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SPECIAL SECTION: WITNESSING ENVIRONMENTS

Wind, wood, and the entangled life of disasters

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In October 2018, the storm Vaia hit the Fiemme valley (Italy), causing extensive damage to its forests. As in other catastrophic events in the Anthropocene, this disaster was enhanced by the anthropogenic impact on wind patterns. It represents a strong correspondence between geophysical forces and capitalist offshoots in the atmosphere and woodland. The community of Fiemme sought to overcome its traumatic experience by establishing a *kinship of winds*, a cultural model that makes allowance for climate change underlying the linkage of several European wind storms. Caught in this entanglement, the root causes and the repercussions of Vaia are fractured into different temporal scales. With this, I propose a silvicultural turn where the forest might be seen as a parallel community with which to remodel the way of inhabiting the territory. Woods, in this sense, became *embedded witnesses* of climate change.

Keywords: Vaia storm, entangled disasters, community forestry, embedded witnesses, anthropogenic airscape, Fiemme valley, Italy

Facing the disaster in the Fiemme valley

Climate change is in the air. The storm Vaia, which crossed northern Italy in October 2018, was one of the most destructive wind storms of the last twenty years (Chirici et al. 2019), enhanced by the anthropogenic emissions of greenhouse gases. The windthrow, trees that were knocked over, involved more than fourteen million cubic meters of trees, almost one and a half million in the Cavalese Forestry district alone, among the territories most affected by the storm.[1] This article aims to underline the complex engagement between climate change, forest management, and turbulent airscapes that gave rise to the storm Vaia and its catastrophic effects in the Fiemme valley. This territory can be thought of as a "multi-layered object of research" (Bougleux 2015), a cultural landscape in which climate transformations are reciprocally connected with local forestry practices and regional wind patterns. The catastrophic storm of 2018 clearly showed the fragility of the territory of Fiemme, attributable to the failure of its centuries-old forest management, but also the problematic adaptation to these rapid and unexpected changes in weather patterns. Are the forests of Fiemme resistant to contemporary climate change and its wind storms?

First, I give an introductory account of the general (and generative) framework of the Vaia disaster, including its multiple connections with the Capitalocene. Then, I go through the turbulent anthropogenic airscape which, after the disaster, was reframed by the local community with the concept of "kinship." After that, I present the Magnificent Community of Fiemme (MCF), a medieval institution, focusing on the recent repercussions of a historical forest monoculture and the difficult transition to a new silvicultural model. Finally, I merge the different aspects of Vaia's entanglement, showing how humans and forests animate the atmosphere with their agency. Further, referring to my ethnographic material I discuss the possibility of considering the Fiemme forests as witnesses of climate change.

Despite the dramatic situation and restrictions in Italy from early 2020 due to the COVID-19 pandemic, it was possible to carry out almost six months of ethnographic research in Fiemme.[2] My fieldwork was focused on the

1. The district is located in the eastern part of the Autonomous Province of Trento, and includes the Valley of Fiemme and Fassa.

2. In addition to this fieldwork period, there were several weeks of work in municipal archives and in the historical archive of the MCF, which were necessary to consider the centuries-old history of the Fiemme community.

interventions of woodland restoration and reforestation, involving several local stakeholders. More concretely, in addition to numerous interviews with key social actors, I closely observed ordinary and extraordinary woods management practices. An official report by the Autonomous Province of Trento (APT 2020) collects and summarizes the results of the interventions realized so far, giving relevant quantitative data about the entire region. It is important to note that two of the three experimental reforestation sites selected by the province have been located in the Fiemme valley, in which new reforestation techniques will be tested. A complementary aspect of the research consisted of "mapping" the local perception of climate in the light of the Vaia disaster. The aim was to understand whether a new awareness was leading to a change in the way of "living the territory," especially in the relationship with the forest. As in the effective description of Bhojvaid, this kind of ethnographic engagement outlines "how lives and materialities in and of the air represent specific forms of human and non-human intertwining" (Bhojvaid 2020: 77).

