

**Defining the Anthropocene tropical forest: Moving beyond  
'disturbance' and 'landscape domestication' with concepts  
from African worldviews**

Journal:	<i>The Anthropocene Review</i>
Manuscript ID	ANR-23-0012
Manuscript Type:	Review
Keywords:	conviviality, conservation, historical ecology, ohanife, ubuntu, ukama
Abstract:	<p>How the interplay of natural and cultural forces shaping tropical forested landscapes is conceptualized is of vital importance to Anthropocene debates. We contribute to discussions surrounding two concepts: disturbance and landscape domestication. From the perspective of disturbance, humans —whether ancient or modern— are an a priori negative for tropical forests, outside of and alien to nature. From this view, the Anthropocene is a planetary scale aggregation of disturbance. Landscape domestication proposes that humans can shape ecology and plant and animal population demographics, making the landscape more productive and congenial for humans, upgrading or degrading the biodiversity of tropical forests. Herein, tropical forests are key sites where forest peoples shape the Anthropocene itself through their 'domestication' of the tropical forest. Yet this approach can overdetermine culture, ignoring the agency of non-humans, whilst human impacts can be seen as the outcome of intentional modifications to increase landscape productivity, at worst a disavowed projection of 'economic man'. Using the convivial scholarship of Francis Nyamnjoh, we argue that these concepts give incomplete views of tropical forests in the Anthropocene and can be enriched with concepts derived from African worldviews that have 'relationality' and 'wholeness' at their core. These ideas are expressed in by ohanife, deriving from Igbo language, ubuntu, from the Nguni language and ukama, a notion from Shona culture. Together these concepts evince an 'eco-bio-communitarianism' embracing humans, God, spirits, ancestors, animals, and inanimate beings as a 'community of beings' irreducible to the culture-nature divide (moving beyond disturbance) and allowing for the agency and personhood of non-humans (moving beyond historical ecology). This is consonant with Indigenous Amazonian worldviews, such as that of Davi Kopenawa. Approaching human-nature relations from the vantagepoint of Nyamnjoh's idea of conviviality, we elaborate a less incomplete perspective on the cultural and natural shaping of tropical forests in the Anthropocene.</p>

SCHOLARONE™  
Manuscripts

## 1. Introduction

How should the relationship between humans and tropical forests in the Anthropocene be conceptualized? We depart from the observation that the now widespread use of the Anthropocene concept<sup>1</sup> has led to new approaches on how to theorise the interplay of culture and nature in shaping tropical forest landscapes. Two concepts have remained central to this debate and have been key in theorizing human effects on tropical forest landscapes both before and after the introduction of the Anthropocene concept: ‘disturbance’ and ‘landscape domestication’. From the perspective of disturbance, humans — whether ancient or modern — are generally viewed as an *a priori* negative force on tropical forests (Peres et al 2006). By definition, humans are seen to be outside of and alien to nature<sup>2</sup>. From this view, the Anthropocene is, in one sense, a culmination of the disturbance perspective at the planetary scale. The Anthropocene suggests human impact on nature, an impact which in this case is considered alien to, or outside of the tropical forests, and can only be destructive to them. Following this logic, tropical forests are outside of, and threatened by, the Anthropocene (c.f. Malhi et al. 2014; Flores and Staal 2022; Edwards et al. 2019). From the perspective of landscape domestication, conversely, humans shape landscape ecology, plant and animal population demographics, resulting in ‘a landscape more productive and congenial for humans’ (Clement 2014). From this view humans can both upgrade or degrade tropical forest landscapes from the perspective of biodiversity (Balée 2006). Herein, tropical forests are key sites where ancient and modern forest peoples shape the Anthropocene itself (Roberts, Hamilton, and Piperno 2021; Ellis et al. 2013; Roberts, Boivin, and Kaplan 2018), through their ‘domestication’ of the tropical forest (Roosevelt 2013; WinklerPrins and Levis 2021).

---

<sup>1</sup> Which along with proliferating cognates such as Capitalocene, Plantationocene, and so forth, can be conceptualized in a variety of different ways (Davis et al. 2019; Ellis 2018; Moore 2016).

<sup>2</sup> Of course, some more sophisticated positions, that we would group as disturbance, would include some humans, usually those classified as “Indigenous” as being benign vis-à-vis or even stewards of nature. These discourses, including for example Half-Earth, are problematic in that they then exclude the ‘non-Indigenous’ from forests (Lewis et al. 2019; Pritchard and Brockington 2019).

1  
2  
3 Yet, despite their seeming opposition, both of these concepts emanate from the Western  
4 academy are part and parcel of the coloniality of the Anthropocene (Davis and Todd 2017). In order  
5 to decolonise research in tropical forests while critically engaging with the Anthropocene, we argue  
6 that it is necessary to draw the question of how culture and nature interact in shaping tropical forests  
7 into dialogue with the knowledges and ontologies originating in the 'Global South', in particular those  
8 from tropical forest peoples (Fletcher et al. 2021). Our argument is that the concepts used to  
9 understand human impacts on tropical forests are part of what Quijano (2007) describes as the  
10 coloniality of modernity/rationality, and these concepts occupied the core of colonial metropolises  
11 whose violent economies of extractivism expanding throughout the global periphery ultimately  
12 created the Anthropocene (de la Cadena and Blaser 2018; Ferdinand 2019). Therefore, resisting (or  
13 undoing) the Anthropocene in tropical forests and the allied task of decolonizing tropical forest  
14 research requires a critical interrogation of the notions of disturbance and landscape domestication

15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29 The beginning of the Anthropocene is contested, and this has implications for our discussion  
30 here. Candidates include the Early Anthropocene, the onset of farming (dates include 5000 & 8000  
31 ybp), the 1500 Columbian-exchange, the 18C thermo-industrial revolution, or the post 1945 great  
32 acceleration (Gibbard et al. 2022). We find the post 1500 colonization of the Americas the most  
33 compelling beginning for the Anthropocene, that is the social science Capitalocene hypothesis (Moore  
34 2016) or the natural science Orbis spike (Lewis and Maslin 2015). From this view, the Anthropocene  
35 is inherently associated with colonialism and imposition of European-Western knowledge as cultural  
36 universals in colonies. As such, the further unfolding of the Anthropocene is also symbolic not just  
37 material. Scientific disciplines, including ecology, anthropology and archaeology, representing both  
38 sides of this disturbance/landscape domestication debate not only benefited from early colonial  
39 expeditions (Trisos, Auerbach, and Katti 2021; Blanc 2022); colonies were key sites for the  
40 development, experimentation and circulation of foundational ecological, anthropological and  
41 archaeological concepts and practices (Tilley 2011; Grove 1996; Fairhead and Leach, 2000; Baker,  
42 Eichhorn, and Griffiths 2019). Indeed, these Western knowledges historically informed colonial forest  
43 and land-use laws and policies (Fairhead and Leach, 2000), the legacies of which are persistent across  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 post-colonial and contemporary conservation practices and agendas (Kashwan et al., 2021; Chaudhury  
4 and Colla, 2021). Sungusia et al. (2020) highlight how the scientific forestry taught in educational  
5 institutions in both the North and South is a legacy of colonialism that obscures other kinds of  
6 forestry, namely those of Indigenous and local forest peoples. Indigenous knowledge is in resisting  
7 further spread of the Anthropocene, or resisting the coloniality of modernity/rationality that it  
8 represents (Quijano 2007). So, in conceptualizing tropical forests, this knowledge needs to be brought  
9 into dialogue with approaches to human impacts on tropical forests in the Anthropocene, namely  
10 disturbance and landscape domestication.  
11  
12  
13  
14  
15  
16  
17  
18  
19

20  
21 We argue that ‘disturbance’ (foundational to ecology, see Bush et al. 2016), and ‘landscape  
22 domestication’ (a concept associated with historical ecology, see Clement et al. 2015), whilst bringing  
23 important insights, yield an incomplete understanding of tropical forests in the Anthropocene.  
24 Moreover, both concepts are typically embedded in Western scientific institutions (i.e. research  
25 institutes, universities) of scientific forestry and conservation. Both are part of the (neo-)colonial  
26 knowledge of the Western academy (Mawere 2013; Sungusia et al 2020; Chilisa 2017). Relatedly,  
27 ‘disturbance’ and ‘landscape domestication’ have continued to underpin persistent, exclusionary  
28 conservation policies which continue under new global agendas (Kashwan et al., 2021). Both would  
29 benefit from dialogue with concepts associated with ‘other’ knowledges, in particular those of forest  
30 peoples who have their own understandings of how people have shaped tropical forests both today  
31 and historically. Indeed, an ethical response confronting the Anthropocene as a catastrophe of  
32 industrial civilization can only include ‘other’ epistemologies and ontologies, and indeed this is the  
33 only way to trouble and undo the coloniality of Anthropocene modernity/rationality (Quijano 2007)  
34 that inheres in the concepts of ‘disturbance’ and ‘landscape domestication.’  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50

51 In this paper we seek to reveal and reduce the incompleteness of these concepts, drawing on  
52 the work of anthropologist Francis B. Nyamnjoh (2017), who suggests that much scientific work has a  
53 colonial foundation which continues to marginalise or deny other ways of thinking, including those of  
54 African provenance. He notes that the scientific tendency to present one’s research as a complete  
55 understanding of an issue is problematic. Referring to the literary work of Amos Tutuola (a Nigerian  
56  
57  
58  
59  
60

1  
2  
3 writer) based on the Yoruba worldview, he demonstrates that one can improve one's understanding of  
4 a situation by drawing from the best thinking of multiple disciplines, across academic and local  
5 knowledge, from the North and the South. Although knowledge can never be complete, a "convivial  
6 scholarship" approach, Nyamnjoh argues, offers a better understanding of the world as it centres a  
7 way of thinking which explicitly connects multiple traditions, and which may cross the lines  
8 frequently presented in Western scholarship (e.g. nature-culture; pristine-disturbed; ontology-  
9 epistemology). Reflecting this way of thinking, popular African thinking often has a view of "in-  
10 betweenness", straddling the natural and supernatural, the past and the present. With a convivial  
11 scholarship approach, Nyamnjoh argues that scholarship can be invigorated with new directions.  
12 These directions are most accessible to "frontier beings", who are at the crossroads of different ways  
13 of thinking and knowing, able to draw from them simultaneously.

14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27 According to environmental philosophers, "relationality" and "wholeness" are at the core of  
28 African cosmologies (Behrens 2014; Ikeke 2015; Kelbessa 2018); These ideas expressed in the  
29 notions of *ohanife*, deriving from Igbo language, *ubuntu*, a word from the Nguni language and *ukama*,  
30 a notion situated in Shona culture. Together these concepts express an eco-bio-communitarianism  
31 gathering together humans, God, spirits, ancestors, animals, and inanimate beings in a 'community of  
32 beings' irreducible to the culture-nature divide (moving beyond disturbance) and allowing for the  
33 agency and personhood of non-humans (moving beyond historical ecology). This is broadly  
34 consonant with Amazonian Indigenous worldviews, such as articulated by Davi Kopenawa, as we  
35 discuss below.

