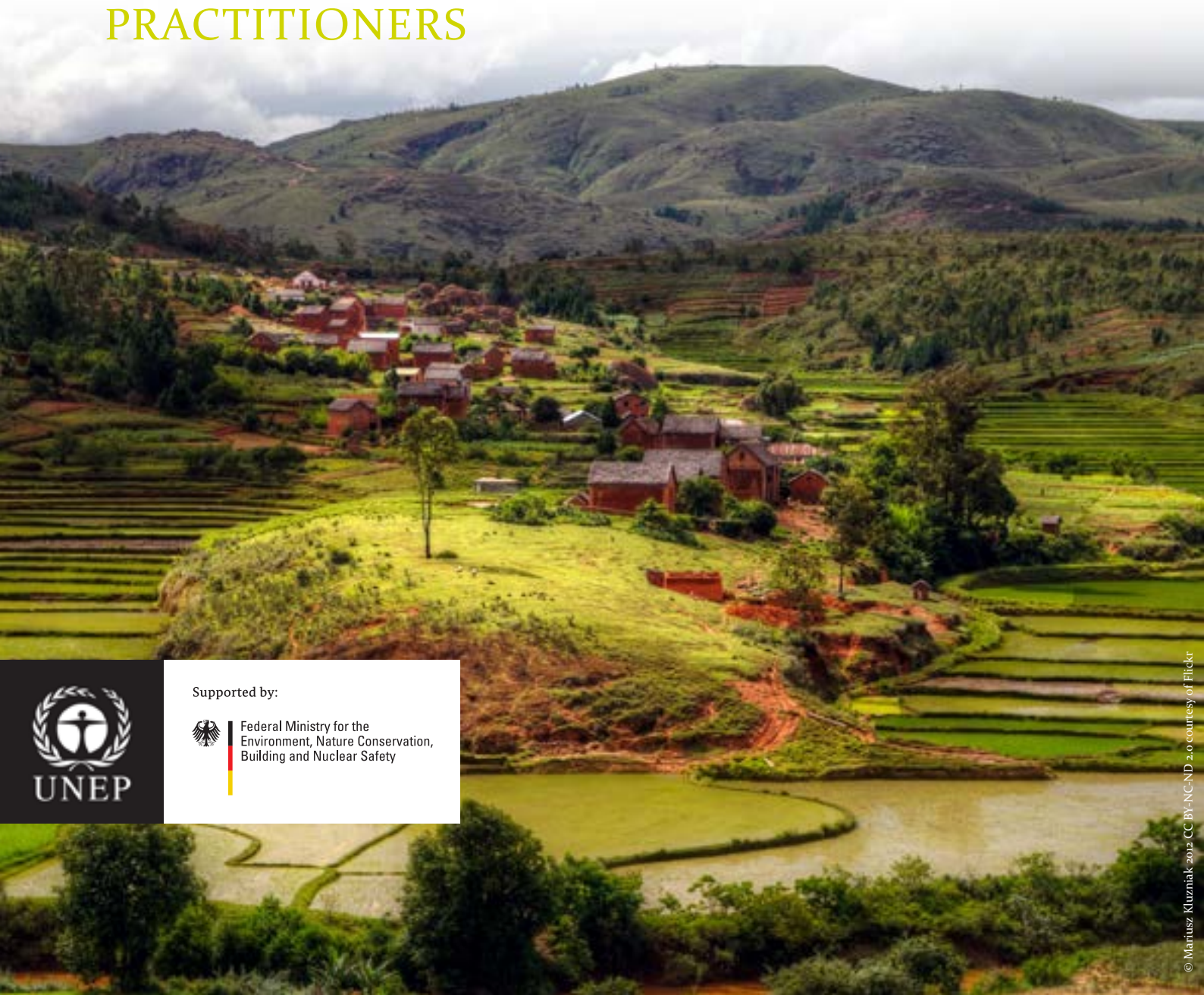
NATURAL CAPITAL ASSESSMENTS AT THE NATIONAL AND SUB-NATIONAL LEVEL

A GUIDE FOR ENVIRONMENTAL PRACTITIONERS



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KEY TERMS AND DEFINITIONS

Biodiversity: The variability among living organisms from all sources, including, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (United Nations, 1992).

Brown economy: An economy that depends excessively on fossil fuels, resource depletion and environmental degradation (UNEP, 2011).

Cultural services: The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including knowledge systems, social relations and aesthetic values (Hassan et al., 2005).

Direct driver: "A driver that unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy" (MA, 2005).

Drivers: "Any natural or human-induced factor that directly or indirectly causes a change in an ecosystem" (MA, 2005), or "the overarching socio-economic forces that exert pressure on the state of the environment" (UNEP, 2012a).

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment acting as a functional unit (United Nations, 1992).

Ecosystem assets: In this guide, these are spatially defined stocks of ecosystems (e.g. soils, biodiversity, freshwater and biomass) that yield a flow of valuable future ecosystem services.

Ecosystem functioning: The structural components of an ecosystem (e.g. plants, species, water, soil, atmosphere) and how they interact with one another, both within and across ecosystems (SEQ Ecosystem Services Framework, n.d.).

Ecosystem resilience: The capacity of an ecosystem to absorb shocks and disturbance while retaining the same level of fundamental functions (Walker et al., 2004).

Ecosystem services: Benefits people obtain from ecosystems. These include provisioning services, such as food and water; regulating services, such as regulation of floods, drought, land degradation and disease; supporting services, such as soil formation and nutrient cycling; and cultural services, such as recreational, spiritual, religious and other non-material benefits (MA, 2005).

Ecosystem service valuation: This expresses the relative importance/worth of natural capital assets to people through the estimation of relevant stocks and flows in monetary terms (SEEA-EEA, 2014).

Environmental externalities: This refers to the economic concept of uncompensated environmental effects of production and consumption that affect consumer utility and enterprise cost outside the market mechanism (OECD, 2003).

Green economy: An economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2011).

Green economy plan: In this guide, green economy plans are referred to in the context of delivering and implementing the details of the overarching green economy strategy within a defined region.

Green economy strategy: In this guide, green economy strategies are referred to in the context of an overarching approach to instating and achieving a transition to a green economy within a defined region (e.g. National Green Economy Strategy).

Impacts: In this guide, these are considered to be the resulting effects of sectoral activities (or those brought about by any actor(s)) upon ecosystem assets and/or ecosystem services, encompassing both negative and positive effects.

Indirect drivers: "A driver that operates by altering the level or rate of change of one or more direct drivers" (MA, 2005).

Natural capital: In this guide, this is understood as the stocks of Earth's natural assets and resources, such as soil, water, air and biodiversity.

Natural capital accounting: This sets out to value and incorporate the contribution of natural resources and their inherent processes and functions (e.g. timber, carbon sequestration and air filtration by woodland) into national accounts (The World Bank, 2015).

Natural Capital Assessment: A landscape-focused synthesis of information on the natural environment, focusing on natural capital assets and ecosystem services and how these can be best utilised without damaging or depleting them (Benami & Wilkinson, 2013).

Natural capital impact: "The negative or positive effect of business activity on natural capital. The effect can be an increase or decrease, as well as the consumption or restoration, of natural capital" (Natural Capital Coalition, 2015).

Planning unit: In this guide, this is used to describe the relevant sub-national public authority operating under the respective national government.

Provisioning services: The products people obtain from ecosystems; these may include food, freshwater, timber, fibres and medicinal plants (Hassan et al., 2005).

Regulating services: The benefits obtained from the regulation of ecosystem processes, including the regulation of climate, water and some human diseases (Hassan et al., 2005).

Supporting services: "Supporting services or ecological functions are the underpinning structures and processes that ultimately give rise to ecosystem services" (CICES, 2016). Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and habitat provisioning (Hassan et al., 2005).

1. Executive Summary

Overreliance on investment in the so-called 'brown economy'[1] between the late 20th and early 21st centuries led to a state of financial imbalance and was a contributing factor in the global financial crises of 2008. An alternative economic paradigm, centred on a 'greening' of the economy, provides greater focus on investment in renewable energy, energy efficiency, public transportation, sustainable agriculture, ecosystem and biodiversity protection, and land and water conservation. These 'green economies' are also likely to be more resilient and socially inclusive, particularly in the face of environmental pressures, such as climate change.

Almost all economic activities are dependent on 'natural capital' in some form or another. Natural capital refers to the stocks of the Earth's natural assets and resources, such as soil, water, air and biodiversity. These stocks provide humans with a flow of goods and benefits – known as 'ecosystem services' – which positively impact our well-being. Indeed, for business operations to successfully function long-term, and for human well-being to be sustained, this resource base must be maintained or restored. This is a fundamental part of the greening of economies.

[1] An economy that depends excessively on fossil fuels, resource depletion and environmental degradation (UNEP, 2011).

Economic growth in Africa is typically underpinned by dependencies on natural resource exploitation. In order to realise sustainable long-term growth, African economies will need to adapt and shift towards adopting the green economy concept. This transition is vital for contributing to poverty eradication, sustained economic growth, enhanced social inclusion, improved human welfare and increased employment opportunities, while maintaining and sustaining healthy ecosystem functioning.

To aid such a shift in thought, it is important to assess natural capital at both national and sub-national levels. Natural Capital Assessments are landscape-focused appraisals that provide information on the natural environment of a planning unit. Specifically, they consider what assets and services nature provides, and how they can be best used without damaging or depleting them. This information reveals the benefits and values of natural capital stocks, and can be used to make better decisions regarding land-use that supports a transition to a green economy approach.

This guidance document, *Natural Capital Assessments at the National and Sub-national Level*, presents eight steps to completing Natural Capital Assessments:

1. **Agree key goals:** agree the overall goal and objectives of the assessment, based on needs and questions facing decision-makers.
2. **Establish scope and scale of the assessment:** identify key natural capital stocks on which to focus, and decide the appropriate scale (geographic, resolution) for decision-makers' needs.
3. **Gather and review data:** collate data on natural capital to inform the assessment.
4. **Identify priority sector dependencies on natural capital:** identify the locations of priority economic activities and key beneficiaries, and their dependencies on natural capital.
5. **Identify priority sector impacts on natural capital:** identify the impacts of economic activities on natural capital.
6. **Establish status and trends in natural capital:** determine indicators to communicate the status and trends in natural capital.
7. **Use scenarios to assess future changes to natural capital:** explore how scenarios can be used in forward-looking assessments of natural capital to support decision-making.
8. **Use the Natural Capital Assessment:** scope policy targets for natural capital in a green economy.

Throughout these eight steps, the assessment should involve stakeholder engagement, excellent communication and capacity building to ensure it is credible, legitimate and relevant to the needs of decision-makers. In particular, building capacity among local experts is important for promoting ownership, trust and long-term success (Ruckelshaus et al., 2013).

Overall, conducting a Natural Capital Assessment demonstrates the key linkages between priority sector activities and the status and trends of natural capital in a planning unit. This helps to inform decision-making that supports long-term sustainable and inclusive economic growth; in turn, generating green jobs, reducing poverty and addressing ecological scarcity and environmental risks.

Résumé

Le recours excessif à l'investissement dans « l'économie brune » [1] entre la fin du XXe siècle et le début du XXIe a entraîné une situation de déséquilibre financier et a contribué aux crises financières mondiales de 2008. Un autre modèle économique, axé sur l'« écologisation » de l'économie, cible davantage l'investissement en faveur des énergies renouvelables, de l'efficacité énergétique, des transports en commun, d'une agriculture durable, de la protection des écosystèmes et de la biodiversité, et de la préservation des sols et des ressources en eau. Ces « économies vertes » favorisent aussi davantage l'inclusion sociale et sont généralement plus résilientes, en particulier face aux pressions environnementales telles que le changement climatique.

Presque toutes les activités économiques dépendent d'une façon ou d'une autre du « capital naturel », c'est-à-dire des stocks de ressources et de richesses naturelles de la planète, notamment les sols, l'eau, l'air et la biodiversité. Ces ressources procurent à l'humanité une multitude de biens et de bienfaits, ou « services écosystémiques », qui ont un effet positif sur notre bien-être. Bien entendu, si l'on veut pérenniser leur exploitation commerciale et améliorer le bien-être des personnes, ces ressources doivent être préservées ou remises en état : c'est un élément essentiel de l'écologisation des économies.

[1] Une économie qui dépend excessivement des combustibles fossiles, de l'épuisement des ressources et de la dégradation de l'environnement (PNUE, 2011).

En Afrique, la croissance économique repose généralement sur une dépendance à l'égard de l'exploitation des ressources naturelles. Pour assurer une croissance durable à long terme, les économies africaines devront s'adapter et s'orienter vers l'adoption du concept d'économie verte. Cette transition est essentielle pour contribuer à l'éradication de la pauvreté, maintenir la croissance économique, renforcer l'inclusion sociale, améliorer le bien-être de la population et accroître les perspectives d'emploi, tout en assurant la pérennité et la bonne santé des écosystèmes.

Pour favoriser ce revirement, il est important d'analyser le capital naturel à la fois à l'échelle nationale et infranationale. Les Évaluations du capital naturel dressent un état des lieux axé sur les paysages permettant de connaître l'environnement naturel d'un territoire donné, notamment les richesses et les services rendus par la nature, et le meilleur usage qu'on puisse en faire sans les altérer ni les épuiser. Ces informations mettent en évidence l'utilité et la valeur des stocks de capital naturel et peuvent servir à prendre de meilleures décisions concernant l'aménagement du territoire, de façon à encourager la transition vers une économie verte.

Ce document d'orientation, intitulé *Évaluations du capital naturel à l'échelle nationale et infranationale*, propose un diagnostic du capital naturel en huit étapes :

1. **Convenir des principaux objectifs :** s'accorder sur les objectifs et la finalité de l'évaluation, en fonction des questions et des besoins auxquels sont confrontés les décideurs.
2. **Définir la portée et l'ampleur de l'évaluation :** identifier les principaux stocks de capital naturel à évaluer et décider de l'échelle (géographique, résolution) adaptée aux besoins des décideurs.
3. **Recueillir et analyser les données :** collecter des données sur le capital naturel afin d'alimenter l'évaluation.
4. **Identifier les éléments de dépendance des secteurs prioritaires à l'égard du capital naturel :** déterminer où se trouvent les activités économiques prioritaires et les principaux bénéficiaires, et la mesure dans laquelle ils dépendent du capital naturel.
5. **Identifier l'impact des secteurs prioritaires sur le capital naturel :** identifier les répercussions des activités économiques sur le capital naturel.
6. **Déterminer l'état et l'évolution du capital naturel :** définir des indicateurs visant à rendre compte de l'état et de l'évolution du capital naturel.
7. **Évaluer l'évolution future du capital naturel à l'aide de scénarios :** envisager l'utilisation de scénarios pour réaliser des évaluations prospectives du capital naturel afin de faciliter la prise de décision.
8. **Tirer parti de l'Évaluation du capital naturel :** repérer des objectifs stratégiques pour le capital naturel dans une économie verte.

L'évaluation doit s'accompagner tout au long de ces huit étapes d'une bonne mobilisation des parties prenantes, d'une excellente communication et d'un renforcement des capacités de façon à assurer sa crédibilité, sa légitimité et sa pertinence face aux besoins des décideurs. Il importe notamment de renforcer les capacités des experts locaux afin de favoriser l'adhésion et la confiance ainsi que la réussite à long terme (Ruckelshaus *et al.*, 2013).

Dans l'ensemble, la réalisation d'une Évaluation du capital naturel met en évidence les principales corrélations entre les activités des secteurs prioritaires et l'état et l'évolution du capital naturel dans un territoire donné. Cette initiative permet de prendre des décisions éclairées en faveur d'une croissance économique inclusive et durable à long terme, qui contribuera à créer des emplois verts, à réduire la pauvreté et à éviter la pénurie des ressources et les risques environnementaux.

Resumen

La excesiva dependencia de la inversión destinada a la llamada «economía marrón»[1] a finales del siglo XX y principios del siglo XXI condujo a una situación de desequilibrio financiero y contribuyó a la crisis financiera de 2008. Un paradigma económico alternativo, centrado en una economía más «verde», permitiría destinar más inversiones a la energía renovable, la eficiencia energética, el transporte público, la agricultura sostenible, la protección de los ecosistemas y la diversidad biológica, y la conservación del suelo y el agua. Es probable que esas «economías verdes» sean también más resilientes e inclusivas desde el punto de vista social, en particular frente a presiones ambientales como el cambio climático.

La práctica totalidad de las actividades económicas depende de un modo u otro del capital natural. Por «capital natural» se entienden las reservas de recursos y bienes naturales de la Tierra, como el suelo, el agua, el aire y la diversidad biológica. Esas reservas ponen al servicio de la humanidad un flujo de productos y beneficios, llamados «servicios de los ecosistemas», que tienen efectos positivos en nuestro bienestar. De hecho, es fundamental que esa base de recursos se mantenga o restaure para que la actividad comercial pueda funcionar adecuadamente a largo plazo y para que mejore el bienestar humano. Es un elemento clave para que las economías sean más ecológicas.

[1] Una economía que depende en exceso de los combustibles fósiles, el uso abusivo de los recursos y la degradación ambiental (PNUMA, 2011).

El crecimiento económico en África suele caracterizarse por la dependencia de la explotación de los recursos naturales. Para lograr un crecimiento sostenible a largo plazo, las economías africanas deberán adaptarse y comenzar a adoptar el concepto de economía verde. Esta transición es vital para contribuir a la erradicación de la pobreza, el crecimiento económico sostenible, una mayor inclusión social, un nivel más elevado de bienestar humano y más oportunidades de empleo, al tiempo que se mantiene en funcionamiento un ecosistema saludable.

Para fomentar ese cambio de mentalidad, es importante evaluar el capital natural tanto a escala nacional como subnacional. Las evaluaciones del capital natural son valoraciones centradas en los paisajes que ofrecen información sobre el entorno natural de una dependencia de planificación. En particular, se examinan los activos y servicios que proporciona la naturaleza y la mejor manera de utilizarlos sin dañarlos ni agotarlos. La información revela los beneficios y el valor de las reservas de capital natural y puede utilizarse para tomar decisiones más acertadas sobre el uso de la tierra, de modo que se facilite la transición hacia una economía verde.

En este documento de orientación, *Evaluaciones del capital natural a escala nacional y subnacional*, se presentan ocho pasos para realizar las evaluaciones:

1. **Acordar los objetivos clave:** determinar la meta y los objetivos generales de la evaluación en función de las necesidades y los asuntos a los que se enfrenten los responsables de la toma de decisiones.
2. **Establecer el alcance y la amplitud de la evaluación:** identificar las reservas de capital natural clave que deben analizarse y decidir la envergadura adecuada (geográfica, resolución) para responder a las necesidades de los responsables de la toma de decisiones.
3. **Recopilar y examinar los datos:** compilar datos sobre el capital natural para incluirlos en la evaluación.
4. **Identificar la dependencia del capital natural de los sectores prioritarios:** localizar las actividades económicas prioritarias y sus principales beneficiarios, así como su dependencia del capital natural.
5. **Identificar el impacto de los sectores prioritarios en el capital natural:** identificar el impacto de las actividades económicas en el capital natural.
6. **Determinar la situación actual y las tendencias en el capital natural:** fijar indicadores de la situación actual y las tendencias del capital natural.
7. **Utilizar escenarios para evaluar los cambios futuros del capital natural:** analizar el uso posible de los escenarios en evaluaciones prospectivas del capital natural para ayudar a la toma de decisiones.
8. **Usar la evaluación del capital natural:** delimitar las metas políticas del capital natural en una economía verde.

Las partes interesadas deben participar en los ocho pasos, que deben caracterizarse por una comunicación excelente y la construcción de capacidades para garantizar la credibilidad, la legitimidad y la pertinencia de la evaluación de cara a las necesidades de los responsables de la toma de decisiones. Reviste especial importancia mejorar las capacidades de los expertos locales para promover la asunción del proyecto como propio, la confianza y el éxito a largo plazo (Ruckelshaus *et al.*, 2013).

En general, las evaluaciones del capital natural ponen de manifiesto los vínculos clave que existen entre las actividades de los sectores prioritarios y la situación actual y las tendencias del capital natural en las dependencias de planificación. Aportan información para tomar decisiones que redunden en un crecimiento económico sostenible e incluyente a largo plazo, al tiempo que se generan empleos ecológicos, se reduce la pobreza y se afrontan la escasez ecológica y los riesgos ambientales.

Резюме

Чрезмерный упор на инвестирование в так называемую «коричневую экономику» в конце 20-го – начале 21-го веков привел к возникновению финансовой неустойчивости и стал одним из факторов, способствовавших развитию глобального финансового кризиса 2008 года. Альтернативная экономическая парадигма, сосредоточенная на «озеленении» экономики, обеспечивает повышенную концентрацию внимания на инвестициях в возобновляемые источники энергии, энергоэффективность, общественный транспорт, устойчивое сельское хозяйство, защиту экосистем и биоразнообразия, сохранение земельных и водных ресурсов. Эти элементы «зеленой экономики», вероятно, также обладают более высоким потенциалом противодействия неблагоприятному развитию событий и социальной всеохватности, особенно перед лицом таких составляющих экологической нагрузки, как изменение климата.

Практически все виды экономической деятельности зависят от «природного капитала» в той или иной форме. К природному капиталу относятся запасы природных богатств и ресурсов планеты Земля, таких как почва, вода, воздух и биоразнообразие. Эти запасы служат для человечества источником товаров и благ – известных как «экосистемные услуги» – которые оказывают положительное воздействие на наше благосостояние. В самом деле, для успешного осуществления хозяйственной деятельности в долгосрочной перспективе и повышения уровня благосостояния человека эта ресурсная база должна сохраняться или восстанавливаться. Это – основополагающий элемент «озеленения» экономики.

[1] Экономика, характеризующаяся чрезмерной зависимостью от ископаемых видов топлива, истощением ресурсов и деградацией окружающей среды (UNEP, 2011).

Определяющими факторами экономического роста в Африке, как правило, являются различные виды зависимости от эксплуатации природных ресурсов. С тем, чтобы реализовать устойчивый долгосрочный рост, экономику африканских стран необходимо адаптировать и переориентировать на осуществление концепции «зеленой экономики». Этот переход является жизненно важным с точки зрения искоренения нищеты, обеспечения поступательного экономического роста, повышения уровня социальной всеохватности и благополучия человека, а также расширения возможностей трудоустройства при одновременном сохранении и обеспечении устойчивого функционирования здоровых экосистем.

Чтобы помочь такому сдвигу в образе мышления, важно проводить оценку природного капитала как на национальном, так и на субнациональном уровнях. Доклады об оценке природного капитала представляют собой ландшафтно-ориентированные экспертные оценки органа по планированию, содержащие информацию о природной окружающей среде. В конкретном плане в этих докладах рассматривается, какие именно активы и услуги обеспечиваются природой и каким образом они могут быть наилучшим образом использованы без нанесения им ущерба или их истощения. Эта информация раскрывает выгоды и ценности, обеспечиваемые запасами природного капитала, и может использоваться для повышения качества решений в области землепользования, способствующих переходу к реализации концепции «зеленой экономики».

Настоящий руководящий документ – «Проведение оценки природного капитала на национальном и субнациональном уровнях» – содержит описание восьми этапов подготовки Докладов об оценке природного капитала:

1. **Согласование ключевых конечных целей:** достижение согласия относительно всеохватывающей цели и задач проведения оценки на основе существующих потребностей и вопросов, стоящих перед директивными органами.
2. **Определение предметного охвата и масштаба оценки:** выявление ключевых запасов природного капитала, на которых следует сосредоточить внимание, и принятие решения о соответствующем масштабе (географический охват, разрешающая способность), отвечающем потребностям директивных органов.
3. **Сбор и анализ данных:** упорядочение данных о природном капитале с целью наполнения доклада об оценке конкретным содержанием.
4. **Выявление факторов зависимости приоритетных секторов от природного капитала:** определение местоположения объектов реализации приоритетных видов экономической деятельности и ключевых выгодоприобретателей, а также степени их зависимости от природного капитала.
5. **Выявление факторов воздействия приоритетных секторов на природный капитал:** выявление факторов воздействия различных видов экономической деятельности на природный капитал.
6. **Определение текущего состояния и тенденций изменения природного капитала:** определение показателей, позволяющих осуществлять информационное взаимодействие по вопросам текущего состояния и тенденций изменения природного капитала.
7. **Использование сценариев развития для целей оценки изменений природного капитала в будущем:** исследование вопроса о том, каким образом сценарии развития могут быть использованы в перспективных оценках природного капитала для целей оказания поддержки процессу принятия решений.
8. **Использование Докладов об оценке природного капитала:** определение предметного охвата целевых задач политики в отношении роли природного капитала в «зеленой экономике».

На протяжении указанных восьми этапов процесс оценки следует основывать на принципах вовлечения заинтересованных сторон, превосходно налаженного информационного взаимодействия и наращивания потенциала, обеспечивающих ее достоверность, правомочность и соответствие потребностям директивных органов. В частности, наращивание потенциала местных экспертов имеет важное значение с точки зрения поощрения ответственности, доверия и долгосрочного успеха (Ruckelshaus et al., 2013).

В целом, подготовка Докладов об оценке природного капитала позволяет продемонстрировать ключевые взаимосвязи между видами деятельности в приоритетных секторах и текущим состоянием, а также тенденциями изменения природного капитала в рамках органа по планированию. Это помогает наполнить конкретным содержанием процесс принятия решений, обеспечивающий долгосрочный, устойчивый и всеохватывающий экономический рост, что, в свою очередь, способствует созданию «зеленых» рабочих мест, сокращению масштабов нищеты и решению проблем, связанных с дефицитом природных ресурсов и экологическими рисками.

ويرتكز النمو الاقتصادي في أفريقيا عادة على الاعتماد على استغلال الموارد الطبيعية. ولتحقيق النمو المستدام على المدى الطويل، ستحتاج الاقتصادات الأفريقية إلى التكيّف والتحوّل نحو تبني مفهوم الاقتصاد الأخضر. ويُعد هذا التحوّل أمراً حيوياً للقضاء على الفقر، والمساهمة في النمو الاقتصادي المستدام، وتعزيز الاندماج الاجتماعي، وتحسين الرفاه البشري، وزيادة فرص التوظيف، مع الحفاظ على النظم البيئية الصحية وإدامتها.

وللمساعدة في إحداث هذا التحول في الفكر، من المهم تقييم رأس المال الطبيعي على المستويين الوطني ودون الوطني على حد سواء. وتقييمات رأس المال الطبيعي هي عبارة عن تقييمات تركز على الأراضي وتوفّر معلومات عن البيئة الطبيعية لوحدة تخطيط. وعلى وجه التحديد، فهي تتناول الأصول والخدمات التي توفرها الطبيعة، وأفضل السبل لاستخدامها دون الإضرار بها أو استنفادها. وتكشف هذه المعلومات عن فوائد مخزون رأس المال الطبيعي وقيمته، ويمكن استخدامها لاتخاذ قرارات أفضل فيما يتعلق باستخدام الأراضي على النحو الذي يدعم التحوّل إلى نهج الاقتصاد الأخضر.

وتقدّم هذه الوثيقة التوجيهية، التي تحمل عنوان "تقييمات رأس المال الطبيعي على المستوى الوطني ودون الوطني"، ثماني خطوات لإتمام تقييمات رأس المال الطبيعي:

1. **الاتفاق على الأهداف الرئيسية:** الاتفاق على الهدف العام والأغراض من التقييم، استناداً إلى الاحتياجات والأسئلة التي تواجه صناع القرار.

2. **تحديد نطاق وحجم التقييم:** تحديد المخزون الرئيسي لرأس المال الطبيعي المراد التركيز عليه، وتقرير النطاق المناسب (الجغرافي، المتعلق بقرار) لتلبية احتياجات صناع القرار.

3. **جمع واستعراض البيانات:** تحديد البيانات عن رأس المال الطبيعي لإثراء التقييم بالمعلومات.

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4. **تحديد القطاعات ذات الأولوية من رأس المال الطبيعي:** تحديد مواقع الأنشطة الاقتصادية ذات الأولوية والمستفيدين الرئيسيين، واعتمادهم على رأس المال الطبيعي.

5. **تحديد آثار القطاعات ذات الأولوية على رأس المال الطبيعي:** تحديد آثار الأنشطة الاقتصادية المترتبة على رأس المال الطبيعي.

6. **تحديد الحالة والاتجاهات في رأس المال الطبيعي:** تحديد مؤشرات للتعبير عن حالة رأس المال الطبيعي واتجاهاته.

7. **استخدام السيناريوهات لتقييم التغييرات المستقبلية في رأس المال الطبيعي:** استكشاف إمكانية استخدام السيناريوهات في تقييمات رأس المال الطبيعي التي تستشرف المستقبل وذلك بهدف دعم عملية صنع القرار.

8. **استخدام تقييم رأس المال الطبيعي:** تحديد نطاقاً لمقاصد السياسات المتعلقة برأس المال الطبيعي في الاقتصاد الأخضر.

على امتداد الثماني خطوات، ينبغي أن يُشرِك التقييم الأطراف المعنية، وأن يتسم بالتواصل الجيد وبناء القدرات لضمان أن يتمتع بالمصداقية والشرعية وأن يراعي احتياجات متخذي القرارات. وعلى وجه الخصوص، فإن بناء القدرات بين الخبراء المحليين يعد خطوة مهمة لتعزيز الملكية والثقة والنجاح على المدى الطويل (Ruckelshaus et al., 2013).

وعموماً، فإن إجراء تقييم رأس المال الطبيعي يوضح الروابط الرئيسية بين أنشطة القطاعات ذات الأولوية وحالة رأس المال الطبيعي واتجاهاته في وحدة تخطيط. وذلك يساعد على توفير المعلومات لعملية صنع القرار التي تدعم النمو الاقتصادي المستدام والشامل على المدى الطويل؛ الذي يثمر بدوره عن خلق الوظائف الخضراء والحد من الفقر ومعالجة الندرة الإيكولوجية والمخاطر البيئية.