The catastrophic effects of Vaia act like a revealing crisis (Solway 1994; Oliver-Smith 1996: 304), pointing out the vulnerability of the valley. In many respects, the upsetting impact of disasters is similar to other violent experiences, such as wars, pogroms, or genocide (Meiner and Veel 2013). The trauma of these communities "reflects the point at which the body of language becomes indistinguishable from that of the world" (Das 2003: 293). Hence the need to give voice to what happened, providing a testimony that finds confirmation in the territory. Despite the pandemic restrictions, during fieldwork I was able to conduct numerous formal interviews but, more importantly, I spent all the time I could listening to the testimonies of many inhabitants who shared their memories with me. Beyond the inevitable trauma, the storm produced a new awareness in the community,[3] which can be summed up in a sentence repeated by many: "Vaia brought woods back to the center."

The slopes of Fiemme represent the most crucial arena in which human and nonhuman communities of the valley are convoked to negotiate their future possibilities of existence. As Latour notes, this also means that each ecology is inextricably political and, as such, it needs witnesses, someone being called to testify, that is, give them a voice. Indeed, "to convoke" comes from the Latin *convocare* (*cum-vocare*), which means "to call together." In the aftermath of the storm Vaia, new forestry represents both a reframed strategy and a convocation of nonhuman actors, called to testify to climatic change. But what distinguishes a witness from the pure retention of historical events, from "simple" evidence of climate change?

It took a long period of collective reflection to pass from the evidence to the witness, from the circumscribed observation of landscape fragility to the attestation of a historical transition. This passage has been accomplished by identifying and recognizing the crucial role of nonhuman actors and geophysical forces, associating their agency with the human one. As we will see, woods are convoked as witnesses, in the double sense of testimonies and of the subjects who testify.

Local environmental knowledge, cultural representations of Vaia, and community forestry experience form the scaffolding on which I assembled scientific notions about climate change. Each of them responds to a particular aspect of the disaster and, in a more extensive way, of the alterations of regional climate patterns: the elaboration of new narratives about the Vaia storm allows an overcoming of traumatic memories; the centuries-old governance of woodland provides in-depth knowledge of the territory; and finally, ecological expertise has been employed to imagine new strategies to contrast extreme atmospheric events. In this regard, the community of Fiemme seems to have picked up the suggestion of Latour: "We are rather witnessing the obligation to relearn completely the way we are going to have to inhabit the Old World" (Latour 2017: 290).

Despite scientific research efforts to predict realistic scenarios, climate change still resists our attempts at domestication. Thus, to comprehend the root causes of the Vaia storm and its cultural impact, our anthropological perspective has to take into account both the role of nonhuman species (Kohn 2013; Haraway 2016) and geophysical forces (Baudo, Tartari, and Vuillermoz 2007; Bhojvaid 2020), and the several temporal scales

3. Considering the importance of this term, some indications are required. With "community" I refer to all the inhabitants of the valley directly or indirectly involved in the management, exploitation, or surveillance of forests. Out of a population of 20,609 residents, almost 95 percent are forest owners, as members of the MCF. Furthermore, about 300 families are directly involved in the wood supply chain. Besides the local forestry technician and warden, I also consider public officials who work (and often live) in the valley as part of the community.

that characterized the anthropogenic processes (Bougleux 2015). Disasters are only the most dramatic signs of these global transformations, "spike events" of a gradual and continuous flux of changes. Significantly, climate change models primarily concern the global circulation of water and air,[4] vulnerable to human interference. A notable example is atmospheric brown clouds, "regional-scale plumes of air pollution that consist of copious amounts of tiny particles" emitted from anthropogenic sources, with the capacity to alter the Asian monsoon system (UNEP 2008: 10–11). Extreme atmospheric events, just like glacier melting or land desertification, are neither only geophysical phenomena nor are limited to the Anthropocene. Indeed, it may be better to use the concept of a "Capitalocene," which has the advantage of marking precise cultural practices, as observed by Lanternari:

> Nor should the responsibility for disastrous catastrophes . . . be imputed to a theoretical factor devoid of concrete consistency such as the idea of "anthropocentrism," rather than to the cynical profiteering and unscrupulous individualism dominant in Western civilization. (Lanternari 2003: 135, my translation)

Considering the role of the Capitalocene in causing climate change requires a reconceptualization of our image of nature (Hastrup 2013; Latour 2017: 139–43). In this regard, capitalist-driven activities represent noncyclical amplifiers of cyclical forces that are shaping the atmosphere (Connolly 2017). Disasters reveal an agency of natural forces that exist independently from human perception (Oliver-Smith 2004: 18–20). Of course, disasters show how communities are vulnerable to this agency, which is often—as in Fiemme—the indirect consequence of complex engagements between humans and other living beings.