36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47 An engagement with Nyamnjoh's work, particularly his notions of convivial scholarship and  
48 in-betweenness, is timely given the ongoing decolonial discussions about recognising non-Western  
49 knowledges by a growing range of disciplines (Todd 2016; Hernandez and Spencer 2020; Martinez  
50 2018; Reyes-García et al. 2019; Murphy 2011; Franco-Moraes et al. 2021) including conservation  
51 science (Skandrani 2018). We argue that future thinking about tropical forests in the Anthropocene  
52 should reflect an intercultural dialogue between different traditions of knowledge, or what Boaventura  
53 de Sousa Santos (2014) calls an "ecology of knowledge". In this paper we offer some insight into  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 what such a dialogue might entail by curating diverse perspectives for understanding tropical forest  
4 landscapes, engaging with Amazonia and Africa in particular. These perspectives strikingly  
5 underscore the singularity and limits of the dominant concepts of disturbance and landscape  
6 domestication, while constituting a broader ‘ecology of knowledge’ from which to imagine and create  
7 convivial epistemologies of Anthropocene tropical landscapes.  
8  
9  
10  
11  
12

13  
14 The paper is structured as follows. In section two we outline our critiques of ‘disturbance’,  
15 section three focuses on ‘landscape domestication’, drawing examples from Amazonia since this is  
16 the research arena where the debates between proponents of these two concepts have occurred.  
17  
18 Section four outlines Nyamnjoh’s convivial framework in order to present perspectives from Africa to  
19 complement disturbance and landscape domestication thinking. The paper then uses the example of  
20 sacred forests to reveal diverging understandings of these cultural and natural spaces from the  
21 disturbance, landscape domestication and African perspectives, respectively. Section five presents our  
22 concluding discussion.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

## 37 2. Disturbance

43 Disturbance is a foundational concept in ecology. A commonly cited definition is “any relatively  
44 discrete event in time that disrupts ecosystem, community, or population structure and changes  
45 resources, substrate availability, or the physical environment” (Pickett & White 1985:7). In scientific  
46 forestry, disturbance is defined as “a cause, a physical force, agent, or process, either abiotic or biotic,  
47 causing a perturbation (which includes stress) in an ecological component or system; relative to a  
48 specified reference state and system; defined by specific characteristics” (Rykiel 1985:364). As can be  
49 seen from this definition, the disturbing agent is seen as external to the ‘ecological component or  
50 system’, itself understood as having a particular baseline ‘reference system or state,’ into which the  
51 agent intervenes. According to Battisti et al. (2016: v), the “anthropogenic processes that interfere  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 with the structure and dynamics of the components and the environmental systems” are threats, which  
4 are specifically human-induced events. Curiously, scientific management of landscapes exempts itself  
5 from this category of disturbance. The idea of disturbance sees anthropogenic influences as negative  
6 (degrading) to nature, and exterior (separate) to it. Classic ecological examples include fires, flooding,  
7 and clear-cutting. Ecologists also distinguish between “natural” (e.g. a naturally occurring fire often  
8 caused by lightning) as opposed to “anthropogenic” (e.g. a fire set by people) disturbance. In this  
9 paper, we are particularly interested in anthropogenic disturbance, which is frequently used to refer  
10 negatively to human impacts on forests with no critical discussion of the concept, with the human  
11 being an *a priori* negative for nature (e.g. Moreno Matero et al. 2017; Martínez-Ramos et al. 2016).

12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23 The notion of disturbance is problematic because it doesn't consider the 'why' questions of  
24 what people do in forests (e.g. politics, warfare, settlement, agriculture) all of which are necessary to  
25 understand the impact of past societies (Ellis 2021), as indicated by anthropogenic soils and  
26 concentrations of useful species in tropical forest landscapes (Fraser et al. 2014). From the above  
27 definition we can understand disturbance as the interruption of a normal or settled condition.  
28  
29  
30  
31  
32  
33 However, when applied to tropical forests this has at least two harmful effects: firstly, we don't know  
34 why there was an 'interruption' (why did it happen?), and secondly the 'interruption' (in this case  
35 anthropogenic) is seen as outside of and separate from the forest which is being interrupted. On a  
36 conceptual level, this thinking is related to a separation of culture and nature that has shaped European  
37 thought from the Greeks through the Enlightenment to modern science, and has characterised  
38 European colonial thinking (Arnold 1996; Acker et al 2016).

39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
Disturbance posits an original state (i.e., climax) (Clements 1936) which humans can only  
affect negatively. Palaeoecology has demolished the idea of an original state in favour of the *longue-*  
*durée*: the appearance and abundance of heliophilic species in fossil pollen spectra are generally used  
as an indication of past human impacts on forest cover. Interpretation of pollen spectra shows that  
over the last five millennia the African Guinean-Congolian rainforest has undergone two major phases  
of regression, characterised by the expansion of secondary formations at the expense of mature forests  
(Vincens et al. 1999, Ngomanda et al. 2005, 2007). In the context of biodiversity, one hypothesis

1  
2  
3 states, for example, that the current presence in the overstorey of mature tropical forests of  
4  
5 heliophilous species unable to regenerate is linked to past anthropogenic impacts (mainly shifting  
6  
7 cultivation) (van Gemerden et al. 2003), with the current forest bearing the legacy of the past (Morin-  
8  
9 Rivat et al. 2017). This suggests the importance of anthropogenic factors in the maintenance of certain  
10  
11 species abundance. However, the theory of original climax vegetation long been shown to be  
12  
13 erroneous —because even without humans, ecological systems are constantly in dynamic and non-  
14  
15 linear flux (Botkin 1990).  
16  
17

18  
19 Conceiving of humans as being outside of nature fundamentally misrepresents forest peoples  
20  
21 and misrecognises their cultures. The nature:culture binary is frequently alien to forest peoples'  
22  
23 knowledge systems. Claude Levi-Strauss (1962) and Philippe Descola (1989) revealed the Manichean  
24  
25 culture:nature binary as central to the globalization of Western thought (see Kialo, 2007). However, if  
26  
27 we aim to have a more just vision of tropical forests, and accept anthropogenic influence on  
28  
29 biodiversity, then it becomes impossible to exclusively use the term 'disturbance' (that is, without  
30  
31 combining it with other concepts that capture agency), since it reduces humans to inanimate objects  
32  
33 lacking purposeful actions and knowledge.  
34  
35

36  
37 While the "intermediate disturbance hypothesis" posits that some disturbance can be positive  
38  
39 for local species diversity (Osman 2015), so opening the door to the possibility that people can be  
40  
41 beneficial to nature, it does not offer a conceptual alternative to disturbance, and so can only refer to  
42  
43 an external human intervention (e.g. separate and outside of nature) being inadvertently, rather than  
44  
45 purposefully or intentionally, beneficial to biodiversity. The term 'human-modified,' which is used by  
46  
47 some ecologists, does have the potential to offer a more useful alternative to disturbance, since  
48  
49 'modified' does imply intentionality. Yet in the widely cited paper which introduces the term  
50  
51 (Gardner et al 2009), it is used interchangeably with disturbance, without the authors addressing or  
52  
53 even acknowledging the potential contradictions of the two terms (i.e. disturbance implies  
54  
55 unintentional impacts by an external humanity, whereas 'modified' could capture intentionality). In  
56  
57 conflating these two terms, the potential to use the term 'modified' together with 'disturbance' to  
58  
59 overcome some of the limitations of the latter is foreclosed. For example, a shifting cultivation field in  
60



1  
2  
3 a forest is clearly an intentional modification, but the opportunities it provides for successional species  
4  
5 once the field is fallowed are not and could be understood as intermediate disturbance if overall  
6  
7 biodiversity increases.  
8  
9

10 Attempts to disaggregate disturbance can also trap us in depicting humans as having only  
11  
12 negative effects on tropical forest biodiversity. Peres et al.'s (2006) disaggregation of different kinds  
13  
14 of disturbance provides greater descriptive precision for ecologists, and is logical within its own terms  
15  
16 of reference. While the authors' category of 'highly detectable disturbance' (i.e., industrial  
17  
18 deforestation, dams, roads and mining) is unarguably negative from the viewpoint of tropical forest  
19  
20 conservation, whether or not their other categories of 'marginally detectable' and 'almost  
21  
22 undetectable' disturbance are overwhelmingly negative can be called into question. This is because  
23  
24 they understand even benign activities like collection of non-timber forest products as threats (2006:  
25  
26 Table 1). The authors even propose a new concept "cryptic disturbance", to address these unknowns.  
27  
28 The concept of disturbance, even disaggregated in this way, is unable to grasp conceptually that ways  
29  
30 of life that have existed in the region for millennia like non-timber forest product collection,  
31  
32 subsistence hunting and the use of fire might not be threats to the tropical forest but rather have  
33  
34 shaped its current biodiversity in ways that are positive for species diversity and human wellbeing.  
35  
36  
37

38 The issue with ideas of "marginally detectable" and "almost undetectable" disturbance is the  
39  
40 way that the huge impacts of industrial civilization (i.e., mega-dams) are lumped together into the  
41  
42 same concept of disturbance which is also used to describe the impacts of the livelihood of forest  
43  
44 peoples; one example given in the Peres et al. 2006 paper is "old shifting cultivation fields." In this  
45  
46 way, the large-scale industrial impacts are conflated with the ways of life of the very forest peoples  
47  
48 who are often the best stewards of the forest (see Ramos et al. 2021); the impacts of these forest  
49  
50 peoples are conceived solely and negatively as agents of disturbance. Such a perspective where all  
51  
52 forms of human impact are glossed as disturbance can be used to support a version of fortress  
53  
54 conservation, which calls for conservation interventions such as protected areas, to separate human  
55  
56 disturbance from the natural world (Brockington 2002; Büscher et al 2017; Wilson 2016), rather than  
57  
58 disentangling benign or 'positive' impacts by forest peoples from destructive impacts of megadams.  
59  
60

1  
2  
3 In discussions on pre-Columbian Amazonia meanwhile, the positions taken by different  
4 researchers on the extent to which current forests bear the legacies of the actions of pre-Columbian  
5 Native Amazonians can be ranged along a continuum. One extreme is what was once called the  
6  
7 ‘pristine forest’ position, where people in the pre-Columbian period were thought to have had limited  
8 impacts on the forest (Meggers 1971). Nowadays, few ecologists or archaeologists and others would  
9 support this position. But whilst they acknowledge significant pre-Columbian impacts, they continue  
10 to theorize them as ‘disturbance’ (see Barlow et al. 2012). But the issue with glossing all human  
11 impacts as disturbance in the pre-Columbian period is the same as that of the present: it dehumanizes  
12 Amazonian peoples by stripping them of the capacity to purposefully shape environments.  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

23 Attempts to address these problems by some ecologists thus far are inadequate. For example,  
24 Grimm et al. (2017: 1) note that “the issue of conflating [the] urban with disturbance becomes clear  
25 when one adopts a view of cities as ecosystems... since people themselves are part of and creators of  
26 the system...” This implies that people are not ‘part of and creators of the system’ outside of urban  
27 spaces and sets up a theoretically untenable opposition between non-urban areas, where people can  
28 only disturb the environment, and urban areas where people are part of it and create it.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38

### 39 **3. Landscape domestication**

40  
41  
42  
43  
44 The opposing proposition to disturbance that we explore in this paper is “landscape domestication”,  
45 supported by historical ecologists, and some archaeologists (e.g. Levis et al. (2017) and Terrell et al.  
46 (2003). As noted above, in Amazonia, scholars working with the concept of disturbance today accept  
47 significant pre-Columbian impacts: almost no one working within this paradigm supports the idea of a  
48 pristine forest anymore. The substantive differences between the two positions today then turn on i)  
49 *the question of scale*: proponents of landscape domestication think pre-Columbian impacts on forests  
50 and soils were more extensive than those who talk about disturbance, compare e.g. Clement et al.  
51 (2015) with Bush et al. (2016), and, ii) *intentionality*: are such impacts on the forest just ‘disturbance,’  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 or are they the outcome of conscious design? This question is basically ignored by those working  
4 with disturbance, and is answered by way of either a) *cultural determinism* or b) *niche construction* by  
5 some proponents of the domesticated landscape.  
6  
7  
8  
9

10 In a recent iteration of the most frequently cited definition, landscape domestication is “A  
11 cultural process during which human intervention in the landscape and manipulation of landscape  
12 components cause changes in landscape ecology and in the demographics of its plant and animal  
13 populations, resulting in a landscape more productive and congenial for humans” (Clement 2014).  
14 The idea of the domesticated landscape, associated with historical ecology, argues that people can  
15 both improve or degrade tropical forest landscapes from the perspective of biodiversity (Balée 2006).  
16 Such an approach conceptually privileges people’s ability to change forest ecosystems over that of  
17 biophysical factors. Proponents of landscape domestication have engaged in debates with ecologists  
18 over the extent to which Amazonia is anthropogenic or pristine (Clement et al. 2015; Bush et al.  
19 2016). Among historical ecologists thinking about landscape domestication, there are two approaches:  
20 a culturalist approach and a niche construction approach. We now deal with these in turn.  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33

