15.8	14.5			
B.4- i2. Existence of a National Agricultural Strategy and Action Plan	15.1	15.8	14.5			
B.5 - i1. Existence of approved and scientifically sound methodology for stock assessment of commercial fish species in inland waters	14.4	14.6	14.7	14.b	2.3	
B.5 - i2. Existence of approved and scientifically sound methodology for establishing harvest quotas for commercial species in inland waters and the Black Sea	14.4	14.6	14.7	14.b	2.3	
B.5 - i3. Trends in stocks of commercial species in inland waters and the Black Sea	14.4	2.3	6.6	14.b	14.6	14.7
B.5-i4. Existence of effective legal and institutional frameworks for the management of aquaculture in place	14.7	2.3				
B.6 - i1. Existence of improved legislative and institutional framework for sustainable hunting	15.5	15.7				
C.1- i1. Existence of defined conservation statuses for all rare and economically important fauna species; existence of the updated national “Red List”	15.5					
C.1- i2. Existence of widely accepted checklists for major groups of organisms	15.5					
C.1- i3. Existence of a functional biodiversity monitoring system	15.5	17.18				

Georgia NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance		
C.1- i4. Existence of guidelines on developing a “Red List” of crop landraces, domestic animal landraces and crop wild relatives	15.5	2.5				
C.1.- i5. Existence of a national “Red List” of crop landraces, domestic animal landraces and crop wild relatives	15.5	2.5				
C.2-i1. Changes in the conservation status of “Red List” species	15.5					
C.2-i2. Population trends of economically valuable species	15.5	15.9				
C.2-i3. Existence of an effective system for the mitigation of humanwildlife conflicts (through the development and implementation of a mitigation strategy and the identification and assessment of both involved species and the form and extent of conflicts)	15.5					
C.3 - i1. Existence of newly adopted laws, regulations and standards	15.2	15.5				
C.4-i1. The existence of adopted relevant regulations	15.2	15.5				
C.4-i2. Existence of an approved plan of the national protected areas network	15.1	15.5	14.5			
C.4-i3. The total area of protected areas	15.1	15.5	14.5			
C.4-i4. The number of connected protected areas and ecological corridors	15.1	15.5	14.5			
C.4-i5. Number of agreements on transboundary cooperation in PAs management	15.1	15.5	14.5	6.5		
C.4-i6. Existence of results from a protected areas management effectiveness assessment	15.1	15.5	14.5			
C.4-i7. Number of functioning consultation councils of protected areas	15.1	15.5	14.5			
C.5- i1. In situ conservation status of farmed and domesticated animals and endemic species of cultivated plants and their wild relatives, including other socioeconomically as well as culturally valuable species	2.5					
C.5- i2. Existence of protected area management plans incorporating issues of agricultural biodiversity	15.5	2.5				
C.5- i3. Existence of a list of ex situ collections of nattional significance and their databases	2.5					
C.5- I4. Existence of management plans of the ex situ collections of national significance	2.5					
C.6-i1. Number and abundance of species (biodiversity index) in the Black Sea and inland waters						
C.6-i2. Existence of management plans for selected freshwater fish species	14.4	14.a	15.1	15.5	6.6	
C.6-i3. Existence of new marine protected areas in the Black Sea	14.5					
C.6-i4. Number of artificial reefs installed in the Black Sea	14.2					

Georgia NBSAP Indicator	SDG Targets with primary relevance			SDG Targets with secondary relevance		
D.1-i1. Ratification documents for the Nagoya Protocol and ITPGRFA and enacted national legislation for their implementation	15.6	2.5				
D.2- i1. Existence of a report on the study of climate change impact on biodiversity; recommendations for addressing the most pressing issues	13.3					
D2-i2. Number of national and local strategic plans in which climate change and biodiversity issues are integrated	13.2	13.1				
E.1-i1. Classification of Georgia's habitats applying the EU guidelines and recommendations	15.5					
E.1-i2. Existence of a regularly updated database of biodiversity (including priority habitats)	15.5					
E.1 – i3. Number of trained foresters, rangeland managers, wildlife managers, hunters and fishermen	15.c	2.3	2.4			
E.1 – i4. Number of forestry, hunting units and protected areas equipped with modern technologies	15.2	15.5		2.a		
E.1 – i5. Existence of updated forestry curricula at appropriate educational institutions	15.2	4.7				
E.2- i1. Existence of a national concept on teaching biodiversity issues	4.7	13.3				
E2-i2. Comprehensiveness of biodiversity-related topics in textbooks/manuals (relevant chapters)	4.7	13.3				
E2-i3. Biodiversity topics integrated in relevant training and professional development programmes for schoolteachers	4.7	13.3				
E2-i4. Improved incorporation of biodiversity issues in the curricula of higher and professional education	4.7	13.3				
E2-i5. Percentage of school and university students and teachers informed on biodiversity issues (results of quantitative and qualitative studies including the gender dimension)	4.7	13.3				
E2-i6. Number (by sector) of training courses in biodiversity provided for people employed in other sectors	4.7	13.3				
E2-i7. Number of biodiversity education programmes and programme participants at school clubs, national parks, museums and libraries	4.7	13.3				
E.3- i1. Existence of enacted relevant legislation and approved guidelines	2.5					

