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REPORT

Topic: "Forests in the world from a point of view of the science-policy interface"

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What is forest?

At first glance, the answer is very simple, because forest is a term known even to small children. But it becomes more complicated if we have to come with a strict and unambiguous definition, *e.g.* for legal or economic purposes. It is caused, *inter alia*, by high variability in this main land cover type, making it the most diversified one. Forests are commonly considered to be sites or areas where trees prevail. Moreover, there has not been commonly accepted approach what is a tree, forming together with bushes and shrubs and herbs woody species. In addition, tree covers differ each other in various parts of the world by shape, forms and density.

There are approx. 800 forest definitions, but many of them are only descriptive, with lack of quantitative criteria (LUND 2008). According to the most common forest definition elaborated by FAO (2000), forest is a land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able reaching *in situ* these thresholds. The FAO forest definition does not include land that is predominantly under agricultural or urban land use. On the other hand, the FAO forest definition includes:

i. Areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years;
ii. Forest roads, firebreaks and other small open areas;
iii. Areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 metres;
iv. Windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters;
v. Rubber-wood, cork oak and Christmas tree plantations: in Europe, the annual consumption of Christmas trees is approx. 58 million trees.

As stated above, in the FAO´s approach, forest is determined both by the presence of trees and the absence of other predominant land uses. Low canopy

cover is the FAO forest definition most important weaknesses. Pursuant the above definition, forest could also be vineyards, hop gardens or dense bush or savannah (Australia, Africa). The USDA Forest Service defines forest with canopy cover of at least 25% while the U. S. National Park Service with that of minimally 60% (LUND *l.c.*). Just increasing the above parameter from 20% to 10% significantly increases the area considered to be forest (UNEP/FAO/UNFF 2009, SASAKI & PUTZ 2009). The reason is evident: higher forest cover allows countries to report lower numbers in the deforested area and deforestation (the conversion of forest to other land use or the permanent reduction of the tree canopy cover below the minimum 10 percent threshold) rate (PUTZ & REDFORD 2010, PLESNÍK 2012).

Global forest cover: state of, and changes and trends in

Forests cover almost 31% of total land area on Earth (4 billion hectares, *i.e.* area four times bigger than Europe), being the second largest global land cover type, after farmland (FAO 2015). The number is based on FAO definition: there are also different global forest cover size estimations (*e.g.*, SEXTON *et al.* 2016, CURTIS *et al.* 2018, WATSON *et al.* 2018, ZHANG *et al.* 2020) but FAO´s number is considered as the most relevant and has been simultaneously the most respected worldwide.

Across the globe, forest are distributed unevenly. The five most forest-rich countries (the Russian Federation, Brazil, Canada, the United States of America and China) account for more than half of the total forest area. Thus, the global forest cover is quite vulnerable. On the other hand, ten countries or territories have no forest at all and additional 54 ones have forest on less than 10 percent of their total land area. Globally, the average forest cover per capita is 0.6 hectares (FAO 2015).

The fact that at present forests cover almost one third of the Earth´s terrestrial area seems to be quite good. Nevertheless, it is necessary to take into account that at the Neolith Era/New Stone Age (8,000 years ago, before the Neolithic

Revolution had introduced farming), forests covered approx. half of the total land area on Earth. The decline is the global forest cover has been caused mostly by humans, but also by some natural drivers (climate change, fires, *etc.* – FAO 2000).

The table below shows the main forest characteristics in the world, Europe, i.e. pan-European region, and in the European Union (EUROSTAT 2015, FAO 2015, Forest Europe 2015)

	world	**Europe**	**European Union**
Forest cover (%)	30.6	44.5	37.9
Change in forest cover since 1990 (%)	-1.0	2.7	3.2
Proportion of forests in protected areas (%)	16.2	4.5	13.0
Proportion of undisturbed forests (%)	31.9	27.2	1.9
Proportion of planted area from the total forest cover (%)	7.2	8.1	34.4

From 1990 to 2015, there was a natural loss of some 129 million hectares of forests on the planet (the size of South Africa) with an annual rate -0.13%. Large-scale planting of trees is significantly reducing the net loss of forest area globally. Afforestation (establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest: it implies a transformation of land use from non-forest to forest) and natural expansion of forests through succession in some countries and regions have reduced the net loss of forest area significantly at the global level.

There are differences in changes in forest cover among the individual regions on Earth. South America and Africa continue to have the largest net loss of forest while in North and Central America and Oceania forest cover has been stable. In Europe and Asia, forest cover increased in 2000-2015, mainly due to large-scale subsided afforestation schemes (FAO 2015).

The net change in forest area in the period 2010–2015 is estimated at –3.3 million hectares per year (an area about the size of Belgium), down from –8.3 million hectares per year in the period 1990–2000.

We can summarize as follows:

i. A good news: The rate of global deforestation has been decreasing;
ii. A bad news: but it has been still alarmingly high and deforestation occurs mainly in primary forests, particularly in tropical developing countries and in Siberia.

The more recent data will be available in the second half of 2020. Moreover, large-scale deforestation has been continuing or even increasing in Brazil, Democratic Republic of Congo and Indonesia and preliminary data show that deforestation on the Earth has been increasing due to less enforcement and control during the COVID-19 pandemic (CORLETT *et al.* 2020). In 2017 – 2020, huge forest fires occurred in Greece, the Russian Federation (Siberia), Brazil (Amazonia), Australia and the U.S.A. (ARTÉS *et al.* 2019).