34 Archaeologist Clark Erickson claims Native Amazonians “created the world that they wanted  
35 through human creativity, technology and engineering, and cultural institutions” (Erickson 2004:456).  
36 Together with anthropologist William Balée, he writes “Historical ecologists support a version of  
37 cultural determinism” (Balée and Ericson 2006:5). In this way, “ADE [Amazonian Dark Earth]  
38 formation, which involves careful production of biochar and management of soil micro-organisms, *is*  
39 *intentional soil engineering*.” (Erickson 2008:171, our emphasis). There is merit in this culturalist  
40 approach. In particular, it moves beyond a simplistic culture-nature separation that characterises the  
41 discipline of ecology and the concept of disturbance. It also affords people the possibility for  
42 purposeful action and intentional to change the forest. Yet it is problematic in terms of how it thinks  
43 about the production of biochar and management of soil microorganisms, because firstly ‘biochar’  
44 and ‘soil-microorganisms’ are alien concepts to Native Amazonians: they do not think about charcoal  
45 and the soil in the same way that scientists do. In addition, it is not supported by the evidence: as  
46 Arroyo Kalin (2015:11) notes, “all carefully documented archaeological cases of *terras pretas*  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 evidence these were not purpose-built agricultural soils but rather anthrosols formed on substrates  
4  
5 produced by former settlement activity.”  
6  
7

8           There is also a etymological problem with ‘domesticated landscapes’ because the term  
9  
10 ‘domesticated’ is generally not held to be intentional, but rather a co-evolutionary process (Rindos  
11  
12 1984). This ends up causing confusion. Because while ‘landscape domestication’ is held to be  
13  
14 intentional, plant domestication within those landscapes is co-evolutionary (Clement 1999).  
15  
16 Landscape domestication therefore over-determines culture, ignoring the agency of nature. This is  
17  
18 evident in the widespread use of the term “anthropogenic forests” to describe locales where there is a  
19  
20 concentration of useful species. Even if some species are the result of past human management, many  
21  
22 species in any given *locale* are not. So, to describe the whole space as “anthropogenic” exaggerates  
23  
24 culture while downplaying nature. Indeed, nature is seen as a blank slate for the projection of  
25  
26 unlimited human agency and creativity. But Nature does things. Rivers, trees, animals, geological  
27  
28 processes and the climate act and in predictable and unexpected ways (Clark 2014). And in many  
29  
30 Indigenous worldviews, this is not surprising because rivers, trees, animals and even mountains can be  
31  
32 persons.  
33  
34  
35

36           More recently, scholars in historical ecology have begun to employ Niche Construction  
37  
38 Theory. From this perspective, humans are seen as ecosystem engineers and creating ‘anthromes’ (see  
39  
40 Ellis and Ramankutty 2008) including in Amazonia Dark Earths and ‘anthropogenic’ forests. Niche  
41  
42 construction theory, unlike the culturalist approach, is therefore compatible with the biological  
43  
44 concept of domestication. But for both culturalist and the niche construction approaches,  
45  
46 ‘domesticated landscapes’ are seen as the outcome of modifications to increase productivity. This  
47  
48 raises the possibility that each is a disavowed or unconscious projection of Western “economic man”,  
49  
50 *Homo economicus*, an individual maximising their utility (see Ingold 2000: Chapter 1-3). From this  
51  
52 viewpoint, Indigenous knowledge exists, in part, for the purpose of rational resource management. As  
53  
54 Clement et al. (2020:41, our emphasis) state “each of these peoples has its *own traditional ecological*  
55  
56 *knowledge about niche construction.*” But “traditional ecological knowledge” is not only “about”  
57  
58 “niche construction”. This statement is incomplete because it reduces Native Amazonian knowledges  
59  
60

1  
2  
3 and practices to those that serve to make the landscapes that they inhabit more productive and  
4 congenial. So, the argument becomes circular: X human impact improves the environment, therefore  
5 it must have been intended to do so. The idea that people domesticated large portions of their  
6 landscape only to make them more “productive and congenial” as per Clement’s definition above is a  
7 reductionist stance reducing complex interactions with forests to that of a modern, western utilitarian  
8 subject interested in maximizing production.  
9  
10  
11  
12  
13  
14

15  
16 For instance, in the Colombian Amazon, close to the town of Leticia, Tikuna Indigenous  
17 people are well aware of the agricultural potential of the *terra preta* soils that occur in the landscapes  
18 they inhabit. But they do not farm these soils. When asked why, they explain it is because the *terras*  
19 *pretas* are “not theirs.” They are “soils of the ancestors”, made by people in the past; on sites  
20 subsequently abandoned by their former inhabitants. They respect and do not visit these places, which  
21 they see as ‘spiritual property’. Because of their deep respect for the ancestors, things belonging to  
22 those ancestors (like *terra preta*) cannot be appropriated today (Torres and Cuartas 2013). This is  
23 broadly similar to the norms protecting sacred forests generally across sub-Saharan Africa, as we will  
24 see later. For many Indigenous Amazonians, such as the Yanomami, and indeed many African  
25 societies, tropical forests are not ‘anthropogenic’ or ‘domesticated’ nor ‘the culturally constructed  
26 niche of humanity’ but are saturated with non-human persons, including spirits and ancestors, with  
27 whom one must negotiate when interacting with it (i.e. cutting a tree or killing game) (Kopenawa  
28 2013; see also Kohn 2013). Returning to the argument of Clement et al., we can ask just how is this  
29 Indigenous knowledge ‘about’ niche construction?  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45

46 Evidence from research in Africa also shows how cultural influences on biodiversity and  
47 landscapes can be the outcome of settlement patterns, politics, warfare, sacred areas, the demands of  
48 the ancestors, and so not only the outcome of ‘Indigenous knowledge’ and its intentional or fortuitous  
49 improvements productivity, per se (Fraser et al 2014; 2015, Hymas et al 2021). How can we move  
50 beyond the stale impasses of the disturbance vs landscape domestication debate? We now turn to this  
51 question.  
52  
53  
54  
55  
56  
57  
58  
59  
60

#### 4. Theorizing beyond the West: African perspectives

Most historical ecological work has focused on Amazonia, as reflected in our discussion above.

Historical ecology in and on tropical Africa has not yet flourished as it has in Amazonia: the number of studies is quite limited. Following a few isolated works dating back to the 1990s and 2000s (Schmidt 1994, Garine et al. 2003, Yasuoka 2009), historical ecology emerged during the 2010s (Davies 2010; Lane 2010; Ichikama 2012, 2015; Yasuoka 2013; Pawlowicz et al. 2014, Salpeteur 2010, 2018; de Saulieu et al. 2016, 2018; Boles et al. 2019; Walters et al 2015). However, studies in the fields of environmental anthropology, ethnoecology and environmental history are considered by some authors (de Saulieu et al. 2018) as precursors of historical ecology on tropical Africa (Fairhead & Leach 1996, Juhé-Beaulaton 1995, 1998, Juhé-Beaulaton & Roussel 1998, Carrière 2003).

Although historical ecology and related disciplines often depend on local knowledge, its theoretical frameworks are rooted in Western approaches, a tendency which Armstrong and Junqueira (2021) suggest should be greatly reduced. As historical ecology is still an emerging field of research in and on Africa, it is an opportunity to be creative and go beyond the limits identified above and to enrich the approach with concepts and perspectives based on a dialogue with other ways of thinking and representing the human-environment relations from the continent.

The previous two sections have shown how ‘disturbance’ and ‘landscape domestication’ reproduce worldviews about tropical forests rooted in the Western Academy. Although these are ideas generally accepted by many ecologists and historical ecologists, we submit that both concepts provide an incomplete view of forest landscapes. The illusion of completeness is sustained when scholars draw from a limited, but highly accepted form of scholarship, accepting it as universal (Nyamnjoh 2017). Referring to Tutuola’s writings, and celebrating incompleteness as the normal order of things, Nyamnjoh’s framework suggests that recognising incompleteness of knowledge is an exciting opportunity for scholars to seek creative ways to better understand the complexity of the world. Nyamnjoh encourages a “meaningful dialogue” between and within disciplines, between “modern science” and local knowledge (2017: 54) to foster a more inclusive way of conducting research (2017:

1  
2  
3 62). Similar to how Amos Tutuola's literary creatures, drawn from Yoruba beliefs, are incomplete  
4 beings that become complete only when drawing the best parts from others, scholarship could enrich  
5 its understanding of tropical forests, through dialoguing across perspectives, theories and knowledges  
6 (e.g. Nyamnjoh 2015, 2017). He proposes that scientific advances could have a more holistic  
7 approach by bringing together scholarship from the global North and the South. Nyamnjoh (2017)  
8 offers a convivial framework whereby we can consider the multiplicity of perspectives and notions of  
9 forests and landscapes, including those that move beyond dualisms of nature and culture, to embrace  
10 the place of people in relation to forests, plants, animals, earth, from the past to the future, from the  
11 natural to the supernatural. Recognition of our incomplete knowledge is a crucial step to advance  
12 knowledge-making together (Nyamnjoh 2020a).

13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25 As shown in the previous sections, to see forests as either being disturbed or domesticated is  
26 an incomplete view, based largely on Western concepts from ecology and historical ecology. To  
27 propose a way out of the limited debate on disturbance versus landscape domestication, we draw on  
28 the concepts discussed by scholars in the field of environmental philosophy, drawn from African  
29 worldviews (Kelbessa 2021). We suggest that *ohanife*, deriving from words in the Igbo language  
30 (Chimakonam 2018), *ubuntu*, a word from the Nguni language (LenkaBula 2008, Chibvongodze  
31 2016, Etieyibo 2017) and *ukama*, a notion situated in Shona culture (Murove 2004, 2009) could be  
32 useful for engaging in a reflection on how humans and forests are conceived within African contexts.  
33 Moreover, the relational ethics, such as between the past, present and future, embedded in these  
34 worldviews (Berhens 2014; Ikeke 2015; Kelbessa 2018) can inform environmental management  
35 practices, going beyond the utilitarian or productivist Western view of relations between humans and  
36 nature. Writings about these three concepts focus more on how they can be mobilized to (re)activate  
37 historically and culturally grounded environmental ethics (Murove 2004) and meaningful  
38 conservation practices (Mawere 2013), and address both social and environmental justice (LenkaBula  
39 2008, Le Grange 2012). However, they can also contribute to a broader reflexion on how we  
40 conceptualize landscapes and interactions between humans and nature.  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 The concept of *ohanife*, proposed by Chimakonam (2018), derives from two words in Igbo (a  
4 language from south-eastern Nigeria): *Oha* and *Ife*. *Oha* refers to humans, usually a community of  
5 people, and *Ife* means things or non-humans, including both non-human beings (e.g. plants, animals)  
6 and non-living or inanimate things. *Ohanife*, as an Igbo synonym of ecosystem, means “a network or  
7 community of humans and non-humans”. The concept is nourished by the idea of “relationship”,  
8 embedded in the Igbo notion of *ezi n’ulo*, but also common in many places in Sub-Saharan Africa  
9 (Chimakonam 2018). According to Chimankonam (2018), the notion of *ezi n’ulo*, and more  
10 specifically the *ezi n’ulo* architecture, expresses the interactions between environments of humans and  
11 non-humans. Grounded on this notion, *Ohanife* expresses the relationship of interdependence and  
12 complementarity of all existing things (whether human or non-human, animate or inanimate) within a  
13 common home. This idea of relationality of all existing things is also embedded for instance, in the  
14 notion of *ubuntu*.

15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
Whereas writings in philosophy and social sciences about *ubuntu* mainly focus on human  
relationships and questions of humanness, some argue that most of the discussions are too  
anthropocentric (LenkaBula 2008). The notion of *ubuntu*, a Nguni word, is commonly used in South  
Africa and is understood through proverbs, like *umuntu ngumuntu ngabantu* (in Nguni language),  
roughly translated into English as “a human being is a human being because of [its relation with]  
other human beings” (Letseka 2012:48). The idea that the humanness of each individual results from  
relationships with other human beings, is embedded in the concept of *ubuntu*. However, LenkaBula  
(2008) and Chibvongodze (2016) argue that *ubuntu* is not only about human; *ubuntu* or *botho* (in the  
Sotho language) expresses also the interconnectedness of humans, with the earth and other non-  
humans like plants or animals. Humanness needs to be understood as an expression of  
interconnectedness between individuals (humans), the society and the biophysical world; according to  
Legrange (2012) and Murove (2004), *ubuntu* is a concrete expression of *ukama*.