Annex 4 - Cross-mapping of indicators under the Biodiversity Indicators Partnership to the Aichi Biodiversity Targets and Sustainable Development Goals

In this table the indicators brought together under the Biodiversity Indicators Partnership (BIP) as of 2016 have been mapped to both the Aichi Biodiversity Targets (ABTs) and the Sustainable Development Goals (SDGs) to support the identification of indicator synergies between these processes.

This table is also available at www.bipindicators.net with the full names of the Aichi Biodiversity Targets and the Sustainable Development Goals and Targets. During 2017 the table will be updated with support from UN Environment, the European Commission (EC) and the Federal Office for the Environment (FOEN), Switzerland, to include: 1) new indicators as the Biodiversity Indicators Partnership expands its membership in light of the updated list of indicators for the Strategic Plan for Biodiversity 2011-2020; and 2) greater characterisation of how the indicators can be used at the national level.

	Operational BIP Indicators	Aichi Biodiversity Targets	SDGs and Targets	Applicable at the national level?†
Strategic Goal A	**Biodiversity Barometer** (www.bipindicators.net/biodiversitybarometer)	1	4.7, 12.8	Y
	Ecological Footprint (www.bipindicators.net/ecologicalfootprint)	4	8.4, 12.2	Y
	Red List Index (impacts of utilisation) (http://www.bipindicators.net/redlistindexforbirdsmammalsandamphibians)		8.4, 12.2, 14.3, 15.1, 15.7	
	Percentage of Category 1 nations in CITES (www.bipindicators/net/category1nationsincites)		15.5, 15.7	
Strategic Goal B	**Wetland Extent Trends Index** (www.bipindicators.net/wetindex)	5	6.6 (SDG indicator no. 6.6.1)*	
	Forest area as a percentage of total land area (www.bipindicators.net/forestextent)		15.1 (SDG indicator no. 15.1.1), 15.5	Y

	Operational BIP Indicators	Aichi Biodiversity Targets	SDGs and Targets	Applicable at the national level?†
Strategic Goal B	**Marine trophic index** (www.bipindicators.net/mti)	6	2.4 12.2, 12.8 14.4, 14.7, 14.b, 14.c	Y
	Marine Stewardship Council certified catch (www.bipindicators.net/certifiedfisheries)		14.4, 14.7, 14.b	Y
	Proportion of fish stocks within biologically sustainable levels (www.bipindicators.net/fishstocksinsafebiologicallimits)		14.4 (SDG indicator no. 14.4.1), 14.7, 14.c	
	Red List Index (impacts of fisheries) (www.bipindicators.net/rli/2010)		14.4, 14.7, 14.c	Y
	Area of forest under sustainable management: total FSC and PEFC forest management certification (www.bipindicators.net/forestcertification)	7	2.5 6.4, 6.5, 6.6 8.4, 8.5, 8.7, 8.8 12.2, 12.5, 12.6, 12.7, 12.8 13.1 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.c 16.3, 16.5 17.1, 17.11	Y
	Trends in loss of reactive nitrogen to the environment (www.bipindicators.net/nitrogenloss)	8	2.4 14.1 15.1	Y
	Trends in nitrogen deposition (www.bipindicators.net/nitrogendeposition)		2.4 14.1 15.2	Y
	Red List Index (impacts of pollution) (www.bipindicators.net/rli/2010)		14.1 15.3	Y
	Red List Index (impacts of invasive alien species) (www.bipindicators.net/rliimpactsofias)	9	15.8	Y
	Trends in the numbers of invasive alien species introduction events (www.bipindicators.net/iasintroductionevents)		15.8	Y
	Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species (www.bipindicators.net/iaslegislationadoption)		15.8 (SDG indicator no. 15.8.1)	Y
	Climatic impacts on European & American birds (www.bipindicators.net/10climaticimpactsoneuropeanbirdpopulations)	10	13.3 14.2 15.4, 15.5	
	Cumulative human impact on marine ecosystems (www.bipindicators.net/10climaticimpactsoneuropeanbirdpopulations)		14.1, 14.2	Y

