NISMOD

Hands-On 9 – A framework for understanding the influence of nature and its services on the Sustainable Development Goals (SDGs)
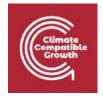
This hands-on exercise gives an overview of the SDG influence tool, **which is available on Github here or on Zenodo here, which will need to be downloaded to undertake this session.** The tool provides a framework to identify the broad range of influences of nature and its critical ecosystem services across various targets of the SDGs. A user can specify a natural ecosystem of interest, and the tool helps identify the respective SDG targets that can be influenced.

Learning Objectives

- Recall how different services can be delivered by nature to influence SDGs

- Explain the importance of non-forest ecosystems for underpinning SDG progress

- Provide an example of how practitioners can strategically utilise nature for delivery on specific SDG goals and targets.

Activity 1: Navigating the SDG influence excel tool

The SDG influence excel tool is based on recent research, which conceptualises how both built environments and natural ecosystems provide certain services, which in turn benefit society and underpin achievement of SDG targets (Fuldauer et al. 2021). This research involved searching for literature evidence to identify influences of the built and natural environment on each SDG target. This hands-on focuses on the natural environment, though we will make reference to the built environment findings that relate to nature. The framework covers the following set of natural or semi-natural ecosystems, which include *both* non-forest *and* forest ecosystem: grasslands, savannas & shrublands, forests, rivers & lakes, wetlands & peatlands, barren, polar/alpine, and croplands. Whilst natural environments also include marine ecosystems such as seagrass, coral and oyster reefs (see mini-lecture 15.1), these were out of the scope of the research study). Depending on their context, these ecosystems can provide a set of the following services: regulating (e.g. flood protection or carbon sequestration), provisioning (e.g. food, water, transport, energy or medicines), supporting (e.g. habitat), and cultural

services (e.g. heritage, recreational) (see mini-lecture 15.2) (Wood et al. 2018; Dasgupta 2020; Blicharska et al. 2019).

The SDG influence excel tool is made up of a number of steps, represented by different tabs.

1. Users can understand the breadth of the sectors and natural ecosystems that are part of the tool.

2. Users can define the various services provided by each natural ecosystem.

3. Users can identify the direct SDG influences, which are defined as cases where SDG targets are directly described in terms of the service provided by the natural ecosystem. Users can also identify indirect SDG influences, described as cases whereby the SDG target is not directly described in terms of the service, but where published evidence indicates SDG target links.

4. Users can use the tool to work backwards from SDG targets and identify how a target can be influenced through various ecosystem services from nature via unique, cross-sectoral or substitutable influences, as described below.

We will discuss each step in turn in the following sections. Figure 9.1 provides an overview of the tool navigation.
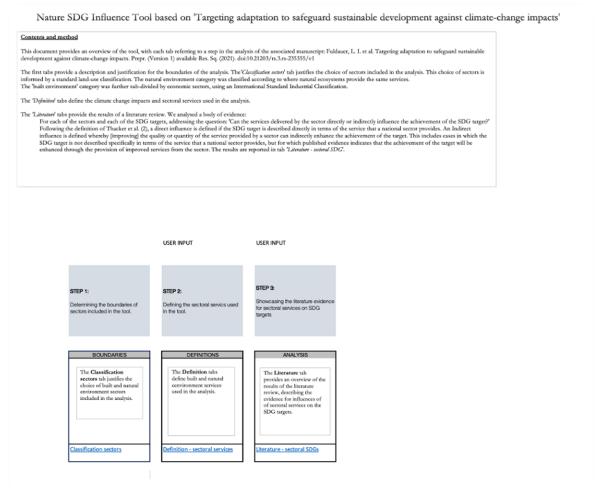
Nature SDG Influence Tool based on 'Targeting adaptation to safeguard sustainable development against climate-change impacts'

Contents and method

This document provides an overview of the tool, with each tab referring to a step in the analysis of the associated manuscript: Fuldauer, L. I. et al. Targeting adaptation to safeguard sustainable development against climate-change impacts. Prepr. (Version 1) available Res. Sq. (2021). doi:10.21203/rs.3.rs-235355/v1

The first tabs provide a description and justification for the boundaries of the analysis. The '*Classification sectors*' tab justifies the choice of sectors included in the analysis. This choice of sectors is informed by a standard land-use classification. The natural environment category was classified according to where natural ecosystems provide the same services. The 'built environment' category was further sub-divided by economic sectors, using an International Standard Industrial Classification.

The '*Definition*' tabs define the climate change impacts and sectoral services used in the analysis.