The notion of *ukama*, coming from Shona culture (Zimbabwe), refers to the interrelatedness  
between people within the community, including the living and the non-living (ancestors and unborn),  
other spirits and the non-human biophysical world (Murove 2004, 2009, Le Grange 2012). Similar



1  
2  
3 worldviews are shared across the continent; for instance, the Oromo people from Ethiopia (Kelbessa  
4 2018:316) view “human beings as an equal part of a vibrant interconnected whole. They see  
5  
6 themselves as within nature, not as subjects detached from it”. In the western highlands of Cameroon,  
7  
8 the worldview of the Nso’ people, is “first and foremost, communitarian” (Tangwa 1996:192).  
9  
10 According to Tangwa, this eco-bio-communitarianism goes beyond human communitarian, but also  
11  
12 encompass, animals, plants, the earth, spirits and ancestors.  
13  
14  
15

16  
17 Several authors also draw attention to the ethical dimension associated to these belief  
18  
19 systems. Murove (2004) depicts them as an ‘ethic of the interdependence’ of humans within the  
20  
21 society to which they belong (including the living, the dead and the unborn) and to the environment  
22  
23 on which they all depend. In particular, central to numerous African worldviews, is the relationship  
24  
25 between the living, the ancestors and the unborn, which implies intergenerational responsibilities and  
26  
27 duties, leading for instance to specific environmental practices. *Ukama* expresses well these  
28  
29 entanglements between past, present and future generations (Murove 2007). Wiredu (1994:46) wrote,  
30  
31 “of all the duties owed to the ancestors none is more imperious than that of husbanding the resources  
32  
33 of the land so as to leave it in good shape for posterity. [...] The upshot is that there is a two-sided  
34  
35 concept of stewardship in the management of the environment involving obligations to both ancestors  
36  
37 and descendants which motivates environmental carefulness, all things being equal”.

38  
39  
40 The environmental ethics of African worldviews, in particular the idea of reciprocity and  
41  
42 duties toward the environment, is highlighted by Behrens (2014), Ikeke (2015), LenkaBula (2008),  
43  
44 Legrange (2012) and Murove (2004). Nyamnjoh (2020b) uses an eating metaphor to capture the idea  
45  
46 of reciprocity that inform humans-environment relations in the Grassfields of Cameroon: “not only we  
47  
48 [humans] are expected to eat in order to survive, to sustain ourselves and to be able to fulfil our  
49  
50 ambitions, but we are expected as well to make it possible for others to eat in order for us to keep  
51  
52 eating”. By “others” Nyamnjoh refers to fellow humans & the plants and animals in the environment  
53  
54 from which people draw for sustenance and says that “you[humans] have to spend time in the wider  
55  
56 environment, take whether vegetation or animals, grooming them, growing them, offering them an  
57  
58 environment to reproduce themselves, so you can continue to benefit from them”. Thus, following the  
59  
60

1  
2  
3 above perspectives, the practices of humans on the environment could be informed by ethics of  
4 stewardship and duties, either directly towards environment or duties to ancestors/unborn mediated by  
5 practices on plants, animals or land, thus not necessarily by a strict utilitarian view in order to increase  
6 productivity *per se*.  
7  
8  
9  
10

11  
12 One could argue that this conceptualization of human-environment relations is still  
13 anthropocentric and seemingly utilitarian, stressing that the ideas of interdependency and reciprocity  
14 between humans and the environment are grounded on human interests and needs, echoing the  
15 culturalist approach of landscape domestication. Bassey & Primaro (2019:129), discussing the  
16 worldview of Igbo culture from Nigeria, argue that even though humans occupy a central position in  
17 African cosmologies, it is not anthropocentrism but “anthropoholism because, despite man's central  
18 role (Anthropo), man is just a part of the (whole) environment, as such cannot exist outside the  
19 environment, and cannot be understood without allusion to the environment (Holism)”.

20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30 Returning to our central concern about landscapes and forest history, the ideas of relationality  
31 and wholeness associated with African worldviews and conceptual tools from environmental  
32 philosophy when viewed through Nyamnjoh’s convivial framework, extend Western ideas of  
33 disturbance and landscape domestication to provide an alternative understanding of the landscape or  
34 the forest as an integrated whole, a common home (Chimakonam 2018), characterized by the  
35 interconnectedness and web of relations between humans, ancestors, spirits, plants, animals and other  
36 entities. These worldviews strongly emphasize the interconnectedness of humans and the environment  
37 and so differs from Western thinking (Behrens 2014). They do not consider humans as external to the  
38 so-called “natural world”, unlike the Western view that underlies the concept of disturbance. African  
39 relational views offer a perspective to think of human as “part and parcel” of the forest landscapes,  
40 rather than a disturbing external element, and does not presume *a priori* its negative or positive impact  
41 on other entities or webs of relations. Etieyibo (2017:637) explains that ubuntu considers “that all  
42 beings including humans, God, spirits (nameless dead and ancestors), animals, and inanimate beings  
43 belong together in a ‘community of beings’”. Through this, reality is seen as a closed system where  
44 everything hangs together, where the spiritual, physical or human worlds overlap. The interconnection  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 between beings or entities and the interface between humans, the physical and “supernatural” realms,  
4 are sometimes inscribed in the landscape through specific vegetation types, sacred places, sacred trees  
5 and so on, visible in the forest biodiversity and structure that ecologists study (Engone Obiang et al.  
6  
7 2014; Walters et al. 2019). The notions of *ukama* or *ubuntu*, as place-based concepts, show an  
8  
9 “aliveness of place” and enable people to “build bridges across different entities” (Woldeyes and  
10  
11 Belachew 2021: 67, 70).  
12  
13  
14

15  
16 These worldviews and theoretical insights from environmental philosophy allow us to go  
17  
18 beyond dualistic thinking. Indeed, it is important to note that a worldview that stresses the  
19  
20 interconnectedness, of all living beings (Sindima 1990 cited by Berhens 2014) and puts relationality at  
21  
22 the center of the understanding of the world (Ikeke 2015), does not entail collapsing differences  
23  
24 between entities or phenomena, or denying socially-embedded logics of prioritisation. Thinking of the  
25  
26 interconnectedness of the human with the biophysical and spiritual realms does not imply there is no  
27  
28 distinction between them (Ikeke 2015). No entities are equal: “the universe is a composite of divine,  
29  
30 spirit, human, animate and inanimate elements, hierarchically perceived, but directly related and  
31  
32 always interacting with each other” (Oborji 2005, cited by Ikeke 2015:183). All entities have their  
33  
34 own properties and potency. The idea that all entities, animate or inanimate, bear potency could be a  
35  
36 starting point to conceptualize the agency of both humans and non-humans.  
37  
38  
39

40  
41 This has strong resonances with native Amazonian worldviews, such as those written about  
42  
43 by Yanomami shaman Davi Kopenawa. His book *The Falling Sky* presents the end of the world  
44  
45 (which we can understand as the corrosive effects of the arrival of capitalism in the form of gold  
46  
47 mining enclaves or indeed the arrival of the Anthropocene). Kopenawa’s name was given to him by  
48  
49 Yanomami spirits known as Xapiri, because of his rage at the destruction caused by white people, in  
50  
51 particular, by gold miners. The Yanomami, like the African peoples described above, inhabit a world  
52  
53 saturated with spirits who are part of nature, including animal ancestors who manifest physically as  
54  
55 game. Part of becoming a shaman was taking *yākoana* snuff (which contains the potent hallucinogen  
56  
57 DMT, and is also the xapiri’s food). The Yanomami world is full of xapiri. Animals, trees and plants  
58  
59 are spirits: the natural world is alive with non-human persons. Shamans “call,” “bring down,” and  
60

1  
2  
3 make “dance” xapiri spirit helpers, the primordial “images” (utupë) of a highly heterogeneous (and  
4 potentially infinite) set of beings, entities, and objects. The triangulation of animal ancestors (yarori  
5 pë), game (yaro pë), and shamanic animal images (also yarori pë) is a fundamental aspect of  
6 Yanomami ontology (Kopenawa 2013:501). His narrative reveals a worldview with striking  
7 similarities to *ohanife*, *ubuntu* and *ukama*:  
8  
9  
10  
11  
12

13  
14 I grew up spending my time in the forest, and this is how little by little I started to see the  
15 xapiri. My attention was always focused on game and during the night the images of the  
16 animal ancestors presented themselves to me. ....This often happened to the elders’ children,  
17 in the time when the white people were still far away from our forest. But since they have  
18 gotten close to us, the children and the youngsters are not the way we used to be. Today, the  
19 power of the yãkoana often scares them. They are afraid that they will die from it, and  
20 sometimes they even lie to themselves to the point of thinking that one day they could turn  
21 into white people.  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31

32 *The Falling Sky* provides a powerful exposition of how the actual destruction of Indigenous  
33 (and by extension other subaltern) worlds by industrial extractivism is principal way the  
34 Anthropocene is made manifest in tropical forests. A key insight is that what is at stake, alongside  
35 nature and particular ways of life, are other-than human persons such as spirits. These are all features  
36 of Native Amazonian and African ‘worlds’ the destruction of sacred places and spirits means the end  
37 of the world for these peoples, according to them (Blaser and de la Cadena 2018:1).  
38  
39  
40  
41  
42  
43  
44

45 The focus is that the centrality of relationality and wholeness in many African and  
46 Amazonian worldviews, can help theorize human-environment relations differently, in order to reach  
47 a less incomplete understanding of the complex histories of forests and landscapes in Africa.  
48 Although common features of African worldviews in relation to the environment have been identified  
49 (Berhens 2014, Kelbessa 2018, Ikeke 2015), our purpose is neither to apply the above concepts  
50 everywhere, nor to deny the facts that worldviews change over time and that different perspectives  
51 may coexist at the same time within societies, even at an individual level. Tangwa (1996) underlines  
52 the erosion of worldviews in relation to the environment due to colonialism, resulting in the  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 imposition of European languages and systems of education and the introduction of Christianity.  
4  
5 However, different, hybrid or opposite worldviews may (and should) coexist, be in tension and  
6  
7 contradiction, between and within individuals and communities while informing practices on the  
8  
9 environment, depending on the context and the stakeholders involved.  
10

11  
12 *Ubuntu, ohanife* and *ukama*, relationality and wholeness help to show how it is important to  
13  
14 look at concepts and theoretical insights from various disciplines (e.g. environmental philosophy and  
15  
16 ecology), to foster conversations between various traditions of knowledge, across geographies, in  
17  
18 order to reduce the dominance of some concepts that sustain an incomplete view of forests and  
19  
20 landscapes. The above discussion also underlines the theoretical potential of notions and ideas  
21  
22 grounded in local belief systems, to foster a critique of dominant western concepts and dualistic  
23  
24 views, in order to move beyond narrow ways of thinking about tropical forests. Nyamnjoh highlights  
25  
26 the importance of documenting local or popular cosmologies for their “epistemological significance”  
27  
28 and fecund role in theory-building (Nyamnjoh 2015).  
29  
30  
31

32 To put the three different perspectives we have outlined into dialogue (disturbance, landscape  
33  
34 domestication and African worldviews), we will now look at how each of them would understand  
35  
36 sacred forests. Sacred forests are prevalent around the globe and important to cultural heritage and  
37  
38 conservation (Barrow 2019). They encompass wide variety of ecological types, along a spectrum from  
39  
40 ‘no evidence of human impacts’ to ‘anthropogenic’ in terms of species composition. They are also  
41  
42 associated with a variety of forms of social valuation and institutions. But what they typically share is  
43  
44 that the vegetation is afforded a degree of conservation by virtue of its being sacred (Bhagwat and  
45  
46 Rutte 2006). As spaces that are at once cultural and natural, they provide an interesting example to go  
47  
48 beyond disturbance and landscape domestication as concepts.  
49  
50