ملخص تنفيذي

أدى الإفراط في الاعتماد على الاستثمار فيما يُسمى بـ "الاقتصاد البنيّ"[1] في الفترة ما بين أواخر القرن العشرين وأوائل القرن الحادي والعشرين إلى حالة من عدم التوازن المالي، كما كان عاملاً مساهماً في الأزمة المالية العالمية التي نشبت في عام 2008. أما النموذج الاقتصادي البديل، الذي يتمحور حول " تخضير" الاقتصاد، فيوفّر مزيداً من التركيز على الاستثمار في مجال الطاقة المتجددة وكفاءة الطاقة والنقل العام والزراعة المستدامة والنظام الإيكولوجي وحماية التنوع البيولوجي وحفظ الأرض والمياه. وهذه "الاقتصادات الخضراء" من المرجح أيضاً أن تكون أكثر مرونة وشموليةً من الناحية الاجتماعية، وبخاصة في مواجهة الضغوط البيئية، مثل تغيّر المناخ.

تعتمد جميع الأنشطة الاقتصادية تقريباً على "رأس المال الطبيعي" بشكل ما أو بآخر. ويشير رأس المال الطبيعي إلى المخزونات من الأصول والموارد الطبيعية للأرض، مثل التربة والماء والهواء والتنوع البيولوجي. وتوفّر هذه المخزونات للبشر تدفقاً من السلع والمنافع - المعروفة باسم 'خدمات النظام الإيكولوجي" – التي تؤثر إيجابياً على رفاهنا. وفي الواقع، كي تتم العمليات التجارية بنجاح على المدى الطويل، ولكي يتحسّن الرفاه البشري، يجب المحافظة على هذه القاعدة من الموارد أو استعادتها. وهذا جزء أساسي من تخضير الاقتصادات.

[1] الاقتصاد الذي يفرط في الاعتماد على الوقود الأحفوري واستنزاف الموارد والتدهور البيئي (برنامج الأمم المتحدة للبيئة، 2011)

执行摘要

20世纪末和21世纪初之间，对所谓“棕色经济”投资的过度依赖导致了金融不平衡的状况，这也是造成2008年全球金融危机的一个因素。另一种以发展绿色经济为中心的经济模式对可再生能源、能源效率、公共交通、可持续农业、生态系统和生物多样性保护，以及土地和水资源保护的投资给予了更大重视。这些“绿色经济”也可能更富有抗逆力和社会包容性，尤其是在面对环境压力，如气候变化时更是如此。

几乎所有的经济活动都依赖于某种形式的“自然资本”。自然资本是指地球的自然资产和资源的储备，如土壤、水、空气和生物多样性。这些储备为人类带来了商品的流动和利益（被称为“生态系统服务”），会对人类的福祉产生积极影响。事实上，为了商业运作的长期成功和人类福祉的改善，必须保持或恢复这个资源库。这是发展绿色经济的基本组成部分。

非洲经济的增长通常依赖于自然资源的开采。为了实现可持续的长期增长，非洲经济将需要适应并转而采用绿色经济的概念。这种转变对于消除贫困、实现经济持续增长、增强社会包容、改善人类福祉、增加就业机会至关重要，而同时又能维护和保持健康的生态系统功能。

为了帮助在思想上进行这样的转变，同时在国家和次国家层面评估自然资本就非常重要。自然资本评估是以景观为重点的评价，提供有关规划单位的自然环境信息。具体而言，此类评估考虑大自然提供何种资产和服务，以及在不破坏或耗尽它们的前提下，如何使之得到最好的利用。此类信息显示了自然资本储备的益处和价值，并且可被用于做出有关土地利用的更好的决策，以支持向绿色经济方式的转变。

本指导文件《国家和次国家自然资本评估》提出了完成自然资本评估的八个步骤：

1. **就主要目标达成一致**：基于决策者的需求和所面临的问题，就评估的总体目标和具体目标达成一致。
2. **建立评估范围和规模**：确定要关注的关键自然资本储备，并决定满足决策者需求的适度规模（地理、决心）。
3. **收集和审查数据**：整理关于自然资本的数据，为评估提供依据。
4. **确定优先部门对自然资本的依赖**：识别优先的经济活动和主要受益者的位置，以及它们对自然资本的依赖。
5. **确定优先部门对自然资本的影响**：确定经济活动对自然资本的影响。
6. **确立自然资本的状况和趋势**：确定用来传达自然资本的状况和趋势的指标。
7. **使用场景来评估未来的自然资本变化**：探讨如何在自然资本的前瞻性评估中使用场景来支持决策。
8. **使用自然资本评估**：在绿色经济中审视自然资本政策目标。

评估的每个步骤都应该包括利益相关方的参与、良好的沟通和能力建设，以确保评估可信、合法并对相关决策者的需求有价值。当地专家团队的能力建设对于促进责任感、信任和长期成功尤为重要(Ruckelshaus et al., 2013)。

总体而言，开展自然资本评估展示了一个规划单位中的优先部门活动和自然资本的状况和趋势间的关键联系。这将有助于为支持长期可持续和具有包容性的经济增长的决策提供信息；同时也有助于创造绿色就业机会、减少贫困和解决生态稀缺和环境风险。

2. Introduction

2.1 SETTING THE SCENE – NATURAL AND OTHER TYPES OF CAPITAL

'Capital' is a key concept in economic theory. An increasing capital stock per capita is essential if levels of human welfare are to improve over time. There are five commonly defined types of capital (Figure 1): financial, manufactured, human, social and natural (FAO, n.d.; Forum for the Future, n.d.). Varying levels of importance and weight have been placed on these capitals, sometimes at the expense of others and often resulting in overexploitation.

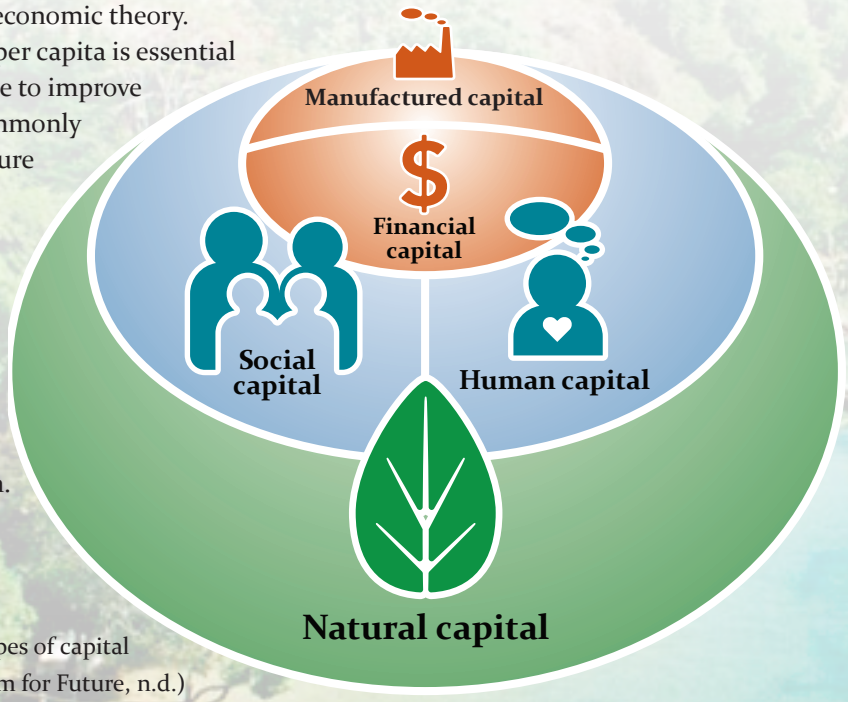


Figure 1: The five types of capital (adapted from Forum for Future, n.d.)

Manufactured capital includes the physical assets or goods contributing to the production process (e.g. factories, tools and machinery). Financial capital is that which allows the trading and ownership of other types of capital (e.g. bonds, shares and banknotes). Social capital comprises the institutions that sustain and grow human capital (e.g. education facilities, social networks and civil organisations). Human capital is the knowledge, well-being and abilities required for productive work. These four types of capital are underpinned by natural capital – the stocks of Earth's natural assets and resources, including soil, water, air and biodiversity (Forum for the Future, n.d.).

In its broadest sense, natural capital – sometimes referred to as 'ecological' or 'environmental capital' – refers to the stocks of Earth's natural assets and resources, such as soil, water, air and biodiversity. These stocks of natural capital provide humans with a flow of goods and benefits that positively impact our well-being. The assets and resources of natural capital can be further defined as stocks of natural resources, such as deposits of fossil fuels, minerals and aggregates, and stocks of 'ecosystem assets', which are cycled and renewed as part of wider ecosystem functions, for example, water. Ecosystem assets, as opposed to non-renewable natural resources, are the type of natural capital considered within this guide (Box 1).

Box 1: Ecosystem asset definition

Within this guide, ecosystem assets are defined as the stocks found within ecosystems (for example, soils, biodiversity, freshwater and biomass) that are cycled and renewed as part of wider ecosystem functions and which yield a flow of valuable ecosystem services*. These ecosystem services contribute to economic activity and human well-being either directly or in conjunction with other forms of capital; Figure 2 presents this conceptual framework.

Given the importance of maps in Natural Capital Assessments, in this instance, ecosystem assets are considered in a spatial manner (e.g. areas of habitat, fertile soils, freshwaters, etc.). It is critical that Natural Capital Assessments are spatial as the provision of ecosystem services is influenced by spatial patterns of ecosystem assets, and ecosystem services are brought into effect by the location of the beneficiaries. In addition, spatially explicit information is more useful for policy setting and planning because questions from decision-makers pertain not only to what activities or investments to undertake, but also where to place them.

Throughout, it is important to stress the distinction between natural capital stocks and the ecosystem services they provide. Ash et al., (2010) provide the example of a forest ecosystem, within which, the natural capital stock is forest biomass and the ecosystem services (flows) include, for example, annually harvested wood. In general terms, stock metrics are expressed in quantity terms (e.g. tonnes, ha, etc.) and ecosystem service flow metrics are expressed in quantities per unit time (e.g. kg/year, m^3/second, etc.).

It is also useful to consider the distinction between ecosystem services and 'ecosystem function'. Haines-Young and Potschin (2010) provide a useful commentary on this point, noting that ecosystem function describes the capacity or capability of an ecosystem to produce or provide an outcome ('service') of potential use to people, thus contributing to human well-being. The example given is of an ecological structure (e.g. a woodland) having the capacity or capability (i.e. the function) to provide an action (e.g. the slowing down of surface water), which could be helpful to nearby people (i.e. the beneficiaries). This action – the modification of surface waters and prevention or reduction of flooding impacts – is, therefore, an ecosystem service.

*This is also equivalent to the definition of ecosystem assets provided in the SEEA-EEA (2014) and the definition of 'Ecosystem Capital' proposed by the EU 'Mapping and Assessment of Ecosystem and their Services' initiative (Maes et al., 2013).

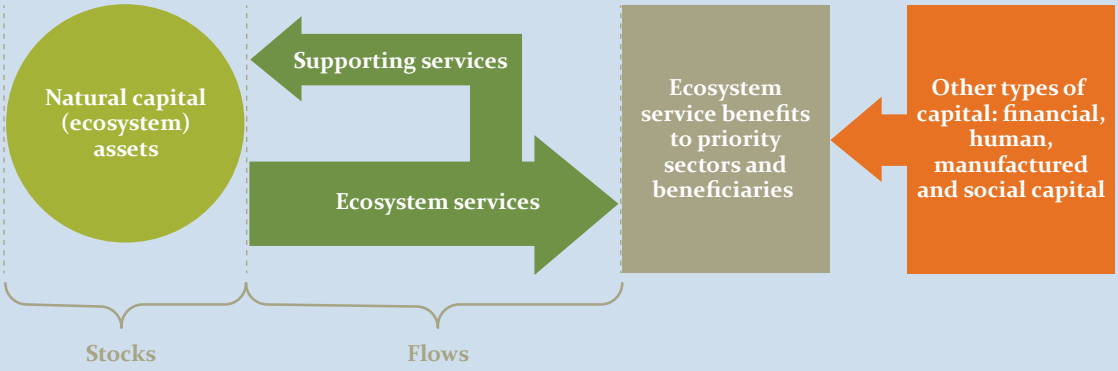


Figure 2: Conceptual model of the linkages between natural capital assets, services and key sectors (adapted from Dickson et al., 2014)

Historically, the importance of natural capital has been overshadowed by a focus on financial and manufactured capital, often making it seem 'economically invisible'. Due to this economic invisibility, natural capital has tended to be either neglected or exploited by business, industry and markets in general. However, greater attention and focus on sustainability and conservation in the last few decades has brought the importance of natural capital to the fore.

In addition, there is now a better understanding and appreciation of the fact that natural capital underpins the ability of other forms of capital to produce benefits for people, and so, its importance should not be undervalued or underestimated. Defining natural capital as a concept, and recognising the important role it plays in our general welfare, are the first steps in accounting for it within decision-making processes. Indeed, the natural capital concept is an important element of a holistic evidence base for decision-makers. It helps them to compare the different paths they can take and understand the advantages of, and opportunities for, mainstreaming the environment across the economy. The Natural Capital Coalition states that "integrating natural capital in business decision making leads to better business decisions with the benefits of greater resilience, improved security of supply and ultimately a sustainable business model" (Maxwell et al., 2014). Thus, the benefits of integrating natural capital in decision-making are incurred by governments, communities and business.

Natural capital also has a major role to play in achieving international development targets. For example, goals 14 and 15 of the Sustainable Development Goals (SDGs) focus directly on the sustainable use and preservation of natural resources[2]. In addition, there are clear links between natural capital and many of the other SDGs; including, for example, reference to: improving resilience to extreme events and disasters; ending hunger and promoting sustainable agriculture; sustainable water management and sanitation; sustainable and clean energy; growing and diversifying the economy; developing resilient infrastructure; developing sustainable cities; ensuring sustainable consumption and production (particularly, with regards to the efficient use of natural resources); and tackling climate change.

[2] 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, halt and reverse land degradation, and halt biodiversity loss.

2.2 THE GREEN ECONOMY

2.2.1 What is a green economy?

Between the late 20th and early 21st centuries, overreliance on investment in the so-called 'brown economy', or capital (mis-)allocation (i.e. fossil fuels, property, financial assets), led to a state of financial imbalance and was a significant factor in the global financial crises of 2008. As a result of the 2008 financial and economic crises, there was increased favour for, and traction towards, an alternative economic paradigm that could address the many interrelated issues which previously combined to such catastrophic effect (Fedrigo-Fazio and ten Brink, 2012). This alternative economic paradigm centres on a 'greening' of the economy, in which greater focus is placed on investment in renewable energy, energy efficiency, public transportation, sustainable agriculture, ecosystem and biodiversity protection, and land and water conservation, and whereby "material wealth is not delivered perforce at the expense of growing environmental risks, ecological scarcities and social disparities" (UNEP, 2011). Indeed, green economies are likely to be more resilient, particularly in the face of environmental pressures, such as climate change.

To define this greener paradigm, UNEP proposes that a green economy should result in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2010). Furthermore, the 2011 UNEP Green Economy Report states that "to be green, an economy must not only be efficient, but also fair", whereby "fairness implies recognising global and country level equity dimensions, particularly in assuring a just transition to an economy that is low-carbon, resource efficient, and socially inclusive" (UNEP, 2011).

The consideration of environmental externalities should also be included within this greening of the economy. Environmental externalities are often unaccounted- and uncompensated-for by-products or side effects of production and consumption. However, such externalities do have significant costs associated to them, and valuing them as part of a green economy approach allows a better understanding and management of factors like water use, greenhouse gas emissions and pollution (Putt del Pino & Perera, 2013). Box 2 sets out how Africa is positioned in relation to, and approaching, the green economy.

Box 2: Africa and the green economy

In Sub-Saharan Africa, natural resources are inextricably linked to the livelihoods, jobs and well-being of the majority of the population (GIZ, 2013). Such reliance upon natural resources makes it imperative that the management of natural assets is done in a sustainable way.

In 2012, seven of the ten fastest growing economies globally, were in Africa (GIZ, 2013). Yet, in Africa, economic growth of this nature typically is underpinned by dependence on, and exploitation of, natural resources. In order for this growth to be sustainable in the long run, these economies need to be adapted and built around growth models that focus on 'green growth' or the green economy concept. The African Development Bank (AfDB) states that "pursuing inclusive economic growth through policies, programmes and projects that invest in sustainable infrastructure, better manage natural resources, build resilience to natural disasters, and enhance food security" is essential for green growth (GIZ, 2013).

An effective and integrated transition to a green economy in Africa will provide economic opportunities and underpin growth potential that is dependent on natural resources. In turn, it will increase resilience and adaptability, helping to combat the challenges presented to African economies by climate change and environmental degradation.

The many benefits of transitioning to a green economy approach are widely acknowledged and appreciated throughout Africa, and much support exists to bring about the required changes in approaches, processes and practices. Indeed, in his keynote address on *Green Economy and Structural Transformation in Africa* at the 2011 African Economic Conference, the then Prime Minister of Ethiopia, Meles Zenawi, stated that, despite the various social and environmental challenges faced throughout Africa, African countries are well placed to shift to a green economy and to realise the economic benefits of doing so (GIZ, 2013).

An example of how this transition to a green economy is being rolled out is provided by Kenya. In its draft *Green Economy Strategy and Implementation Plan* specific reference is made to the outcomes of the 2012 United Nations Conference on Sustainable Development (UNCSD) ('Rio+20'), which stated that transitioning to green economy approaches will provide a means towards achieving sustainable development. In common with other African countries, this is a priority area for Kenya and they look towards a green economy transition as a means of contributing to "eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems" (GESIP, 2015).

Furthermore, it was recognised in UNEP's 2014 *Kenya Green Economy Assessment Report* that transitioning to a green economy approach will make medium- and long-term positive contributions to all sectors of the economy, and that a green growth path will result in "faster growth, a cleaner environment, and high productivity, relative to the 'business as usual' growth scenario" (GESIP, 2015).

These examples demonstrate the intent and willingness of African countries to adapt to green growth models and to transition to green economies, in recognition of the multitude of positive outcomes that can be achieved in doing so.

2.2.2 Importance of resilience for a green economy

It is generally agreed that biodiversity is a critical component of natural capital and is key to maintaining 'ecosystem functioning' (Balvanera et al., 2006; Cardinale et al., 2012; Tilman et al., 2006). The concept of ecosystem functioning, where the structural components of an ecosystem (such as plants, species, water, soil, atmosphere) interact with one another, both within and across ecosystems (SEQ Ecosystem Services Framework, n.d.), is represented in Figure 2 by the returning 'supporting services' flows arrow. Maintaining a sufficient quantity of particular natural capital stocks supports ecosystem functioning and, therefore, the direct delivery of ecosystem services to the economy and human activity. In addition, it is important in maintaining the ability of such stocks to respond to shocks and continue delivering ecosystem services under changing conditions (TEEB, 2010b). In this regard, biodiversity plays an important role in maintaining the flow of ecosystem services during times of disturbance or stress that ecosystems may experience. This is achieved via 'functional redundancy', where an ecosystem contains a number of different species, each with similar functions, but which are affected by disturbance in different ways (Elmqvist et al., 2003). The capacity of an ecosystem to absorb shocks and disturbance while retaining the same level of fundamental functions is commonly referred to as 'ecosystem resilience' (Mori et al., 2013).

This resilience of ecosystems to continue to deliver services is subject to ecological tipping points. If these tipping points are surpassed, ecosystem assets (such as forests) can change relatively suddenly to a degraded state (UNEP, 2014a). This can result in, for example, changed biodiversity assemblages and reduced ecosystem service delivery. Future economic growth may, therefore, be compromised if these thresholds of degradation are breached. This can, in turn, undermine vital or economically important ecosystem services (UNEP, 2011). Such an example of a threshold being breached would be the collapse of a fish stock; this was nearly the case in West Africa in 2002 where fish stocks crashed by 80 per cent (New Scientist, 2002). Staying within such ecological limits is a fundamental premise of a green economy. This is also recognised by the international commitment to Aichi Biodiversity Target 15, which aims to enhance ecosystem resilience and carbon stocks in order to help mitigate climate change.

Accounting for the above, biodiversity is identified as a key characteristic of natural capital, not only for the delivery of ecosystem services, but also for its roles in ecosystem resilience (TEEB, 2010b) and in supporting Ecosystem Based Adaption (EBA) to climate change (Doswald & Osti, 2011). Due to the role of biodiversity in ecosystem resilience, and the existence of tipping points for this aspect of natural capital, a precautionary approach to conserving biodiversity is recommended (TEEB, 2010b). Thus, promoting ecosystem resilience is a key feature of green economy plans and aligns with the Convention on Biological Diversity's (CBD) Ecosystem Approach.

2.2.3 Equity and social inclusion in a green economy

Green economies should not only be geared towards reducing environmental risks and scarcities, but also ameliorating poverty and social inequity (UNEP, 2011). In particular, the rural poor are considered to be "fundamentally dependent on ecosystem services" delivered by the types of natural capital considered in this guide (ten Brink et al., 2012). Accordingly, the improvement and sustainable use of natural capital can improve human well-being, alleviate poverty and support livelihoods that increase equity across current and future generations (ten Brink et al., 2012). Certain women's groups also have an important role to play in the management of natural capital in a green economy; for instance, it is commonplace in Africa for women to be the predominant gender collecting, processing and marketing natural goods and products, thus assuming informal land management roles. However, within some communities, women may have limited access to the benefits of ecosystem assets (IFAD, n.d.). Green economies that promote social inclusiveness can legitimise and strengthen the roles of women as managers of natural resources and contributors to sustainable development.

2.2.4 Achieving a green economy

Various suggestions and recommendations have been put forward as to how to achieve a green economy. Critically, it should be noted that a green economy approach retains focus on growth. This is contrary to common misconceptions, which wrongly consider that a green economy approach will inhibit opportunities for wealth creation, economic progress and employment (UNEP, 2011). In fact, it is likely that growth will be equal to, or greater than, the business as usual approach when shifting towards a green economy (UNEP, 2011). It is proposed by UNEP (2011) that the contribution of 1.3 trillion USD per year (a 'green investment' scenario of around 2 per cent of current global GDP) until 2050 across ten central sectors of the economy[3] will enable a shift towards clean, low-carbon technologies; social equity; resource and energy efficiency; the provision of green jobs in areas like recycling; poverty reduction (and ultimately eradication); and the prevention of biodiversity and ecosystem service loss. It also calls for the elimination of fossil fuel subsidies, an introduction of green taxes and improved energy efficiency.

The reallocation of private sector investments, encouraged and supported by targeted public expenditure, policy reforms and regulation changes, will provide the funding needed to achieve this 2 per cent green investment target. Additionally, mechanisms like REDD+ (Reducing Emissions from Deforestation and Forest Degradation) will also provide valuable contributions (UNEP, 2011).

2.2.5 Linkages between natural capital and priority sectors

As outlined above, the UNEP *Towards a Green Economy* report (2011) prioritises ten sectors whose reform has the potential to drive whole economies towards a green economy trajectory. Of these, agriculture, fishing, forests and water are the priority sectors whose goods and services are derived significantly from natural capital. Therefore, the improved management and enhancement of the supporting ecosystems provides an opportunity to sustain and increase output from these sectors in the long-term (ten Brink et al., 2012). Additional or alternative sectors and natural capital resources beyond those suggested in UNEP's *Towards a Green Economy* report (2011) may also be a priority, but this is dependent upon the context of the Natural Capital Assessment. Irrespective of the prioritisation of sectors, almost all economic activities are dependent on natural capital in some form or another. As such, for business operations to continue functioning successfully in the long-term, the ecosystems, processes, functions and resources upon which they rely must be maintained or restored.

[3] agriculture, buildings, energy supply, fisheries, forestry, industry, tourism, transport, waste and water

Box 3: The green economy and marine ecosystems

Throughout this guide, reference is made to 'land-use' and 'land cover', and other related terms that imply a focus on the terrestrial realm. Yet, while direct and explicit reference to the marine realm (including the high seas, coastal zones, intertidal zones and estuaries) is limited, this is in no way any reflection that it is not, and should not, be considered within the scope of a Natural Capital Assessment.

The importance of the marine realm cannot be understated due to the range and scale of the critical ecosystem services it delivers; for example, food security, climate regulation, nutrient cycling and storm protection. Such services underpin human well-being and livelihoods in various sectors.

Indeed, the scale and importance of the marine realm in achieving a green economy transition is well captured in UNEP's *Green Economy in a Blue World* (2012b): "a worldwide transition to a low-carbon, resource-efficient Green Economy will not be possible unless the seas and oceans are a key part of these urgently needed transformations."

Central to the objectives of a green economy is the inclusion of environmental externalities into decision-making and business models. This can be achieved by investing in natural capital (UNEP, 2011), factoring in the true value of nature into buying decisions, and including natural capital in annual reports and GDP[4]. The better understanding of natural capital dependencies will serve to highlight the risks and opportunities that exist (for example, through supply chains), and the true values natural capital stocks provide. In turn, this stimulates better decision-making and greater levels of sustainability (Maxwell et al., 2014).

Beyond the economic values associated with natural capital, value is also derived from closely held moral, religious or cultural beliefs (Oksanen, 1997). These wider values of nature were recognised in the Rio+20 outcome document *The Future We Want* (United Nations, 2012). Indeed, they can act as an important driver of policy actions to conserve nature, thereby enhancing natural capital within the planning unit under consideration. Furthermore, it should be noted that, while Natural Capital Assessments focus on the value of nature to people, we may also want to protect nature for reasons beyond human perception; for instance, the intrinsic value of species and their right to exist. This falls outside the Natural Capital Assessment (it does not aid economic transition, per se), but can provide a parallel justification for action to protect nature.

2.2.6 The need to assess natural capital

It has been consistently noted that it is difficult, if not impossible, to manage what is not measured. In this regard, the biophysical quantification of natural capital is acknowledged as an essential step in informing its sustainable management (Dickson et al., 2014). As such, this step-by-step guide is designed to inform the user on how to mobilise and assess biophysical information on natural capital, create maps of the distribution of ecosystem assets and ecosystem service flows, and use this information to support a transition to a green economy. While targeted at the implementation of Natural Capital Assessments at the sub-national scale, many of the concepts presented here are applicable at all levels.

[4] http://bankofnaturalcapital.com/

2.3 WHAT IS A NATURAL CAPITAL ASSESSMENT?

Natural Capital Assessments, and the related process of natural capital accounting[5], are tools with which a country's natural assets and resources can be measured and managed (WAVES, 2015a). Natural Capital Assessments are landscape-focused (Box 3) and spatially explicit appraisals that provide information on the natural environment of a planning unit. Specifically, they consider what assets and services nature provides, and how they can be best used without damaging or depleting them. This information reveals the benefits and values of ecosystem assets, and can be used to make better decisions regarding land-use that supports a transition to a green economy approach (Benami and Wilkinson, 2013).

It is possible to conduct assessments where the focus is purely on the measurement of extent and/or condition of assets without reference to benefits and values to people; however, this does not satisfy the scope of the Natural Capital Assessment process set out in this guide, as the human interaction aspect is a central feature and concern.

Natural Capital Assessments can be conducted via a number of different approaches depending on the needs of those conducting the assessment and the end users. Different types of assessments, or studies encompassing elements of Natural Capital Assessment (for example, the use of locally relevant data to assess sites), can be employed, including Ecosystem Assessment, Natural Capital Analysis, Systematic Conservation Planning and Suitability Mapping (Benami and Wilkinson, 2013).

In common with other studies, Natural Capital Assessments need to be credible, legitimate and relevant to the needs of decision-makers in order to be successful (Ash et al., 2010; Cash et al., 2002).

In practice, Natural Capital Assessments can be undertaken at national and sub-national levels. They look at landscapes and seascapes to identify and weigh up the benefits arising from different management and decision options, such as land-use planning, targeted Payment for Ecosystem Services (PES) schemes, Water Funds, REDD+, city planning and supply chain decisions. To do this, the natural capital and its benefits across a region are mapped in the first phase of an analysis of ecosystem and natural capital properties, i.e. the existing stocks of natural capital and flows of ecosystem services are analysed. Secondly, these data are linked with the existing and potential societal and economic benefits, and the services valued and demanded by the society, and are transformed into locally relevant development scenarios for the future. These results are then incorporated into legal and spatial planning, suitably directing public authorities' decision-making on land-use and investment at the sub-national scale (Bastian et al., 2013; Benami and Wilkinson, 2013).

Natural Capital Assessments provide a broader picture of a country's economic assets, including ecosystem assets (for example, soils and their associated processes and functions) which are often overlooked, or not even accounted for, during planning processes. Thus, Natural Capital Assessments set out an evidence base that both demonstrates the impact of the economy on the environment (in particular, on ecosystem assets), as well as how natural resources contribute to the economy (specifically, those services that are often unaccounted for). Hence, when combining Natural Capital Assessments with an economic accounting system, it is possible to get a more holistic view of development progress than with standard measures, such as GDP, alone (WAVES, 2015b).

[5] Natural capital accounting sets out to value and incorporate the contribution of natural resources and their inherent processes and functions (e.g. timber, carbon sequestration and air filtration by woodland) into national accounts (The World Bank, 2015). This is differentiated from Natural Capital Assessments, which aim to gain an understanding of what assets and services nature provides, how these affect (positively and negatively) human well-being, and how they are being impacted upon.

An assessment of natural capital provides detailed information that can guide how to better manage the economy. The evidence gained from a Natural Capital Assessment, including statistics and indicators, enables the evaluation of different policy options, thus assisting in a transition to a green economy. The policy options arising from an assessment will vary, from investing in ecosystems to ensure the continued flow of ecosystem services, to optimising decisions on land-use depending on the location of the natural capital stocks in question (WAVES, 2015a). There will also be options regarding delivery and financing, whether through changes in regulation, incentives, or pricing. Building this type of management strategy for the economy can help with balancing the trade-offs between sectors, such as ecotourism and agriculture, as well as helping realise the value of ecosystem services, such as flood protection (WAVES, 2015b). Thinking about the beneficiaries and the drivers of natural capital loss can also aid discussions on who should bear the costs of any changes that are needed.