The '*Literature*' tabs provide the results of a literature review. We analysed a body of evidence:
For each of the sectors and each of the SDG targets, addressing the question: 'Can the services delivered by the sector directly or indirectly influence the achievement of the SDG target?' Following the definition of Thacker et al. (2), a direct influence is defined if the SDG target is described directly in terms of the service that a national sector provides. An Indirect influence is defined whereby [improving] the quality or quantity of the service provided by a sector can indirectly enhance the achievement of the target. This includes cases in which the SDG target is not described specifically in terms of the service that a national sector provides, but for which published evidence indicates that the achievement of the target will be enhanced through the provision of improved services from the sector. The results are reported in tab '*Literature - sectoral SDG*'.

Figure 9.1: Overview of the tab 'Contents and method' for the SDG influence tool. For visualisation purposes only.

Try It: Open the SDG influence excel tool and navigate through each tab.

Activity 2: Defining services provided by nature (as well as socio-economic sectors)

The tab 'Definition – sectoral services' provides an overview of the various natural ecosystems considered in the tool, an explanation of what these entail, their links to the classification for the International Union for the Conservation of Nature (IUCN) and an overview of the services provided by each ecosystem. For example, forests (tropical and temperate) provide a wealth of different ecosystem services, including, amongst others, food, wood, medicines, nutrient recycling, carbon sequestration,

purification of air, recreational services, etc. (see Figure 9.2). It is important to note that the tool here provides an exhaustive list of *potential* services provided by a certain ecosystem, however, the quality and quantity of the services will largely depend on the geographical and climatic context, the ecosystem condition, governance, etc. (see mini-lecture 18.1). For example, whilst a tropical biodiverse forest will provide huge carbon sequestration and habitat services for biodiverse and critical species, degraded temperate forests will not provide an equal quantity or quality of these critical services. Equally, existing non-forest ecosystems may provide more benefits for carbon sequestration and biodiversity (and may also be critical for local livelihoods) in the selected context than forests, for example terrestrial wetlands and peatlands, or grasslands, savannas and shrublands. Therefore, it is critical to assess each ecosystem in its context, and adjust the interpretation of the findings from this framework.

Figure 9.2 below (tab 'Definition- sectoral services') shows an example of the range of *potential* services provided by forests globally. These can be adjusted by users depending on the specific geographic context.

Category	Ecosystems	Socio-economic	Explanation	Link to IUCN (see Boogart, 2019)	Service Type	Services
USGS/Major Ecosystem Types						
	Forest (tropical & temperate)		Deciduous forest land, evergreen forest land, mixed forest land, boreal forest and woodlands	T1 Tropical -sub-tropical forests	Provisioning services	food, fuel / energy; wood / timber for wildlife species
				T2 Temperate - boreal forests & woodlands	Regulating services	nutrient recycling; waste recycling; carbo
					Cultural services	recreation; aesthetic and passive use val
					Economic services	timber / logging; food; fuel; medicines

Figure 9.2: Example overview of ecosystem, an explanation, link to the IUCN classification and example services of the ecosystem.

Try It: Navigate to the 'Definition – sectoral service' tab. Identify the potential services provided by 'grassland, savanna and shrubland.'

Activity 3: Direct and indirect influences of nature on SDG targets

Natural ecosystems, and the services they provide, can influence SDG targets in different ways. Direct influences are defined as cases where SDG targets are described explicitly in terms of the service that a natural ecosystem provides. For example, target 11.6 *"By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management"* is directly influenced by both the 'purification of air' services provided by forests, and the 'waste management' services provided by the water & waste sector.

An indirect influence is identified where the SDG target is not described specifically in terms of the service that a sector provides, but for which published evidence indicates that improving the quality or quantity of the service provided by a sector can enhance the achievement of the target, following the definition of Fuldauer et al. (2021). For example, target 4.1 *"By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes"* can be indirectly influenced by nature and ecosystem services, as there is evidence

that improving the quality or quantity of nature's freshwater supply, as well as its climate adaptation services that reduce the urban heat effect, can improve school attendance and educational outcomes (Blicharska et al. 2019) and thereby support achievement of the target.

As described in Activity 2, depending on the geographic context and natural ecosystem of interest, the services provided by ecosystems will differ. A user can identify the applicable services provided by that specific natural ecosystem in the Tab 'Definition – sectoral services.' In the tab 'Literature - sector SDGs,' a user can then navigate to the ecosystem of interest, e.g. forests and scroll down through the direct influences to find the services of interest. For example, Figure 9.3 shows that the forest ecosystem service 'provision of medicines' directly influences SDG target 3.8.

Goal	Target	Target description	Forest (Tropical and temperate)
			• Provisioning: Food, freshwater, medicines, natural habitat; natural resources, timber for provision of shelter, energy provision through fuel/ bioproducts, seeds • Regulating: natural flood protection creating resiliencen, carbon sequestration, primary production, nutrient cycling, prevention of soil erosion; control of pests through filtering contaminants; purification of air; purification of water; waste recycling; provision of firebreaks • Cultural services: recreation, heritage; green space; health and wellbeing • Economic services: timber and logging; tourism
	3.8	Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	Direct influence: provision of medicines

Figure 9.3: Example of direct influence on SDG target.