	Operational BIP Indicators	Aichi Biodiversity Targets	SDGs and Targets	Applicable at the national level?†
Strategic Goal C	**Protected area coverage** (www.bipindicators.net/pacoverage)		11.4; 14.5 (SDG indicator no. 14.5.1); 15.4 (SDG indicator no. 15.4.1)	Y
	Protected Area Management Effectiveness (www.bipindicators.net/pamanagement)		11.4; 14.5; 15.2, 15.4, 15.5, 15.7, 15.c	Y
	Protected area coverage of ecoregions (www.bipindicators.net/pacoverage)		6.6; 11.4; 14.5; 15.1 (SDG indicator no. 15.1.2), 15.2, 15.4, 15.5, 15.7, 15.c	
	Protected area coverage of Key Biodiversity Areas (www.bipindicators.net/pacoverage)		11.4; 14.5; 15.1 (SDG indicator no. 15.1.2), 15.2, 15.4, 15.5, 15.7, 15.c	
	Wild Bird Index (www.bipindicators.net/WBI)		2.4; 12.2, 12.8; 15.1, 15.2, 15.5, 15.b	Y
	Wildlife Picture Index (www.bipindicators.net/wildlifepictureindex)		6.6; 15.1, 15.5	Y
	Living Planet Index (www.bipindicators.net/lpi)		14.2, 14.4; 15.1, 15.4, 15.5, 15.7, 15.8	Y
	Red List Index (www.bipindicators.net/rli/2010)		2.4; 6.6; 11.4; 12.2, 12.4, 12.5; 13.1; 14.1, 14.2, 14.3, 14.4, 14.5, 14.7, 14.b, 14.c; 15.1, 15.2, 15.4, 15.5 (SDG indicator no. 15.5.1), 15.7, 15.8, 15.b, 15.c	Y
	Genetic diversity of terrestrial domesticated animals (www.bipindicators.net/domesticatedanimals)		2.5	Y

	Operational BIP Indicators	Aichi Biodiversity Targets	SDGs and Targets	Applicable at the national level?†
Strategic Goal D	**Red List Index (species used for food and medicine)** (www.bipindicators.net/rli/2010)		6.6, 9.4, 12.2, 14.4, 14.7, 14.b, 14.c, 15.4, 15.5, 15.7, 15.c	Y
	Ocean Health Index (www.bipindicators.net/oceanhealthindex)	14	2.4, 8.4, 12.2, 12.8, 14.2, 14.3, 14.4, 14.6, 14.7, 14.c, 15.5	Y
	Red List Index (pollinating species) (www.bipindicators.net/redlistindexforpollinators)		2.4, 15.4	Y
	Number of Parties to the CBD that have deposited the instrument of ratification, acceptance, approval or accession of the Nagoya Protocol (www.bipindicators.net/NagoyaProtocolratification)	16	2.5, 15.6 (SDG indicator no. 15.6.1)	
Strategic Goal E	**Number of countries with developed or revised NBSAPs** (www.bipindicators.net/statusofNBSAPs)	17	1.b, 13.2, 15.9	
	Index of linguistic diversity (www.bipindicators.net/ild)	18	1.4, 16.7	Y
	Growth in species occurrence records accessible through GBIF (www.bipindicators.net/numberofgbifrecordsovertime)	19	11.4, 14.a, 15.5, 15.8, 15.9, 17.6	Y
	Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems (www.bipindicators.net/oda)	20	10.b, 15.a (SDG indicator no. 15.a.1), 15.b (SDG indicator no. 15.b.1), 17.3	Y

Further information on the indicators can be found at www.bipindicators.net

www.unep.org

United Nations Environment Programme
P.O. Box 30552 - 00100 Nairobi, Kenya
Tel.: +254 20 762 1234
Fax: +254 20 762 3927
e-mail: publications@unep.org
www.unep.org