Data for Natural Capital Assessments must meet certain key criteria in relation to the scale and goals of the assessment. For instance, natural capital data need to be available at a spatial resolution that is suitable for the scale of the assessment. The finer the scale, the more detailed the assessment will be and, ultimately, the more thorough the map of natural capital stocks and ecosystem service flows. The data may also need to be temporally relevant, enabling the measurement of change over time (UNEP-WCMC, 2015).

The priority sectors to focus on for a Natural Capital Assessment depend on the structure of the economy, the physical characteristics of the natural capital and its location (UNEP, 2012a), and the objectives of the assessment. In some sectors, such as agriculture, fisheries, forestry and water management, natural capital plays a primary role; therefore, it is entirely possible that an assessment may highlight opportunities for improved land-use planning that will benefit both the sectors and the natural capital reciprocally. For example, land with more fertile soil could be reserved for agriculture, while less fertile land could be assigned to urban development or used for alternative crops that restore soil quality.

Where natural capital has an indirect role in other sectors, such as tourism and manufacturing, Natural Capital Assessments can identify and expand knowledge on limits for sustainable use within which they should aim to operate. For instance, nature-based tourism is often dependent on the inherent character and natural beauty of a site or landscape. As such, if management or land-use practices take place beyond a set of identified 'safe' limits and thresholds, thus threatening the quality and/or quantity of the natural capital, the business potential for this type of tourism will be negatively impacted upon. Manufacturing, on the other hand, often relies on available water resources and other raw materials; if these are sourced unsustainably and exceed identified safe limits, it could prove catastrophic for the longevity of the company or industry involved.

Previous Natural Capital Assessments and guides have focused on national and global scales. Yet, the effective implementation of green economy strategies requires action to be taken at a sub-national level and supported by decisions and policy at a national level. Sub-national Natural Capital Assessments can be up-scaled to inform decision-making at all levels, and can complement national-scale assessments. Some of the best known initiatives with a focus on natural capital include: the Millennium Ecosystem Assessment (MA, 2005), the United Kingdom's National Ecosystem Assessment (UK NEA), The Economics of Ecosystems and Biodiversity (TEEB), and the Natural Capital Protocol (currently being developed by the Natural Capital Coalition (2015)).

2.3.1 Natural capital indicators

Indicators for the identification and communication of natural capital issues, policy formulation, policy assessment, and policy monitoring and evaluation are essential for tracking progress through the green economy policy cycle (Figure 3). Robust natural capital indicators can assist planners in developing effective green economy policies that address, among other issues, negative trends in ecosystem assets. An important role of any Natural Capital Assessment is to identify these trends and their causes, as well as their impacts on society, the economy and the environment. This guide sets out a general process for selecting or developing indicators to communicate these trends and their causes using the data gathered. In turn, these indicators can provide the basis for designing appropriate policy interventions (i.e. natural capital investments and policy instruments) to address issues related to natural capital.

It should be noted that natural capital issues and their indicators will vary between planning units (UNEP, 2015). Furthermore, any final policy package requires the consideration of both intended and unintended consequences of interrelated policies when prioritising different goals (environmental, social and economic) (UNEP, 2014d). As such, policies for natural capital should also consider supporting other economic and social objectives of transitioning to a green economy, such as moving away from industrial operations that are harmful to human health and environmentally degrading.

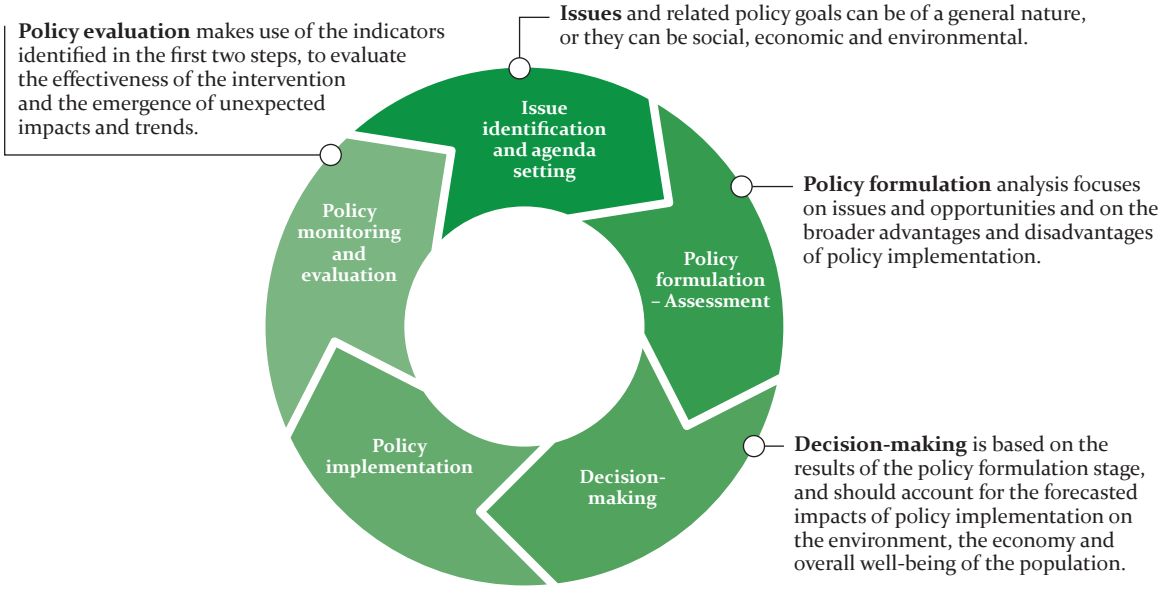
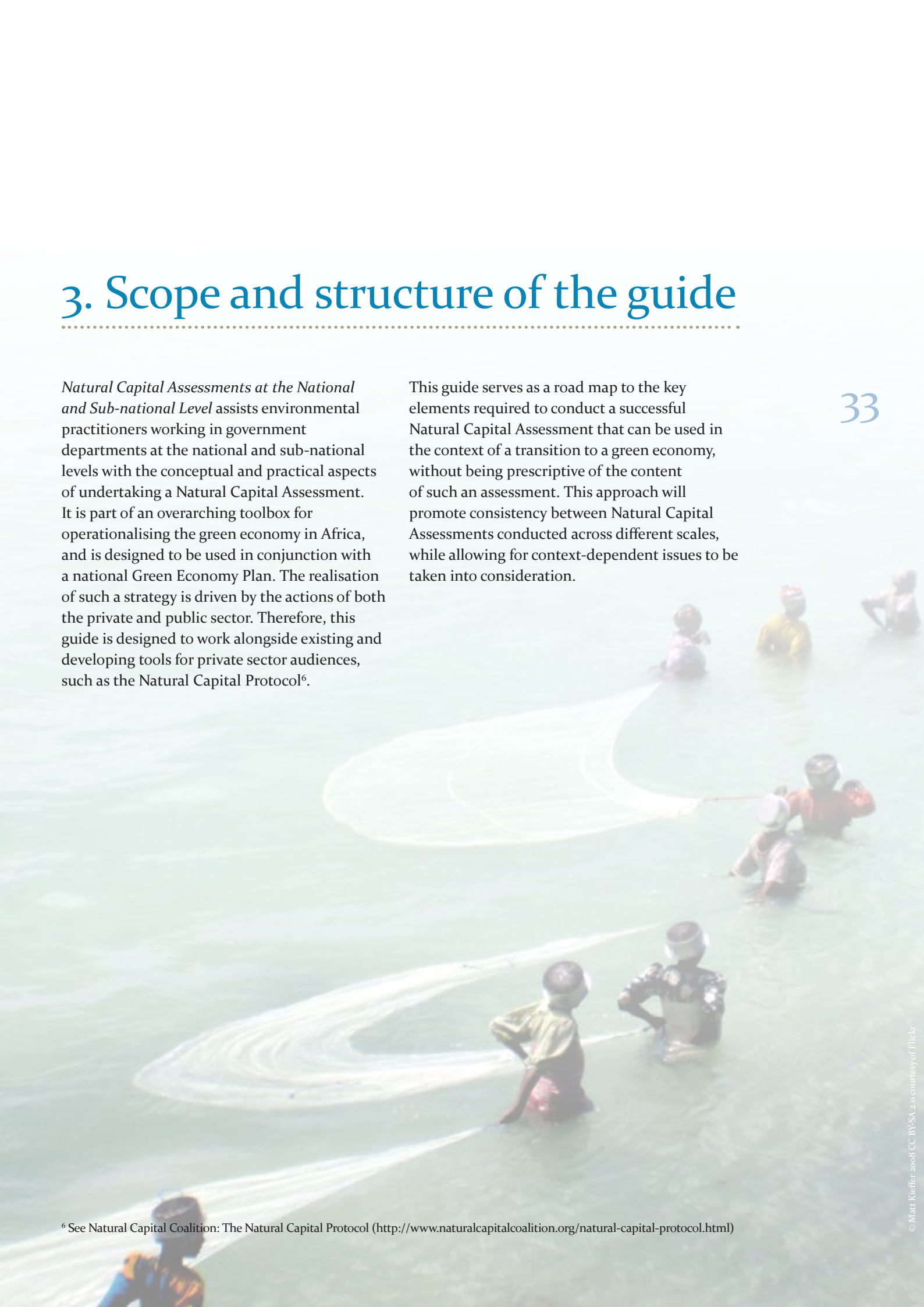


Figure 3: Integrated policy cycle for the transition to a green economy (UNEP, 2015b)

3. Scope and structure of the guide

Natural Capital Assessments at the National and Sub-national Level assists environmental practitioners working in government departments at the national and sub-national levels with the conceptual and practical aspects of undertaking a Natural Capital Assessment. It is part of an overarching toolbox for operationalising the green economy in Africa, and is designed to be used in conjunction with a national Green Economy Plan. The realisation of such a strategy is driven by the actions of both the private and public sector. Therefore, this guide is designed to work alongside existing and developing tools for private sector audiences, such as the Natural Capital Protocol[6].

This guide serves as a road map to the key elements required to conduct a successful Natural Capital Assessment that can be used in the context of a transition to a green economy, without being prescriptive of the content of such an assessment. This approach will promote consistency between Natural Capital Assessments conducted across different scales, while allowing for context-dependent issues to be taken into consideration.



[6] See Natural Capital Coalition: The Natural Capital Protocol (http://www.naturalcapitalcoalition.org/natural-capital-protocol.html)

This guide is primarily aimed at environmental practitioners working specifically within sub-national planning units in African countries. However, many of the processes have been designed to be undertaken at the national level within any country. By using similar methods, sub-national Natural Capital assessments can easily feed into national assessments. Therefore, this guide is also useful in a national context, providing that the necessary adjustments for a larger scale assessment are undertaken (Step 2).

Natural Capital Assessments at the National and Sub-national Level aims to provide the following:

1. An overview of the concepts of natural capital and the green economy.
2. A framework for conducting a Natural Capital Assessment in the context of a Green Economy Plan.
3. A step-by-step guide to undertaking a Natural Capital Assessment, including: determining the scale of the assessment; identifying the key goals; assessing data requirements; prioritising sector dependencies on natural capital; identifying the drivers of ecosystem change; establishing the status and trends of natural capital; and interpreting the analysis.
4. Real world examples demonstrating the application of techniques advocated at each step.
5. Guidance on stakeholder engagement, obtaining validation of the assessment and successfully communicating its findings.

3.1 HOW TO USE THIS GUIDE

Natural Capital Assessments at the National and Sub-national Level follows the approach set out in UN System of Environmental-Economic Accounting – Experimental Ecosystem Framework (SEEA-EEA, 2014), by considering the physical measures of ecosystems in terms of extent and condition (i.e. the stock) and the expected ecosystem service flows from these stocks. This characterisation is also broadly in accordance with other established national frameworks for measuring changes in natural capital, including the Natural Capital Index in the Netherlands (PBL Netherlands Environmental Assessment Agency, 2012), Natural Capital Asset (NCA) Index in Scotland (SNH, 2012), and the Norwegian Nature Index (Certain et al., 2011).

A tiered approach is taken to move through the eight Natural Capital Assessment steps outlined in this guide (Figure 4).

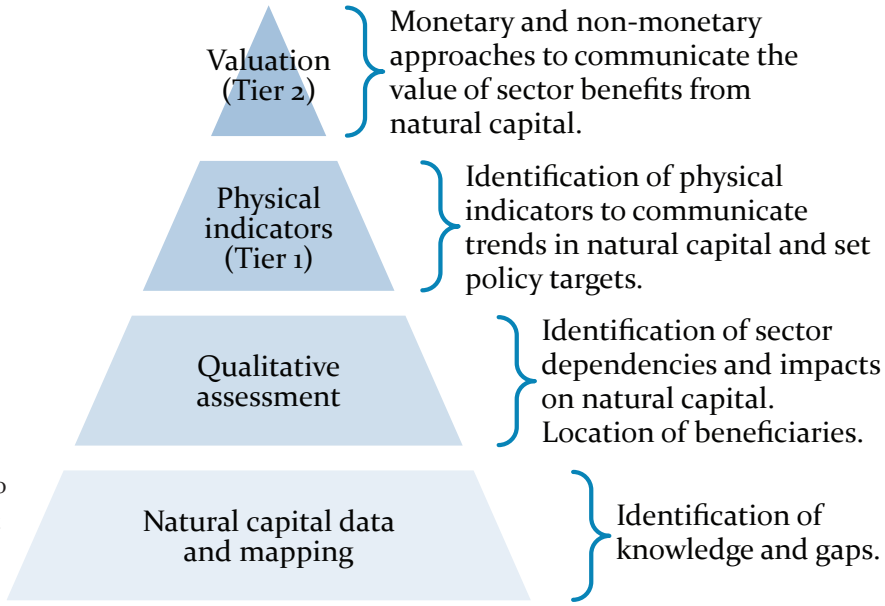


Figure 4: Tiered approach to Natural Capital Assessment (adapted from ten Brink, 2008)

The base of the pyramid comprises the knowledge, and gaps thereof, collected and identified in Steps 1 to 3. In Steps 4 and 5, these data are assessed to determine the nature of priority sector dependencies and impacts on ecosystem assets. Indicators to broadly communicate the status, trends and impacts of such dependencies and assets are determined in Step 6. Step 7 demonstrates how scenarios can be used in forward-looking assessments of natural capital to support decision-making at national and sub-national levels. Finally, Step 8 focuses on using the Natural Capital Assessment, in particular, to aid the scoping of policy targets for natural capital in a green economy. Information is aggregated at the tip of the pyramid, where these data can be reduced to a single aggregate dollar value. The Natural Capital Assessment can assist in this valuation process, but this document does not provide specific guidance on such natural capital accounting work. However, an explanation of where to find the necessary information to undertake valuation and natural capital accounting is highlighted in Step 6.

Natural Capital Assessment is designed to provide an evidence base for evaluating:

- the status and trends of natural capital in the selected planning unit;
- the contribution of ecosystem services to priority sectors, livelihoods and well-being in the planning unit;
- which sector activities, both within and outside of the planning unit, are driving change in natural capital; and
- what policy targets can be set to ensure that natural capital continues to contribute to the sustainability of economic activities of priority sectors, livelihoods and well-being in the planning unit.

Understanding the findings of Natural Capital Assessments not only ensures that existing natural capital resources are used more efficiently, but also identifies opportunities for investment in natural capital to support further economic development and enhance well-being. Natural Capital Assessments, as with other assessment types, should be iterative processes, allowing movement back and forth between the steps presented in this guide in close consultation with researchers, analysts, stakeholders and decision-makers.

Each step is designed around a set of key questions, and presents a practical checklist of actions to undertake during the assessment process. These actions draw on stakeholder engagement, communication and capacity building strategies. The steps may be conducted consecutively, but can also be conducted in parallel, according to the assessment context, resources available and national work plans.

3.2 KEY RESOURCES

This guide draws on a range of resources prepared following the publication of the Millennium Ecosystem Assessment in 2005 (MA, 2005). Where appropriate, individual steps conclude with a list of key resources that can assist in completing the step.

In addition, there are a range of resources designed to support practitioners with the more generic, practical elements of undertaking an assessment (Box 4).

Box 4: Key resources for undertaking the practical elements of a Natural Capital Assessment

The Millennium Ecosystem Assessment (MA) brought the best available information and knowledge on ecosystem services to the attention of policymakers and decision-makers by assessing the consequences of ecosystem change for human well-being (MA, 2005). The findings of the MA were published in *A Manual for Assessment Practitioners* (Ash et al., 2010) in order to make its methods, and the methods of associated sub-global assessments, widely accessible to practitioners. Key chapters within this manual that refer to the practical elements of conducting an assessment are:

- Governance structure (Chapter 2.3.2)
- Communicating uncertainty (Chapter 4.6.2)
- Stakeholder engagement (Chapter 2)
- Capacity building (Chapter 2.4.4)
- Communicating the assessment findings (Chapter 2)
- Peer review (Chapter 2.4.4)

Additional resources that may be useful include:

- *Guide on Production and Integration of Assessments From and Across All Scales* (IPBES, 2016)
- *TEEB – The Economics of Ecosystems and Biodiversity (2013): Guidance Manual for TEEB Country Studies. Version 1.0.*
- The Sub-Global Assessment (SGA) Network website (www.ecosystemassessments.net)
- The IPBES Catalogue of Assessments on Biodiversity and Ecosystem Services (http://catalog.ipbes.net/)

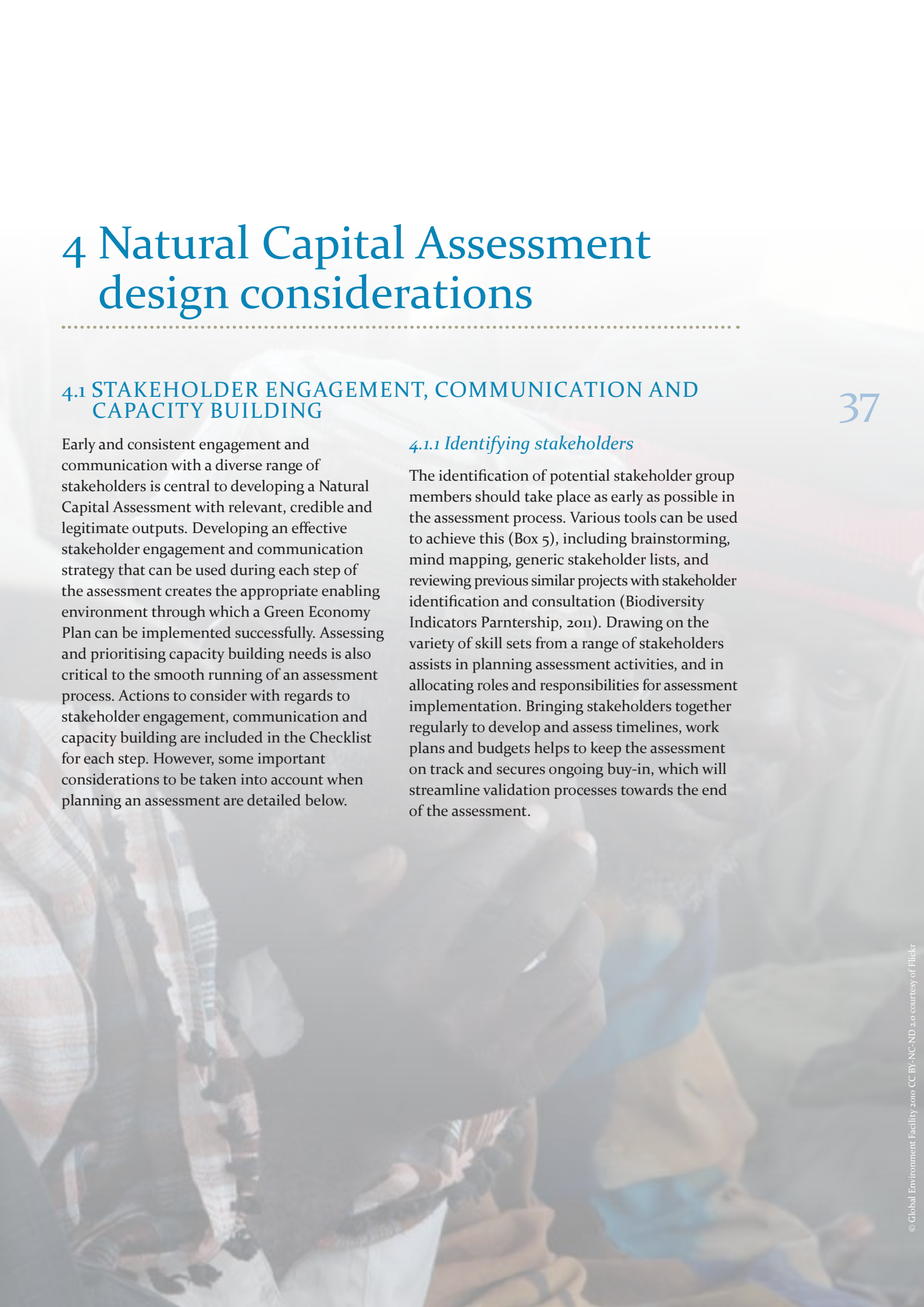
4 Natural Capital Assessment design considerations

4.1 STAKEHOLDER ENGAGEMENT, COMMUNICATION AND CAPACITY BUILDING

Early and consistent engagement and communication with a diverse range of stakeholders is central to developing a Natural Capital Assessment with relevant, credible and legitimate outputs. Developing an effective stakeholder engagement and communication strategy that can be used during each step of the assessment creates the appropriate enabling environment through which a Green Economy Plan can be implemented successfully. Assessing and prioritising capacity building needs is also critical to the smooth running of an assessment process. Actions to consider with regards to stakeholder engagement, communication and capacity building are included in the Checklist for each step. However, some important considerations to be taken into account when planning an assessment are detailed below.

4.1.1 Identifying stakeholders

The identification of potential stakeholder group members should take place as early as possible in the assessment process. Various tools can be used to achieve this (Box 5), including brainstorming, mind mapping, generic stakeholder lists, and reviewing previous similar projects with stakeholder identification and consultation (Biodiversity Indicators Parntership, 2011). Drawing on the variety of skill sets from a range of stakeholders assists in planning assessment activities, and in allocating roles and responsibilities for assessment implementation. Bringing stakeholders together regularly to develop and assess timelines, work plans and budgets helps to keep the assessment on track and secures ongoing buy-in, which will streamline validation processes towards the end of the assessment.



Box 5: Forms of stakeholder engagement in an assessment process

Strong stakeholder engagement is key to a successful Natural Capital Assessment. The following methods of stakeholder engagement can be selected and combined as required, depending on the context of the assessment.

Stakeholders can be:

- Consulted on the needs for an assessment.
- Consulted on key questions framing the assessment.
- Given information on assessment progress, findings and opportunities to participate.
- Asked to contribute knowledge to the assessment report.
- Asked to contribute contextual information about ecological or social systems.
- Consulted on the condition and trends of ecosystem services and human well-being in a planning unit.
- Asked to attend a public hearing about assessment processes and findings.
- Asked to attend education or capacity building workshops on assessment processes and findings.
- Asked to participate in the assessment process as students, interns or fellows of the assessment.
- Asked to participate in the assessment governance.
- A formal end user of the assessment products.
- Asked to participate in the peer review of the assessment.
- A partner in the dissemination of assessment findings.

Source: Ash et al. (2010)

4.1.2 Conflicts of interest

Clear planning for engaging stakeholders is key to ensuring the involvement of a balanced and wide-ranging group. Highly participatory processes, such as conducting Natural Capital Assessments, always carry a risk of conflicts of interest among stakeholders. Issues around power dynamics and social inequity with regards to control over land and resources should be recognised and addressed as far as possible. For example, a forest landscape study in the Congo Basin found that local people received few benefits from the prevailing forest management strategies due to corruption in both the public and private sector (Endamana et al., 2010).

Therefore, developing a conflict of interest policy is essential to account for any perceived risks to the independence of the assessment process. The assessment team, and various governance groups, should be prepared to deal with these issues proactively in order to minimise any interruptions to the process. Ash et al. (2010) suggest ways of dealing with these issues, including:

- establishing by consensus clear, but flexible, rules of participation;
- having an agenda and clear objectives for each meeting that is convened;
- promoting communication among members between meetings; and
- if the governing body is large, creating a committee to deal with operative issues between meetings.

Incorporating these considerations into the assessment process contributes to the buy-in and ownership of the outputs of the assessment. It is important, however, to ensure validation of the assessment process, as well as the end products. Therefore, maintaining contact with all stakeholder groups at key points during the process is essential to the overall success of the assessment in terms of integrating it with a Green Economy Plan.

4.1.3 Developing a communication strategy

The development of a communication strategy for the assessment should be conducted at the outset of the process and applied consistently throughout the assessment steps. This ensures that a wide range of stakeholders are engaged with the assessment and that they see its processes and outputs as relevant, credible and legitimate.

Stimulating and retaining the interest of a diverse range of stakeholder groups is essential; a well-constructed communication strategy allows a free flow of information between these groups and the assessment team, ultimately, determining the impact of the assessment. Indeed, choosing the best ways to present the information from the assessment to the intended audiences requires great care (Box 6).

Box 6: Target groups and report style

Decision-makers

- Content and information should be short, specific, fact-based and up-to-date.

Media

- Content should be simple, short and relevant to a broad audience, with messages that can be easily linked to other issues in the news.

Students

- Content should be well explained and the language should be clear and concise.

Scientists

- Content should be fact-based and rely on the latest data. The language can be scientific and include technical terms.

Indigenous and Local Knowledge (ILK) Holders

- Content should be simple, straightforward and address local concerns. It should be disseminated via the most suitable media or communication method.

Source: UNEP (2007)

Devising a strategy for ongoing communication within the assessment team (internal communication) should be developed early in the process. Effectively communicating with each member of the team assists with the identification of issues, such as mobilising data, delivering progress reports and keeping the assessment on track.

4.1.4 Key messages and key findings

Thinking about the goal(s) of an external communication strategy and focusing resources on the specific target audience determines the appropriate means for dissemination of assessment outputs. There are many ways of presenting information according to the needs, and time available, of the target audience. As set out in the IPBES *Guide on The Production and Integration of Assessments From and Across All Scales* (IPBES, 2016), for interested parties with little time to fully engage, it is important to synthesise and summarise technical information into 'key messages'. Key messages are regularly confused with 'key findings' in assessments, and therefore, do not necessarily convey the content and conclusions in ways that resonate most effectively with target audiences. Key findings set out the facts and information directly sourced from technical chapters for example; whereas key messages are a "strategic culling of the points most relevant to each audience, presented in a way that promotes the credibility of the findings" (Ash et al., 2010; Table 1).

Table 1: Examples of the key findings and key messages of the UK NEA (2011)

Key Findings	Key Messages
The economic, human health and social benefits that we derive from ecosystem services are critically important to human well-being and the UK economy, and each should be considered when evaluating the implications of changes in ecosystems and their services.	The natural world, its biodiversity, and its constituent ecosystems, are critically important to our well-being and economic prosperity, but are consistently undervalued in conventional economic analyses and decision-making.
The landscape of the UK has changed markedly during the last 60 years with the expansion of enclosed farmlands, woodlands and urban areas, and the contraction and fragmentation of semi-natural grasslands, upland and lowland heaths, freshwater wetlands and coastal margin habitats.	Ecosystems and ecosystem services, and the ways people benefit from them, have changed markedly in the past 60 years, driven by changes in society.

4.1.5 Communicating uncertainty

The clear communication of uncertainties that arise within the technical information (also known as 'confidence') is inherently linked to the perceived credibility of an assessment. Demonstrating what is not known, as well as what is certain, contributes to the clarity of the assessment findings. When discussing uncertainties in knowledge, confidence refers to how certain the experts are about the findings (data and information) presented. Low confidence describes a situation where there is incomplete knowledge and, therefore, it is not possible to fully explain an outcome or reliably predict a future outcome. High confidence conveys that there is extensive knowledge available to explain an outcome or predict a future outcome with much greater certainty (IPBES, 2016). Using clear terminology for communicating uncertainties is essential to ensure transparency around assessment findings; in turn, this contributes to the buy-in of stakeholders in the assessment outputs. However, this is typically challenging (Ruckelshaus et al., 2013).

4.1.6 Capacity building

Conducting a Natural Capital Assessment is highly resource intensive, involving a range of experts, stakeholders and administrative staff. Evaluating the technical capacities of the assessment team during the planning of an assessment can help to identify training needs and set realistic budgets for these needs. It may also be necessary to undertake capacity building with stakeholders at the start of an assessment in order to inform them of the process, and the purpose and use of the intended outputs. Building the capacity of local researchers to continue these analyses ensures that these assessments are not one-off activities, but are undertaken on a regular basis. Increasing capacity at a local scale will also lead to greater legitimacy of the findings and outputs.

5. Step-by-Step guide to undertaking a Natural Capital Assessment

Figure 5:
The eight steps to completing Natural Capital Assessments

The eight steps to undertaking a Natural Capital Assessment outlined in this guide (Figure 5) have been designed to lead users through the process. Each step begins with a series of key questions. These questions are addressed by following the actions described under each sub-heading. These steps are not designed as a 'recipe' for a Natural Capital Assessment as each assessment process will be determined by the context within which it is undertaken. Therefore, users should see this as a flexible framework and apply the advice at each step according to their specific situation in the planning unit concerned. The checklist at the end of each step highlights the key actions to be undertaken to achieve the required outcomes, together with considerations of stakeholder engagement, communication and capacity building.