The same process can be repeated for indirect influences, which can be found when scrolling to the right of the 'Literature - sector SDG' tab.

Try It: Navigate to the 'Literature - sector SDG' tab. Identify which SDG targets can be directly *or* indirectly influenced by the air purification services from 'grassland, savanna and shrubland.'

Activity 4: Using SDG targets as a starting point to inform NbS inclusion

Users may also start with an SDG target and identify *how* it is influenced by the various services provided by the natural or built environment. The literature has differentiated three different types of influences of *how* an SDG target can be influenced through the services provided by built or natural environments, which are described below (Fuldauer et al. 2021):

1)   **Unique SDG influence**: A unique influence is identified when a sector's service provides independent, singular contributions towards achievement of an SDG target. For example, target 16.3 *"Promote the rule of law at the national and international levels"* is uniquely influenced by (i.e. directly described in terms of only) the 'law enforcement' services provided by the public administration sector. This function cannot be substituted by the services of another sector.

2)   **Cross-sectoral SDG influence**: A cross-sectoral influence is identified when a sector's service provides independent, cross-sectoral contributions towards achievement of an SDG target. For example, target 11.4 *"Strengthen efforts to protect and safeguard the world's cultural and natural heritage"* requires the 'cultural heritage' services from the arts & recreation sector as well as the 'natural heritage' services from the forest sector. The services from these sectors must both be safeguarded to ensure target achievement.

3)   **Substitutable SDG influence**: A substitutable influence is identified when sectors provide a service that can be substituted by another sector. In such a case, various sectors provide the same service to achieve progress towards the SDG target, presenting decision-makers with a choice of how to safeguard target achievement in the face of acute and chronic climate change impacts. For example, target 6.1 *"Achieve universal and equitable access to safe and affordable drinking water"*, can be achieved through the water provision services directly abstracted from mountainous rivers or via water utilities.

These three types of influences enable users to identify how an SDG target can be directly influenced. These types of influences are encoded in the tool in columns BG – BK. For example, Figure 9.4 shows how target 1.4 is influenced through cross-sectoral means.
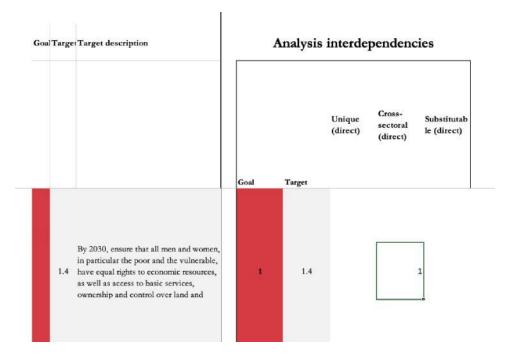
Figure 9.4: Overview of interdependent influences for target 1.4.

A user can navigate to the direct influence overview (Columns E-Z) and see which natural environment or built environment influences act in cross-sectoral ways to influence the SDG target. For example, for target 1.4, the tool shows that the different natural or semi-natural ecosystems and the built environment sectors provide services that influence the target in cross-sectoral ways (see Figure 9.5).
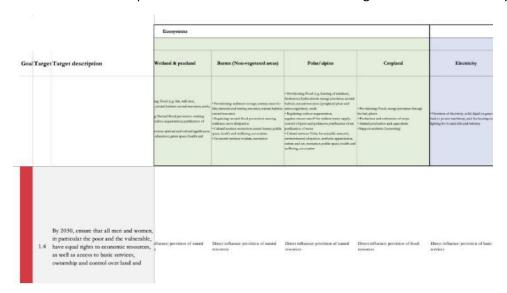

Figure 9.5: Overview of which sector's services influence target 1.4.

Try It: Navigate to the 'Literature - sector SDG' tab, columns BG-BK. Identify how SDG target 15.4 *"By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance*

their capacity to provide benefits that are essential for sustainable development" is influenced by different services, and list the sector's services here.

Summary

In the exercises, a user was introduced to the SDG influence excel tool, which can be used as a framework to understand how various services provided by nature can influence SDG targets. Users can also understand how an SDG target can be achieved through unique, cross-sectoral or substitutable influences from different sector's services. Thereby, the tool, as summarised in this hands-on exercise, provides an initial understanding of influences of the natural and the built environment on the SDG targets. Hands-on 10 gives a detailed overview of actions that practitioners can take in order to enhance the potential influences described in this hands-on.

Bibliography

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