The concept of vulnerability has been intensively investigated in anthropology (Bankoff, Frerks, and Hilhorst 2004; Crate 2008; Lazrus 2012; Boulton 2016) and other social disciplines (Cardona 2004; Thomas et al. 2019), giving particular attention to the conditions of its cultural production (Barrios 2017b). Focusing on vulnerability allows researchers to translate the multidimensionality of catastrophic events into concrete life circumstances (Oliver-Smith 2004: 10). In this sense, disasters are not purely physical or natural occurrences, but the actualization of potential social vulnerability (Ballard, McDonnell, and Calandra 2020). Moreover, considering the relationship between human societies and their ecological context, the vulnerability can be seen as a reduced capacity to *correspond with* the environment or, better, with a limited set of environmental circumstances and actors (Cardona 2004: 37). In other words, we have to take into account the active contribution of nonhuman species capable of balance, and enhance or contrast the anthropogenic impact according to the relationship that human societies establish with them.

The lack of correspondence is often due to an erroneous synchronization between different temporal scales: obsolete forestry management, an early rainy season, the underestimation of a virus diffusion rate—they can all cause a disaster. Silvicultural interventions, such as clear-cutting, reforestation, or ecological thinning, implicate different temporal rhythms. These practices can be thought of as planned and small-scale disturbances of forest equilibrium, but their long-term effects are difficult to predict with certainty:

> The scenario is definitely destined to vary over the next few decades, and it is important to remember that damaged, mature woods were born one hundred, one hundred and fifty years ago, while the woods that will rise after Vaia—both naturally and by plantation—will begin to perform their practical functions only in thirty–sixty years. (APT 2020: 65).

Today, anthropogenic processes represent a new, complex, and unstable variable in global geophysical dynamics, forcing researchers, communities, and policy makers to continuously reframe their temporal scale (Bougleux 2015: 67). Disasters are often represented as discontinuous occurrences, characterized by several "un-" conditions: unpredictable, uncertain, unexpected, and so on (Shaw 1992). Instead, the risk exists only as a possibility, linked to the representations of certain phenomena (flood, earthquake, storm) in the collective imaginary, but these social representations are often fragmented through several actors, policies, and disciplines. Thus vulnerability can be thought of as a consequence of this fragmentation, characterized by a lack of

4. Air is much more than a mixture of gases: billions of bacteria, spores, yeasts, and other microorganisms permeate the atmosphere, spreading across Earth carried by global airstreams (Howe 2015). The weather-world (Ingold 2011: 120–22) is quite inhabited. However, these microorganisms cannot have a real effect on their environment's more turbulent occurrences, such as wind storms.

coordination between stakeholders, and asymmetries in power distribution.

When applied to woodlands, vulnerability depends on several factors: the forest structure, the characteristics of the trees, the condition of the land, and the practice of forest management (Peltola, Gardiner, and Nicoll 2013). However, the quantification of the critical wind speed, which causes uprooting and breakage, remains a very uncertain factor linked to regional wind patterns, casual extreme turbulences, and, of course, silvicultural strategy. This cultural practice is fundamental to providing long-term risk assessment, especially in communities like Fiemme, which base their success on the sustainable exploitation of wood. In light of climate change, any effective approach must assume that we are facing an irreversible transformation: the first step in evaluating its size is recognizing the multiple connections that entangle disasters, the dense texture of interactions and interferences between living beings, geophysical forces, and their different temporal scales. Vaia, which hit the valley in a single traumatic night, was connected to other similar catastrophic wind storms that crossed Europe in the last few decades. The increase in frequency, intensity, and magnitude of these disastrous storms constitutes clear evidence of climate transformations (Ulbrich, Leckebusch, and Pinto 2009; Usbeck et al. 2010; Gardiner et al. 2013).