5.1 STEP 1: AGREE KEY GOALS

The purpose of Step 1 is to identify and agree the key goals of the assessment and which ecosystem assets to focus on. Natural Capital Assessments should not be conducted in isolation from existing policies and commitments, but rather as a complementary activity that underpins and improves decision-making regarding the economy and environmental sustainability. In addition, Natural Capital Assessments help stakeholders understand how wider goals and targets can be met in ways which have not been considered previously. At this early stage, multi-stakeholder engagement is key to ensuring the relevance, credibility and legitimacy of the assessment process and outputs. This is crucial to securing buy-in, and for the further engagement of the wider community.

By the end of Step 1, you should be able to answer the following key questions:

- What are the goals in your country's Green Economy Strategy and Plan?
- What other related national goals or objectives have already been agreed in other relevant national and sub-national strategies or plans?
- What are the key goals of the Natural Capital Assessment?

5.1.1 Review existing relevant national and sub-national goals

Firstly, identify relevant green economy goals and objectives that have already been agreed, both at a national and sub-national level. It is essential to consider identifying goals which are SMART, i.e. specific, measurable, achievable, realistic and time-bound (Doran, 1981). Relevant goals are those that impact, or are dependent, on ecosystem assets or ecosystem services in order to be successfully achieved. Undertake desk-based studies to review the existing relevant national and sub-national policies, plans and commitments. Begin by reviewing both the national and planning unit Green Economy Plans (may also be known as Green Economy Strategies, or other titles) and associated documents to identify their goals and objectives (Table 2).

Table 2: Green economy strategies and plans for seven African countries (UNEP, 2015a)

Country	Green Economy Strategy or Plans
Ethiopia	Climate Resilient Green Economy (CRGE) Initiative (2011-2025) seeks to achieve middle income status by 2025 in a climate-resilient green economy. The CRGE Initiative promotes socio-economic targets, such as rural development, improved health, job creation in high value-added production, local production of efficient stoves, and rural employment in areas like afforestation/reforestation, forest management, and livestock/poultry.
Ghana	Ghana's Shared Growth and Development Agenda (GSGDA) II: 2014-2017 focuses on socio-economic transformation through inclusive, sustainable growth coupled with job development. One of the strategies under GSGDA II is to promote the adoption of the principles of a green economy in national development planning. Specifically, the Government's policy will focus on enhancing the capacity of the relevant agencies to adapt to climate change impact, mitigate the impact of climate variability and promote a green economy. In addition, Ghana's Medium Term National Development Policy Framework currently integrates components of a green economy with targets to enhance per capita income to at least 3,000 USD by 2020. Movement forward is anticipated with the ongoing development of a Green Economy Action Plan and implementation of green businesses through the SWITCH Africa Green project.
Kenya	Kenya's Medium-Term Plan (2013-2017) endorses the development of a national Green Economy Strategy. Indeed, the Kenya National Green Economy Strategy and Implementation Plan is currently being drafted. It explicitly focuses on green growth opportunities through renewable exploitation, carbon credits, resource efficiency promotion and clean production systems. Integrated throughout the Plan is a 'Green Jobs Approach', which maps out current and future opportunities in green job creation, including in the fields of organic farming, renewable energy, forestry, planning and waste management.
Mozambique	Mozambique's Green Economy Roadmap (2012) sets the objective to gradually develop an integrated economic growth model that is more favourable for human development, environmental resilience and sustainability by 2030.
Rwanda	Rwanda's Green Growth and Climate Resilience – National Strategy for Climate Change and Low Carbon Development (2011) highlights its momentum towards a green transition. In order for the country to achieve its goal of development and climate resilience by 2050, the Strategy seeks to guide national policy and planning, mainstream climate change into all sectors of the economy, and to position Rwanda to access international funding. Rwanda has declared its intention to achieve sustainable land-use and water management, alongside the preservation of biodiversity and ecosystem services.
Senegal	Senegal's National Strategy for Economic and Social Development (2013-2017) specifically mentioned 'promoting green economy' as one of the strategic objectives to achieve sustainable growth.
South Africa	The Green Economy Accord (2011) adopted under South Africa's New Growth Path, was signed by representatives of the South African Government, business representatives, organised labour and the community constituency at the Parliament of South Africa (Box 8).

As the concepts of natural capital and green economy are relatively new, expand your search by looking for goals linked to sustainable development, low-carbon development, natural resources, ecosystem services and biodiversity. An example of a relevant goal/objective is presented in Box 7. In addition to Green Economy Strategies and Plans, other documents may include relevant goals and objectives, such as:

- National Biodiversity Strategies and Action Plans
- National ecosystem assessments
- District development plans
- Protected Areas systems and plans
- National forest plans
- Fisheries policies
- Water policies
- Land-use plans
- Agricultural plans
- Environmental impact legislation
- Endangered species legislation
- Long-term development strategies
- Five-year economic development plans
- District development plans
- Adoption of the Millennium Development Goals (MDGs) at the national level
- Adoption of the Sustainable Development Goals (SDGs) at the national level

Box 7: Two goals from the Kenya National Green Economy Strategy and Implementation Plan

Objective 3.3: To increase per capita water availability by 200m^3 by 2025

Strategic Actions:

- Reduce non-revenue water by half
- Promote rainwater harvesting (at household and institutional) level through increased water collection and storage

Objective 3.4: Upscale wildlife conservation programmes

Strategic Actions:

- Promote establishment of conservancies to secure wildlife migration corridors and dispersal areas
- Enforcement of anti-poaching regulations as stipulated by the Wildlife Act

Source: GESIP (2015)

By the end of the desk-based study, you should have a better understanding of how the Natural Capital Assessment aligns with other strategies, plans, polices and commitments. The resulting list of all relevant existing national and sub-national goals is then ready for review, prioritisation and acceptance by the wider stakeholder group (Box 8).

Box 8: Prioritising National Green Economy Programmes for the Limpopo Province, South Africa

In 2010, the South African government hosted a Green Economy summit in order to pave the way for the development of a Green Economy Plan. This led, in 2011, to South Africa launching a Green Economy Accord, setting out an agreement between government, business and civil society, and setting green job creation and clean energy generation goals for example. These actions were implemented in order to advance the country's New Growth Path towards achieving a greener economy over the medium to long-term (UNEP, 2013). In setting out these accords and agreements, it was acknowledged that the transition to a green economy in South Africa is linked to many ongoing national plans, strategies and policies (UNEP, 2013), and that these will be of importance in realising a green economy in South Africa. National plans, strategies and policies of significance include:

- National Development Plan, *Vision 2030*
- 2009-2014 Medium Term Strategic Framework and 12 outcomes
- Integrated Resource Plan and Integrated Energy Plan
- 10-year Innovation and Global Research Plan
- New Growth Path, Green Economy Accord and Green Jobs Report
- Industrial Policy Action Plan
- National Water Resource Strategy
- Environmental fiscal instruments (e.g. carbon tax, green fund)
- National Strategy for Sustainable Development and Action Plan (NSSD1)
- National Climate Change Response Policy
- Agriculture and rural development
- National Skills Development Strategy 3
- 2009 South African Framework for Responding to Economic Crisis
- National Green Economy Summit and Programmes' reports
- Transport and human settlement

Nine national green economy programmes are identified and prioritised within the South African Green Economy Plan (UNEP, 2013); these are:

1. Resource conservation and management
2. Sustainable waste management practices
3. Water management
4. Environmental sustainability: greening and legacy; major events and tourism; research, skills, financing and investments
5. Green buildings and the built environment
6. Sustainable transport and infrastructure
7. Clean energy and energy efficiency
8. Agriculture, food production and forestry
9. Sustainable consumption and production

When developing a sub-national Green Economy Plan, the Limpopo Province team used these overarching themes (referred to as 'programmes') to identify province-specific priorities (Table 3).

Table 3: Examples of how South Africa's national programmes have been prioritised within the Limpopo Province Green Economy Plan (Letsoalo, 2013)

National programme	Limpopo priorities	
Water management	• Facilitate water security in Limpopo by increasing awareness of sustainable and efficient use and consumption • Efficient use of water in mining • Alternative water storage • Improved reticulation systems • Recycling of water from sewage farms	• Reduce agricultural water consumption • Water harvesting from fog and rain • Sewage Treatment Plant (STP) biogas production • Catchment management • Reduce household water consumption • Regulate swimming pools
Sustainable consumption and production (SCP)	• Establish Limpopo as a Green Tourism Destination nationally and internationally • Green Limpopo's tertiary sector	

5.1.2 Confirm and validate key goals

The second part of Step 1 is the engagement of a wide range of stakeholders in order to reach agreement on the key goals of the Natural Capital Assessment.

Identify the stakeholders (Box 5) and bring them together in a workshop, allowing them to actively participate in the process of selecting the key goals and ecosystem assets. Note that you may need to build capacity for workshop facilitation in order to ensure optimal stakeholder engagement during this process. Provide participants with the results of the desk-based study in good time before the workshop, and explain that their role is to identify which goal/objective they think is most important for their planning unit and why.

Once you have discussed the goals/objectives, use a scoring exercise to agree which ones the assessment should focus on. Ask each participant to rank the goals/objectives in terms of relevance to the assessment context in order to produce a shorter set of 'key goals' for the assessment.

At the end of Step 1, you will have established the purpose of the Natural Capital Assessment you are undertaking. You should have identified key goals for the specific planning unit you are reviewing, and you will have a good understanding of how the Natural Capital Assessment aligns with existing national and sub-national policies, strategies and commitments.

Checklist	✔
Key actions	
Review existing relevant national and sub-national goals and objectives	
Confirm and validate key goals for the assessment	
Stakeholder engagement	
Identify which stakeholder groups to engage in the process	
Organise a stakeholder workshop to confirm and validate key goals for the assessment	
Carefully record workshop participant viewpoints and interventions to demonstrate the credibility, relevance and legitimacy of the assessment	
Communication	
Provide workshop participants with the necessary documentation and clear objectives of the workshop in good time to allow for adequate preparation	
Communicate the results of the workshop in a timely fashion	
Capacity building	
Build capacity for workshop facilitation in order to ensure optimal stakeholder engagement	

5.2 STEP 2: ESTABLISH THE SCOPE AND SCALE OF THE ASSESSMENT

Step 2 clarifies the scope of the Natural Capital Assessment in terms of ecosystem assets. The same collaborative process applied in Step 1 can be used to identify which ecosystem assets are linked to the agreed key goals of the assessment.

Natural Capital Assessments can take place across a number of different scales. Terms such as 'sub-national' can mean different things to different people. Therefore, deciding which spatial scale the assessment will focus on is vital for the assessment findings to be meaningful. National planning periods and the availability of data will also have an impact on determining the temporal scale of the assessment.

By the end of Step 2, you should be able to answer the following key questions:

- Which ecosystem assets should the assessment focus on?
- What are the scales which need to be considered in the Natural Capital Assessment?
- What is the sub-national scale of governance?
- What are the boundaries of the area the planning unit is responsible for?
- Why is it necessary to take into account the impact of the neighbouring districts?

5.2.1 Defining the scope of the assessment

Natural capital includes stocks of natural resources and stocks of ecosystem assets that are cycled and renewed as part of wider ecosystem functioning; examples of both are identified in Table 4. Ecosystem assets, as opposed to non-renewable natural resources, are the type of natural capital considered in this guide. Using the list of key goals agreed in Step 1, aid stakeholders to identify which ecosystem assets are, or will be, affected.

Table 4: Natural capital: examples of ecosystem assets and natural resources (Dickson et al., 2014)

Natural capital	
Natural resources	**Ecosystem assets**
• The recoverable stock of fossil fuels (i.e. coal, oil and gas) • The recoverable stock of minerals (including metals, uranium etc.) • Aggregates (including sand) • Fossil water stores (i.e. deep underground aquifers replenished over centuries) • Deep ocean stores of carbon • Land (i.e. space for activity to take place) • Ozone layer (protective value) • Solar energy (i.e. as a source of energy, including plant growth)	• Biodiversity – the stock of plants, animals, fungi and bacteria which contributes to ecosystem services, such as food, fuels, fibre, medicine, genetic resources (for developing new crops or medicines), tourism, etc. • Soils for producing crops (note that the crops themselves are better considered a produced asset in this instance) • Surface fresh waters (e.g. for drinking water, hydropower, irrigation, washing, etc.) • The store of organic carbon (held in terrestrial plants and soils, as well as in marine organisms) • Landscape (in terms of aesthetic values for enjoyment, including tourism use)

As an example, the ecosystem assets, services and benefits required to obtain Objective 3.3 of Kenya's Green Economy Strategy ('to increase per capita water availability by 200m³ by 2025'; Box 7) are described in the conceptual model of Figure 6. The ecosystem service benefit required to attain this objective is the increased availability of clean water. Some of the key provisioning and regulating services required to provide this benefit are water provision and regulation, and water purification and filtration. The supporting service of maintenance of the hydrological cycle is also required. These services are provided by, but not limited to, ecosystem assets, such as freshwater bodies, forests and wetlands.

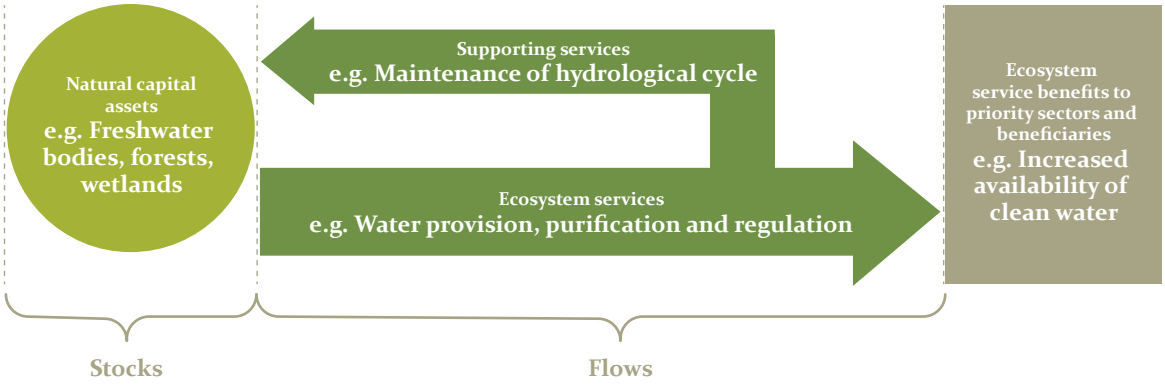


Figure 6: Example of ecosystem assets, services and benefits required to attain Objective 3.3 of Kenya's Green Economy Strategy (Objective 3.3 To increase per capita water availability by 200m³ by 2025) (adapted from Dickson et al., 2014))

5.2.2 Determine the scale of the assessment

When determining the scale of your Natural Capital Assessment, there are two different aspects to consider: the scale of governance and the spatial scale. In terms of governance, 'sub-national' can refer to any level below the national level. Numerous administrative units and corresponding terms exist at the sub-national scale, such as community, council, county, district and so forth. Generally, spatial scale refers to the borders of the relevant planning unit as you would see them on a map. Spatial boundaries can be flexible, however, as natural capital is not limited by borders imposed by society. For example, watersheds may cross several administrative boundaries, often resulting in challenges when assessing and managing associated hydrological systems. This should be considered at an early stage as it can add a layer of complexity to the Natural Capital Assessment process.

The scale of your Natural Capital Assessment should depend on the types of decisions and policies the planning unit is responsible for making. Sub-national parts of government often require finer scale assessments than national governments because policymaking at this level requires more detail. Taking into consideration the scale of policies required to achieve a green economy (Box 9) will help you to determine at which scale to conduct your Natural Capital Assessment.

Box 9: Responsibilities of sub-national authorities to be considered when deciding the appropriate sub-national scale of the assessment

- Establishing regulation – for instance, waste disposal, construction permits
- Guiding investment – possibly steering investment towards green initiatives across sectors
- Limiting public spending in areas harmful to natural capital – limiting spending on subsidies with negative impact on the environment
- Using taxes and market-based instruments – providing incentives and disincentives to the private sector to encourage them to use natural capital sustainably
- Investing in education – supporting research institutes and schools with their environmental education, which will feed into the future generations and their understanding of the value of natural capital

(Network of Regional Governments For Sustainable Development, 2011)

To ensure that the assessment generates useful findings, the scale of the assessment needs to match the scale at which the sub-national administration undertakes actions within the planning unit. For example, when assessing and mapping the natural capital of a small community, you may decide to focus on identifying all the tree species present in a forest. Yet, this level of detail may not be necessary in order to direct action at a county-wide level; indeed, a more generalised picture is often required at these scales, such as the locations of the forests themselves (IPBES, 2016).

In other words, conducting a Natural Capital Assessment at a larger scale than required may not provide enough data and information for decision-makers to form appropriate policies for a transition to a green economy. On the other hand, an unnecessarily detailed assessment will be costly to perform, and runs the risk of turning attention to minor issues and away from areas where progress could be made. Thus, finding the right balance between the two is crucial if the assessment is to aid a transition to a green economy. By reviewing the aims of the assessment captured in Step 1, you will be able to determine the level of detail best suited to achieving these aims.

In addition, it is important to understand that a Natural Capital Assessment is a snapshot in time; hence, you will need to consider the temporal dimension of the assessment alongside spatial and governance scales. This involves looking at the type of monitoring programme the assessment will use, as well as the frequency of any subsequent natural capital analyses needed to support different scenarios (for example, policy or climate change scenarios).

5.2.3 Review the implications of scale

The defined spatial boundaries of your specific planning unit provide the obvious focus for the Natural Capital Assessment. Yet, it is essential to fully understand the scale of the biophysical elements that will be analysed as part of the Natural Capital Assessment. This is particularly pertinent in the case of large ecosystems that cross borders and planning unit boundaries. For example, rivers often provide a variety of ecosystem services throughout their catchment areas. If a Natural Capital Assessment in one planning unit does not take into account the benefits the river provides in the neighbouring districts and areas, the policies deriving from that assessment may be detrimental to the benefits experienced elsewhere. Furthermore, natural capital benefits may be being realised within the planning unit that originate from natural capital stocks that exist beyond the planning unit boundary. Ignoring these potential benefits may fail to capture important opportunities for natural capital investment.

At both national and sub-national levels, you need to identify any ecosystem assets that originate from outside of, or cross between, the spatial boundaries of the assessment. For example, Lake Victoria is a large, tropical freshwater lake that sits between Tanzania (51%), Uganda (43%) and Kenya (6%). The lake is an important source of fresh water and provides a range of employment opportunities, for example, through the fisheries sector. Despite this, the discharge of raw sewage into the lake is commonplace and results in pollution and nutrient loading. In turn, this causes fish deaths and the depletion of fish stocks, and the choking of the lake shore by invasive water hyacinth (Njiru et al., n.d.). Essentially, activities taking place in one country's portion of the lake are heavily impacted upon by processes occurring outside of that country's national boundaries. This is a simple example of how important it is to consider assessment boundaries, and review how the ability of specific ecosystem assets to provide ecosystem services might be affected by cross-boundary issues and activities.

Hence, when conducting a Natural Capital Assessment, communicating and cooperating with the planning units of neighbouring areas can help to avoid such negative outcomes. In addition to communicating with neighbouring areas, cooperation across scales of governance helps ensure consistency. Establishing consistent scales for Natural Capital Assessments conducted across individual planning units helps to evaluate findings between and across planning units.

5.2.4 Identify sectors for focus

Once you have determined the scope and scale of the assessment, you can confirm the sectors of relevance. Priority sectors for a transition to a green economy will have already been identified in the Green Economy Plan for the planning unit you are considering. In addition, stakeholders within the planning unit may be able to help you to refine the level of detail at which to focus on in each of the priority sectors within the assessment.

It should be appreciated that different sectors may not always operate within predetermined spatial boundaries. Sectors outside of the assessment boundaries may have an impact on the natural capital within the boundaries. Thus, identifying the stakeholders across spatial boundaries helps to provide a more holistic assessment (Box 10).

Box 10: The Lake Victoria fisheries as a priority sector

The fisheries sector is recognised as one of the major sectors integral to reducing persistent poverty as part of a transition to a green economy (UNEP, 2011). The largest tropical lake in the world, Lake Victoria, occupies an area of almost 70,000km^2 spread over three countries: Kenya, Tanzania and Uganda. It is one of the world's largest inland fisheries, supporting several million people and contributing to economic growth and food security in the region. Since the 1960s, however, human activities near the lake have increased nutrient loads, resulting in major ecological changes and detrimental effects on the lake ecosystem (Wang et al., 2012).

Despite these pressures, the Lake Victoria fisheries are currently the only artisanal inland fisheries contributing significantly to global fish markets; they are worth an estimated 350 million USD per year (Marshall and Mkumbo, 2011). The human population in the basin has doubled over the last 30 years and the total number of people directly dependent on fishing has grown at an even faster rate (Table 5).

Table 5: Employment in the fisheries sector around Lake Victoria (Marshall and Mkumbo, 2011)

	c. 1978	c. 1989	2008
No. of boats	11,100	21,987	69,400
Catch per boat (t yr^{-1})	7.91	23.06	14.41
Estimated direct employment	52,800	105,500	199,200
Estimated secondary employment	158,400	316,500	597,600
Total estimated employment	211,200	422,000	796,800

Looking ahead, the rapidly expanding population will continue to increase pressures on the fisheries. A joint management programme was designed to share the resources of Lake Victoria after the lake and its basin were designated an "area of common economic interest" by the East African Community (NEMA, 2009). Coordinated management strategies introduced by the three countries around the lake have, historically, taken a top-down approach, but there is a growing movement towards involving the local communities to ensure effective management practices (Marshall and Mkumbo, 2011). Managing untreated pollution originating from the many factories and populated areas close to the lake is a key part of both national and sub-national Green Economy Plans in this region (Wang et al., 2012). For such plans to be successful, it is vital that stakeholders both within, and outside of, the specific planning unit boundaries are identified and engaged to ensure a holistic view of sectoral impacts and benefits.

At the end of Step 2, you will have decided upon the scale of the assessment and reviewed the implications of using that scale. In addition, you will have aligned the sector focus of the assessment with the relevant Green Economy Plan for the region and have taken into account stakeholder concerns.

5.2.5 Key resources

The key resources listed below will provide you with useful additional information to support this step:

- Guide on production and integration of assessments from and across all scales (IPBES, 2016) – Chapter 2
- Ash, et al. (2010). Ecosystems and Human Well-being: A Manual for Assessment Practitioners. Washington DC: Island Press P42-43

Checklist	✔
Key actions	
Determine the scale of the assessment	
Review the implications of scale	
Identify sectors for focus	
Stakeholder engagement	
Identify the key stakeholders with influence according to the assessment scale (these can include those both within, and outside of, the assessment boundaries)	
Communication	
Ensure lines of communication are open and clear between neighbouring districts, planning units and levels of government	
Capacity building	
Consider employing geographic information system (GIS)/mapping specialists to help delineate and communicate assessment boundaries and potential trans-boundary issues	

5.3 STEP 3: GATHER AND REVIEW DATA

Step 3 of the Natural Capital Assessment concentrates on gathering and reviewing data on natural capital for the planning unit. Data collection should focus on the key goals and ecosystem assets identified in Step 1, while taking into account the spatial and temporal scales agreed in Step 2. The interpretation of these data underpins the assessment. Therefore, Step 3 is likely to be revisited at numerous points throughout the assessment.

By the end of Step 3, you should be able to answer the following key questions:

- What data do you need for the assessment?
- What data and knowledge do you have?
- Where are the data gaps?
- How can the identified data gaps be filled?

One of the major objectives of a Natural Capital Assessment is to present data and knowledge to policymakers that they can trust and use in support of decisions. To enable this, data and maps need to be identified, collated, organised, analysed and evaluated in a systematic, transparent and thorough way. The availability, quality and scale of data are usually highly variable. It is, therefore, necessary to follow certain key principles and practices when collecting, processing and using data to ensure that they are accepted by stakeholders and decision-makers and that they can be updated and further synthesised in a standard format. To achieve this, apply the following principles when collecting data:

- Include all relevant and available data, information and knowledge from different knowledge systems and sources (e.g. indigenous and local knowledge).
- Ensure transparency at all steps of collection, selection, analysis and archiving of data to enable informed feedback on assessments and replication of results, and to enable comparisons across scales and time.
- Be systematic and methodical through all steps of the assessment process, and keep documentation of your methods, how representative the available evidence is, and any gaps or uncertainties in that evidence (IPBES, 2016).

It should be noted that your assessment stakeholder group is a valuable asset which you can draw upon when identifying and validating data. Use participatory processes, such as surveys, workshops and short interviews, to help increase input into the data collation process.

5.3.1 Review types of data required

Natural Capital Assessments use a multitude of qualitative and quantitative data types and maps, such as biophysical data, economic data, census data, and indigenous and local knowledge. Data from a broad range of sources is required in order to produce assessment outputs that are credible and legitimate.

Biophysical data

The inventory of data required for a Natural Capital Assessment ideally contains data on the stocks of ecosystem assets, ecosystem services and their trends. This includes information on spatial and temporal variations in the quantity and condition of the ecosystem assets, such as land and habitat, water, soils and forests. Spatial data, maps and remote sensing are valuable sources of information for assessments as they allow for the location and extent of ecosystem assets to be mapped. Data on the quality of ecosystem assets is also vital for supporting the assessment process. This should include environmental monitoring data, such as water quality, pollution levels, biodiversity and the occurrence of invasive species.

Economic and social data

The most useful economic data for a Natural Capital Assessment is that which provides information about priority sector dependencies, and impacts on, natural capital in the planning unit. Certain economic data can also help to identify opportunities for natural capital investment. Useful data includes:

- market studies for priority sectors (e.g. future demand for sectoral outputs);
- data on economic output/transactions to identify the scale and location of sectors;
- data on jobs and employment figures for sector activities; and
- data on licenses and use rights (e.g. water abstraction).

Social data is also important for understanding the context of the planning unit. For example, data on population change may imply increasing pressure on ecosystem assets within the planning unit. Socio-economic data is also essential for identifying key beneficiary groups that may be targeted in any subsequent Green Economy Plans. For example, the rural poor may be may be a target beneficiary group in the context of achieving a more equitable society. In addition, supporting the role of certain women's groups for achieving the sustainable use of natural capital may be an important area for a Green Economy Plan and relevant for achieving the social goals of a more inclusive green economy.

Indigenous and Local Knowledge

Indigenous and Local Knowledge usually consists of many different types of data (e.g. written, oral, tacit, practical and scientific) that has been empirically tested, applied and validated by local communities over time. To use indigenous and local knowledge in a Natural Capital Assessment requires recognition that ethical protocols are used and agreed which support a dynamic interactive cycle (International Society of Ethnobiology, 2006). IPBES has drafted a range of approaches for working with indigenous and local knowledge in assessments of biodiversity and ecosystem services (Table 6); you can usefully apply these to your Natural Capital Assessment.

