

Forests

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This is a preprint of the following chapter:

*Kull, CA (2023) Forests. In **Handbook of the Anthropocene**, edited by Wallenhorst, N & C Wulf. Cham: Springer, 139-144.*

reproduced with permission of Springer Nature. The final authenticated version is available online at: https://doi.org/10.1007/978-3-031-25910-4_22

Abstract

The Anthropocene draws attention to how humans have increasingly shaped forests in the past, how forest loss and forest planting play a key role in today's climate emergency, and how we think about forests and forest stewardship in the future. In this handbook entry I review the human moulding of forests, both constructive and destructive, since prehistoric times and suggest a conceptualization that explicitly incorporate human elements among the many processes constituting forests.

Text

We all know what forests are. “An extensive tract of land covered with trees and undergrowth...” says the Oxford English Dictionary. But what are forests in the Anthropocene? The Anthropocene concept begs a question not touched by the quotidian use of the term: what is natural, and what is human, in forests? For many, forests have become synonymous with ‘nature’, for the interplay of land with insects, animals, fungi, plants, and especially trees, creating a canopy over the heads of human visitors, a home for wild creatures, and a provisioner of diverse goods and services. Yet this equivalence with ‘nature’ obscures the ancient and on-going, persistent and omni-present role of people in shaping forests. It complicates our management of forests in the present-day climate emergency. And it limits conceptions of forest stewardship in an Anthropocene future.

Vegetation communities we would recognize as ‘forests’ first emerged in the late Devonian and came to dominate the Earth in the Carboniferous era (between 390 and 300 million years ago) before losing ground to glaciers in the Late Palaeozoic. Initially composed of unfamiliar plants similar to giant club mosses and tree ferns, forest species evolved over millennia to include conifers and flowering plants (Willis and McElwain 2002). Forests came and went with climate variations and continental moves, persisting in certain forest refugia, and developing together with the pathogens, fire, insects, fungi, and animals who shaped them, including primates and finally humans. At the beginning of the Holocene, some 12,000 years ago, some 44% of the earth's land surface was occupied by forests and woodlands, of which

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only one quarter was untouched by humans. Today, forests and woodlands occupy 28% of the land surface, including roughly 8% still untouched by humans and 20% with various densities of human residence (Ellis et al. 2021).

Most forests in which people live, wander, observe, cultivate, collect, hunt, exercise, or travel, are shaped in one way or another by the people who came before. Most forests are anthropogenic, some highly so, in ways that are not always visible to the untrained eye or the casual observer from the modern, urbanized world. We collectively shape forests – their extent, the amounts and types of species in them, the shape and health of individual species – through obvious activities like cutting and planting, but also through numerous less direct actions like introducing or removing animals (hunting, grazing livestock), by setting or dousing fires, fertilizing, collecting and spreading seeds, fruit, roots, fungi, insects, and altering the hydrological and climatological regime (extracting water, flooding a reservoir, enriching the carbon plants breath in the atmosphere, and warming, wetting, or drying the climate).

Like the impacts of elephants (pushing over trees, fertilizing forest soils), ants (transporting seeds, structuring soils) or lightning (burning stands), these human impacts extend back to ancient times, but in contrast with other forest shapers, human impacts have accelerated in volume and speed in recent millennia, regularly adding new influences of greater scale (from metal tools to bulldozers). Below follow four examples of how the forests we visit today are shaped by the people that came before us.

1. The forests of the Amazon basin constitute some 40% of the world's tropical forest area and are often seen as a global symbol of primeval, ancient forest. However, archaeological evidence shows that forests were, in impressively widespread regions, shaped by pre-Columbian populations, as shown by the presence of 'dark earths', domesticated forests, and earthworks like raised fields, ditches and embankments. While its precise influence remains debated, the footprint of ancient human presence is clear. In the past century, these forests have become strongly threatened by large-scale conversion to industrial pasture and cropland (Rostain 2016; WinklerPrins and Levis 2021).

2. Europe's forests suffered widespread clearing at human hands beginning in prehistoric times. In the past 150 years, forests have regrown in many areas due to abandonment of marginal land uses. Today, signs of human modelling are everywhere in the forest stands of temperate Europe. A casual visitor sees nature; a more observant visitor notices the tree stumps, access roads, signposts, and log piles and understands that they are signs of the ongoing management of the forests that lead to particular species compositions and stand structures. These forests each have unique histories from centuries ago to today: as village commons, feudal estate, crop field, goat pasture, government revenue forest, peri-urban charcoal source, regional natural park, and more. These multitudes of histories, over millennia of use, combined with recent management, fashion today's forests, from the conifers that have replaced hardwoods in the Jura massif, to acacia thickets in Portugal or beech forest parks in Germany (Mather and Fairbairn 2000; Williams 2003; Kaplan et al. 2009; Krumm and Vitková 2016).

3. The humid greenness of south-east Asia hosts diverse human-shaped forests. Dipterocarp natural forests hide histories of logging, trapping, and itinerant slash-and-burn cultivation. While some are now classified as protected areas, deforestation is strong. Many more forests are diverse forms of populated agroforests, tended to by villagers keen on encouraging

diverse harvests of fruits, seeds, poles, and other products (Michon 2005). Finally, vast acreages of uniform greenery, designated on government maps as ‘forestlands’, are, when inspected closer, mono-cropped with acacias, rubber, pines, eucalypts, and oil palms (Cochard et al. 2020). It should be noted that such ‘economic forests’ can be seen around the world, from eucalypts and radiata pines in Chile, New Zealand, and South Africa, to black locust or Douglas-fir in Europe, or Chinese fir and poplar in China, ranging from straight-lined monocrops to more complex silvicultural arrangements.