51 The weaknesses of the concept of disturbance when applied to sacred groves are clear in a  
52  
53 recent example by Kossi et al. (2020) who indicate that 57% of the sacred groves located “at former  
54  
55 settlements” in northern Togo are disturbed by their specific management practices and human  
56  
57 activities, which leads to a significant reduction in the floristic diversity. Kossi et al. call for “action to  
58  
59 safeguard the sacred groves and promote community forestry that respects the principles of  
60

1  
2  
3 biodiversity conservation” (Kossi et al. 2021). It is easy to expose the limits of such an approach, by  
4 asking, at what historical moment does a human-made sacred forest located on the site of an old  
5 settlement become “natural” in order that it can then be “disturbed”? This is distinct from African  
6 cosmologies where human culture is seen as an extension of the natural world rather than separate  
7 from it (Lanz 2000:113/114).  
8  
9  
10  
11  
12

13  
14 Fraser et al (2016) described what they referred to as sacred agroforests in northwestern  
15 Liberia that had an understorey of tree crops (originally Kola and more recently Cacao), an overstorey  
16 of tropical forest species located on fertile anthropogenic dark earths that mark the archaeological  
17 sites of historic settlements (Fraser et al. 2016). A historical ecologist talking about domesticated  
18 landscapes might say that the Loma people of this region intentionally enriched soils to be able to  
19 cultivate tree crops and improve the productivity of the landscape, or they might see it as a form of  
20 niche construction, or as a kind of biocultural heritage. But if ask you the Loma themselves where  
21 these sacred agroforests are located and whose ancestors created them about these places, they say  
22 they are “old town spots.” Cutting and burning is forbidden here, although this is sometimes  
23 challenged by the youth, who in some instances cut them down to produce chili peppers for the  
24 market (Fraser et al. 2015). The reason cutting and burning are forbidden for the Loma is that two of  
25 its most common tree species are linked to people: *Ceiba pentandra* - linking them to ancestors since  
26 it was used to mark grave sites prior to the practice of marking with headstones, and *Cola nitida*  
27 which links them to the living, as mothers plant umbilical cords wrapped around seeds, thereby  
28 linking the Cola tree to the person the baby will become. More profoundly, the reason the spaces are  
29 sacred is linked to the presence of the metaphysical power “salɛ,” which is a feature of ancestors,  
30 trees, and ritual objects. If we accept that these forests are neither disturbed, nor domesticated  
31 landscapes, we find ourselves at Nyamnjoh’s crossroads of different ways of thinking. We can  
32 simultaneously draw from Western ideas of disturbance and landscape domestication, understanding  
33 that people have shaped these landscapes, understanding that the vegetation is indeed different from a  
34 forest that is not an “old town spot”, while also acknowledging the spiritual dimension of these places,  
35 which link the Loma to their ancestors.  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 5. Concluding discussion

In this paper we have grappled with the question of what is the best way to think about humans and the tropical forests in the Anthropocene. We looked at how debates on the interplay of natural and cultural forces shaping tropical forested landscapes have been influenced by the Anthropocene concept. We argued that disturbance and ‘landscape domestication’ (two concepts commonly used to answer this question) despite their merits, yield uncomplete understandings of tropical forests in the Anthropocene, and should be complemented with concepts from the worldviews of forest peoples themselves. We provided examples of *ohanife*, *ubuntu*, or *ukama* from Africa, noting the resonances of these concepts with those of Amazonian Indigenous worldviews, looking at the example of Yanomami shaman Davi Kopenawa. Together these concepts express what can be seen as an ‘eco-bio-communitarianism’ embracing humans, God, spirits, ancestors, animals, and inanimate beings as together comprising a ‘community of beings’ irreducible to the culture-nature divide (moving beyond disturbance) and allowing for the agency and personhood of non-humans (moving beyond historical ecology).

Our point is that thinking about the Anthropocene can enriched/discussed by other concepts/theories proposed by other researchers dealing with relatedness/relationality/wholeness to understand interactions between human (living and ancestors), non-human and biophysical worlds etc, in African and indeed Amazonian contexts. A related issue is the devaluation of non-academic knowledge and perspectives, also a problem for Amos Tutuola, the Yoruba who inspired Nyamnjoh’s (2017) work on the subject. This is problematic for researchers producing ‘scientific knowledge’ based on ethnographies and oral sources (see Okoro 2008). These oral sources and ethnographic data (e.g. ethnoecological knowledge about forests) are considered only as raw data that would become ‘real knowledge’ after analysis by researchers (Nhemachena 2016). This raises the problem of the

1  
2  
3 dominance of scientific knowledge, which in many cases could not be produced without non-  
4 academic knowledges.  
5  
6

7  
8 Moreover, while the term ‘Indigenous’ (people/knowledge/scholars etc.), which is widely  
9 used in the Americas, and which makes sense (politically, historically, intellectually) because of the  
10 settler colonial history that transformed these continents, the term is not directly equivalent or  
11 uniformly relevant in the African context (cf. Lane 2015). Even in the Americas, the dominance of the  
12 term Indigenous can obscure other non-Indigenous peoples (Fraser 2018). So, depending on the  
13 context, it may be better to use other terms to describe ‘non-hegemonic’ knowledge/perspectives as  
14 non-Western, rather than ‘Indigenous.’ It also depends on how people or researchers qualify  
15 themselves. In the same spirit, this paper’s title uses the plural African perspectives so as to avoid the  
16 same trap of reification/universalization.  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26

27  
28 The work of Zoe Todd (2016) can help in treating the notion of Indigeneity with due care.  
29 She calls for a decolonial approach that explicitly acknowledges the contributions of Indigenous  
30 thinkers whose work has significantly contributed to current trends in Western scholarship. It is part  
31 of a deep reckoning with ‘indebtedness’ that is part of keeping with convivial epistemologies. This  
32 recognition is necessary in order to address ongoing structural colonialism in the academy that  
33 marginalises Indigenous, black and non-Western scholars while at the same time appropriating their  
34 labour and thought without due recognition. These voices need to be brought from the margins to the  
35 centre of academic discourses and debates (Nyamnjoh 2020). Recognising and working with these  
36 ideas, and collaborating with these colleagues can transform our understanding of forests, and also  
37 change our disciplines. Many disciplines are opening up to Indigenous ways of viewing the world,  
38 including in international policy circles, such as in the International Panel on Biodiversity and  
39 Ecosystem Services (IPBES) (Tengö et al. 2017), creating dynamic shifts in perspectives of how  
40 Indigenous and local knowledge are valued. Importantly too, various examinations of pathways  
41 towards much needed transformation continue to point to the centrality of pluralizing sustainability  
42 knowledge and experiences, including through the inclusion of local and Indigenous perspectives  
43 (Escobar 2020; Hamilton & Ramcilovic-Suominen 2023; Hernandez and Spencer 2020)  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 We have shown how ‘disturbance’ and ‘domesticated landscapes’ each limit us from  
4 understanding forest history and how it relates to the Anthropocene, but through adopting  
5 Nyamnjoh’s Conviviality framework, and working with other knowledge bases and worldviews of  
6 forests, we can obtain a more complete understanding of the tropical forests in which we research. We  
7 encourage ecologists, conservation scientists and historical ecologists to embrace a diversity of views  
8 and recognise the limits and incompleteness of Western ecological thinking within and against the  
9 Anthropocene, with an aim to decolonise ecology (Ferdinand 2019). They can begin by incorporating  
10 concepts from forest peoples’ worldviews into their work, and engaging with the work of researchers  
11 working in these areas.  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27

## 28 **References**

- 29  
30 Acker, A., Olaf K., Tittor, A., 2016. The Social Production of Nature between Coloniality and  
31 Capitalism (Introduction). *Fiar* 9 (2): 5–24.  
32  
33 Arroyo Kalin, M. 2015. Landscaping, Landscape Legacies, and Landesque Capital in Pre-Columbian  
34 Amazonia. In *The Oxford Handbook of Historical Ecology and Applied Archaeology*. Edited  
35 by Christian Isendahl and Daryl Stump  
36  
37 Baker, K., Eichhorn, M.P. and Griffiths, M. 2019. Decolonizing Field Ecology. *Biotropica* 51 (3):  
38 288–92. <https://doi.org/10.1111/btp.12663>.  
39  
40 Balée W. & Erickson, C. (2006). Time, Complexity and Historical Ecology. In Balée W. & Erickson  
41 C. (Eds.), *Time and Complexity in Historical Ecology: Studies in the Neotropical Lowlands*  
42 (pp. 1-18). New York: Columbia University Press.  
43  
44 Barlow, J., Gardner, T.A., Lees, A.C., Parry, L. & Peres, C.A. 2012. How pristine are tropical forests?  
45 An ecological perspective on the pre-Columbian human footprint in Amazonia and  
46 implications for contemporary conservation. *Biological Conservation*, 151, 45–49.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Battisti, C., Poeta, G., Fanelli, G. 2016. The Concept of Disturbance. In An Introduction to  
4  
5 Disturbance Ecology: A Road Map for Wildlife Management and Conservation, edited by  
6  
7 Corrado Battisti, Gianluca Poeta, and Giuliano Fanelli, 7–12. Environmental Science and  
8  
9 Engineering. Cham: Springer International Publishing. [https://doi.org/10.1007/978-3-319-](https://doi.org/10.1007/978-3-319-32476-0_2)  
10  
11 [32476-0\\_2](https://doi.org/10.1007/978-3-319-32476-0_2).  
12  
13
- 14 Büscher, B., Fletcher R., Brockington D., Sandbrook C., Adams W.M., Campbell L., Corson C.,  
15  
16 Dressler W., Duffy R., Gray N., Holmes G., Kelly A., Lunstrum E., Ramutsindela M. &  
17  
18 Shanker K. 2017. Half-Earth or Whole Earth? Radical ideas for conservation, and their  
19  
20 implications. *Oryx* 51 (03): 407–410. <https://doi.org/10.1017/S0030605316001228>  
21  
22
- 23 Botkin, D.B. 1990. *Discordant Harmonies*. Oxford University Press. 256pp  
24
- 25  
26 Bush, M McMichael, C.H., Piperno, D.R. Silman, M., Barlow, J. Peres, C.A. Power, M., Palace,  
27  
28 M.W. 2015. Anthropogenic influence on Amazonian forests in pre-history: An ecological  
29  
30 perspective. *Journal of Biogeography*. 42:12  
31  
32
- 33 Bhagwat, SA, Rutte, C. 2006. Sacred groves: potential for biodiversity management. *Frontiers in*  
34  
35 *Ecology and the Environment* 4(10) 519-524  
36  
37
- 38 Blanc, G. 2022. *The Invention of Green Colonialism*. Polity Press  
39
- 40  
41 Blaser, M and de la Cadena, M. 2018. Introduction: PLURIVERSE Proposals for a World of Many  
42  
43 Worlds. In Mario Blaser and Marisol de la Cadena (eds). *A World of Many Worlds*. Duke  
44  
45 University Press. pp 1-22.  
46  
47
- 48 Brockington, Dan. 2002. *Fortress Conservation: The Preservation of the Mkomazi Game Reserve,*  
49  
50 *Tanzania*. 1st publ. African Issues. Oxford: The International African Institute.  
51  
52
- 53 Barrow, E., 2019. *Our future in nature: trees, spirituality and ecology*. BalboaPress, Bloomington, IN.  
54
- 55  
56 Bassey, S., Pimaro Jr, T. M. 2019. Enyimba's Notion of Madukaku and The Question of  
57  
58 Anthropocentrism. In *African Environmental Ethics*. *International Journal of Environmental*  
59  
60 *Pollution and Environmental Modelling*, 2(3), 129-136.