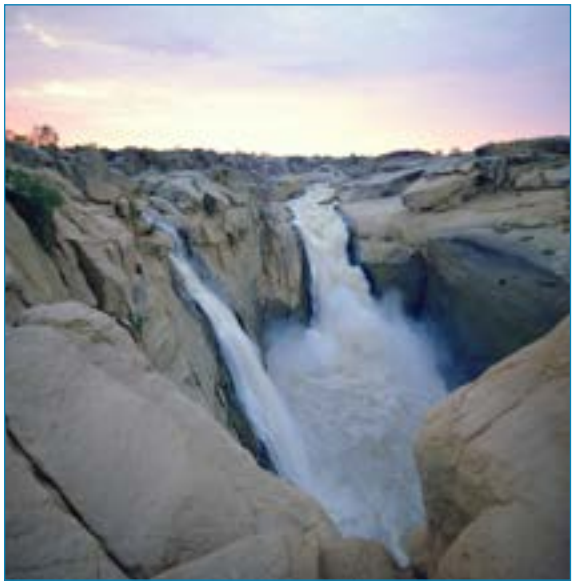


Table 6: Draft approaches for working with indigenous and local knowledge in assessments of biodiversity and ecosystem services (IPBES, 2016, p. 103)

1	Putting indigenous and local people and their places first
2	Defining mutual goals, benefits and benefit-sharing
3	Recognising and supporting rights and interests
4	Recognising and respecting diverse world views
5	Understanding and respecting different types of working culture
6	Building dialogue to address gaps, convergence and synergies between Indigenous and Local Knowledge and science
7	Establishing mutual trust and respecting intercultural differences
8	Practicing reciprocity, giving back and capacity building
9	Recognising and respecting intellectual and cultural rights
10	Ensuring culturally appropriate storage of, and access to, information
11	Using formal and informal agreements and statements

5.3.2 Locate and collate data

In order to collate the most accurate data, focus on identifying available data at the smallest scale first, i.e. at the planning unit or sub-national scale. Once you have identified the gaps in the relevant sub-national/planning unit data, you can source data from levels above this, i.e. national, regional or global. However, the use of data from such scales should be considered with caution as they might not be at a high enough resolution or lend themselves to disaggregation. Useful sources of data include:

- Local and national governmental departments and agencies
- Water sector databases
- Agricultural centres
- Cooperatives and trade organisations
- Protected areas
- Ecotourism agencies/ministries
- Regionally focused institutes
- Active non-governmental organisations that have regional and landscape-scale focus e.g. WWF, Conservation International (CI)
- Regionally focused initiatives, projects and research groups
- Universities
- Museum collections
- Local practice-based knowledge from communities
- Indigenous and local knowledge groups
- Citizen science contributions

Once the local and national datasets have been collated, the following sources might be helpful to fill any data gaps:

- Literature search engines such as 'Web of Science' and 'Google Scholar'
- Published journal articles and books
- 'Grey literature' (print and electronic literature produced by government, academics, business and industry, but not controlled by commercial publishers)
- Literature resources from Biodiversity Heritage Library and others

5.3.3 Construct a map of natural capital

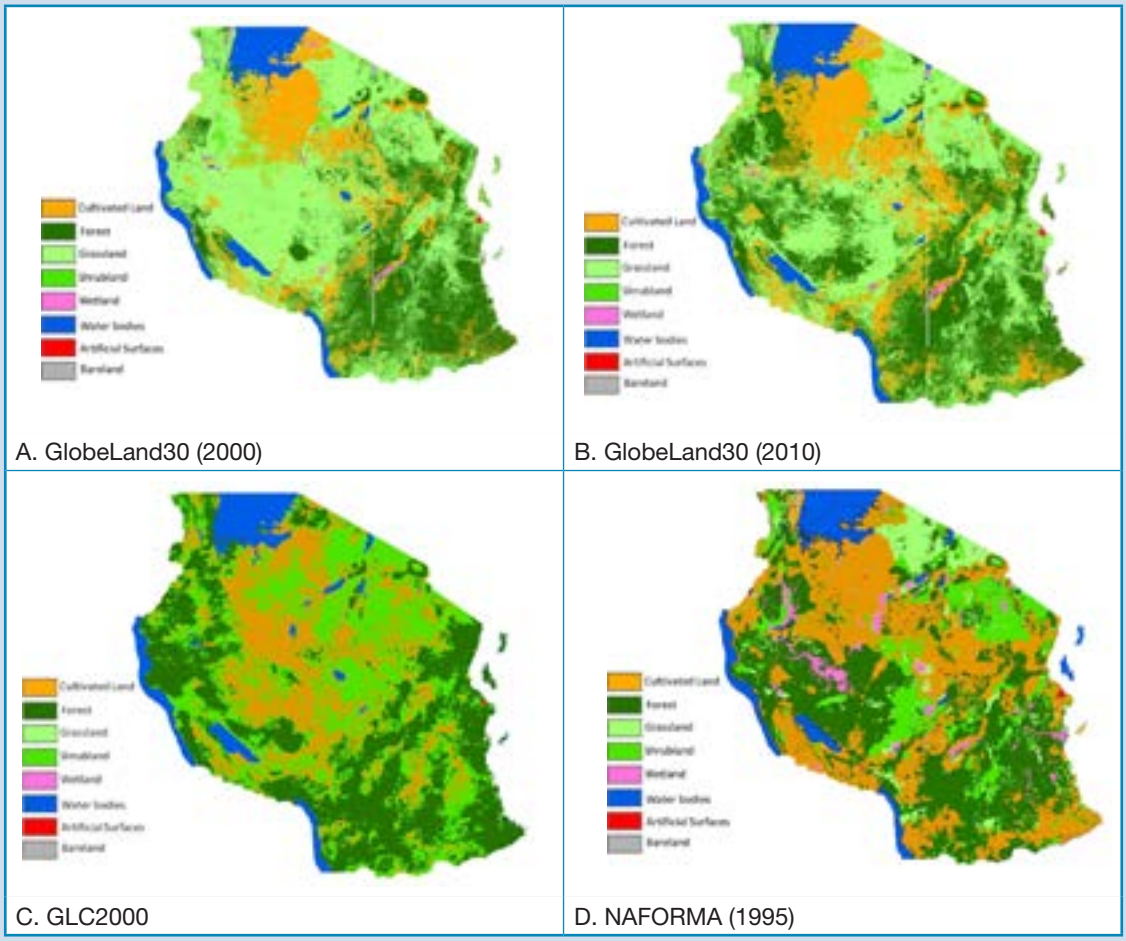
Mapping ecosystem assets can be particularly useful for sub-national land-use planning as it can help to sort priorities and identify problems that are specific to area, boundary or scale. This type of mapping can also be used to examine synergies and trade-offs between different ecosystem assets and services (Dickson et al., 2014).

Remote sensing can be used to map ecosystem assets and ecosystem services. It is achieved through the monitoring of the Earth's surface at regular, routine intervals in an automated fashion by earth observation satellites. Recent technological advances have led to higher spatial resolutions and more advanced and frequent measurements. Remote sensing is, therefore, being increasingly used on smaller scales where it can be used to map habitats and predict species distribution (UNEP-WCMC, 2015). Using remote sensing within an assessment has many advantages, such as: it is a relatively cheap and rapid way to acquire up-to-date information over a large geographical area; it provides a continuous, repetitive and large-scale synoptic view; it is a practical way to obtain data from inaccessible and dangerous areas; and, the data it provides are easy to manipulate with a computer and combine with other data in geographic information systems (GIS) (Brown et al., 2014; Secades et al., 2014).

Land cover maps that describe the physical nature of the land can be a particularly useful tool when conducting Natural Capital Assessments; for instance, in identifying particular habitat types that deliver key ecosystem services, such as forests. If no land cover maps are available, they can be produced using geographical datasets for buildings, roads, crops, forests and environmentally sensitive areas (UNEP, 2014c). To map ecosystem assets, the extent of ecosystems or habitat types is often used. A correlation between ecosystem classification and spatial data on land cover/land-use is then sought using this data (Box 11; UNEP-WCMC, 2015).

Box 11: Mapping Tanzania's habitat types at the national scale (UNEP-WCMC, 2015, p. 22)

A suite of land cover products at various spatial resolutions for Tanzania is set out in Figure 7 below. GlobeLand 30 (2000 and 2010) has a spatial resolution of 30m, while GLC2000 is 1km, and the Tanzania National Forestry Resources Monitoring and Assessment (NAFROMA) data are vector polygons of land cover interpreted by national experts. Although GLC2000 is a widely used global land cover product, it may not be appropriate for habitat definition at finer spatial scales than the grid cell size (1km). The GlobeLand30 product can be used to infer habitat at a much finer spatial resolution (30m), while also allowing change to be estimated from 2000 to 2010. However, it is only limited to 10 land cover classes compared to the 22 classes of GLC2000 and 25 classes of NAFORMA.



A. GlobeLand30 (2000)

B. GlobeLand30 (2010)

C. GLC2000

D. NAFORMA (1995)

Figure 7: Land cover products at various spatial resolutions for Tanzania (UNEP-WCMC, 2015)

5.3.4 Methods to capture missing data

In addition to land cover maps, you can use other maps of ecosystem assets in your Natural Capital Assessment. For example, many countries have generated soil quality maps in order to inform agricultural development, while hydrological maps might exist to support the water sector. You might be able to obtain these from government departments, industry bodies, universities or institutions, such as geological societies.

Once you have collated all the relevant mapping data for natural capital at the desired scale, construct a composite map of key ecosystem assets for the planning unit. This should not only include the extent of ecosystem assets, but also their quality and, ideally, their capacity to deliver ecosystem services.

It is vital to appropriately archive the data used in the assessment as most digital storage media have short lifetimes of only a few years. Archiving ensures that data is preserved and maintained in file formats that are likely to be usable in the future. This guarantees transparency and provides the opportunity for replication (IPBES, 2016). By archiving the data, the planning unit can easily access the information in the future when it comes to monitoring, or reporting on, their natural capital.

5.3.5 Address data gaps

As assessments generally rely on the collation and analysis of existing information, the availability of reliable data can often be a major limiting factor. Assessments are rarely associated with the collection of new data; however, when significant gaps are identified in the availability of robust data at the relevant scale, it may be necessary to address these gaps through data collection activities (Box 12).

Box 12: Using remote sensing to detect trends in land-use and land cover change in the Nech Sar National Park, Ethiopia

The Nech Sar National Park (NSNP) is a designated Protected Area that lies within a biodiversity hotspot in Southern Ethiopia. BirdLife International have also classified this area as an Important Bird and Biodiversity Area. Growing populations within the area have led to the increased construction of physical infrastructure, generated an unsustainable demand for fuel wood, and caused the expansion of agricultural areas. This has, in turn, led to widespread habitat degradation in the NSNP (Fetene et al., 2016).

Studies conducted within the NSNP have sought to define the magnitude and direction of change in land-use/land cover over time and which land cover/habitat types have been more affected by landscape disturbance. These studies have also attempted to identify the key drivers of landscape degradation and land cover change in the NSNP (Fetene et al., 2016).

There is a lack of historic data on land-use and land cover change in the NSNP (Fetene et al., 2016). Therefore, in order to understand the spatial and temporal patterns of landscape disturbance and degradation, remote sensing was employed using Landsat mapping data. The Landsat archive became freely available in early 2008 (Roy et al., 2010). It was used to analyse both temporal and spatial patterns of disturbance and landscape degradation in the terrestrial habitats of the NSNP using historical to recent observations at 30m resolution.

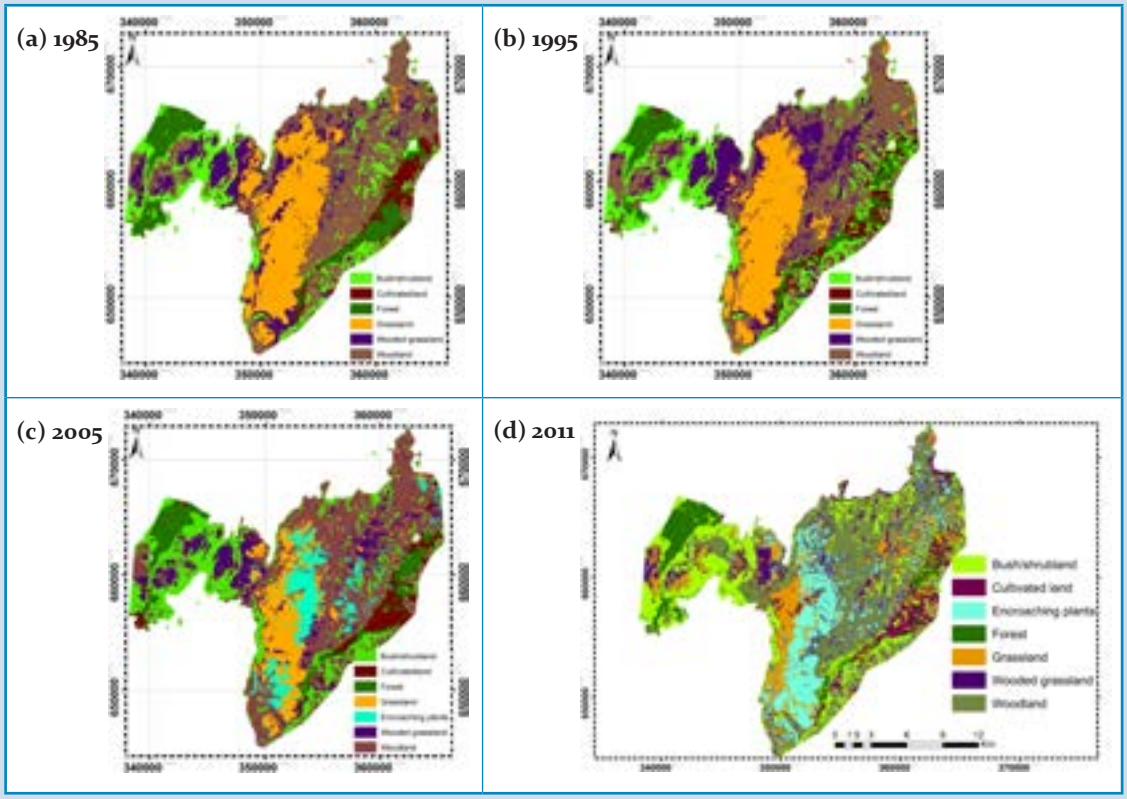


Figure 8: Terrestrial land cover maps of the NSNP provided by Landsat imagery (Fetene et al., 2016)

The results showed that changes in anthropogenic land-use corresponded with dramatic shifts in both vegetation type and vegetation density (Figure 8). The main observed trends in degradation show the modification from forest to cultivated land and from open grassland to bush/shrub encroachment. The drivers of this change were found to be increasing anthropogenic pressures exacerbated by poor Protected Area governance related to unstable organisational structures (Fetene et al., 2016).

The choice of which data gaps to address is an issue of prioritisation, and depends on a variety of aspects, such as the key goals of the assessment, the level of rarity of the data, and the risks to the biodiversity and ecosystem assets under consideration (IPBES, 2016). It may also depend on what other needs have been identified, for example, if certain data is needed to set up a natural capital accounting system to monitor progress towards a green economy.

Therefore, conduct an open discussion with national level governmental agencies and other sub-national district representatives when choosing which data gaps to address. This will enable the alignment of any data collected on status and trends with data of national or larger scales. In addition, such new data needs to be linked to important natural capital and sector relationships to be useful for the assessment. Indeed, there are some toolkits that could be suitable for this purpose, such as the Toolkit for Ecosystem Service Site-based Assessments (TESSA) (Peh et al., 2013). This toolkit provides practical guidance on how to measure and monitor a number of ecosystem services at the site scale with limited time and resources, and how to assess the potential impacts of changes in land-use on these services. An example from Malawi, described in Box 13, illustrates how the issue of limited data at the sub-national level was addressed.

Box 13: An illustration of how Malawi addressed the issue of limited data at the sub-national level

The Government of Malawi developed its first *Malawi State of Environment and Outlook Report* in 2010 with support from the Poverty-Environment Initiative (PEI) of the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) (Ministry of Natural Resources, Energy and Environment, 2010). Accurate district-level data in Malawi was lacking, as such, this proved a significant challenge in developing the report. In order to enhance the available data and district environmental management, in 2013, the government revised its *Decentralized Environmental Management Guidelines*, with support provided by PEI Malawi. These revised guidelines sought to address data gaps and inconsistencies in earlier iterations in use at the district-level. The guidelines were also aimed at helping district councils to include emerging and critical environmental issues in their preparation of district development plans and social and economic profiles, such as waste management and climate change.

Informed by both the revised guidelines and the Malawi State of Environment Report, the Mwanza District launched its District State of Environment Report in February 2014. Poverty-environment references are included within this report. Four other district councils – Kasungu, Nkhata-Bay, Nsanje and Zomba – also included poverty-environment and climate change objectives, indicators and baselines in their district socio-economic profiles in the first half of 2014.

It was stated at the launch of the Mwanza District State of Environment Report that "the report provides a picture of the state and trends of the environment and natural resources in the district, thus informing the Council to make appropriate resource allocations." These district-level State of Environment Reports provide significant resources in Malawi, supporting the monitoring and review of the environment and the associated implications for poverty reduction, leading to the informed setting of policy and budget decisions. The district report and its social and economic profiles will also guide actions taken by community groups to promote the sustainable use of resources.

An alternative method you can use to address gaps in the data is to model the available data. Models are useful in assessments because they allow gaps, in both space and time, to be filled in a consistent way. They also allow extrapolation within reasonable limits (Ash et al., 2010). As part of the assessment process, it is preferable to use models that have already passed peer review, rather than making new methods that will need to be peer reviewed themselves. As an example, the SEEA-EEA identifies the terrestrial model, GLOBIO, for filling data gaps in biodiversity distribution (Alkemade et al., 2009). Examples of other potentially useful models are Co$ting Nature (Mulligan et al., 2010), Water World (Mulligan, 2013) and PREDICTS (Newbold et al., 2015). For PREDICTS, the approach is based on a meta-analysis of global datasets containing large numbers of existing site-level studies on species distribution and abundance. Each study site is scored for the levels of the key drivers of biodiversity loss, including land-use, land-use intensity, land-use history, population density and proximity to roads (as a proxy for habitat fragmentation) (Newbold et al., 2015).

However you achieve it, once you have filled any data gaps, revisit and update the natural capital map for the planning unit.

Step 3 of the Natural Capital Assessment requires the consideration of data sources in order to produce the most credible, relevant and legitimate assessment outputs. These activities can be resource intensive, so careful planning and budgeting is necessary from the outset. Collaborating with stakeholders that routinely gather and/or interpret data for decision-making is essential to streamline efforts and capitalise on available expertise. At the end of this step, there should be a robust database of available datasets from which to draw upon, and a detailed map of the relevant ecosystem assets at the scale concerned.

Checklist	✔
Key actions	
Review types of data required	
Locate and collate data	
Construct a map of natural capital	
Address data gaps	
Stakeholder engagement	
Incorporate the assessment of data requirements and potential sources into stakeholder meetings	
Draw on the varied knowledge and expertise of specialist data holders, such as indigenous and local knowledge groups	
Communication	
Be clear about the methodologies used in data collection and data analyses	
Capacity building	
Consider employing mapping and/or GIS specialists and modelling experts as required	
Build training for data collection and archiving into the assessment budget	

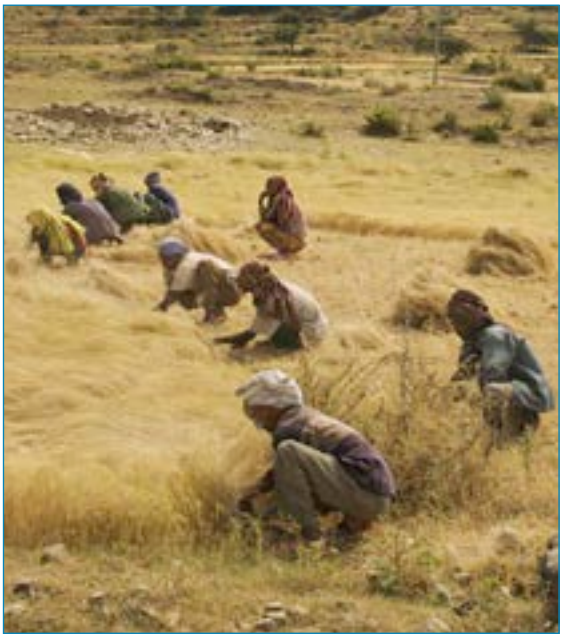
5.4 STEP 4: ASSESS SECTOR DEPENDENCIES ON ECOSYSTEM ASSETS

Step 4 of the Natural Capital Assessment seeks to identify and map where priority sector activities that are dependent on ecosystem assets are taking place. It also maps the locations of any vulnerable beneficiaries that are dependent on these assets and the services that they provide. Finally, Step 4 assesses the nature of these dependencies and identifies any ecosystem assets delivering services that cannot be readily substituted. Assessing these dependencies is fundamental to making the case for sustainable management of natural capital and transitioning to a green economy within the planning unit.

By the end of Step 4 you should be able to answer the following key questions:

- Where are priority sector activities that are dependent on ecosystem assets taking place?
- Where are vulnerable beneficiaries with high dependencies on ecosystem assets?
- How are these vulnerable beneficiaries characterised (e.g. using economic, social and demographic data)?
- What are the ecosystem services linking specific ecosystem assets with priority sector activities?
- Are there any vulnerable beneficiaries associated with the ecosystem services identified?
- Which ecosystem services are difficult to substitute?

The scope of Step 4 is driven by the context of the planning unit and the agreed key goals identified in Step 1. These key goals provide the basis from which you should identify the priority sectors, beneficiaries and specific ecosystem assets that the Natural Capital Assessment will focus on. The conceptual model presented in Figure 2 (Section 2.1) illustrates how ecosystem assets provide a flow of ecosystem services that are realised by priority sectors, alongside any associated vulnerable beneficiary groups; as such, it provides the framework around which you can build a picture of these linkages within your assessment. The level of detail considered in Step 4 should match the scope and scale of the assessment decided in Step 2.



5.4.1 Mapping priority sector activities and vulnerable beneficiaries

Your first task in Step 4 is to map the location of priority sector activities and any vulnerable beneficiary groups with high dependencies on ecosystem assets in the planning unit. This provides a good foundation for exploring sector linkages with ecosystem assets, while also establishing a spatial planning context for decision-making.

Locating priority sector activities and any vulnerable beneficiaries

Beyond the formal economic sectoral activities, it is also important to identify and locate beneficiary groups that have high dependencies on ecosystem assets through informal activities. For example, local communities, such as the rural poor, engaged in subsistence fishing activities. You should seek to identify these groups in your Natural Capital Assessment. There are a number of potential sources of information that will be relevant to your planning unit; for instance, you may have already obtained useful information from government agencies during Step 3, including:

- Land cover and land-use maps
- Data on economic output/transactions identifying the scale and location of sector activities
- Data on jobs and employment for sector activities
- Data on licenses and use rights (e.g. water abstractions)
- Socio-economic data identifying beneficiaries with potentially high dependencies on natural capital for formal and informal employment and livelihood opportunities

The above list is certainly not exhaustive and further information may be obtained from trade organisations, cooperatives, research institutes, indigenous peoples' groups and NGOs (Step 3, section 5.3.2).

Using a participatory approach

In planning units with data limitations, it is useful to employ a participatory approach in order to capture a local understanding of ecosystem asset dependencies and value structures (Paudyal et al., 2015). This is particularly relevant for groups that are highly dependent on ecosystems for their livelihoods, such as indigenous communities. For example, TEEB (2010b) estimated that "ecosystem services and other non-marketed goods account for between 47 per cent and 89 per cent of the 'GDP of the poor'" (i.e. the effective GDP or total source of livelihood of rural and forest-dwelling poor households). Making use of semi-structured interviews and focus groups, supported by expert opinion and field observations, will help to inform your assessment of ecosystem service benefits (Paudyal et al., 2015).

5.4.2 Assessing the links between ecosystem assets and priority sector activities

The conceptual model presented in Figure 2 (Section 2.1) shows how ecosystem assets deliver ecosystem services that provide benefits to priority sectors and, in turn, beneficiaries. Your second task in Step 4 is to describe how geographically defined areas of sector activities (and any associated vulnerable beneficiary groups) depend on specific ecosystem assets and the flow of the particular ecosystem services they provide. This is fundamental to understanding the role of ecosystem assets in supporting economic activity and livelihoods in the planning unit.

Table 7 offers an approach you may use for presenting the linkages between ecosystem assets and priority sector activities for the planning unit. The example presented in Table 7 is based on an economic assessment of ecosystem services provided by the Sourou Valley wetlands, Burkina Faso (Somda and Nianogo, 2010). The following sub-steps provide you with a framework for populating your own version of Table 7:

1. **Column 1:** Identify ecosystem assets in the planning unit that provide priority sector inputs.
2. **Column 2:** Identify the ecosystem services delivered by the ecosystem assets in sub-step 1 that provide priority sector inputs. Characterise how important these ecosystem services are on the basis of how, and how much, they enhance/underpin priority sector performance.
3. **Column 3:** Identify the locations within the planning unit where these important ecosystem services are providing inputs to priority sector activities.
4. **Column 4:** List the priority sectors that benefit from ecosystem service inputs (e.g. agriculture, forestry, water, etc.).
5. **Column 5:** Identify and confirm the location of any vulnerable beneficiary groups that depend on the priority sector activities undertaken at the locations identified in sub-step 3; for example, a vulnerable beneficiary group may carry out subsistence agricultural practices, or other informal economic activities, and, therefore contribute to the total agricultural sector. It should be noted that for some formal priority sector activities there may be no such groups.
6. **Column 6:** Identify if there are effective substitutes for ecosystem service inputs for priority sector activities.

As part of your Natural Capital Assessment, it is important to identify if more efficient (yet sustainable) use of ecosystem assets is possible; for instance, recognising which under-used ecosystem services could support diversified employment opportunities. You will be able to review the potential to exploit such opportunities in Step 7. Nonetheless, useful foundations for such analysis will be established during this stage of the Natural Capital Assessment.

Table 7: An approach for identifying the linkages between ecosystem assets and priority sector activities for the planning unit. Based on ecosystem services provided by the Sourou Valley wetlands, Burkina Faso (Somda and Nianogo, 2010)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Ecosystem asset	**Ecosystem service**	**Where does the service provide an input into priority sector activities?**	**Benefiting priority sector**	**Vulnerable beneficiary groups**	**Cost of substitute for ecosystem service**
Agricultural areas surrounding the Sorou River	Regulating (soil fertility - nutrients provided by rich wetland soils)	Identified agricultural areas	Agriculture	Local communities have high dependencies on agricultural production for livelihoods and sustenance	Medium: fertiliser could be used but may have high impact on other services
Sorou River and impoundment waters	Provisioning (fish)	Fishery areas	Fisheries	Local communities have high dependencies on fish for livelihoods	Medium: expensive alternative food sources are available
Areas of Acacia woodland on Sorou River banks	Provisioning (timber, fuel wood)	Areas of Acacia woodland on Sorou River banks	Forest	Local communities have high dependencies on wood for fuel and construction	High: expensive, but possible, to obtain goods from market
Sorou Valley wetland areas	Cultural (animals for nature viewing, e.g. hippopotamus)	Ecotourism areas	Tourism	Revenue from ecotourism is important in supplementing livelihoods in local communities	High: there are limited opportunities for this type of nature viewing in the area
Sorou Valley Wetland Areas	Provisioning Fresh (water supply, groundwater recharge and discharge)	Boreholes in populated areas	Water	Many communities in the valley are dependent on water yield from boreholes	High: obtaining large quantities of water from alternative sources would be expensive and/or time consuming

Column 1: Identify which ecosystem assets are providing important ecosystem services

You will have mapped the location of ecosystem assets in the planning unit during Step 3 of the assessment process. List these ecosystem assets in column 1 of Table 7, and the relevant ecosystem services they deliver in column 2. Note that many ecosystem assets will produce multiple important ecosystem services.

There are a number of studies that can assist in identifying which ecosystem assets deliver specific ecosystem services; some useful resources are provided at the end of this Step (e.g. the Millennium Ecosystem Assessment (MA, 2005); Section 5.4.4). In addition, supplement this process with stakeholder engagement in order to 'ground-truth' which ecosystem assets are most important for ecosystem service delivery within the planning unit context.

Column 2: Identify important ecosystem services

While there is not yet an agreed approach for measuring the complete bundle of ecosystem services provided by an area of natural capital (Reyers et al., 2014), there are a number of well-known studies and initiatives that can provide a starting point for identifying the ecosystem services delivered by ecosystem assets and their benefits to priority sectors. Some useful resources are provided at the end Step 4 (Section 5.4.4).

As an example, relevant ecosystem services for priority sectors and beneficiaries could be identified from the Common International Classification of Ecosystem Services (CICES) framework, for example. CICES has been developed to support national accounting frameworks being developed in the EU and by the UN Statistics Division; the CICES framework can be accessed through website provided in the key resources for Step 4 (Section 5.4.4). Alternative classifications systems that could also be employed include the Final Ecosystem Goods and Services Classification System (FEGS-CS). A website for this system is also provided in the key resources for Step 4 (Section 5.4.4).

It is important to be inclusive and expansive when assessing ecosystem services derived from ecosystem assets within the planning unit. It is vital to research, and to include, diverse views, including those of indigenous and local knowledge holders whose livelihood activities will be closely tied to ecosystem assets and services (Step 3). Engaging with stakeholders from the outset is key to this process.

When assessing priority sector dependencies, you should consider all relevant ecosystem services and assets. For instance, agricultural ecosystem assets produce crops – a provisioning ecosystem service. But, in this context, provisioning ecosystem services may not be the only services being derived from this ecosystem asset. It is possible that the agricultural practices might be supporting populations of pollinators, which provide regulating services within this ecosystem asset, as well as within adjacent ones. Furthermore, maintaining genetic diversity or strains of agriculturally important species and hybrids represents an important supporting ecosystem service.

Comprehensive assessments of ecosystem services generated within the planning unit require the support of natural scientists and other experts, including ecosystem modellers. Nonetheless, it is likely that you will be able to characterise a substantial number of important ecosystem asset to priority sector linkages based on existing information; you can use this to populate your version of Table 7.

Column 3: Identify where ecosystem services provide inputs into priority sector activities

You will have generated a map of priority sector activities in the first part of this Step. This provides the basis for establishing formal and informal economic links to ecosystem assets via the ecosystem services they deliver. Establishing the ecosystem service links between specific ecosystem assets and the activities of the priority sectors may be relatively straightforward when asset and activity occupy the same geographic space. For example, timber provisioning services delivered by forest ecosystem assets are realised in the same location as they are produced via the forestry sector activities practised there. In other places, priority sector benefits from ecosystem assets may be realised elsewhere within the planning unit through physical linkages. For instance, regulating services, such as water purification provided by forest ecosystems, are likely to benefit water extraction activities at downstream locations. These physical linkages need to be understood in order to associate

specific ecosystem assets with locations/areas of priority sector activities (also known as 'back-mapping'; Box 14). Once identified, enter the locations where ecosystem services are supporting/contributing to priority sector activities into column 3 of Table 7.

Some ecosystem asset to priority sector links may relate to assets or activities that are located outside of the planning unit. For example, a planning unit containing a large area of forest ecosystems may be providing important soil stabilisation and sediment retention regulating services. In turn, these services can have a positive impact on the quality and productivity of inland fisheries in downstream planning units. Alternatively, the reverse may be true – there may be important ecosystem assets outside the planning unit delivering important ecosystem services that underpin priority sector activities within the planning unit. Such links that extend beyond the planning unit boundary should be captured in the scope of the assessment. Indeed, they may form the basis for establishing PES arrangements.

Box 14: An example of identifying ecosystem asset and sector linkages

Balmford et al. (2008) provide an example of 'back-mapping' ecosystem services to ecosystem assets, illustrated by the example of water purification regulating services provided by forest areas. In this scenario, the water sector is benefiting from the provision of clean, fresh water. The ecosystem assets providing this ecosystem service are two areas of upstream forest (Figure 9), with the areas of forest in close proximity to the water course being of particular importance (darker green shades in Figure 9b). Figure 9b identifies a range of potential beneficiaries/users of the water sector. However, the actual beneficiaries/users realising the ecosystem services (water purification and clean water provision) provided by the forest ecosystem asset are primarily those downstream of the forest areas (Figure 9c). As Balmford et al. (2008) show, the value of the clean water ecosystem service, established according to its use (Figure 9d), can be back-mapped (physically linked) to the specific ecosystem asset responsible for its provision via the hydrological system (Figure 9e).