Primary forests and their key role in ecosystem functioning including maintaining biological diversity at the global level

Surprisingly, primary or undisturbed forests (forests of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed) account for 31.9% of the global forest area and are key for global biological diversity and climate change mitigation and adaptation. Main driver of deforestation is not logging for timber, but seeking for new agricultural or urban land (slash & burn approach - LEBLOIS *et al.* 2017, FERRER VELASCO *et al.* 2020). Selective logging can be profitable if dealing with the highly demanded timber.

The global area of planted forest is increasing – it now accounts for 7.2% of total forest area or 290 million hectares. Most of the planted forests was established through afforestation, *i.e.* planting of areas not forested in recent times, particularly in China (see above). One-quarter of all the forests planted comprises introduced non-native, often invasive alien species (FAO 2015, HOLL & BRANCALION 2020).

Global forests are not the world´s lungs, rather are world´s air-condition or a humidifier. Particularly, they are a safebox of the global biological diversity, namely at the species level. Although tropical rainforests cover 6 % of the Earth´s terrestrial land, they harbour more than half of the wild plant and animal species. Only the Amazonian rainforest is inhabited by a quarter of scientifically described terrestrial species (GIBSON *et al.* 2011). On 10 hectares of primary/virgin forest in Malaysia, 780 tree species grow, *i.e.* more than in the U.S.A. and Canada together (THOMPSON *et al.* 2002). Therefore, it is more than alarming that global forest biodiversity is being lost at high rate (IPBES 2019).

Bushmeat (meat from wildlife species that are hunted for human consumption) provides people with proteins from wild animals. If hunting is commercial, not substistence, *i.e.* for consumption by hunters or their families only, or has not

been sustainable, it can threaten up to 80 % forest mammal species, particularly when providing food for people living in big cities (BRASHARES *et al.* 2011, IPBES *l.c.*). Bushmeat hunting creates empty forest syndrome (REDFORD 1992, WILKIE *et al.* 2011): the term refers to an ecosystem that is void of large vertebrates and which is characterized by an otherwise excellent, often less disturbed natural or semi-natural habitat, and often have large, fully grown trees, although they lack particularly large vertebrates as a result of human impact. The solution is to develop and use alternative available and nutrient-rich food resources, *e.g.* provided through the New Green Revolution.

Forests and protected areas

The area of forest within a protected area system has increased by 150 million hectares since 1990 while two-thirds of this increase has been since 2000. Nowadays, 16.2 of world´s forest are located in protected areas of various type (FAO 2015). Unfortunately, only 5 % of the forest protected areas on the globe are effective (ANDAM *et al.* 2008). In addition, to meet their conservation goals, forest protected areas should be viewed in a broader landscape, thus enhancing both biological diversity through landscape connectivity as well as functioning the forest ecosystems protected.

Moreover, in 2001 – 2014, globally forest loss rate increased in all the IUCN protected area categories and was even more significant in those with stricter protection regime (LEBERGER *et al.* 2020). We should also take into account that in buffer zones of protected areas in tropics and subtropics providing a suitable habitats for threatened species, there has been an intensive deforestation continuing (FORD *et al.* 2020).

Forest management

Because people expect from forest ecosystem various benefits, the latter are managed for those purposes accordingly: some of them display multiple use providing at the same time people with various benefits (see table below).

Designated functions of the world's forests (%), FAO (2015)

Production	30
Water regime and soil protection	8
Nature conservation	12
Social services	4
Multiple use	24
Other	7
Unknown	15

Approx. 30% of the world's forests (close to 1.2 billion hectares) are primarily used for production of wood and non-wood products. After a decrease in the 1990s, wood removals began to increase. Nevertheless, global wood removals are equivalent to 0.7 percent of the total growing stock. At the global level, woodfuel accounted for about half of the removed wood and in Africa, it provides 27% of total primary energy supply there (FAO 2015).

Forest and human society in the Anthropocene

More than 1.6 billion people depend on forests for their livelihoods and forests are home to an estimated 1.2 billion people around the world. 80 % of people in developing countries rely on traditional medicines, up to half of which originate

from plants found mainly in tropical forests. Forest biodiversity is the basis for more than 5,000 commercial products, from aromatic oil distilled from leaves to herbal medicines, food and clothing (FAO 2015).

80% of the world's forests are publicly owned, but ownership and management of forests by communities, individuals and private companies is on the rise (FAO 2015).

Unique role is played by forests in carbon sequestration: they store half of the total terrestrial above-ground carbon. Burning particularly tropical forests is responsible for 10 – 25 % of all the greenhouse gas emissions and 340,000 deaths on Earth (SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY 2009, IPCC 2014).

Loss of forest ecosystem services on the planet is estimated to be USD 2–5 trillion annually, *i.e.* 3 - 8 % of the global gross domestic product (SUKHDEV 2010).

At the global level, no legally binding commitment on forest protection, conservation and management has been agreed because some attempts to adopt an international multilateral treaty dealing with the topic failed. United Nations Forum on Forests (established 2000) has been rather an advisory body then implementation authority (FLEMMING *et al.* 2011).

Therefore, real sustainable forest management can ensure both well-functioning forests with all the processes necessary and providing the benefits to humans including timber and non-timber products.

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