- 1  
2  
3 Behrens, K. G. 2014. An African relational environmentalism and moral considerability.  
4  
5 Environmental Ethics, 36(1), 63-82. <https://doi.org/10.5840/enviroethics20143615>  
6  
7
- 8 Boles, O.J.C., Shoemaker, A., Courtney Mustaphi, C.J. 2019. Historical Ecologies of Pastoralist  
9  
10 Overgrazing in Kenya: Long-Term Perspectives on Cause and Effect. *Hum Ecol* 47, 419–434  
11  
12 <https://doi.org/10.1007/s10745-019-0072-9>  
13  
14
- 15 Cadena, Marisol de la, and Mario Blaser. 2018. *A World of Many Worlds*. Duke University Press.  
16  
17 <https://doi.org/10.2307/j.ctv125jpsz>  
18  
19
- 20 Carrière, Stéphanie. Évolution des paysages forestiers. In *Les orphelins de la forêt: Pratiques*  
21  
22 *paysannes et écologie forestière (Les Ntumu du Sud-Cameroun)*. Marseille: IRD Éditions,  
23  
24 2003. <https://doi.org/10.4000/books.irdeditions.10265>.  
25  
26
- 27 Chimakonam, J. O. 2017. Ohanife. An account of the ecosystem based on the African notion of  
28  
29 relationship. In *African Philosophy and Environmental Conservation*. Routledge.  
30  
31
- 32 Chilisa, Bagele. 2017. ‘Decolonising Transdisciplinary Research Approaches: An African Perspective  
33  
34 for Enhancing Knowledge Integration in Sustainability Science’. *Sustainability Science* 12  
35  
36 (5): 813–27. <https://doi.org/10.1007/s11625-017-0461-1>.  
37  
38
- 39 Clements, Frederic E. 1936. ‘Nature and Structure of the Climax’. *The Journal of Ecology* 24 (1):  
40  
41 252. <https://doi.org/10.2307/2256278>.  
42  
43
- 44 Chandler, D. and Reid, J. 2020. *Becoming Indigenous. Governing Imaginaries in the Anthropocene*.  
45  
46 Rowman.  
47  
48
- 49 Chaudhury, A., Colla, S. 2021. Next steps in dismantling discrimination: Lessons from ecology and  
50  
51 conservation science. *Conservation Letters*, 14(2), e12774.  
52  
53
- 54 Chibvongodze, D. T. 2016. Ubuntu is not only about the human! An analysis of the role of African  
55  
56 philosophy and ethics in environment management. *Journal of Human Ecology*, 53(2), 157-  
57  
58 166. <https://doi.org/10.1080/09709274.2016.11906968>  
59  
60

- 1  
2  
3 Clark, N. 2014. *Inhuman Nature: Sociable Life on A Dynamic Planet*. Sage  
4  
5  
6 Clement, C.R. 1999. 1492 and the loss of Amazonian crop genetic resources. I. The relation between  
7  
8 domestication and human population decline. *Economic Botany*. 53:188–202  
9  
10  
11 Clement C.R. 2014. Landscape Domestication and Archaeology. In: Smith C. (eds) *Encyclopedia of*  
12  
13 *Global Archaeology*. Springer, New York, NY. [https://doi.org/10.1007/978-1-4419-0465-](https://doi.org/10.1007/978-1-4419-0465-2_817)  
14  
15 [2\\_817](https://doi.org/10.1007/978-1-4419-0465-2_817)  
16  
17  
18 Clement, C.R., Denevan, W.M., Heckenberger, M.J, Junqueira, A.B., Neves, E.G., Teixeira, W.G.  
19  
20 Woods, W.I. 2015. The domestication of Amazonia before European conquest. *Proceedings*  
21  
22 *of the Royal society B*. 282:1812  
23  
24  
25 Clement, C., Levis, C. Franco-Moraes, J. Junqueira, A.B. 2020. Domesticated Nature: The Culturally  
26  
27 Constructed Niche of Humanity. In Balduf (ed). *Participatory Biodiversity Conservation*  
28  
29 *Concepts, Experiences, and Perspectives*. Springer.  
30  
31  
32 Clements, Frederic E. 1936. Nature and Structure of the Climax. *The Journal of Ecology* 24 (1): 252.  
33  
34 <https://doi.org/10.2307/2256278>.  
35  
36  
37 Chibvongodze, D.T. 2016. Ubuntu is Not Only about the Human! An Analysis of the Role of African  
38  
39 Philosophy and Ethics in Environment Management, *Journal of Human Ecology*, 53:2, 157-  
40  
41 166, DOI: 10.1080/09709274.2016.11906968  
42  
43  
44 Davis, Heather, and Zoe Todd. 2017. “On the Importance of a Date, or, Decolonizing the  
45  
46 Anthropocene.” *ACME: An International Journal for Critical Geographies* 16 (4): 761–80.  
47  
48  
49 Davis, Janae, Alex A. Moulton, Levi Van Sant, and Brian Williams. 2019. “Anthropocene,  
50  
51 Capitalocene, ... Plantationocene?: A Manifesto for Ecological Justice in an Age of Global  
52  
53 Crises.” *Geography Compass* 13 (5): e12438. <https://doi.org/10.1111/gec3.12438>.  
54  
55  
56 Davies, M. 2010. A View from the East: An Interdisciplinary ‘Historical Ecology’ Approach to a  
57  
58 Contemporary Agricultural Landscape in Northwest Kenya, *African Studies*, 69:2, 279-297,  
59  
60 DOI: 10.1080/00020184.2010.499202

- 1  
2  
3 Edwards, David P., Jacob B. Socolar, Simon C. Mills, Zuzana Burivalova, Lian Pin Koh, and David  
4  
5 S. Wilcove. 2019. "Conservation of Tropical Forests in the Anthropocene." *Current Biology*  
6  
7 29 (19): R1008–20. <https://doi.org/10.1016/j.cub.2019.08.026>.  
8  
9
- 10 Ellis, Erle C. 2018. *Anthropocene: A Very Short Introduction*. Oxford University Press.  
11  
12
- 13 Ellis, Erle C., Jed O. Kaplan, Dorian Q. Fuller, Steve Vavrus, Kees Klein Goldewijk, and Peter H.  
14  
15 Verburg. 2013. "Used Planet: A Global History." *Proceedings of the National Academy of*  
16  
17 *Sciences* 110 (20): 7978–85. <https://doi.org/10.1073/pnas.1217241110>. Etieyibo, E. 2017.  
18  
19 Ubuntu and the environment. In: *The Palgrave handbook of African philosophy*. Afolayan, A.  
20  
21 and Falola, T. (Eds.) Palgrave Macmillan, New York. (pp. 633-657). 10.1057/978-1-137-  
22  
23 59291-0  
24  
25
- 26 Ellis, E. C. and N. Ramankutty. 2008. Putting people in the map: anthropogenic biomes of the world.  
27  
28 *Frontiers in Ecology and the Environment* 6(8):439-447.  
29  
30
- 31 Ellis, Erle C. 2021. People Have Shaped Most of Terrestrial Nature for at least 12,000 Years. *PNAS*  
32  
33 118 (17).  
34  
35
- 36 Erickson, C. 2003. Historical Ecology and Future Explorations. In *Amazonian Dark Earths: Origin,*  
37  
38 *Properties, Management*. Johannes Lehmann, Dirse C. Kern, Bruno Glaser, and William I.  
39  
40 Woods (eds), pp. 455-500. Kluwer, Dordrecht  
41  
42
- 43 Erickson, C. 2008. Amazonia: The Historical Ecology of a Domesticated Landscape. In *Handbook of*  
44  
45 *South American Archaeology*, edited by Helaine Silverman and William Isbell. Springer,  
46  
47 New York. Pp157-183  
48  
49
- 50 Escobar, A. (2020). *Pluriversal politics: The real and the possible*. Duke University Press.  
51  
52
- 53 Fairhead, J. and Leach, M. 2000. Shaping socio-ecological and historical knowledge of deforestation  
54  
55 in Sierra Leone, Liberia and Togo. In: Cline-Cole RA and Madge C (eds) *Contesting Forestry*  
56  
57 *in West Africa*. Aldershot: Ashgate, pp. 64–95.  
58  
59  
60

- 1  
2  
3 Ferdinand, M. 2019. Une écologie décoloniale: penser l'écologie depuis le monde caribéen,  
4 Anthropocène Seuil. Éditions du Seuil, Paris.Franco-Moraes, Juliano, Charles Roland  
5  
6 Clement, Joana Cabral de Oliveira, and Alexandre Adalardo de Oliveira. 2021. A Framework  
7 for Identifying and Integrating Sociocultural and Environmental Elements of Indigenous  
8 Peoples' and Local Communities' Landscape Transformations. *Perspectives in Ecology and*  
9 *Conservation* 19 (2): 143–52. <https://doi.org/10.1016/j.pecon.2021.02.008>.  
10  
11  
12  
13  
14  
15  
16 Fraser, J., Fairhead J. and Leach, M. 2014. Anthropogenic Dark Earths in the Landscapes of Upper  
17 Guinea, West Africa: Intentional or Inevitable? *Annals of the Association of American*  
18 *Geographers*, 104:6, 1222-1238  
19  
20  
21  
22  
23 Fraser J., Frausin, V. and Jarvis A. 2015. An intergenerational transmission of sustainability?  
24 Ancestral habitus and food production in a traditional agro-ecosystem of the Upper Guinea  
25 Forest, West Africa. *Global Environmental Change* 31:226-238  
26  
27  
28  
29  
30  
31 Fraser, J. A., M. Diabaté, W. Narmah, P. Beavogui, K. Guilavogui, H. De Foresta, and A. B.  
32 Junqueira. 2016. Cultural valuation and biodiversity conservation in the Upper Guinea forest,  
33 West Africa. *Ecology and Society* 21(3):36.  
34  
35  
36  
37  
38 Fraser, J.A. 2018. Amazonian struggles for recognition. *Transactions of the Institute of British*  
39 *Geographers*. 43:718–732.  
40  
41  
42  
43 Fletcher, Michael-Shawn, Rebecca Hamilton, Wolfram Dressler, and Lisa Palmer. 2021. “Indigenous  
44 Knowledge and the Shackles of Wilderness.” *Proceedings of the National Academy of*  
45 *Sciences* 118 (40): e2022218118. <https://doi.org/10.1073/pnas.2022218118>.  
46  
47  
48  
49  
50 Flores, Bernardo M., and Arie Staal. 2022. “Feedback in Tropical Forests of the Anthropocene.”  
51 *Global Change Biology* 28 (17): 5041–61. <https://doi.org/10.1111/gcb.16293>.Gardner, T.A.,  
52 Barlow, J., Chazdon, R., Ewers, R.M., Harvey, C.A., Peres, C.A. and Sodhi, N.S. 2009.  
53 Prospects for tropical forest biodiversity in a human-modified world. *Ecology Letters*, 12:  
54 561-582. <https://doi.org/10.1111/j.1461-0248.2009.01294.x>  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Garine E., Langlois O., Raimond C., De Garine-Wichatitsky M. 2003. Paysage fortuit ou nature  
4 construite?: écologie historique des savanes soudaniennes au Nord Cameroun. In Des milieux  
5 et des hommes: fragments d'histoires croisées. Muxart Tatiana (ed.), Vivien Franck-  
6 Dominique (ed.), Villalba Bruno (ed.), Burnouf Joëlle (ed.). Amsterdam. Elsevier, 151-160.  
7  
8  
9  
10  
11  
12 Gibbard, Philip, Michael Walker, Andrew Bauer, Matthew Edgeworth, Lucy Edwards, Erle Ellis,  
13 Stanley Finney, et al. 2022. "The Anthropocene as an Event, Not an Epoch." *Journal of*  
14 *Quaternary Science* 37 (3): 395–99. <https://doi.org/10.1002/jqs.3416>.  
15  
16  
17  
18  
19 Grove, R. H. 1996. *Green imperialism: Colonial expansion, tropical island Edens and the origins of*  
20 *environmentalism, 1600-1860*. Cambridge, UK: Cambridge University Press.  
21  
22  
23  
24 Grimm, N.B., Pickett, S.T.A., Hale, R.L., Cadenasso, M.L. (2017) Does the ecological concept of  
25 disturbance have utility in urban social–ecological–technological systems? *Ecosystem Health*  
26 *and Sustainability*. 3(1):1-18.  
27  
28  
29  
30  
31 Geralda, C., and A. Braga Junqueira. 2021. 'Historical Ecology: Challenges and Perspectives in a  
32 Changing World'. In *Methods in Historical Ecology: Insights from Amazonia*, edited by  
33 Guillaume Odonne and Jean-François Molino, 171–77. Oxon. UK: Routledge.  
34  
35  
36  
37  
38 Hamilton, R. T. V., & Ramcilovic-Suominen, S. (2023). From hegemony-reinforcing to hegemony-  
39 transcending transformations: horizons of possibility and strategies of escape. *Sustainability*  
40 *Science*, 1-12  
41  
42  
43  
44  
45 Hecht, S.B., Morrison, K.D & C. Padoch (eds). 2013. *The social lives of forests : past, present, and*  
46 *future of woodland resurgence*. University of Chicago Press  
47  
48  
49  
50 Hernandez and Spencer. 2020. Weaving Indigenous Science into Ecological Sciences: Culturally  
51 Grounding Our Indigenous Scholarship. *Human Biology* 92 (1): 5.  
52  
53 <https://doi.org/10.13110/humanbiology.92.1.05>.  
54  
55  
56  
57 Ichikawa, M. 2012. Central African forests as hunter-gatherers' living environment: An approach to  
58 historical ecology. *African study monographs. Supplementary issue*, 43, 3-14.  
59  
60