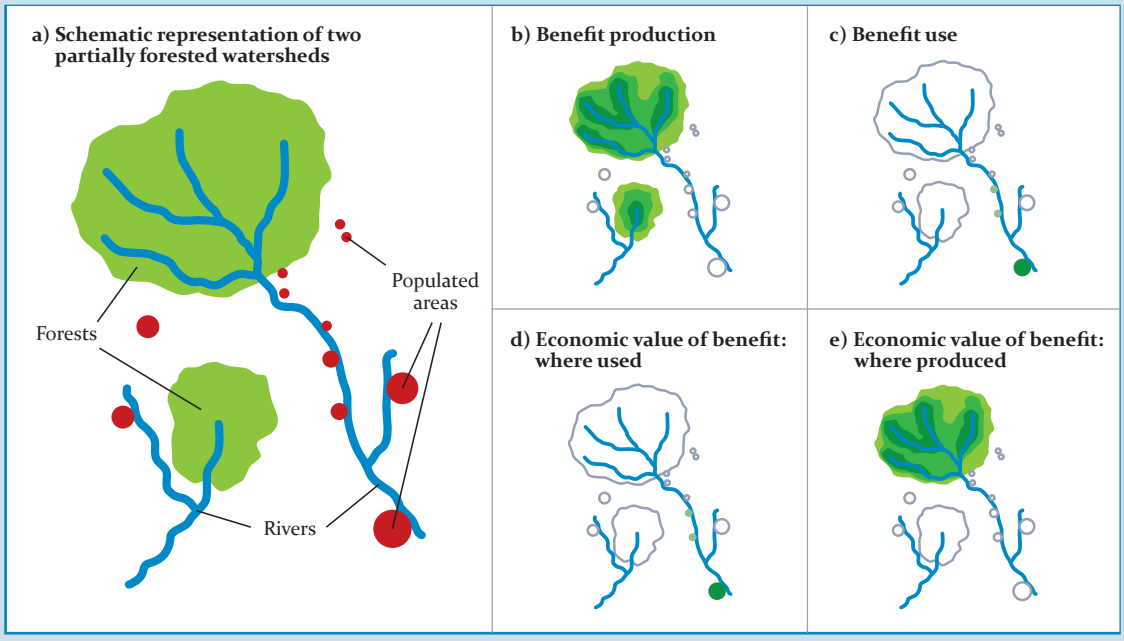


Figure 9: An example of back-mapping – linking water purification services provided by forest areas to beneficiaries

Column 4: List priority sectors using specific ecosystem services

Once you have identified the specific location or area in which important ecosystem services are providing inputs to priority sector activities, list the benefiting sectors in Column 4 of Table 7.

Column 5: Identify the location of any vulnerable beneficiary groups

An equitable and socially inclusive allocation of resources is fundamental to achieving a green economy. Within a planning unit, it is vital that access to important ecosystem services is maintained and safeguarded for vulnerable beneficiary groups with high dependencies on ecosystem assets for their livelihoods. Step 4 of the assessment provides an opportunity to identify the ecosystem assets most relevant to meeting the needs of these groups.

Use the map constructed in the first part of Step 4 (Section 5.4.1) to capture where vulnerable beneficiary groups are located. Engage with these groups to establish which priority sector activities/livelihood opportunities are of most importance to their well-being and where these activities are undertaken. Using this information, link any groups that are highly dependent on specific ecosystem services with the areas/locations where the priority sector activities occur and enter the results into column 5 of Table 7.

Column 6: Assess if there are any suitable substitutes for ecosystem services

The assessment of ecosystem asset to sector linkages should be supported by a review of the potential for substituting the ecosystem service provided by the asset with an effective alternative. Natural capital includes 'critical stocks', whose functions cannot be substituted with other types of capital stocks (e.g. manufactured capital) (Ekins et al., 2003). Natural pollination regulating services, for example, are difficult to substitute with the use of mechanical or manual means. However, it may be easier to substitute provisioning services, such as wild foods, if there are inexpensive alternative foods available. It is important to consider how easy it is to substitute an ecosystem service in order to help prioritise the management and protection of ecosystem assets. Capture your assessment of this in column 5 of Table 7; it can be qualitative or based on a quantitative estimate of cost.

5.4.3 Step summary

Once you have completed Step 4 of your Natural Capital Assessment, you will have a table of ecosystem asset to priority sector links. This reveals the flow of ecosystem services from ecosystem assets, and how and where these services are realised by priority sectors (and any vulnerable beneficiaries) within the planning unit. Revealing these dependencies provides vital information for landscape planning decisions in order to maximise the long-term benefits realised from these assets. This also helps decision-makers to account for the specific needs of vulnerable groups with high dependencies on ecosystem assets.

Constructing Table 7 in a spreadsheet package, such as Excel, allows the links between ecosystem assets and priority sectors to be explored from different perspectives. Data sorting functions can be used to rapidly organise information on the basis of sectors, ecosystem assets, ecosystem services and beneficiary groups. In Step 5, the drivers of change for ecosystem assets and their ability to provide ecosystem services are identified.

5.4.4 Key resources

Some useful resources for characterising priority sector dependencies on ecosystem services for a Natural Capital Assessment include:

- Millennium Ecosystem Assessment (MA, 2005)
- The Economics of Ecosystems and Biodiversity (TEEB) reports (www.teebweb.org), including the forthcoming 'TEEB for Agriculture and Food'
- Intergovernmental Platform on Biodiversity and Ecosystem Services (www.ipbes.net)
- Sub-Global Assessment (SGA) Network (http://ecosystemassessments.net)
- UN System of Environmental Economic Accounting (SEEA) for Water, monitoring framework for the water sector
- Common International Classification of Ecosystem Services (CICES) (http://cices.eu/)
- Final Ecosystem Goods and Services Classification System (FEGS-CS) (http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=257922)

Checklist	✔
Key actions	
Map priority sector activities and vulnerable beneficiaries using a participatory approach	
Locate priority sector activities and any associated vulnerable beneficiary groups	
Construct the conceptual model of priority sector to ecosystem asset linkages	
Identify which ecosystem assets are delivering the ecosystem services that provide priority sector inputs and/or enhance priority sector performance	
Identify important ecosystem services for priority sector performance	
Identify where important ecosystem services are providing inputs into priority sector activities	
List specific priority sectors using important ecosystem services	
Identify the location of any vulnerable beneficiary groups	
Review if, how and where ecosystem services provided by ecosystem assets can be substituted in the planning unit	
Stakeholder engagement	
As required, develop strategies for participatory approaches that allow stakeholders to validate data and fill any gaps	
Include scoping sessions for Step 4 into the initial stakeholder workshop in order to establish key working and user groups	
Communication	
Consider the results of Step 4 in indicator development for communication (as discussed in Steps 6 and 8)	
Capacity building	
Use the support of natural scientists and experts in ecosystem modelling, or provide training for such modelling	

5.5 STEP 5: IDENTIFY PRIORITY SECTOR IMPACTS ON NATURAL CAPITAL

Step 4 establishes the dependencies of priority sectors and beneficiaries on natural capital. Step 5 carries out an assessment of priority sector impacts on ecosystem assets, giving specific consideration to identifying the direct sectoral drivers that result in natural capital degradation and accumulation (or improved access to natural capital benefits). This is key to informing the sustainable use of natural capital in the planning unit. The importance of indirect and external drivers of impacts on natural capital is also covered.

By the end of Step 5 you should be able to answer the following key questions:

- What are the negative impacts of priority sector activities on ecosystem assets?
- What are the positive impacts of priority sector activities on ecosystem assets?
- What are the implications of indirect drivers for priority sector impacts on natural capital in the planning unit?
- What are the implications of external drivers (i.e. beyond the planning unit) for priority sector impacts on natural capital in the planning unit?

Defining drivers and impacts

In the context of this guide, 'impacts' are considered to be the resulting effects of sectoral activities (or those brought about by any actor(s)) on ecosystem assets and/or ecosystem services, encompassing both negative and positive effects.

The Natural Capital Coalition (Natural Capital Coalition, 2015) provide the following definition which serves to underpin our use of the term 'impact' in this guide: "Natural Capital Impact: the negative or positive effect of business activity on natural capital. The effect can be an increase or decrease, as well as the consumption or restoration, of natural capital."

These impacts are brought about, or influenced by, various 'drivers'. There are several well-defined examples of what drivers are. Firstly, the Millennium Ecosystem Assessment puts forward that a driver is "any natural or human-induced factor that directly or indirectly causes a change in an ecosystem" (MA, 2005). Secondly, UNEP's fifth Global Environment Outlook states that drivers are "the overarching socio-economic forces that exert pressure on the state of the environment" (UNEP, 2012a); for example, economic processes like consumption and production. Finally, it is useful to consider the definition in use by the Natural Capital Coalition with specific reference to natural capital which states that an 'impact driver' is "a measurable quantity of a natural resource that is used as an input to production (e.g. construction materials) or a measurable non-product output of business activity (e.g. emissions). Impact drivers are generally expressed in quantitative units (e.g. kg, cubic metres, hectares etc.) and may already be included in company non-financial reporting or generated through life-cycle assessments" (Natural Capital Coalition, 2015).

It is also commonplace to discuss drivers in the context of their action or function upon ecosystems. Again, referring to the definitions set out in the Millennium Ecosystem Assessment, these are described as 'direct drivers' – "a driver that unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy"; and 'indirect drivers' – "a driver that operates by altering the level or rate of change of one or more direct drivers" (MA, 2005).

Some examples of direct and indirect drivers:

Examples of direct drivers:

- Habitat changes (driven through land-use/ land cover change, physical modification of rivers, or water withdrawal from rivers)
- Overexploitation
- Invasive alien species
- Pollution
- Climate change

Examples of indirect drivers:

- Population change (demographic drivers)
- Change in economic activity (economic drivers)
- Socio-political drivers
- Cultural (and religious) drivers
- Technological change (science and technology)

5.5.1 Assess negative sector impacts

Sectoral activities can negatively impact on natural capital in multiple ways. However, there will be common, direct impacts that are generally consistent across ecosystem assets in the planning unit – these are direct drivers. Based on the UK NEA (2011), the following list of direct drivers of natural capital change is a useful starting point for considering these negative sectoral impacts :

- Land-use/habitat change
- Pollution and nutrient enrichment
- Overexploitation/over-harvesting
- Invasive species (e.g. inadvertent introduction though aquaculture)

It is important to remember that drivers affect natural capital at different spatial and temporal scales. This means that important drivers at one time and place, might not be important at a smaller (or larger) scale, or over longer (or shorter) time periods. As such, your assessment of sectoral impacts should be based on spatially explicit data. Modelling analysis will also be required in order to understand the temporal implications of these impacts.

Depending on the planning unit context and the scale of your Natural Capital Assessment, it may be necessary to expand the list of direct drivers to capture other direct drivers that are impacting the status and resilience of the ecosystem assets you identified in Step 1. Again, using a participatory process for this is essential to ensure the assessment is credible, legitimate and relevant. Some questions that can assist in the identification of direct drivers include:

- What has affected natural capital and ecosystem services in the past?
- Are there any policies or subsidies that affect these drivers?
- What are the drivers that cause gradual changes in the assets?

Once you have produced a list of drivers, you can identify those sectors from which the drivers originate. Here, the cause-effect relationship between drivers of negative natural capital impacts and priority sector activities can be analysed. Desk-based research can help in identifying such relationships; for instance, UNEP and WWF (2013) evaluate drivers of natural capital impacts from specific sector perspectives. Finally, review the information you collected in Step 3 to establish an evidence base for the drivers of priority sector impacts:

- Land cover maps will reveal land-use change driven by certain sectors (e.g. agriculture and transport).
- Environmental monitoring data and remote sensing can identify evidence associated with pollution (e.g. water quality monitoring) and nutrient enrichment (e.g. images of algal blooms) from sectoral activities.
- Economic data can be used to assess where overexploitation by sectors may have led to decreasing yields (e.g. unsustainable timber harvesting in the forest sector).
- Biodiversity monitoring can reveal if sectoral activities have contributed to invasive species proliferation (e.g. for aquaculture (Naylor et al., 2001)).

Engaging stakeholders in this process will help you to prioritise negative priority sector impacts for action. Thus, resources can be targeted at addressing those impacts that are most relevant to the planning unit. Stakeholder engagement is also essential for confirming whether these impacts are significant and whether they are being encountered by stakeholders within the planning unit.

5.5.2 Assess positive sector impacts

Identifying sectoral activities that result in accumulation, conservation, or improved access to natural capital and its benefits is important for formulating policy responses that enable a transition to a green economy. In particular, it is helpful for targeting the expansion of the 'green jobs' market. Promoting and expanding the ecotourism sector in a sustainable manner, for instance, can support funding for Protected Areas and improve ecosystem services delivery, such as soil stabilisation and fresh water provision. For each priority sector (both for formal and informal economic activity), consider the following:

- Does the priority sector positively impact on the ability of any ecosystem assets to deliver ecosystem services (i.e. does it contribute to increasing stocks of natural capital)?
- Does the priority sector impact enhance the ability of other priority sectors or key beneficiaries to benefit from ecosystem services provided by ecosystem assets in the planning unit? What are these ecosystem services?

Stakeholder engagement is fundamental in confirming that proposed positive sectoral impacts for natural capital are actually experienced 'on the ground' within the planning unit.

5.5.3 Consider indirect drivers impacting natural capital

Indirect drivers are those that alter rates of change associated with the direct drivers of natural capital impacts. These can include population change, change in economic activity, socio-political drivers (such as changing regulations), cultural drivers and technological drivers (UK NEA, 2011). Understanding how these indirect drivers are likely to interact with direct drivers is complex and will depend on the planning unit context. Nonetheless, it is important to put natural capital impacts and their direct drivers in context against a background of indirect drivers whose impact will vary both spatially and temporally. To confirm the relevance of indirect drivers at your planning unit scale, ask the following:

- How will population growth affect direct drivers of sectoral impacts on natural capital?
- What are the implications of changing consumption patterns and market forces on direct drivers of sectoral impacts on natural capital?

Understanding the key interactions between indirect and direct drivers is important for selecting which sector impacts to manage in the transition to a green economy. You may be able to access national level studies to support this assessment, such as studies of future demand for sectoral outputs or demographic forecasts.

5.5.4 Consider external drivers impacting natural capital

In addition to impacts arising from priority sector activities within the planning unit, there may be external drivers that present potentially significant risks to sector activities. One such driver is climate change, which has a global impact on natural capital, and poses risks like drought, flooding and changing biological assemblages. Analysis of different climate change scenarios can provide insight into which ecosystem assets – and, therefore, which economic sectors – are likely to be most affected. Maintaining and enhancing stocks of natural capital (specifically, ecosystems and biodiversity) is a well-recognised adaption strategy to help people adjust to the adverse effects of climate change (Doswald and Osti, 2011). This Ecosystem Based Adaptation (EBA) is also an essential strategy for building resilience in the landscape to deal with other internal and external shocks. In turn, this reduces future risks to the value of natural capital, and promotes and diversifies employment and livelihood opportunities in the planning unit.

Beyond common or global drivers, there may be external drivers specific to the planning unit context that require consideration. In particular, some priority sector activities within the planning unit may be dependent on ecosystem service flows originating from outside of the planning unit. For example, CSIRO (2008) found that the impact of water resources development in the River Murray, Australia, has reduced flow at the river mouth by 61%. Such continuing trends present a significant risk to biodiversity in the area, as well as the agriculture and water sectors. Impacts brought about by such drivers are also likely to be exacerbated by climate change (CSIRO, 2008).

Once you have completed Step 5 of your Natural Capital Assessment, you will have a list of negative and positive priority sector impacts for the planning unit. In addition, you will have established a background of indirect and external drivers of natural capital impacts facing the planning unit. Finally, you will have assessed the relative importance of priority sector impacts in conjunction with indirect and external drivers relevant to the planning unit, and considered the potential of such drivers to exacerbate impacts in the future. It is important that you document and disseminate this information as part of a wider communication strategy to gain support for a transition to a green economy. Engage with stakeholders throughout Step 5 in order to prioritise those sector impacts requiring sustainable management.

5.5.5 Key resources

The following key resources may provide additional useful information on drivers and impacts for use in this step:

- Millennium Ecosystem Assessment (MA, 2005). Ecosystems and human well-being: A framework for assessment. Washington, D.C.: World Resources Institute. Chapter 7: Drivers of Ecosystem Change.
- UK NEA (2011). UK National Ecosystem Assessment Technical Report. UNEP-WCMC, Cambridge. Chapter 3: The Drivers of Change in UK Ecosystems and Ecosystem Services.
- UNEP & WWF, 2013. TEEB Scoping Study for Georgia. United Nations Environment Programme (UNEP), Geneva, Switzerland.

Checklist	✔
Key actions	
Assess negative priority sector impacts by identifying direct drivers	
Assess positive priority sector impacts	
Consider indirect drivers that impact natural capital	
Consider external drivers that impact natural capital	
Stakeholder engagement	
Engage with stakeholders to identify a list of the drivers of negative priority sector impacts on natural capital in the planning unit	
Engage with stakeholders to identify which priority sector activities have a positive impact on natural capital in the planning unit	
Consult with stakeholders to identify a list of natural capital impacts for management in order to account for the implications of indirect and external drivers	
Communication	
Document and disseminate priority sector impacts on natural capital, and their drivers, as part of a wider communication strategy to gain support for green economy transition	
Capacity building	
Consider employing mapping and/or GIS specialists to help in the spatial assessment of data regarding priority sector impacts on natural capital	

5.6 STEP 6: ESTABLISH THE STATUS AND TRENDS IN NATURAL CAPITAL

Natural capital has been consumed, converted or degraded at a rate that now threatens both future economic growth and well-being (UNEP, 2007). As ecosystems continue to be used unsustainably, and natural capital stocks are reduced further, societal challenges associated with the loss of benefits from nature will rise, along with the likelihood of surpassing critical ecological thresholds or "tipping points" (ten Brink et al., 2012). Against this background, understanding and communicating the status and trends of natural capital can support decision-making across a broad range of social, environmental and economic domains, and aid a transition to a green economy. To this end, Step 6 focuses on how to select and determine biophysical indicators for communicating the status and trends of natural capital and identifying natural capital related issues. It should be appreciated at the outset that it may take you several iterations to generate a suitable set of natural capital indicators to guide a green economy transition.

By the end of Step 6 you should be able to answer the following key questions:

- Which indicators can communicate the status and trends of natural capital in the planning unit?
- What are the status and trends in natural capital?
- Which ecosystem assets are in a condition that places them at risk of crossing ecological thresholds?
- How can valuation help communicate the status and trends in natural capital?
- How can natural capital accounting help communicate these status and trends?

Using a tiered approach to analyse the status and trends of natural capital can be helpful in order to build on the assessment outputs achieved so far (Figure 10). This can help to determine biophysical indicators for natural capital (Tier 1), and identify the role of valuation of natural capital and its benefits (Tier 2). You can apply this tiered approach to both Steps 6 and 8 of your Natural Capital Assessment. While providing specific guidance on valuation in Tier 2 is beyond the scope of this guide, the use of the approach is reviewed, and an indication of useful resources is provided if you wish to extend the assessment further in this direction (Step 8, section 5.8.2). It should be appreciated, however, that reducing the assessment to a value metric may not always be the most useful approach to support decision-makers.

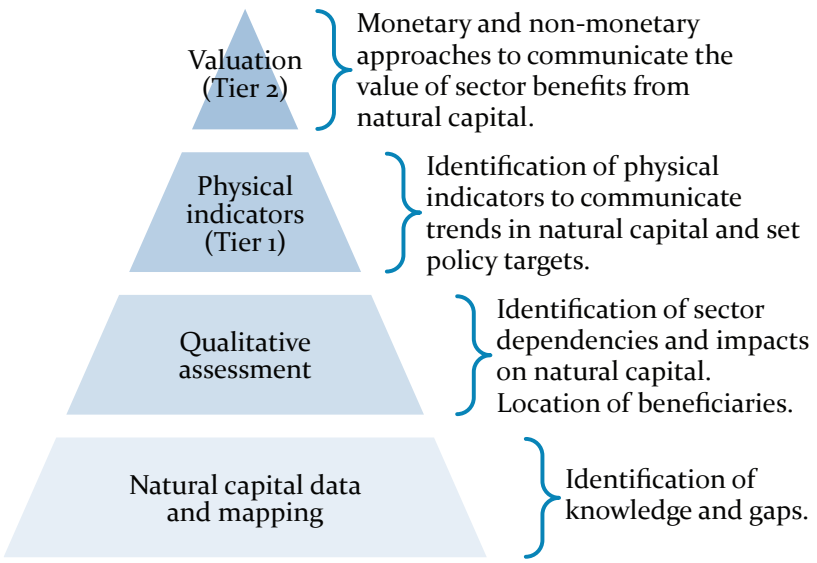


Figure 10: Tiered approach to Natural Capital Assessment (adapted from ten Brink, 2008)

Finally, given the commitment of a number of countries to construct natural capital accounts, this guide offers a brief review of existing approaches. The usefulness of accounting approaches, such as SEEA, is their capacity to generate integrated indicators for decoupling economic growth from natural capital degradation and resource efficiency (UN, 2012).

5.6.1 Determining indicators for Natural Capital Assessment (Tier 1)

Natural Capital Assessments mobilise significant amounts of data. To simplify the complexity of communicating these sector-environment interactions, 'indicators' can be employed to support specific management purposes (Müller and Burkhard, 2012). UNEP (2014d) characterises an indicator as an instrument that describes and/or gives an order of magnitude to a given condition (or phenomenon). Indicators provide current and historical information on the state of a system and are particularly useful for highlighting causal relationships between different components of that system (Box 15). Using existing indicators, identified through the desk-based review conducted in Step 1, can support coherent policymaking and serves to rationalise expenditure and effort.

Determine indicators to communicate the status of natural capital

The approach to assessing natural capital within this guide is based on the extent, condition and services delivered by ecosystem assets (SEEA-EEA, 2014). As such, the status of natural capital within a planning unit should be determined based on measures related to these characteristics. Use the following broad actions to determine relevant indicators for your Natural Capital Assessment:

1. Review the data gathered in Step 3, and summarised in Step 4, to confirm the distribution and types of natural capital in the planning unit.
2. Review the data gathered in Step 3 to confirm the condition of natural capital in the planning unit (e.g. soil quality, pollution levels and biodiversity).
3. Draw up a list of ecosystem assets relevant to the key goals established in Step 1.

The set of indicators you determine through this process may be relatively simple, spatial indicators, such as area of forest loss. Alternatively, you may require more complex indicators based on indices of biodiversity and ecosystem service quality, such as the Norwegian Nature Index. The indicators you decide on will be context dependent. Things to consider when determining indicators include:

- the existence of a reference condition, or condition for comparisons over time; and
- consistency in units when data is aggregated in the same indicator (Brown et al., 2014).

The availability of appropriate 'reference conditions' (or baseline) for the chosen indicators is essential to establish the relative measure of natural capital condition over time and to communicate its current status. There is no universally suitable approach to determining reference conditions. The SEEA-EEA (2014) suggests the reference condition should include information on a state of minimal human disturbance. Yet, in many cases (much of Europe, for example), it may be impossible to estimate such reference conditions due to the long history of human development. Alternatively, a reference condition can be established on the basis of a historical benchmark where time-series information exists; for example, the Living Planet Index (LPI) uses conditions observed in 1970 as the reference (McRae et al., 2008). Another approach involves using context, rather than historical data, as a reference; for instance, is the status of natural capital in the planning unit catchment in line with the rest of the country? What is the relative difference between the current condition of natural capital in the planning unit and a relevant baseline? Alternatively, a socially aspirational target could be adopted for the reference condition, possibly based on specific policy targets derived in Step 8.

Box 15: Characteristics of successful indicators

Participants in a 2010 Biodiversity Indicators Partnership (BIP) capacity building workshop identified that a successful indicator should be:

- Scientifically valid
- Based on available data (important for capacity building, allowing easy generation of the indicator on a regular basis)
- Responsive to the change in the issue of interest (important for communicating trends)
- Easily understandable
- Relevant to the user's needs
- Used!

(Biodiversity Indicators Partnership, 2011)

Determine indicators to communicate trends in natural capital

Following the approach adopted by UNEP (2014d), base indicators to communicate changes in natural capital on both trends in status and trends in impacts. Both of these should be based on a time-series of observations.

The set of indicators you select to communicate trends in natural capital may match, or be closely aligned with, the indicators you have already established to communicate the status of natural capital. For instance, establishing the status of natural capital compared to a reference condition provides a basis for identifying trends in that status. However, current and reference observations alone are not sufficient for analysing trends or the potential impacts of recent decision-making on natural capital in the planning unit.

For some natural capital stocks, decreasing trends will be a concern (such as species loss), whereas, for other stocks, increasing trends may be a worry (such as increasing levels of water abstraction). As well as looking at trends of concern, it is important to identify any positive trends in natural capital that may be occurring in the planning unit, such as an increase in forested area in recent years.

To assess negative and positive impact trends you will need to make direct use of the assessment of priority sector impacts completed in Step 5. Specifically, review Step 5 to detect causal relationships between a trend observed in priority sector activities and an impact on natural capital. As an example, use of fertiliser (tonnes) by the agricultural sector could be a useful (proxy) indicator to help explain trends in water quality, where nitrate enrichment of surface waters is an identified trend of concern. Alternatively, expansion of a sustainably managed forest sector could be a positive impact trend. It is important to establish if there are single or multiple sectors driving these trends, and which sectors have the highest impact.

Summarise the status and trends of natural capital

Once you have determined a list of suitable indicators for ecosystem assets in the planning unit, prepare a concise summary of status and trends of natural capital for the planning unit. This will form an important part of communicating the results of the Natural Capital Assessment and will help to engage stakeholders in prioritising actions.

Box 16 presents an example of a set of indicators for communicating natural capital issues.
At this stage of the assessment, give further consideration to the use of modelling in order to interpolate future trends in natural capital, or to back-cast in order to fill data gaps. These types of approaches can be used to inform indicators for both trends and impacts.

Box 16: An example of a set of indicators for the forest sector, Ghana

Ghana has the highest deforestation rate in Africa. This presents a major threat to sustainable development within the country, and reducing forest loss has become a national priority. In order to monitor deforestation trends, the following set of indicators were developed:

- Annual deforestation rate (%)
- Percentage wood of total fuel used by the energy sector (% of total)
- Expansion of land used by agricultural sector (% of total land)

(UNEP, 2015)

5.6.2 Scope ecosystem assets for threshold risks

Figure 2 (Section 2.1) provides a stock-flow framework for natural capital benefits. But this masks the complexities of ecosystems that may be subject to condition thresholds or ecological tipping points, beyond which ecosystem service delivery collapses. In situations characterised by such non-marginal changes and uncertainty, it may be prudent to rely on a 'precautionary principle' for management, and establish safe minimum standards or other regulatory mechanisms, rather than rely on economic instruments associated with green economic policies (TEEB, 2010b).

In this sub-step, ecosystem assets within the planning unit should be scoped out for their risk of breaching such tipping points or condition thresholds. Understanding these risks is crucial for establishing safe operating spaces within which the economy and society can develop. These thresholds will be particularly relevant for natural capital which is not easily substituted (identified in column 5 of the conceptual model you constructed in Step 4, Section 5.4.2), so prioritise these assets for the scoping assessment.

The Natural Capital Asset Check (NCAC) (Dickie et al., 2014), developed under the UK NEA Follow-on Project, provides a useful and structured approach to organise information on whether thresholds are in danger of being crossed. Given the existence of thresholds for biodiversity and the delivery of ecosystem services (Luck et al., 2009), and its role in ecosystem resilience, biodiversity should be considered a particularly critical characteristic of ecosystem assets in the planning unit. Figure 11 sets out the steps of the NCAC. The 'asset performance' step allows the user to consider whether the delivery of an ecosystem service from an ecosystem asset is likely to collapse. Where information suggests this is a possibility, a warning should be raised (termed a 'Red Flag') (Box 17).

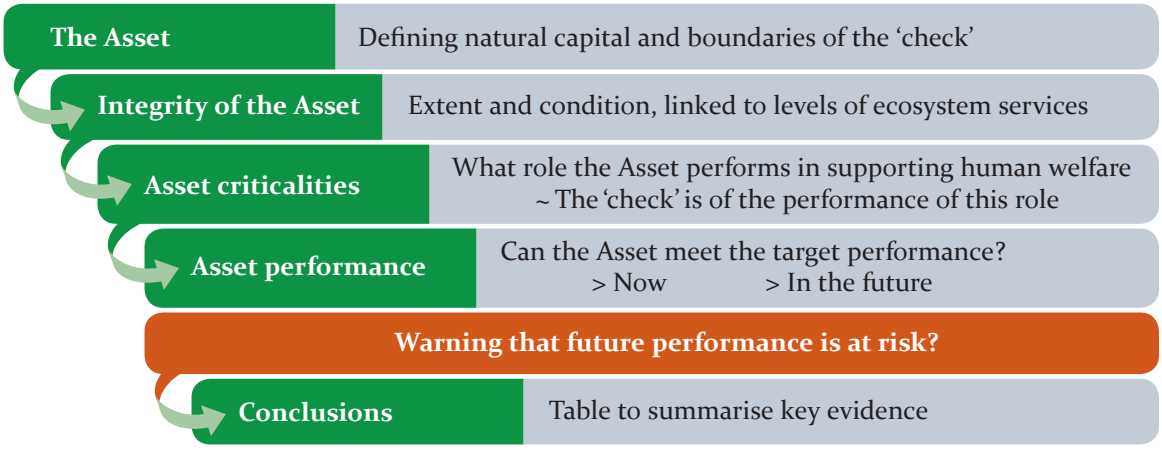


Figure 11: Summary of the Natural Capital Asset Check (NCAC) (Dickie et al., 2014)

The NCAC process is data hungry and is likely to require expertise from both natural and social scientists. Nonetheless, this should not prevent you from broadly scoping which ecosystem assets within the planning unit may require further assessment, or which should be protected or enhanced purely on precautionary grounds (e.g. establishing Protected Areas). Key questions that can help you perform this scoping exercise are:

- Is the current status of natural capital particularly poor?
- Are concerning trends in natural capital taking place at an increasing rate?
- Are these concerning trends associated with characteristics closely related to ecosystem functioning (e.g. biodiversity)?
- Are any critical levels for the ecosystem asset established within the planning unit or in other contexts (e.g. minimum viable populations, minimum flow regimes, etc.)?
- Is the provision of ecosystem services from the ecosystem asset likely to be sustainable over the long-term (particularly in the face of expected changes, such as climate change or development plans)?