These anthropogenic changes concern the entire Earth, but they locally materialize according to different cultural practices and policies, following those lines that compose and intertwine the entangled meshwork of living beings (Ingold 2011). In this regard, the Vaia storm is intertwined with both communities inhabiting the Fiemme territory. The following sections deal with two manifestations of this meshwork: the enhancement of European extreme wind storms, and the rational simplification of local forests.

StormVaia and its kinship

Catastrophes can be described as the result of the destructivity of geophysical phenomena enhanced by human activities (Barrios 2017a: 253). However, we have to remember that trees also contributed to the Vaia disaster: not as mere passive objects, but as nonhuman actors who responded specifically to an extreme atmospheric event. To move ahead with the anthropogenic implications of Vaia, we have to unpack the storm's "naturalness" (Ballard, McDonnel, and Calandra 2020), considering first of all how the Fiemme community reshaped its cultural conception of wind. Rather than viewing the wind as a natural force, the Capitalocene configures it as an expression of anthropogenic airscapes. Starting from the first Industrial Revolution, capitalism has contributed massively to atmospheric pollution, heightening the cyclical warming phase of Earth. One of the repercussions of this centuries-old interference is the reinforcement of extreme atmospheric phenomena (Barrios 2017b: 156). It goes without saying that, because of these dynamics, the climate is a very elusive research object. It can be thought of as a fluid and unstable entity (Boulton 2016), an unresolved process due to its dealing with different ranges of scale (Hastrup 2013: 13–20). And yet climate materializes into each territory, influencing living beings in several ways. With its focus on human-environment interactions, anthropology is increasingly involved in climate research (Crate 2008; Lazrus 2012; Oliver-Smith and Hoffman 2019; Ballard, McDonnell, and Calandra 2020; O'Reilly et al. 2020). Local ethnography often highlights the vulnerability and the fragility of marginalized communities. As suggested by Susan Crate, "anthropologists are strategically well-placed to interpret, facilitate, translate, communicate, advocate, and act both in the field and at home in response to the cultural implications of unprecedented climate change" (Crate 2008: 571). In that regard, I chose to carry out my research with the community of Fiemme, which is facing a crucial phase of change in the perception (and management) of its environment, and I sought to mediate between interdisciplinary experts and local stakeholders.

The first time I visited the Fiemme valley was eleven months after the passage of Vaia. Despite the interventions of the Provincial Forestry Department, tons of flattened trees still enfolded the slopes. The eccentric wind gust, which blew through the valley in the night between October 29 and 30, 2018, caused estimated damage of between three hundred and four hundred million euros. Part of my fieldwork has been dedicated to particularly damaged areas, including the Cavelonte Valley, located in the south of the Fiemme territory. Ilario Cavada was my guide on this small site. As a forestry technician, he knows in depth every inch of the territory of the MCF. In the two years following the storm he was occupied in drafting a new forest management plan, so he is fully aware of the extent of the damage. Although most of the windthrow involved the eastern slopes—and in particular the "artificial" woods—Ilario showed me that in Cavelonte it was the west side that was the most damaged.

Only a small part of the eastern side was affected by the storm there. This situation is due to the particular behavior of the Vaia winds, which blew in several directions, unlike the prevailing winds. Many inhabitants described the multidirectional impact as a "mad ball" that randomly bounced across the valley.

Like humans, trees also witnessed this impact; the forest was not destroyed, nor has it simply disappeared. It is typical of the human perspective—and of the capitalist one in particular—to assume that the woodland exists only as long as it remains vertical, implicit in the very definition of forest as a "collection of *stands*." However, as Coccia (2016) suggests, points of view (*points de vue*) are also points of life (*points de vie*), and from a nonhuman perspective the forest has just changed its configuration in relation to Vaia: no longer vertical, but horizontal.