- 1  
2  
3 Hymas, O., Rocha, B. Guerrero, N. Torres, M. Ndong, K. and Walters, G. 2021. There's Nothing  
4  
5 New under the Sun – Lessons Conservationists Could Learn from Previous Pandemics.  
6  
7 PARKS, no. 27 (March): 25–40. <https://doi.org/10.2305/IUCN.CH.2021.PARKS-27-SIOH.en>  
8  
9
- 10 Ikeke, M. O. 2015. The ecological crisis and the principle of relationality in African Philosophy.  
11  
12 Philosophy Study, 5(4), 179-186.  
13  
14
- 15 Ingold, T. 2000. The perception of the environment: Essays in livelihood, dwelling and skill.  
16  
17 Routledge.  
18  
19
- 20 Juhé-Beaulaton, D. 1995. Les paysages végétaux de la Côte des Esclaves du XVII<sup>e</sup> siècle à la veille  
21  
22 de la colonisation: essai d'analyse historique (Doctoral dissertation, Université Panthéon-  
23  
24 Sorbonne-Paris I).  
25  
26
- 27 Juhé-Beaulaton D. 1998. La palmeraie du Sud Bénin avant la colonisation: essai d'analyse historique.  
28  
29 In Chastanet M. (Ed.) Plantes et paysages d'Afrique, une histoire à explorer. Paris, Karthala :  
30  
31 327-352.  
32  
33
- 34 Juhé-Beaulaton, D. Roussel, B. 1998. A propos de l'historicité des forêts sacrées de l'ancienne Côte  
35  
36 des Esclaves. In Chastanet M. (Ed.) Plantes et paysages d'Afrique une histoire à explorer.,  
37  
38 Karthala, pp.382.  
39  
40
- 41 Kashwan, P., V. Duffy, R., Massé, F., Asiyambi, A. P., & Marijnen, E. 2021. From racialized  
42  
43 neocolonial global conservation to an inclusive and regenerative conservation. Environment:  
44  
45 Science and Policy for Sustainable Development, 63(4), 4-19.  
46  
47
- 48 Kelbessa, W. 2018. Environmental Philosophy in African Traditions of Thought. Environmental  
49  
50 Ethics, 40(4), 309-323. <https://doi.org/10.5840/enviroethics201840431>  
51  
52
- 53 Kelbessa, W. 2021. African Worldviews, Biodiversity Conservation and Sustainable Development.  
54  
55 Environmental Values. doi: 10.3197/096327121X16328186623922  
56  
57
- 58 Kialo, P. 2007. Anthropologie de la forêt: populations Pové et exploitants forestiers français au  
59  
60 Gabon. L'Harmattan, Paris.



- 1  
2  
3 Kossi, A. Mazalo, K.P. Novinyo, S.K. Kouami, K. 2021. Impacts of traditional practices on  
4  
5 biodiversity and structural characteristics of sacred groves in northern Togo, West Africa.  
6  
7 Acta Oecologica. 110:1-9.  
8  
9
- 10 Kohn, E. 2013. How Forests Think: Toward an Anthropology Beyond the Human. Berkeley:  
11  
12 University of California Press.  
13  
14
- 15 Kopenawa, D. 2013. The Falling Sky: words of a Yanomami shaman Belknap: Harvard.  
16  
17
- 18 Lanz, T. 2000. The Origins, Development and Legacy of Scientific Forestry in Cameroon.  
19  
20 Environment and History, 6(1), 99-120  
21  
22
- 23 Le Grange, L. 2012. Ubuntu, ukama and the healing of nature, self and society. Educational  
24  
25 philosophy and theory, 44(sup2), 56-67. <https://doi.org/10.1111/j.1469-5812.2011.00795.x>  
26  
27
- 28 LenkaBula, P. 2008. Beyond Anthropocentricity–Botho/Ubuntu and the quest for economic and  
29  
30 ecological justice in Africa. Religion and Theology, 15(3-4), 375-394.  
31  
32 <https://doi.org/10.1163/157430108X376591>  
33  
34
- 35 Levis, C., B. M. Flores, P. A. Moreira, B. G. Luize, R. P. Alves, J. Franco-Moraes, J. Lins, E.  
36  
37 Konings, M. Peña-Claros, F. Bongers. 2018. How people domesticated Amazonian forests.  
38  
39 Frontiers in Ecology and Evolution 5:1–21. doi: 10.3389/fevo.2017.00171.  
40  
41
- 42 Lewis, S.L., C. Wheeler, E.T.A. Mitchard and A. Koch. 2019. Restoring natural forests is the best  
43  
44 way to remove atmospheric carbon. Nature 568, 25-28  
45  
46
- 47 Lane, P. J. 2010. Developing Landscape Historical Ecologies in Eastern Africa: An Outline of Current  
48  
49 Research and Potential Future Directions, African Studies, 69:2, 299-322, DOI:  
50  
51 10.1080/00020184.2010.499203  
52  
53
- 54 Lane, P. J. 2014. 'Being 'Indigenous' and Being 'Colonized' in Africa: Contrasting Experiences and  
55  
56 Their Implications for a Postcolonial Archaeology.' Rethinking Colonial Pasts through  
57  
58 Archaeology, ed. Neal Ferris, Rodney Harrison, and Michael V. Wilcox. Oxford Scholarship  
59  
60 Online, <http://dx.doi.org/10.1093/acprof:osobl/9780199696697.003.0020>

- 1  
2  
3 Le Grange, L. 2012. Ubuntu, Ukama and the Healing of Nature, Self and Society, Educational  
4  
5 Philosophy and Theory, 44: 56-67. [10.1111/j.1469-5812.2011.00795.x](https://doi.org/10.1111/j.1469-5812.2011.00795.x)  
6  
7
- 8 LenkaBula, P. 2008. Beyond Anthropocentricity – Botho/Ubuntu and the Quest for Economic and  
9  
10 Ecological Justice in Africa, Religion and Theology, 15(3-4), 375-394. doi:  
11  
12 <https://doi.org/10.1163/157430108X376591>  
13  
14
- 15 Letseka, M. 2012. In Defence of Ubuntu. Stud Philos Educ 31, 47–60.  
16  
17 <https://doi.org/10.1007/s11217-011-9267-2>  
18  
19
- 20 Malhi, Yadvinder, Toby A. Gardner, Gregory R. Goldsmith, Miles R. Silman, and Przemyslaw  
21  
22 Zelazowski. 2014. “Tropical Forests in the Anthropocene.” Annual Review of Environment  
23  
24 and Resources 39 (1): 125–59. <https://doi.org/10.1146/annurev-environ-030713-155141>.  
25  
26
- 27 Martínez-Ramos, M. Ortiz-Rodriguez, I.A., Piñero, D. Sarukhán, J. 2016. Anthropogenic disturbances  
28  
29 jeopardize biodiversity conservation within tropical rainforest reserves. Proceedings of the  
30  
31 National Academy of Sciences May 2016, 113 (19) 5323-5328; DOI:  
32  
33 [10.1073/pnas.1602893113](https://doi.org/10.1073/pnas.1602893113)  
34  
35
- 36 Martinez, Dennis. 2018. Redefining Sustainability through Kincentric Ecology: Reclaiming  
37  
38 Indigenous Lands, Knowledge, and Ethics. In Traditional Ecological Knowledge: Learning  
39  
40 from Indigenous Practices for Environmental Sustainability, edited by Melissa K. Nelson,  
41  
42 139–74. Cambridge, England: Cambridge University Press.  
43  
44
- 45 Mawere, M. 2014. Environmental Conservation through Ubuntu and Other Emerging Perspectives.  
46  
47 Langaa Research and Publishing.  
48  
49
- 50 Meggers, B. 1971. Amazonia: Man and Culture in a Counterfeit Paradise. Aldine-Atherton, Chicago.  
51  
52 182pp.  
53  
54
- 55 McMichael, C.N. 2021. Ecological legacies of past human activities in Amazonian forests. New  
56  
57 Phytol, 229: 2492-2496. <https://doi.org/10.1111/nph.16888>  
58  
59  
60

- 1  
2  
3 Moore, Jason W. 2016. *Anthropocene or Capitalocene?: Nature, History, and the Crisis of Capitalism*.  
4  
5 PM Press.  
6  
7
- 8 Moreno-Mateos, D., Barbier, E., Jones, P. Jones, H. Aronson, J. López-López, J.A. McCrackin, M.L.  
9  
10 Meli, P. Montoya D. & José M. Rey Benayas. 2017. Anthropogenic ecosystem disturbance  
11  
12 and the recovery debt. *Nat Commun* 8, 14163. <https://doi.org/10.1038/ncomms14163>  
13  
14
- 15 Murove, M. F. 2009. An African Environmental Ethic Based on the Concepts of Ukama and Ubuntu,  
16  
17 in: M. F. Murove (ed.), *African Ethics: An anthology of comparative and applied ethics*  
18  
19 (Pietermaritzburg, University of Kwazulu-Natal Press).  
20  
21
- 22 Murove, M. F. 2004. An African Commitment to Ecological Conservation: The Shona Concepts of  
23  
24 Ukama and Ubuntu. *Mankind Quarterly*, 45(2), 195–215. doi:10.46469/mq.2004.45.2.3  
25  
26
- 27 Murove, M. F. 2009. An African environmental ethic based on the concepts of Ukama and Ubuntu.  
28  
29 In: Murove, M. F. (ed.), *African Ethics: An Anthology for Comparative and Applied Ethics*.  
30  
31 University of Kwazulu-Natal Press  
32  
33
- 34 Murphy, Brenda L. 2011. From Interdisciplinary to Inter-Epistemological Approaches: Confronting  
35  
36 the Challenges of Integrated Climate Change Research: From Interdisciplinary to Inter-  
37  
38 Epistemological Approaches. *The Canadian Geographer / Le Géographe Canadien* 55 (4):  
39  
40 490–509. <https://doi.org/10.1111/j.1541-0064.2011.00388.x>.  
41  
42
- 43 Morin-Rivat, J., Fayolle, A. Favier, C. Bremond, L. Gourlet-Fleury, S. Bayol, N. Lejeune, P.  
44  
45 Beekman, H. and Doucet. J-L. 2017. Present-Day Central African Forest Is a Legacy of the  
46  
47 19th Century Human History. *ELife* 6. <https://doi.org/10.7554/eLife.20343>.  
48  
49
- 50 Nhemachena A., 2016, Animism, Coloniality and Humanism: Reversing the Empire's Framing of  
51  
52 Africa, in Mawere et al, eds, *Theory, Knowledge, development and Politics: What Role for the*  
53  
54 *Academy in the Sustainability of Africa?* Bamenda: Langaa Research and  
55  
56 Publishing Common Initiative Group p 13-54  
57  
58  
59  
60