Box 17: An example of an assessment of the UK's salt-marsh ecosystem asset (Dickie et al., 2014)

The extent and condition of coastal salt-marsh in the UK continues to decline, and the majority of commercial fish stocks continue to be overexploited. The declining trend in fish stocks suggests that the current management measures in place are not resulting in sustainable use of this resource. This poses a threat to the future of some commercial fisheries in the UK. The risk is that the incidence of suitable salt-marsh nursery grounds with sufficient spawning stock biomass may decline, thus leading to stock collapse; this results in a 'red flag'. However, uncertainties remain around the resilience of fish stocks to salt-marsh nursery ground collapse. While coastal salt-marsh can be recovered through managed realignment, the complexity of ecological food webs means that reintroducing habitat may not lead to resurgence in fish stocks. The impact on other ecosystem services from deteriorating salt-marsh (and, therefore, the need for further 'red flags') in these areas is unclear.

Once you have scoped ecosystem assets to see if they risk breaching thresholds, or if they are unable to meet ongoing needs, create a list of priority ecosystem assets for further assessment or protection. Include these priorities in the communication strategy for your Natural Capital Assessment. Engage with stakeholders to prioritise specific ecosystem assets for assessment or precautionary action in Step 8. You may find it necessary to use specialists to perform the NCAC if this capacity does not exist within the assessment team.

5.6.3 Extending the assessment: the role of valuation in communicating status and trends in natural capital (Tier 2)

The failure to account for the full economic value of ecosystems and biodiversity has been a significant factor to their continued degradation (MA, 2005). Undervaluing natural capital benefits can lead to investment decisions that exacerbate this degradation, which can, in turn, negatively impact on a range of economic and social objectives (TEEB, 2010b). The purpose of Tier 2 is to mobilise the necessary information to reveal the relative value of these impacts. These values can provide powerful information for communicating the benefits of different states of natural capital and the economic impacts of negative trends in natural capital stocks; they can also show the positive economic returns realised from investing in natural capital. It should be noted that the focus of such valuations is on the change in ecosystem service flows arising from changes in natural capital stocks (Turner et al., 2003). Therefore, the implications of crossing thresholds are not, generally, captured in valuation frameworks.

Several synthesis documents on valuation approaches are available; for example, TEEB (2010a) provides an excellent and comprehensive review of valuation methodologies available to the practitioner. If you wish to extend your Natural Capital Assessment to include Tier 2, you may require specialists in order to produce a thorough valuation of natural capital benefits for the planning unit. Valuation assessment is an iterative approach between the physical data assessed in Step 6 and the economic impacts considered in Step 8

5.6.4 The role of natural capital accounting in communicating status and trends in natural capital

One major concern with the current System of National Accounts (SNA) is the focus on the measurement of economic activity and the failure to consider the true economic implications of natural capital depletion and degradation (Obst and Vardon, 2014). While the SNA framework provides capacity to organise information on the stocks of some forms of natural capital, traditionally, countries have focused on measures of flow (in particular, GDP) that do not account for the degradation of natural capital. In recognition of the interest in understanding economic and environmental interactions, the UN Statistical Commission has developed the System of Environmental-Economic Accounting (SEEA) as a statistical framework to extend the SNA.

The SEEA is designed to generate a wider range of statistics and indicators to monitor interactions between the economy and the environment. As such, the SEEA can be very useful for revealing trends in the use of natural capital by economic activities, and can help to monitor progress towards a green economy. Relevant environmental and impact measures that the SEEA establishes include (UNSD, n.d.):

- Stocks of natural resources
- Emissions to the environment and waste generation
- Land-use and land cover
- Expenditure on environmental protection and resource management
- The condition and health of ecosystems
- Regulatory services provided by ecosystems

Other natural capital accounting initiatives exist, including: WAVES (Wealth Accounting and the Valuation of Ecosystem Services), developed by the World Bank and focusing on ecosystem services; work by UNEP's Division of Environmental Policy Implementation (UNEP-DEPI) relating to particular ecosystems or specific contexts, for example, the *Guidance manual on valuation and accounting of ecosystem services for Small Island Developing States* (UNEP, 2014c); and the European Union (EU) Mapping and Assessment of Ecosystem and their Services (MAES) project, concentrating on ecosystem capital productivity and resilience. Given the specialist nature of these accounting processes, it is likely that you will require support to construct natural capital accounts for your planning unit.

Step 6 of the Natural Capital Assessment generates a comprehensive set of indicators to communicate the status and trends of natural capital in the planning unit. These indicators are important for both communicating issues with wider audiences, and developing targets for natural capital management that align with a transition to a green economy. The development of these indicators is supported by assessing ecosystem assets to identify those that are at risk of approaching, or breaching, thresholds; such assets may require a precautionary management approach to ensure that they continue to provide ecosystem services in the long-term.

5.6.5 Key resources

Useful resources for natural capital and ecosystem services valuation include:

- UNEP The Economics of Ecosystems and Biodiversity (TEEB) (http://www.teebweb.org/)
- UNEP Ecosystems Services and Economics (http://www.ese-valuation.org/)
- Wealth Accounting and the Valuation of Ecosystem Services (WAVES) (http://www.wavespartnership.org/)
- The Natural Capital Project (http://www.naturalcapitalproject.org/)
- The Environmental Valuation Reference Inventory (https://www.evri.ca/Global/Splash.aspx)
- Natural Capital Asset Check (NCAC) (Dickie et al., 2014)

Useful resources for natural capital accounting include:

- UN System of Environmental Economic Accounting (SEEA) (http://unstats.un.org/unsd/envaccounting/seea.asp)
- UNEP TEEB Advancing Natural Capital Accounting project (http://www.teebweb.org/areas-of-work/advancing-natural-capital-accounting/)
- Wealth Accounting and the Valuation of Ecosystem Services (WAVES) (http://www.wavespartnership.org/)
- European Environment Agency (http://www.eea.europa.eu/ – search 'ecosystem accounting')
- UNEP's Valuation and Accounting of Natural Capital for Green Economy (VANTAGE) initiative
- CBD Ecosystem Natural Capital Accounts (www.cbd.int/doc/publications/cbd-ts-77-en.pdf)

Useful resource for indicator development:

- Guidance for national biodiversity indicator development and use (Biodiversity Indicators Partnership, 2011)

Checklist	✔
Key actions	
Tier 1: Determine indicators for Natural Capital Assessment	
Determine indicators to communicate the status of natural capital	
Determine indicators to communicate trends in natural capital	
Summarise the status and trends of natural capital	
Scope ecosystem assets for threshold risks	
Consider extending the assessment to include the role of valuation and natural capital accounting in communicating status and trends in natural capital	
Stakeholder engagement	
Capture a list of natural capital status and impact indicators for prioritisation with stakeholders (to be validated in conjunction with Step 8 outputs)	
Capture a list of ecosystem assets in the planning unit in danger of breaching thresholds for prioritisation with stakeholders	
Communication	
Provide a clear assessment of the current levels of natural capital indicators and their trends (these will be linked to implications for formal and informal economic activities in the planning unit in Step 8)	
Capacity building	
Consider building capacity, or employing specialists, to assist in scoping ecosystem asset checks	
Consider building capacity, or employing specialists, to assist in undertaking valuation of natural capital benefits in the planning unit	
Consider building capacity, or securing technical support, to assist in constructing natural capital accounts for the planning unit	

5.7 STEP 7: USE SCENARIOS TO ASSESS FUTURE CHANGES IN NATURAL CAPITAL

Step 7 explores how scenarios can be used in forward-looking assessments of natural capital to support decision-making at sub-national or larger scales.

By the end of Step 7, you should be able to answer the following key questions:

- What is the purpose and goal of the scenarios exercise?
- At what scale(s) will you develop the scenarios?
- How would you describe the storyline(s) of the plausible futures?
- Is it appropriate to consider the impacts of climate change in the scenarios?
- How will stakeholders be consulted in the process of developing scenarios?
- How might natural capital change under plausible scenarios?
- How will the results of the scenarios' analysis be communicated?

Scenarios can be defined as "plausible and often simplified descriptions of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships" (MA, 2005). Scenarios provide a structured approach to address the uncertainties and complexities of exploring the impacts of future events on ecosystem service delivery at different scales (Ash et al., 2010).

In assessments of this sort, the term 'scenario' is used to refer to a combination of plausible futures, and potential policy and management interventions (IPBES, 2016). Qualitative scenarios are based on narrative descriptions – phrases, storylines or images – of plausible future circumstances. In comparison, quantitative scenarios present tables, graphs and maps of plausible future circumstances, based on simulation modelling tools that use numerical estimates (Ash et al., 2010).

5.7.1 Determine the purpose of the scenarios exercise

Scenarios can be designed for different purposes, so it is important to have a clear understanding of the goals of a scenarios exercise from the outset. Table 8 gives examples of the different ways that scenarios can help to explore how natural capital might change in the future. Fancourt (2015) provides more information on the different types of scenarios. By defining policy questions for the analysis to examine, it will help to guide you in the entire process of developing your scenarios.

Table 8: Different types of scenarios and their uses (Haines-Young et al., 2014)

Purpose of the scenario	What does the scenario achieve?	Example framing question for scenario analysis
Understanding and knowledge generation	• Compares the implications of different assumptions about the drivers of change. • Identifies plausible futures (rather than making specific predictions).	*What can happen?*
Developing common goals, visioning	• Defines a vision/goal for the future. • Explores the steps/path by which the vision/goal could be realised. • Compares the vision/goal against a baseline ('business as usual') or alternative trend.	*How can a desired or agreed outcome be delivered?*
Communication, shared understanding	• Uses plausible scenarios to illustrate the different possibilities for the future or the consequences of different trends and choices.	*What are the key issues or trends that needs to be considered?*
Policymaking, policy evaluation	• Compares the implications of different policy options (e.g. 'policy on' vs 'policy off' situations). • Assesses consequences and/or risks of policy proposals as part of an impact assessment. • 'Stress tests' policy measures or interventions in different contexts ('wind-tunnelling').	*What if?*
Planning and management	• Compares the implications of different management or planning strategies (often analysis is spatially explicit). • 'Stress tests' management or planning measures or interventions in different contexts ('wind-tunnelling').	*What if?*

5.7.2 Adapt storylines from existing scenario analyses

Many scenarios exist in the literature of biodiversity and ecosystem assessments (MA, 2005; UK NEA, 2011; UNEP, 2012a). Although the names of these scenarios may vary, there are some commonalities in their storylines. These plausible socio-economic scenarios are based on a different set of assumptions about future trajectories in key factors, such as population growth, economic development, environmental protection and technological development. For example, six storylines were developed for the UK NEA (2011) scenarios:

- **Go With The Flow** – society carries on with business as usual, based on the current situation in the system.
- **Green and Pleasant Land** – society adopts a preservationist attitude towards UK ecosystems.
- **Nature at Work** – society promotes ecosystem services through the creation of multifunctional landscapes.
- **Local Stewardship** – society strives to be sustainable within its immediate surroundings.
- **National Security** – society promotes greater reliance on self-sufficiency and efficiencies.
- **World Markets** – society strives for economic growth and the elimination of trade boundaries.

Since developing storylines from scratch can be very time and resource intensive, it may be more efficient for you to explore and adapt storylines from existing scenarios analyses (e.g. UK NEA (2011), and Southern African Sub-Global Assessment (SAfMA) (Biggs et al., 2004) [Box 18]) to the context of your Natural Capital Assessment. The number of storylines you need will depend on the goal you have set for the scenarios analysis, and will also be guided by resource availability. Having more than one scenario will enable you to compare results between scenarios and examine trade-offs. Indeed, such comparisons can help to identify the potential ecosystem service trade-offs of alternative interventions and policies, serving to highlight unacceptable trade-offs. McKenzie et al. (2012) present advice on how many storylines to develop.

To adapt storylines, you will first need to consider the key drivers of change in natural capital (identified in Step 5) at the relevant scale of the scenario analysis (e.g. local, river catchment, national) within the boundaries of the Natural Capital Assessment. If your scenario analysis is being conducted at several scales, you may find that key drivers are common across the different scales. But by working with the input of different stakeholder groups to develop your storylines, you can capture the subtleties of local variation in the key drivers of change and plausible alternative futures (Biggs et al., 2004).

There are numerous methods you can use to create scenarios, such as a Bayesian Belief Network (BBN). A BBN is a framework that graphically represents the flow of information in a system, which can be used in a decision support context (Haines-Young et al., 2013). The approach was used in the UK NEA (2011) to express assumptions about spatial patterns of land cover change for the different scenarios (Haines-Young et al., 2011).

An overview of the main methods for developing scenarios, together with their advantages and disadvantages, is presented in Fancourt (2015). In addition, Methodological Assessment of Scenario Analysis and Models, produced as part of the IPBES process, includes a review of existing scenarios and models of ecosystems and is a useful resource to accompany this guide on Natural Capital Assessments.

5.7.3 Explore the impacts of climate change as part of the scenario development process

Depending on the agreed purpose of your scenarios exercise, it may be appropriate to develop plausible futures that assess the impact of climate change in order to inform climate adaptation planning or climate mitigation policy (McKenzie et al., 2012). There are several different approaches to developing climate change scenarios; for example, 'incremental scenarios' were used in the UK NEA's (2011) scenarios analysis to examine how ecosystems and their services might change under high and low levels of climate change. McKenzie et al. (2012) outline further resources for developing climate change scenarios.

5.7.4 Identify opportunities to engage stakeholders in the scenario development process

Scenario development is an iterative process, so you should seek input from stakeholders throughout. Participatory mapping approaches for scenario development allow you to integrate local stakeholder knowledge of how the system of interest works into your assessment (IPBES, 2016). Box 18 highlights how involving stakeholders was crucial to the development of the scenarios for the Southern African Sub-Global Assessment under the MA (2005).

Box 18: Engaging stakeholders in scenario development in Southern Africa

The Southern African Sub-Global Assessment (SAfMA) under the Millennium Ecosystem Assessment (MA) was conducted at multiple scales and included a scenario development component.

Stakeholder engagement during scenario development:

- ensured the scenarios were plausible representations of the future worlds in which they were being applied;
- raised awareness in local communities and with decision-makers about what could drive their futures and what they might do about it; and
- provided a framework for decision-makers to 'test out' their policies and management practices (Biggs et al., 2004).

Local-scale scenarios for the Gariep River Basin were developed to gain an understanding of potential futures and the uncertainties that may affect the basin, its ecosystems and their services, and the well-being of its inhabitants to the year 2030 (University Stellenbosch, 2004). Four different scenarios were developed: Fortress World, Local Learning, Market Forces, and Policy Reform (Biggs et al., 2004). These scenarios were adapted from the MA global scenarios and the SAfMA regional scenarios to ensure they were applicable at the basin scale. The four scenarios considered key uncertainties, such as the strength and effectiveness of national government, the strength and effectiveness of local government, national economic growth, wealth distribution, and national social and environmental policy. The SAfMA illustrates how scenarios can be applied across a range of scales by identifying common drivers of change.

5.7.5 Exploring how natural capital might change under different plausible futures

The idea of scenarios analysis within a Natural Capital Assessment context, is to explore how natural capital – specifically, ecosystem services – might change under different futures. There are various ecosystem services assessment tools available that incorporate scenarios analysis (Bagstad et al., 2013). One such tool is InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs), which was developed by the Natural Capital Project (Tallis et al., 2011). InVEST, which is free of charge, models and maps the delivery, distribution, and economic value of ecosystem services and biodiversity, and assists decision-makers in "visualising the impacts of decisions and identifying trade-offs and compatibilities between environmental, economic and social benefits" (WWF, n.d.). Scenario maps to compare how ecosystem services are affected under different possible futures can also be developed using InVEST's Scenario Generator (WWF, n.d.). Box 19 illustrates how InVEST has been applied to the Greater Virunga Landscape. McKenzie et al. (2012) provides a useful guide for practitioners on using InVEST to compare ecosystem service trade-offs under different scenarios.

Bagstad et al. (2013) detail other ecosystem service assessment tools; those that include scenarios and may be useful in a Natural Capital Assessment are: EcoServ, Co$ting Nature, Envision, EcoMetrix and ARIES.

Box 19: Using InVEST to model the future quantity and flow of ecosystem services in the Greater Virunga Landscape

The Greater Virunga Landscape crosses the borders of Uganda, Rwanda and the Democratic Republic of Congo. Here, the InVEST model was used by the Albertine Rift Conservation Society (ARCOS) to map key ecosystem services (timber, non-timber forest products, water yield, carbon, and sediment retention) that were identified by stakeholders in the region. In this study, future scenarios were created based on likely changes to land cover as driven by national development policies and strategies (e.g. poverty reduction strategy papers, vision documents and sectoral strategies) (ARCOS, 2012). Stakeholder input was used in the development of the three scenarios: 'Business as usual', 'Green Future' and 'Market Driven'; details of these scenarios are described in Kasangaki et al. (2012). InVEST was used to model the quantity and flow of key ecosystem services (Figure 12) under these three scenarios. For example, the results showed that planned oil exploration in different oil blocks in the Albertine Rift Graben will have a varying impact on water yield in the region. This study has been used to help gain government and stakeholder support for the conservation of ecosystem services and biodiversity in the region.

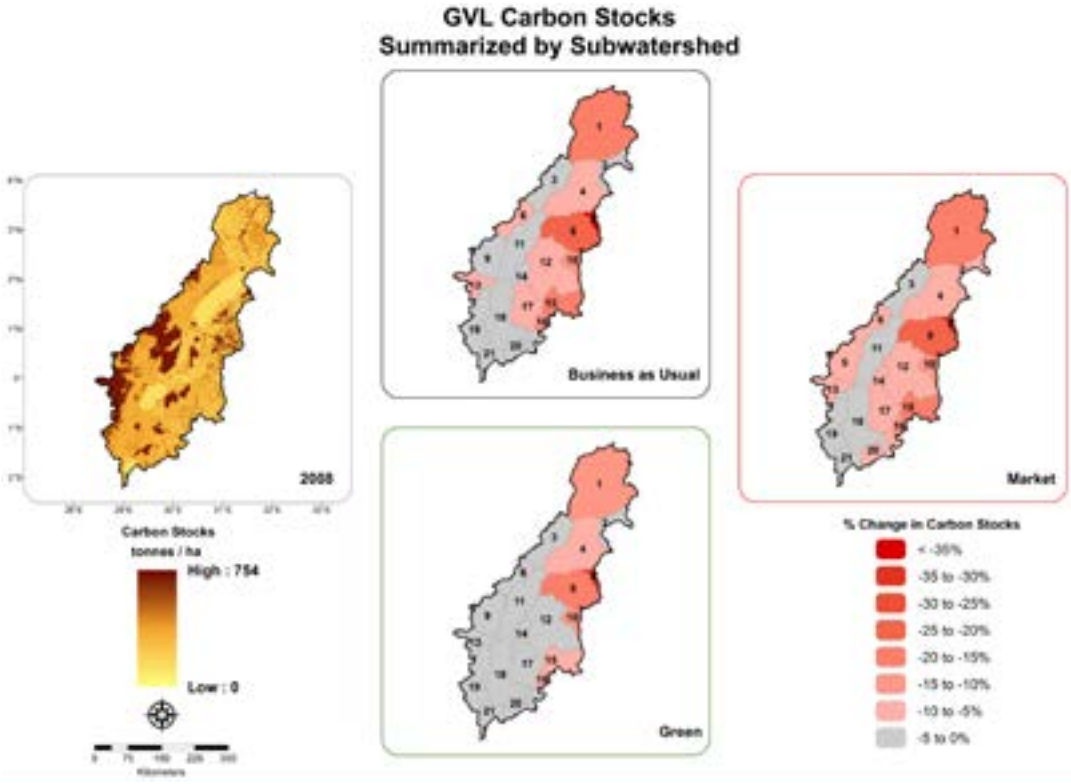


Figure 12: Change in water yield expected under different future scenarios (ARCOS, 2012)

Other studies exist that have specifically used scenarios to explore a region or country's transition into a green economy and how this might impact natural capital. For example, approaches that have been applied in Kalimantan, Indonesia, and South Africa are described in Box 20 and Box 21 respectively.

Box 20: Using scenarios to model a green economy vision in Kalimantan, Indonesia

Scenario development was used to "examine the likely costs, benefits and overall implications of a green economy approach" (Van Paddenburg et al., 2012) in Kalimantan, Indonesia. This exercise formed part of a broader report designed to support government-driven efforts under the Heart of Borneo (HoB) Initiative (which includes Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak)), to mainstream the value of natural capital into economic decision-making as a key element in establishing a green economy (Van Paddenburg et al., 2012).

A participatory approach was adopted to develop two scenarios (Table 9). 'Business-as-usual' was based on land cover and land-use datasets that included the locations of existing permits for forestry, palm oil and mining. In comparison, 'Green Economy' explored the implementation of various changes that recognised the value of natural capital and investing in it; these changes include: palm oil development being restricted to degraded areas; industries based on biodiversity being expanded; and reducing the application of fertilisers and pesticides.

Table 9: Sector-specific assumptions and policies used in the two scenarios (Van Paddenburg et al., 2012)

Theme	Business as Usual (BAU)	Green Economy (GE)
Spatial planning	Limited enforcement or reconciliation of land-use plans leads to deforestation and forest degradation	Coherent land-use plans including the creation of a category for degraded land, expanding community forests and implementation of watershed protection
Protected areas	Poorly managed protected areas lead to loss of biodiversity and fragmentation of natural habitats	Effective protection of natural habitats with improved connectivity among protected areas
Forestry	Widespread conventional logging and plantation within High Conservation Value Forest (HCVF) Areas with inactive forestry concessions result in degradation due to lack of management	Reduced logging, international certification of sustainable forest management, plantations limited to highly degraded or deforested areas that are not HCVF Concession management is improved. Inactive forestry land is protected to reduce degradation. Forest restoration concessions are implemented within natural forest areas following logging.
Palm oil plantation	Oil palm expansion is permitted in natural forest areas and HCVF No improvement in oil plantation management	Oil palm plantations do not expand in any area of natural forest. Land swaps for permits granted within natural forest, to ensure expansion on degraded land only. Roundtable for Sustainable Palm Oil (RSPO) ensures that management practices are improved, including improved fertiliser and pesticide application management
Mining	Mining causes forest degradation within concessions and air and water pollution	Mining follows international good practice guidelines, with improved waste management treatment reducing impacts on air and water quality
Agriculture	No improvement in agricultural practices, increasing reliance on chemical fertilisers, use of monocultures results in greater vulnerability to pests and diseases	Sustainable agriculture practices maintain and restore soil quality, use of chemical fertilisers is reduced, larger biodiversity gene bank provides wild varieties that may be hybridised to ensure greater resilience to pest and diseases

Theme	Business as Usual (BAU)	Green Economy (GE)
Energy	Energy consumption grows, reducing exports and increasing the cost of energy use Power is mostly generated from coal and other fossil fuels, limiting exports and generating GHG emissions	Increased energy efficiency reduces domestic consumption (especially of fossil fuels), renewable energy use expands, costs and impacts fossil fuel consumption are reduced Investments in non-hydro renewable energy power plants are implemented to decentralise power generation and to reduce consumption of coal for electricity supply and lower GHG emissions
Biodiversity-based enterprises	Limited infrastructure and support to advance biodiversity-based products such as NTFP and agro-forestry	Sustainable biodiversity products from legal community forests (NTFP and agro-forestry), bioprospecting and biotechnology supports soil quality, minimises erosion and sedimentation and secures forest carbon by reducing pressure to convert forests
Innovative green sectors	Limited infrastructure and support to advance innovative green sectors	New business models build local economies, e.g. using 'waste products' from waste produced by current HoB industries

The results of the scenarios analysis established a platform for discussions regarding the establishment and implementation of investments, policies and incentives by national and local governments. The establishment of the HoB Initiative is an example of coordinated action between the three countries, but significant challenges remain, and a suitable economic infrastructure will be the main enabler of a transition to a green economy.

For details of the methodology and models used, as well as the limitations of the scenarios analysis, see Van Paddenburg et al. (2012). Summary information on the HoB's *Investing in Nature for a Green Economy* report can be found at http://www.hobgreeneconomy.org/.

Box 21: Using scenarios to identify response options for achieving government targets in South Africa's transition to a green economy

A study in South Africa (UNEP, 2013) assessed the impacts of green economy investments in selected sectors on the wider South African economy. It used the South African Green Economy Model (SAGEM), which is based on a system dynamics modelling approach. Using planned targets and expenditures and/or costs of interventions, the model identifies possible options and opportunities to achieving government targets in each sector.

Four scenarios were developed using the model:

- Business-as-usual (BAU)
- BAU2% – which represented a 2 per cent investment of GDP in the BAU activities
- GE2% – which represented an allocation of 2 per cent of GDP in four priority green economy sectors
- GETS – which is a target-specific scenario aimed at identifying whether policymakers can achieve the medium- to long-term targets following green economy interventions in the prioritised sectors

Stakeholder input enabled the identification of four priority sectors (natural resource management, agriculture, transport and energy) to focus on, from a list of nine key economic sectors set out in South Africa's National Development Plan – Vision 2030. Table 10 shows a comparison of the baseline and the three green economy scenarios for the priority sectors.

Table 10: Comparison of the scenarios for the priority sectors (natural resource management, agriculture, transport and energy) (UNEP, 2013)

Sector and objective	Baseline scenario BAU and BAU 2%	Green economy scenario 2% (GE2%)	Green economy target specific scenario (GETS)
Natural resource management			
Decrease the land cover infested with invasive alien species	Less aggressive investment in restoration of land under invasive alien species	An equal allocation of investment in the clearing of the invasive alien species	Target specific on investment requirement to clear the invasive alien species in the Working for Water (WfW) programme
Agriculture			
Increasing the yield and land under agricultural production	Extensive utilisation of chemical fertiliser	An equal allocation of investment to the use of organic fertiliser	Target specific to the amount of land using organic fertilisers. Assumes that the expansion of land as in the National Development Plan will use organic fertiliser.
Transport			
Improving energy efficiency in the transport section	No investment in energy efficiency	An equal allocation of investment to improving transport sector efficiency	An aggressive investment in transport expansion and energy efficiency in the sector. This was equivalent to 16 per cent of energy efficiency by 2030.
Energy			
Diversification of power energy mix	Investment in coal electricity, with minimal renewable energy. Investment in Kusile and Medupi included in the BAU. This also includes the committed renewable energy development (wind and solar PV).	Assumes equal allocation of investment to all the renewable energy specified in Integrated Resource Plan (IRP) 2010. This includes the new built plans to renewable energy development.	This is a priority expansion of renewable power generation as specified in IRP 2010

5.7.6 Communicate the results to target groups

To inform decisions on the management and use of natural capital, you need to communicate and use the results of your scenarios analysis. Engaging with stakeholders, such as decision-makers, to establish the goal of the exercise and to develop the scenarios themselves is an important step towards the results being credible, legitimate, relevant and used. However, there is no standard recipe for translating findings from a scenario into effective action (Ash et al., 2010). Ash et al. (2010) provides guidance on how to use scenarios for decision support and strategic planning, as well as for other purposes, such as education and information, and scientific exploration and research. Careful planning will help you to improve success at this sub-step and should include how (e.g. through workshops), what (e.g. process vs. results) and to whom (e.g. target groups) aspects of the scenarios will be communicated. Examples from around the world of how the results from scenarios analysis have been used to inform decisions are evaluated in McKenzie et al. (2012). These case studies draw on different policy contexts and goals, and identify lessons learnt from the various approaches used.

5.7.7 Key resources

The following key resources will provide you with additional guidance and information on scenarios for use in this step:

- Ash et al. (2010). Scenario development and analysis for forward-looking ecosystem assessments. In Ecosystems and Human Well-being: A Manual for Assessment Practitioners. Washington DC: Island Press. http://www.unep-wcmc.org/resources-and-data/ecosystems-and-human-wellbeing--a-manual-for-assessment-practitioners
- Fancourt, M. (2015). Scenario building: A review of existing approaches, UNEP. http://www.unep-wcmc.org/system/comfy/cms/files/files/000/000/649/original/Scenarios_Review.pdf
- Haines-Young et al. (2011). The UK NEA scenarios: development of storylines and analysis of outcomes. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, UNEP-WCMC, Cambridge. http://www.nottingham.ac.uk/cem/pdf/NEA_Ch25_Scenarios_Haines-Young_et%20al%20_2011.pdf
- IPBES. (2016). Guide on Production and Integration of Assessments from and across All Scales. Chapter Role of scenarios and models in assessment and decision support. IPBES Deliverable 2(a).
- McKenzie, et al. (2012). Developing scenarios to assess ecosystem service tradeoffs: Guidance and case studies for InVEST users. World Wildlife Fund, Washington, D.C. http://www.naturalcapitalproject.org/pubs/ScenariosGuide.pdf

Checklist	✔
Key actions	
Define the purpose and goals of the scenarios exercise and the scale(s) at which it will be conducted	
Adapt storylines from existing scenario analyses	
Consider exploring the impacts of climate change as part of the scenarios exercise	
Explore how natural capital might change under different plausible futures	
Stakeholder engagement	
Consult with stakeholders to determine relevant storylines for the different scenarios	
Communication	
Communicate the process and results to target groups	
Capacity building	
Consider building capacity to evaluate different policy and climate change scenarios to evaluate investment opportunities for natural capital improvements	

5.8 STEP 8: USE THE NATURAL CAPITAL ASSESSMENT

If natural capital is to continue to yield benefits to current and future generations, policies and regulatory frameworks need to be in place to support a transition to a green economy. This requires the formulation of policy targets to arrest and reverse worrying trends in natural capital and to support the creation of enabling conditions for natural capital investments. Step 8 focuses on using the findings from Steps 1 to 7 of the Natural Capital Assessment to scope policy targets in order to steer and track progress towards a socially inclusive green economy.