4. Around the world, forests reclaim land once cleared by past centuries human uses, retaining signatures of those days. Forests have grown to cover landscapes marred by erosion and a voracious historical appetite for timber and wood during the 1800s are now acting as scenic amenities (and fire threats) around gold mining boom towns in Victoria (Australia) and the Sierra Nevada (US). Old agricultural terraces in Mediterranean Europe now hide under resprouting oak-pine woodlands. In New England, hardwood forests replace the pines that colonized abandoned fields, as pioneer farmers left behind the marginal, stony ground for the deeper soils of the mid-west. In tropical Costa Rica, keen naturalists and government subsidies facilitated a rapid reforestation since the 1990s of pastures previously cleared for beef production. These ‘forest transitions’ (Mather and Fairbairn 2000; Kull 2017) explicitly link forest history with economic and political development.

The Anthropocene concept makes us explicitly recognize that forests have a long, accelerating, sometimes constructive, sometimes destructive relationship with humans. One might debate exactly when human influence on forests pushed the planet into a new Anthropocene era – human impacts on land cover like forests long predate the emergence of industry – but the point is that human influences began a long time ago, have led to the world being dominated by anthropogenic biomes, and have increased exponentially in intensity (Ellis and Ramankutty 2008; Ruddiman et al. 2015)

Now, as we face daunting human-caused climate change, forests have taken on a new level of significance – irrespective of whether they are natural, or human-shaped, or something of a mix. Cutting these forests and converting them to other land uses takes place on a scale so vast that it annually contributes to 12% to human carbon emissions. This is second only to the much larger contribution of burning fossil fuels sourced in large part from long buried Carboniferous forests (van der Werf et al. 2009). These actions are quite literally contributing to the Anthropocene as a geologic era, causing regional and planetary scale changes visible in the geological record (Butler 2021).

Planting forests, on top of reversing rapid deforestation, is seen as an important solution to the climate emergency. International agencies and governments have lined up behind numerous initiatives to plan a ‘trillion trees’ and signed up to a UN Decade on Ecosystem Restoration. So, one could say that the Anthropocene emergency is inspiring even more human shaping of forests. That is, governments and diverse organizations enact policies and undertake projects, funded by donors as well as carbon offset funds, that give forestlands legal protections, that help degraded forests regrow through understory enrichment of important species, and that plant trees anywhere possible. The latter sometimes leads to new forests, often of fast-growing exotics, in easily accessed grassy biomes, leading to criticism of the impacts on biodiversity and livelihoods (Bond et al. 2019).

If the past has been a crescendo of increasingly widespread and heavy-handed human shaping of forests, what does the future hold? Clearly, the human role in shaping where many forests

grow, what trees they consist of, and which forests are left alone is likely to continue. If the Anthropocene concept is about recognizing, belatedly, the scale and impact of the human role in the environment in the past and present, then the future goal should be modifying the human role from one of use (and abuse) towards one of stewardship. While specific definitions of stewardship may be debated, the idea signals recognition of the interdependencies of people and forests, a sense of responsibility to the land and earth, and is built and negotiated based on a mix of locally situated traditions, scientific knowledge, and adaptive experience (Gundersen and Mäkinen 2009; Chapin et al. 2010).

Forests, as we have seen, indeed generally do refer to “tracts of land covered with trees and undergrowth”, but this simple definition from the Oxford English Dictionary hides much. This common-sense concept hides debate over what counts as a forest. What is the boundary between a savanna woodland and a forest? Is an exotic tree plantation, planted in rows, devoid of undergrowth, a forest? What makes a forest a forest? Is it simply the trees, or is it something else – its three-dimensional structure, its ecological functions, the forces that shaped it, or a political designation as forestland?

An Anthropocene definition of forest, which should internalize the human contribution (and damage) to forests, needs to go beyond an ecological concept of forests as ecosystems dominated by trees and consisting of biotic and abiotic flows of nutrients, species, and so on. Forests are indeed constituted by trees and the intersection of diverse processes including biogeochemical cycles, plant growth and decay, insect movements and fungal networks. But the human processes of planting, cutting, owning, legislating, harvesting, managing, and, notably of envisioning a future also constitute forests. To this end, a forest of the Anthropocene is a tract of land, no doubt with trees, continually reshaped through power-laden and ecologically relevant relationships among various people, trees, understory plants, animals, soils, insects, water flows, and more. Various forest types exist, each differentiated by not only “species composition, structure and function, but also by the actions and actors (human and not) deemed necessary for the forest’s persistence, as well as those deemed to threaten it” (Mansfield et al. 2015 p. 287; Kull 2017).

This definition sees humans not as bad destroyers and good protectors operating ‘outside’ the forest concept, but instead recognizes humans ‘within’ its conception of the forest. In this sense, then, forest stewardship, is more than preserving patches of biodiversity, or cultivating woody monuments to carbon capture. Stewardship of Anthropocene forests recognizes forests as complex social-natural assemblages, where the quality of human relationships and human lives is integral to making possible the quality of forests.

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Bio

Christian Kull is a geographer with particular interest in the social dimensions of environmental change in developing countries, islands, and highlands. He has investigated the human dimensions of topics like fire, invasive species, afforestation, and conservation in Madagascar, Africa, India, and Vietnam. Educated in the United States, he has held university posts in Canada, Australia, and Fiji. He is now professor in the Institute of Geography and Sustainability at the University of Lausanne, Switzerland. This research was made possible by the Swiss Programme for Research on Global Issues for Development (r4d, grant 194004).