- 1  
2  
3 Nyamnjoh, F.B. 2020. Decolonising the Academy: A Case for Convivial Scholarship. Carl  
4  
5 Schlettwein Lectures 14. Basel: Basler Afrika Bibliographien.  
6  
7  
8 Nyamnjoh, Francis B. 2017. Drinking from the Cosmic Gourd: How Amos Tutuola Can Change Our  
9  
10 Minds. Bamenda, Cameroon: Langaa Research & Publishing CIG.  
11  
12  
13 Nyamnjoh, Francis B. 2015. Amos Tutuola and the Elusiveness of Completeness. Stichproben.  
14  
15 Wiener Zeitschrift für kritische Afrikastudien. 29 (15): 1-47.  
16  
17  
18 Nyamnjoh, Francis B. 2020a. Becoming Human with Others: Animality and Decolonial  
19  
20 Entanglements. Webinar Millennium: Journal of International Studies.  
21  
22 <https://www.youtube.com/watch?v=HZqtJnGkVIQ>  
23  
24  
25 Nyamnjoh, Francis B. 2020b. Decolonising the Academy: A Case for Convivial Scholarship. Carl  
26  
27 Schlettwein Lectures 14. Basel: Basler Afrika Bibliographien.  
28  
29  
30 Obiang, E. Laurier, N. Ngomanda, A. Hymas, O. Chezeaux, E. and Picard, N. 2014. Diagnosing the  
31  
32 Demographic Balance of Two Light-Demanding Tree Species Populations in Central Africa  
33  
34 from Their Diameter Distribution. Forest Ecology and Management 313: 55–62.  
35  
36  
37 Okoro, J. Ako. 2008. 'Reflections on the Oral Traditions of the Nterapo of the Salaga Area'. History  
38  
39 in Africa 35 (January): 375–400. <https://doi.org/10.1353/hia.0.0000>  
40  
41  
42 Osman, R.W. 2015. The Intermediate Disturbance Hypothesis. Encyclopedia of Ecology (Second  
43  
44 Edition). 3: 441-450  
45  
46  
47 Pawlowicz, M., Stoetzel, J., & Macko, S. 2014. Environmental Archaeology at Mikindani, Tanzania:  
48  
49 Towards a Historical Ecology of the Southern Swahili Coast. Journal of African Archaeology,  
50  
51 12(2), 119–139. <http://www.jstor.org/stable/26505460>  
52  
53  
54 Peres, C. J. Barlow, W. Laurence. 2006. Detecting anthropogenic disturbance in tropical forests.  
55  
56 Trends in Ecology and Evolution. 21:5 227-229.  
57  
58  
59  
60

- 1  
2  
3 Pickett, S. T. A., and P. S. White, eds. 1985. *The ecology of natural disturbance and patch dynamics*.  
4  
5 Academic Press, Orlando, Florida, USA  
6  
7  
8 Pritchard, R. and D. Brockington. 2019. Regrow forests with locals' participation. *Nature* 569 (7758):  
9  
10 630. <https://doi.org/10.1038/d41586-019-01664-y>.  
11  
12  
13 Quijano, Aníbal. 2007. "Coloniality and Modernity/Rationality." *Cultural Studies* 21 (2–3): 168–78.  
14  
15 <https://doi.org/10.1080/09502380601164353>.  
16  
17  
18 Ramos, A., Le Billon, P., Seagle, C., Madzwamuse, M., Walker Painemilla, K., Petriv, I. and  
19  
20 Jauregui, L. (eds.) 2021. *Policy Matters, Special Issue 22, Volume I*. Gland, Switzerland:  
21  
22 IUCN [https://www.iucn.org/commissions/commission-environmental-economic-and-social-](https://www.iucn.org/commissions/commission-environmental-economic-and-social-policy/resources/policy-matters)  
23  
24 [policy/resources/policy-matters](https://www.iucn.org/commissions/commission-environmental-economic-and-social-policy/resources/policy-matters)  
25  
26  
27 Reyes-García, Victoria, Álvaro Fernández-Llamazares, Pamela McElwee, Zsolt Molnár, Kinga  
28  
29 Öllerer, Sarah J. Wilson, and Eduardo S. Brondizio. 2019. The Contributions of Indigenous  
30  
31 Peoples and Local Communities to Ecological Restoration: Indigenous Peoples for Ecological  
32  
33 Restoration. *Restoration Ecology* 27 (1): 3–8. <https://doi.org/10.1111/rec.12894>.  
34  
35  
36 Roberts, Patrick, Nicole Boivin, and Jed O. Kaplan. 2018. "Finding the Anthropocene in Tropical  
37  
38 Forests." *Anthropocene* 23 (September): 5–16. <https://doi.org/10.1016/j.ancene.2018.07.002>.  
39  
40  
41 Roberts, Patrick, Rebecca Hamilton, and Dolores R. Piperno. 2021. "Tropical Forests as Key Sites of  
42  
43 the 'Anthropocene': Past and Present Perspectives." *Proceedings of the National Academy of*  
44  
45 *Sciences* 118 (40): e2109243118. <https://doi.org/10.1073/pnas.2109243118>.  
46  
47  
48 Roosevelt, A. C. 2013. "The Amazon and the Anthropocene: 13,000 Years of Human Influence in a  
49  
50 Tropical Rainforest." *Anthropocene, When Humans Dominated the Earth: Archeological*  
51  
52 *Perspectives on the Anthropocene*, 4 (December): 69–87.  
53  
54 <https://doi.org/10.1016/j.ancene.2014.05.001>.  
55  
56  
57 Rodriguez, I. 2020. The Latin American decolonial environmental justice approach. In Coolsaet, B.  
58  
59 (ed.) *Environmental Justice: Key Issues*. Earthscan.  
60

- 1  
2  
3 Rindos, D. 1984 *The origins of agriculture: An evolutionary perspective*. New York: Academic press.  
4  
5  
6 Rykiel, E.J. 1985. Toward a definition of ecological disturbance. *Austral Ecology* 10(3):361 – 365  
7  
8  
9 Roué, M. 2012. Histoire et épistémologie des savoirs locaux et autochtones. De la tradition à la mode.  
10  
11 *Revue d'ethnoécologie*, (1). <https://doi.org/10.4000/ethnoecologie.813>  
12  
13 de Sousa Santos, B. 2014. *Epistemologies of the South Justice Against Epistemicide*. Routledge  
14  
15  
16 Skandrani, Zina. 2018. 'Decolonizing Ecological Research'. *Journal of Environmental Studies and*  
17  
18 *Sciences* 8 (3): 368–70. <https://doi.org/10.1007/s13412-018-0501-x>.  
19  
20  
21 Salpeteur, M. 2010. *Espaces politiques, espaces rituels: les bois sacrés de l'Ouest-Cameroun*.  
22  
23 *Autrepart*, 55, 19-38. <https://doi.org/10.3917/autr.055.0019>  
24  
25  
26 Salpeteur, M. 2018. Penser l'histoire des paysages avec les sanctuaires boisés. L'exemple de la région  
27  
28 des Grassfields (Cameroun). *Les nouvelles de l'archéologie*, (152), 35-40.  
29  
30 <https://doi.org/10.4000/nda.4215>  
31  
32  
33 Saulieu G. D., Elouga M., Sonké B. 2016. *Pour une écologie historique en Afrique centrale*. Yaoundé :  
34  
35 AUF ; IRD, 212 p.  
36  
37  
38 Saulieu, G. D., Sebag, D., & Oslisly, R. 2018. Vers une écologie historique de la forêt d'Afrique  
39  
40 centrale. *Les nouvelles de l'archéologie*, (152), 24-28. <https://doi.org/10.4000/nda.4191>  
41  
42  
43 Schmidt, P. R. 1994. Historical ecology and landscape transformation in eastern equatorial Africa. In:  
44  
45 *Historical Ecology: cultural knowledge and changing landscapes*. Carole L. Crumley (ed.).  
46  
47 Santa Fe, New Mexico: School of American Research Press, 99-125.  
48  
49  
50 Sungusia, E., Lund J.F., Ngaga Y. 2020. Decolonizing forestry: overcoming the symbolic violence of  
51  
52 forestry education in Tanzania, *Critical African Studies*, 12:3, 354-371. DOI:  
53  
54 10.1080/21681392.2020.1788961  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Terrell, J.E., Hart, J.P., Barut, S. 2003. Domesticated Landscapes: The Subsistence Ecology of Plant  
4 and Animal Domestication. *Journal of Archaeological Method and Theory* 10, 323–368  
5  
6 <https://doi.org/10.1023/B:JARM.0000005510.54214.57>  
7  
8  
9
- 10 Tengö, M, Hill, R. Malmer, P. Raymond, C.M. Spierenburg, M. Danielsen, F. Elmqvist, T. Folke, C.  
11  
12 2017. Weaving Knowledge Systems in IPBES, CBD and beyond—Lessons Learned for  
13 Sustainability. *Current Opinion in Environmental Sustainability* 26 (June): 17–25.  
14  
15 <https://doi.org/10.1016/j.cosust.2016.12.005>.  
16  
17  
18
- 19 Tilley, H. 2011. *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific*  
20  
21 *Knowledge, 1870-1950*. Chicago: University of Chicago Press.  
22  
23
- 24 Torres, C.T., Cuartas J.A 2013. Uso de los suelos antropogénicos amazónicos: Comparación entre  
25 comunidades Caboclas e indígenas Tikunas. *Gestion y Ambiente*. 16:2 5-17.  
26  
27 <https://revistas.unal.edu.co/index.php/gestion/article/view/39559>  
28  
29
- 30 Todd, Z. 2016. An Indigenous Feminist’s Take On The Ontological Turn: “Ontology” Is Just Another  
31  
32 Word For Colonialism: *Journal of Historical Sociology* 29 (1): 4–22.  
33  
34 <https://doi.org/10.1111/johs.12124>.  
35  
36  
37
- 38 Tangwa, G. B. 1996. Bioethics: an African perspective. *Bioethics*, 10(3), 183-200.  
39  
40 <https://doi.org/10.1111/j.1467-8519.1996.tb00118.x>  
41  
42
- 43 Trisos, C.H., Auerbach, J. and Katti, M. 2021. ‘Decoloniality and Anti-Oppressive Practices for a  
44  
45 More Ethical Ecology’. *Nature Ecology & Evolution*, May. [https://doi.org/10.1038/s41559-](https://doi.org/10.1038/s41559-021-01460-w)  
46  
47 [021-01460-w](https://doi.org/10.1038/s41559-021-01460-w).  
48  
49
- 50 Walters, Gretchen, Judith Schleicher, Olivier Hymas, and Lauren Coad. 2015. “Evolving Hunting  
51  
52 Practices in Gabon: Lessons for Community-Based Conservation Interventions.” *Ecology and*  
53  
54 *Society* 20 (4). <https://doi.org/10.5751/ES-08047-200431>.  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Walters, G., Fraser, J.A. Picard, N. Hymas, O. and Fairhead, J. 2019. Deciphering Anthropocene  
4 African Tropical Forest Dynamics: How Social and Historical Sciences Can Elucidate Forest  
5 Cover Change and Inform Forest Management. *Anthropocene* 27: 1–7.  
6  
7  
8  
9  
10 Wilson E.O. 2017. *Half-earth: our planet’s fight for life*. Liveright Publishin Corporation, New York;  
11 London.  
12  
13  
14  
15 Wiredu, K. (1994). “Philosophy, Humankind and the Environment,” in *Philosophy, Humanity and*  
16 *Ecology*, ed. H. Odera Oruka. Nairobi: ACTS Press, p. 46.  
17  
18  
19  
20 WinklerPrins, Antoinette M. G. A, and Carolina Levis. 2021. “Reframing Pre-European Amazonia  
21 through an Anthropocene Lens.” *Annals of the American Association of Geographers* 111  
22 (3): 858–68. <https://doi.org/10.1080/24694452.2020.1843996>.  
23  
24  
25  
26  
27 Wright, J. H., Hill, N. A., Roe, D., Rowcliffe, J. M., Kumpel, N. F., Day, M. Milner-Gulland, E. J.  
28 2016. Reframing the concept of alternative livelihoods. *Conservation Biology*, 30(1), 7-13.  
29  
30  
31  
32 Woldeyes, Y.G., Belachew, T., 2021. Decolonising the environment through African epistemologies.  
33 *Gestion y Ambiente* 24, 61–81.  
34 <https://revistas.unal.edu.co/index.php/gestion/article/view/91881/80278>  
35  
36  
37  
38  
39 Yasuoka, H. 2009. Concentrated Distribution of Wild Yam Patches: Historical Ecology and the  
40 Subsistence of African Rainforest Hunter-Gatherers. *Hum Ecol* 37, 577–587.  
41 <https://doi.org/10.1007/s10745-009-9279-5>  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60