By the end of Step 8 you should be able to answer the following key questions:

- How will the Natural Capital Assessment be used to scope and select policy targets for sustainable management and investment in natural capital?
- Which policies (existing and new), investments, plans and projects can help in the achievement of green economy targets for natural capital?
- What financing mechanisms, such as REDD+, PES or water funds, can create additional incentives for the sustainable management of natural capital?
- How can environmentally extended cost-benefit and natural capital accounting support a transition to a green economy?

In the following sub-steps, reference is made to 'Tier 1' and 'Tier 2', this relates to Figure 10 (Step 6, section 5.6).

5.8.1 Scope policy targets to support transition to a green economy (Tier 1)

The purpose of this sub-step is to analyse how trends in natural capital can impact on priority sector activities and human well-being in the planning unit (broadly following the final step in the natural capital issues identification phase proposed by UNEP (2014d)). This can inform policy responses to address worrying trends and support investment in positive economic outcomes associated with the improved management of natural capital.

Scope indicators in relation to green economy targets

Building on the identification of trends in natural capital highlighted by the indicators you determined in Step 6, this process establishes the broad economic implications of these trends. Using the conceptual model of natural capital to priority sector linkages you developed in Step 4 as a basis for exploring these implications, ensure the perspective remains firmly at the planning unit scale, rather than on individual links. Using this model, identify the ecosystem assets that contribute to the key goals you confirmed in Step 1, as well as sector priorities identified in the Green Economy Plan. In addition, review Steps 5 and 6 to determine trends in natural capital in relation to priority sector activities and impacts. Ultimately, this will help you to define a further list of indicators to communicate progress towards a policy target that will aid or report progress towards a transition to a green economy.

Questions you can ask to help to frame this part of the analysis include:

- Which indicators that are highlighting trends also provide information on the types of natural capital that are delivering the highest benefits for priority sector activities?
- Which indicators that are highlighting trends also provide information on the types of natural capital that are important in terms of equity in the services they provide to key beneficiaries in the planning unit (e.g. rural poor, certain women groups, etc.)?
- Which indicators that are highlighting trends also provide information on the types of natural capital that are providing resilience or ecosystem services that cannot be substituted (i.e. critical natural capital)?

Answering the above questions will help you to specify a set of indicators from the original lists that can be prioritised when ultimately scoping indicators for green economy targets. For example, for planning units where deforestation is a green economy concern, forest area is a realistic indicator to use to identify trends and successful policy outcomes (when a specified increase of forest cover is achieved within a set period). Another, similar, indicator would be the current availability of fresh water per capita and a target level that reflected a scenario under which everyone's needs within the planning unit could be met.

Review Steps 5 and 6 to identify which priority sectors are driving negative trends in natural capital stocks in the planning unit. Questions you can ask to help to frame this part of the analysis include:

- Which indicators provide information on the priority sectors that are having the highest impact on natural capital?
- Which indicators provide information on the priority sectors that are restricting the access of key beneficiaries (e.g. rural poor, certain women groups, etc.) and other priority sectors to natural capital benefits?

Answering the above questions will help you to develop a set of indicators that can be prioritised when ultimately scoping indicators relating to green economy targets.

Generally, indicators relating to green economy targets should be sensitive and be able to communicate positive natural capital outcomes that address issues of concern (i.e. they should reflect the decoupling of economic activity and natural capital degradation). For example, where fertiliser use in the agricultural sector is negatively impacting water quality, nitrate levels are a relevant impact indicator for water. However, a useful target indicator to support green economy transition for the agricultural sector is the percentage area of farmland in the planning unit that is farmed organically. Alternatively, target indicators to reduce natural capital impacts, such as reduced fertiliser use by the agricultural sector, could be used. Increases in these target indicators would be expected to correlate with decreases in the amount of nitrate entering the water (the impact indicator).

It is important that information on the specific formal and informal economic benefits associated with indicators is clear and concisely documented for wider communication. In particular, this information will be crucial for obtaining stakeholder validation and general buy-in to the green economy transition.

Scope indicators for natural capital improvement

As part of a Green Economy Plan, natural capital investment opportunities need to be identified and realised. For instance: where can natural capital improvements increase economic performance by providing ecosystem services that can substitute for manufactured inputs? Where can natural capital improvements generate enhancements in welfare for key beneficiary groups? Where can investments in ecosystem assets lead to the sustainable use or improve the benefits received from natural capital? Scoping potential investment opportunities should include the following actions:

- Identify indicators for natural capital types that are delivering the greatest benefits for priority sector activities. Reviewing the conceptual model generated in Step 4 will help you to identify the types of ecosystem assets that are important for delivering priority sector benefits. In turn, this will reveal opportunities for investment that can yield a more beneficial mix of natural capital in the landscape.
- Identify sectors with positive impacts on natural capital and access to ecosystem service flows. Reviewing the positive impacts of priority sector activities explored in Step 5 will help you to identify useful natural capital investment opportunities. Indicators would then comprise of measures of sector performance. For example, expanding ecotourism to fund Protected Areas, or increasing the extent of the sustainably managed forest sector. Both of these investments would be expected to yield a number of ecosystem service benefits.
- Identify ecosystem assets providing ecosystem service flows whose value is not being realised. Reviewing the conceptual model generated in Step 4 will help you to identify investment opportunities that can make sustainable use of these benefits. This can promote more diversified economic and livelihood activities, contributing to the creation of green jobs. The intensity or level of these activities can be used to set indicators.
- Identify opportunities to build resilience in the landscape. This action is a stated aim of a number of Green Economy Plans (e.g. Ethiopia FDRE (2011) and Kenya GESIP (2015)). This reflects the importance of resilience in ensuring an equitable distribution of natural capital benefits in uncertain future times. Ecosystem assets that are not resilient are at greater risk of losing their value in the future. It should be noted that the consideration of resilience adds another dimension to the management of natural capital in a green economy. This is because resilience is not necessarily equivalent to optimising the delivery of a bundle of ecosystem services, which may increase the vulnerability of natural capital to future changes and shocks (CGIAR, 2014). A number of frameworks exist to provide support in this regard; for example, CGIAR (2014) propose the Ecosystem Services and Resilience (ESR) framework. Developing strategies to build resilience requires a detailed review of the characteristics of natural capital in the planning unit and, probably, specialist support. In this regard, biodiversity is a particularly important characteristic as it underpins resilience for many social-ecological systems (CGIAR, 2014). Biodiversity has, therefore, been described as providing an 'insurance service' (TEEB, 2010b), which is an important aspect for natural capital investment. Indicators of the quality (e.g. populations of sensitive species) and extent of ecosystem assets can be used to track progress in achieving resilience.

Based on the above, construct a list of natural capital investment opportunities for the planning unit to form the basis of green economy investment policy targets; document the likely economic benefits of these investments for wider communication. In addition, engage stakeholders in developing a natural capital investment strategy for the planning unit.

Scope the economic implications of passing ecosystem asset thresholds

Another important consideration in this phase of the analysis is identifying specific ecosystem assets within the planning unit that are approaching thresholds at which ecosystem service delivery may collapse. The economic and social impacts of such collapse can be profound. An example is the collapse of the Canadian Newfoundland cod fisheries in 1992. This area was once renowned as the world's most productive fishing ground, employing 40,000 people. As a result of years of overfishing and incompetent fisheries management, the ecosystem collapsed and 35,000 people lost their jobs (Frank et al., 2005). Potential for a similar fisheries-related catastrophe exists in Kenya, Tanzania and Uganda, where there is extreme pressure exerted on Lake Victoria. The population of the Lake Victoria basin has grown from 4.6 million in 1932, to 27.7 million in 1995, and is estimated to reach 53 million by 2020 (Verschuren et al., 2002). This population growth developed around a booming fisheries industry following the introduction of Nile Perch to Lake Victoria (Marshall and Mkumbo, 2011); however, the proportion of Nile Perch in the total catch from the lake has diminished, and as such, provides a significant area of concern.

Undertaking the NCAC in Step 6 will have identified which specific ecosystem assets may be in danger of approaching such thresholds. The economic implications of passing these thresholds can be inferred from the conceptual model you developed in Step 4; document these for wider communication. In addition, information on thresholds will form the basis for stakeholder engagement when deciding on further investigation or committing to precautionary management (e.g. increasing the extent of Protected Areas in the planning unit).

Scope SMART natural capital policy targets to support a transition to a green economy

Once you have determined a broad set of indicators for natural capital issues, investment and management, scope the structure of suitable policy targets. These should be able to support specific, measurable, achievable, realistic and time-bound (SMART) policies (Doran, 1981). Box 22 presents several natural capital policy targets relevant to the forest sector.

Box 22: Example of indicators for the forest sector in Ghana

In response to the issue of deforestation in Ghana, the following target indicators were developed, against which, policy intervention options could be assessed:

- Annual deforestation rate (decreased by X% in Y years)
- Share of Protected Areas (increased by X% in Y years)
- Share of wood contributing to total fuel used by the energy sector (cut by X% in Y years)

(UNEP, 2015)

Any final SMART policy targets should be based on sound scientific evidence to ensure that they are appropriate and achievable (UNEP, 2014d). Ultimately, you will need to prioritise a small set SMART policy targets based on, and relevant to, the goals you identified in Step 1 of the Natural Capital Assessment; engage with stakeholders to validate and achieve this. In order to support the validation process, explore different policy scenarios to assess trade-offs between sectors, such as ecotourism and agriculture, as well as to help realise the value of underused ecosystem services, such as flood protection. Evaluate different climate change scenarios to help direct diversification strategies in natural capital that promote resilience in the landscape and support future formal and informal economic opportunities. Ensure that results from this work are included in your communication strategy.

Determining specific policy responses is beyond the scope of this guide. However, the following general approaches may be relevant to achieving green economy policy targets in the African context:

- Transparency in natural capital accounting can promote equitable access to information about stakeholder access to, and benefits from, natural capital, empowering civil society to engage with government on more equitable policies.
- Including environmental externalities in pricing can reduce undesirable impacts and trends for society and environment, while offering incentives for economic development.
- Fiscal policies (taxes, tariffs and harmful subsidy removal) that discourage undesired social or environmental impacts can create revenue streams that may be used to encourage desired development.
- When directed toward green products and investments, government spending can assist a nation's transition to a green economy.
- Green financing can provide a critical stimulus for policy and technology adoption.
- Phasing out subsidies that cause undesired consequences can create signals that guide a green economy.
- Regulating businesses to maintain natural capital through a 'polluter pays' principle can reduce the burden on public finances.
- Supporting specific business or private sector actions, such as establishing recycling enterprises (e.g. in Namibia a private sector enterprise is collecting plastic, glass and other recyclable materials and shipping them to South Africa for processing) (GIZ, 2013).

Once you have established quantitative SMART policy targets, they will need to be monitored on a regular basis (ideally annually). This is necessary to establish a time-series for determining progress towards a green economy, but may require building capacity to deliver it over the long-term.

5.8.2 Extending the assessment: Using Total Economic Valuation (TEV) to make the case for investing in natural capital (Tier 2)

Acknowledging and estimating the value of the ecosystem services provided by ecosystem assets is an important step for a transition to a sustainable green economy (UNEP, 2014b). In particular, this can provide the basis for extended cost-benefit analysis and a framework in which different trade-offs can be explored, and this can be conducted by using a Total Economic Valuation (TEV) approach for example. Various examples of such assessments exist, notably within the forest sector. Box 23 provides an example of the contribution of wetlands to the economy of Kenya.

Box 23: Use and economic valuation of the Yala swamp wetland, Kenya (Abila, 2002)

The Yala swamp wetland lies in western Kenya and covers 17,500 hectares. It is both socio-economically important for local communities, and is an important site for biodiversity. However, as this important wetland ecosystem is not formally protected, it is under threat; 2,300 hectares have already been reclaimed for agricultural production, with proposals in place for further reclamations. While agricultural conversion of the wetland will bring about short-term economic benefits for some, these will be obtained at the expense of bundles of ecosystem services that would have provided long-term benefits to human well-being, both in the local area and downstream. The most significant economic activities taking place in, and associated ecosystem services provided by, the Yala swamp wetland are listed below. These show the direct values and benefits provided by the swamp:

- Fishing
- Hunting
- Agriculture
- Fuel
- Building materials
- Mats, seats and basket making
- Water

Further to the above, there are also various indirect values associated to the swamp, including:

- Salt licks
- Medicinal plants
- Vegetables
- Flood control
- Wildlife habitats

Conversion of this wetland would not only result in the loss of important ecological and socio-cultural values associated with the swamp, but it could lead to very expensive replacement costs of associated ecosystem services, such as flood control and water purification. Combined with such replacement costs would be long-term economic, social and environmental problems, including inflated costs, reduction or loss of yields of important crops and materials, and the loss of soil fertility and structural function. This provides a clear economic case for protecting and improving the wetland, for example, by implementing some form of Protected Area status.

Examination of the benefits and losses presented in the Yala Swamp case study in Box 23 clearly reveals that sustainable use of, and investment in, natural capital need not imply a trade-off with economic progress. Indeed, such investment is shown to yield a net economic benefit. UNEP (2012d) provides a further example from the forestry sector. Similar investments in enhancing a broader range of natural capital, such as water, soil and fish stocks, are fundamental to the transition to a sustainable green economy. Such investments can address inequality, given the importance of ecosystem assets to the rural poor (UNEP, 2011). You may need to employ specialists in order to undertake an economic valuation of natural capital benefits for the planning unit.

5.8.3 Using the SEEA-Central Framework to set policy targets for a green economy (Tier 2)

The SEEA-Central Framework (SEEA-CF) (2014) provides an internationally agreed upon statistical framework for understanding the interactions between the environment and economy. The purpose of the framework is to organise and communicate data, aggregates and indicators to inform sustainable development (SEEA-CF, 2014). Relevant SEEA data that link to natural capital issues and improvements and could be used as green economy (policy) target indicators include:

- Natural capital resource use from production and consumption
- Decoupled indicators for emissions and resource use
- Environmental goods and services
- Green jobs
- Environmentally adjusted aggregate measures for depletion (e.g. net savings) or environmentally adjusted value added
- Environmental protection expenditure (UN, 2012)

The SEEA-Experimental Ecosystem Accounts (SEEA-EEA, 2014) extends the SEEA-CF (2014), making it possible to evaluate the extent to which ecosystems are impacted by economic and human activity and revealing the contributions of ecosystems to the economy and human well-being. While no formal framework has been established, SEEA-EEA data have potential to generate a range of indicators for decoupling economic activity from ecosystem and biodiversity degradation, and identifying opportunities for natural capital investment that deliver livelihood benefits. In addition, there are similar and related initiatives on natural capital accounting (e.g. WAVES) discussed in Step 6. These can also be used to inform green economy policy targets. Again, given the specialist nature of these accounting processes, support will typically be required to construct SEEA accounts at the planning unit scale.

In this final step of the assessment, potential natural capital policy targets to support a green economy transition are scoped out from the indicators of natural capital status, trends and impacts in the planning unit. These policy targets are important for both informing the sustainable management of natural capital and directing natural capital investment to support a green economy transition. In addition, ecosystem assets that are at significant risk of approaching thresholds are identified and prioritised for further assessment or precautionary approaches to their management. Promoting resilience and a beneficial mix of natural capital in the planning unit landscape is highlighted as a key consideration in directing such investment to secure benefits for current and future generations.

Checklist	✔
Key actions	
Scope green economy policy targets	
Scope indicators to address natural capital issues	
Scope indicators for natural capital improvement	
Scope management targets for ecosystem assets	
Scope SMART natural capital policy targets to support a transition to a green economy	
Consider extending the assessment by using TEV to make the case for investing in natural capital, or by using the SEEA-CF to set policy targets for a green economy	
Stakeholder engagement	
Scope out a list of green economy target indicators for stakeholder prioritisation	
Determine SMART policy targets for green economy transition	
Communication	
Identify a subset of relevant green economy target indicators and the formal and informal economic benefits associated with these indicators for wider communication. This should be supported with an analysis of different policy and climate change scenarios that reveal the benefits of different investments in improving natural capital	
Capacity building	
Consider capacity building to ensure data to produce indicators for natural capital policy targets continues to be collected on a regular basis (ideally annually) and conduct further investigation of thresholds for ecosystem assets	
Consider building capacity to evaluate different policy and climate change scenarios to evaluate investment opportunities for natural capital improvements	
Consider building capacity or employing specialists to assist in economic valuation to inform natural capital investment policies for the planning unit	
Consider building capacity or securing technical support to assist in constructing SEEA or other natural capital accounts to inform natural capital policy targets for the planning unit	

6 Concluding summary

Natural capital is essential to the performance and growth of economies and human well-being because of the multitude of ecosystem services it provides. Given its importance in supporting manufactured, financial, social and human capital, it should not be taken for granted or undervalued. Defining and recognising natural capital as a concept, and assessing it accordingly, allows it to be accounted for in decision-making. This can foster the sustainable management of natural capital, so that it continues to yield benefits for current and future generations. Understanding the role of natural capital in formal and informal economic activities can inform a more equitable distribution of access to its benefits that can improve the well-being of key beneficiary groups (e.g. rural poor and certain women's groups). This will be crucial in achieving a green economy, where growth follows a sustainable trajectory that is socially inclusive and reduces environmental risks and ecological scarcity.

To this end, this guide sets out a roadmap to assist environmental practitioners with the conceptual and practical aspects of developing, implementing and undertaking *Natural Capital Assessments at the National and Sub-national Level*. The approach taken in defining ecosystem assets follows the UN System of Environmental-Economic Accounting – Experimental Ecosystem Framework (SEEA-EEA, 2014), and considers the physical measures of ecosystems and ecosystem service flows. Accordingly, the wider components of natural capital, such as fossil fuels and minerals, are not considered in this guide. This reflects that ecosystems and biodiversity are typically the most undervalued aspects of natural capital.

The steps presented in this guide are designed around sets of key questions, together with practical checklists of actions, including stakeholder engagement, communication and capacity building strategies. The Natural Capital Assessment is designed to provide an evidence base for understanding and mapping the distribution of natural capital, evaluating its status and trends, and exploring its relationship with priority economic sectors and livelihoods. In turn, this informs the development of policy targets for sustainable management and improvement of natural capital and the transition to a green economy over time. For example, the Natural Capital Assessment can operationalise policies to:

- improve and maintain natural capital and secure the delivery of ecosystem services upon which business operations are reliant in the long-term;
- reduce the impacts of priority sectors on natural capital and reduce ecological scarcity;
- promote efficient and sustainable use of natural capital by priority sectors and support green job creation;
- improve and maintain natural capital benefits in an equitable manner, particularly for vulnerable communities that are dependent on ecosystem services for their livelihoods and well-being;
- protect and improve ecosystem assets at risk of crossing ecological tipping points; and
- improve and build resilience for livelihoods and across ecosystems by establishing a more beneficial mix of natural capital that can also support green jobs and reduce environmental risks associated with climate change and other shocks.

The information mobilised via the assessment also provides a foundation for undertaking valuation of natural capital and constructing natural capital accounts; such valuations can guide the green economy transition process.

The evidence gained from a Natural Capital Assessment enables the evaluation of different mixes of green economy policy options. The policy and action options arising from an assessment will vary. They may include investment in ecosystems to ensure the continued flow of ecosystem services, or more optimised decisions on land-use. The assessment explores different policy scenarios in order to assess trade-offs between sectors, such as ecotourism and agriculture, as well as helping realise the value of underused ecosystem services, such as flood protection. In addition, it evaluates different climate change scenarios to help direct diversification strategies in natural capital that promote resilience in the landscape and support future formal and informal economic opportunities.

In consideration of the above, it is important to stress that green economy policymaking is part of an integrated approach, addressing not only natural capital, but also other economic and social impacts. Accordingly, this guide acts as part of an overarching toolbox for operationalising the green economy in Africa. Policy measures targeted at improving natural capital outcomes must be validated as part of an overarching green economy strategy that considers wider sector and social issues. This will only be achieved via engagement with multiple stakeholders and coordination across multiple ministries and parts of government.

In general, a Natural Capital Assessment should not be viewed as a discrete study, but rather as an iterative science-policy process that updates the evidence base over time via a consultative process among researchers, decision-makers and stakeholders. Building capacity to embed the assessment institutionally will be fundamental to its long-term success as an instrument for guiding a green economy transition.

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7.1 APPENDIX A: WORKSHEETS

Worksheet 1: Agree key goals

By the end of Step 1, you should be able to answer the following key questions:

- What are the goals in your country's Green Economy Strategy and Plan?
- What other related national goals or objectives have already been agreed in other relevant national and sub-national strategies or plans?
- What are the key goals of the Natural Capital Assessment?

Checklist	✔
Key actions	
Review existing relevant national and sub-national goals and objectives	
Confirm and validate key goals for the assessment	
Stakeholder engagement	
Identify which stakeholder groups to engage in the process	
Organise a stakeholder workshop to confirm and validate key goals for the assessment	
Carefully record workshop participant viewpoints and interventions to demonstrate the credibility, relevance and legitimacy of the assessment	
Communication	
Provide workshop participants with the necessary documentation and clear objectives of the workshop in good time to allow for adequate preparation	
Communicate the results of the workshop in a timely fashion	
Capacity building	
Build capacity for workshop facilitation in order to ensure optimal stakeholder engagement	

Worksheet 2: Establish the scope and scale of the assessment

By the end of Step 2, you should be able to answer the following key questions:

- Which ecosystem assets should the assessment focus on?
- What are the scales which need to be considered in the Natural Capital Assessment?
- What is the sub-national scale of governance?
- What are the boundaries of the area the planning unit is responsible for?
- Why is it necessary to take into account the impact of the neighbouring districts?

Checklist	✔
Key actions	
Determine the scale of the assessment	
Review the implications of scale	
Identify sectors for focus	
Stakeholder engagement	
Identify the key stakeholders with influence according to the assessment scale (these can include those both within, and outside of, the assessment boundaries)	
Communication	
Ensure lines of communication are open and clear between neighbouring districts, planning units and levels of government	
Capacity building	
Consider employing geographic information system (GIS)/mapping specialists to help delineate and communicate assessment boundaries and potential trans-boundary issues	

Worksheet 3: Gather and review data

By the end of Step 3, you should be able to answer the following key questions:

- What data do you need for the assessment?
- What data and knowledge do you have?
- Where are the data gaps?
- How can the identified data gaps be filled?

Checklist	✔
Key actions	
Review types of data required	
Locate and collate data	
Construct a map of natural capital	
Address data gaps	
Stakeholder engagement	
Incorporate the assessment of data requirements and potential sources into stakeholder meetings	
Draw on the varied knowledge and expertise of specialist data holders, such as indigenous and local knowledge groups	
Communication	
Be clear about the methodologies used in data collection and data analyses	
Capacity building	
Consider employing mapping and/or GIS specialists and modelling experts as required	
Build training for data collection and archiving into the assessment budget	

Worksheet 4: Assess sector dependencies on ecosystem assets

By the end of Step 4 you should be able to answer the following key questions:

- Where are priority sector activities that are dependent on ecosystem assets taking place?
- Where are vulnerable beneficiaries with high dependencies on ecosystem assets?
- How are these vulnerable beneficiaries characterised (e.g. using economic, social and demographic data)?
- What are the ecosystem services linking specific ecosystem assets with priority sector activities?
- Are there any vulnerable beneficiaries associated with the ecosystem services identified?
- Which ecosystem services are difficult to substitute?

Checklist	✔
Key actions	
Map priority sector activities and vulnerable beneficiaries using a participatory approach	
Locate priority sector activities and any associated vulnerable beneficiary groups	
Construct the conceptual model of priority sector to ecosystem asset linkages	
Identify which ecosystem assets are delivering the ecosystem services that provide priority sector inputs and/or enhance priority sector performance	
Identify important ecosystem services for priority sector performance	
Identify where important ecosystem services are providing inputs into priority sector activities	
List specific priority sectors using important ecosystem services	
Identify the location of any vulnerable beneficiary groups	
Review if, how and where ecosystem services provided by ecosystem assets can be substituted in the planning unit	
Stakeholder engagement	
As required, develop strategies for participatory approaches that allow stakeholders to validate data and fill any gaps	
Include scoping sessions for Step 4 into the initial stakeholder workshop in order to establish key working and user groups	
Communication	
Consider the results of Step 4 in indicator development for communication (as discussed in Steps 6 and 8)	
Capacity building	
Use the support of natural scientists and experts in ecosystem modelling, or provide training for such modelling	

Worksheet 5: Identify priority sector impacts on natural capital

By the end of Step 5 you should be able to answer the following key questions:

- What are the negative impacts of priority sector activities on ecosystem assets?
- What are the positive impacts of priority sector activities on ecosystem assets?
- What are the implications of indirect drivers for priority sector impacts on natural capital in the planning unit?
- What are the implications of external drivers (i.e. beyond the planning unit) for priority sector impacts on natural capital in the planning unit?

Checklist	✔
Key actions	
Assess negative priority sector impacts by identifying direct drivers	
Assess positive priority sector impacts	
Consider indirect drivers that impact natural capital	
Consider external drivers that impact natural capital	
Stakeholder engagement	
Engage with stakeholders to identify a list of the drivers of negative priority sector impacts on natural capital in the planning unit	
Engage with stakeholders to identify which priority sector activities have a positive impact on natural capital in the planning unit	
Consult with stakeholders to identify a list of natural capital impacts for management in order to account for the implications of indirect and external drivers	
Communication	
Document and disseminate priority sector impacts on natural capital, and their drivers, as part of a wider communication strategy to gain support for green economy transition	
Capacity building	
Consider employing mapping and/or GIS specialists to help in the spatial assessment of data regarding priority sector impacts on natural capital	

Worksheet 6: Establish the status and trends in natural capital

By the end of Step 6 you should be able to answer the following key questions:

- Which indicators can communicate the status and trends of natural capital in the planning unit?
- What are the status and trends in natural capital?
- Which ecosystem assets are in a condition that places them at risk of crossing ecological thresholds?
- How can valuation help communicate the status and trends in natural capital?
- How can natural capital accounting help communicate these status and trends?

Checklist	✔
Key actions	
Tier 1: Determine indicators for Natural Capital Assessment	
Determine indicators to communicate the status of natural capital	
Determine indicators to communicate trends in natural capital	
Summarise the status and trends of natural capital	
Scope ecosystem assets for threshold risks	
Consider extending the assessment to include the role of valuation and natural capital accounting in communicating status and trends in natural capital	
Stakeholder engagement	
Capture a list of natural capital status and impact indicators for prioritisation with stakeholders (to be validated in conjunction with Step 8 outputs)	
Capture a list of ecosystem assets in the planning unit in danger of breaching thresholds for prioritisation with stakeholders	
Communication	
Provide a clear assessment of the current levels of natural capital indicators and their trends (these will be linked to implications for formal and informal economic activities in the planning unit in Step 8)	
Capacity building	
Consider building capacity, or employing specialists, to assist in scoping ecosystem asset checks	
Consider building capacity, or employing specialists, to assist in undertaking valuation of natural capital benefits in the planning unit	
Consider building capacity, or securing technical support, to assist in constructing natural capital accounts for the planning unit	

Worksheet 7: Use scenarios to assess future changes to natural capital

By the end of Step 7, you should be able to answer the following key questions:

- What is the purpose and goal of the scenarios exercise?
- At what scale(s) will you develop the scenarios?
- How would you describe the storyline(s) of the plausible futures?
- Is it appropriate to consider the impacts of climate change in the scenarios?
- How will stakeholders be consulted in the process of developing scenarios?
- How might natural capital change under plausible scenarios?
- How will the results of the scenarios' analysis be communicated?

Checklist	✔
Key actions	
Define the purpose and goals of the scenarios exercise and the scale(s) at which it will be conducted	
Adapt storylines from existing scenario analyses	
Consider exploring the impacts of climate change as part of the scenarios exercise	
Explore how natural capital might change under different plausible futures	
Stakeholder engagement	
Consult with stakeholders to determine relevant storylines for the different scenarios	
Communication	
Communicate the process and results to target groups	
Capacity building	
Consider building capacity to evaluate different policy and climate change scenarios to evaluate investment opportunities for natural capital improvements	

Worksheet 8: Use the Natural Capital Assessment

By the end of Step 8 you should be able to answer the following key questions:

- How will the Natural Capital Assessment be used to scope and select policy targets for sustainable management and investment in natural capital?
- Which policies (existing and new), investments, plans and projects can help in the achievement of green economy targets for natural capital?
- What financing mechanisms, such as REDD+, PES or water funds, can create additional incentives for the sustainable management of natural capital?
- How can environmentally extended cost-benefit and natural capital accounting support a transition to a green economy?

Checklist	✔
Key actions	
Scope green economy policy targets	
Scope indicators to address natural capital issues	
Scope indicators for natural capital improvement	
Scope management targets for ecosystem assets	
Scope SMART natural capital policy targets to support a transition to a green economy	
Consider extending the assessment by using TEV to make the case for investing in natural capital, or by using the SEEA-CF to set policy targets for a green economy	
Stakeholder engagement	
Scope out a list of green economy target indicators for stakeholder prioritisation	
Determine SMART policy targets for green economy transition	
Communication	
Identify a subset of relevant green economy target indicators and the formal and informal economic benefits associated with these indicators for wider communication. This should be supported with an analysis of different policy and climate change scenarios that reveal the benefits of different investments in improving natural capital	
Capacity building	
Consider capacity building to ensure data to produce indicators for natural capital policy targets continues to be collected on a regular basis (ideally annually) and conduct further investigation of thresholds for ecosystem assets	
Consider building capacity to evaluate different policy and climate change scenarios to evaluate investment opportunities for natural capital improvements	
Consider building capacity or employing specialists to assist in economic valuation to inform natural capital investment policies for the planning unit	
Consider building capacity or securing technical support to assist in constructing SEEA or other natural capital accounts to inform natural capital policy targets for the planning unit	

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