It is necessary to insist on this "in relation": observing the intertwining of trunks, branches, and roots on the slopes of Cavelonte, I realized how the seemingly chaotic arrangement of the downed trees reflected instead the multidirectional gusts that blew into the valley. In this sense, the passage of Vaia was witnessed by the forest, which embodied the event in its new horizontal configuration. This situation is particularly evident in the Lavazè Pass, a mountain pathway in the northern part of the Fiemme valley: here the woodland is completely flattened for kilometers. The texture of this immense carpet of trees represents a sort of negative cast of Vaia's extreme winds.

Like the forest, the human community also still bore signs of the traumatic experience. Reckoning with these memories was a crucial part of the research. During interviews and conversations, the storm Vaia was a spontaneous argument that each inhabitant has experienced. Stories changed, but some narrative elements were an underlying common thread: the uniqueness of this "big wind," without parallel in the local memory; the fear of flood, like that of the disaster of Stava Valley (1985); the inability to accept such a level of devastation. All these aspects emerge in a recent conversation with an elderly resident:[5]

> Interviewer: So, what do you remember about that night?
>
> Respondent: Of course, the tremendous sound of the wind, howling in the valley. I heard the trees falling down, but saw nothing in the dark. . . . I couldn't sleep. The next morning I went out into the street, and I saw the trees smashed along the slopes. . . . I couldn't believe this has happened overnight, it made me want to cry.[6]

Other communities that had experienced catastrophic storms, such as the "Great Storm" of 1703 (Hastrup 2013: 7–8), the "Big Wind" in Ireland (Carr 1993), or the "Gale of January 1976," have offered similar narrations. As in these historical examples, Vaia became a central element in the social imaginary of the Fiemme community, enriched by supernatural themes: the contained damage to the infrastructure and the absence of both injured people and carcasses of animals aroused wonder in the community. The fact was considered a sort of "miracle," contributing to characterizing Vaia as an inexplicable event, provided with a specific agency. One year after Vaia, the mayors of the valley decided by mutual agreement to organize a ceremony in gratitude to Our Lady of Sorrow, to whom the community is particularly devoted. Thousands of inhabitants, coming from every municipality, took part in the pilgrimage to the Church of the Assumption in Cavalese, the oldest parish of the valley.[7] Many believe that St. Mary protected her devotees from the storm, thus explaining the apparently selective action of the storm, which damaged only trees.

From the extreme force of the wind to the width of the affected area, all these aspects heightened the representation of Vaia as an isolated and meaningless disaster. In this perspective, regaining a sense of normalcy after the storm means first making sense of the traumatic experience. Communities developed several approaches to promote and legitimate their interpretation of disasters, reframing narrations, collective perceptions, and cultural values into understandable—and shareable—visions (Krüger et al. 2015; Ballard, McDonnell, and Calandra 2020:

5. Unless otherwise indicated, the interviews cited in this article were conducted in confidentiality, and the names of interviewees are withheld by mutual agreement. Unless otherwise noted, all translations are my own.

6. Unpublished interview with an inhabitant of the Fiemme valley, residing in Tesero (Italy), February 19, 2020.

7. It is important to note that the 2019 ceremony was a replica of another local ritual: the *Levada*, a procession instituted after World War II in gratitude to St. Mary for having protected the valley from bombing—that is, another possible disaster averted.

4). One of them consists of comparing with past catastrophes, which can induce a meaningful change in the community perception of their disaster (Marzano, Blennow, and Quine 2013). That is what the Fiemme community has chosen to do. Vaia has been reconnected with other destructive wind storms, bypassing its traumatic characterization as an isolated, unforeseen, and inexplicable event. Importantly, other European regions, equally fragile in the face of extreme wind, provide to the community of Fiemme—to its policy-makers and experts involved in rebuilding—useful examples to prepare future intervention strategies.

There is certainly no shortage of cases for such comparison. Between 1950 and 2018, several wind storms crossed Europe, especially the northern regions: Vivian, Lothar, Gudrun, Kyrill, and Klaus, to remember the strongest (Ulbrich, Leckebusch, and Pinto 2009; Gardiner et al. 2010: 30–33). Each of these storms taken individually represents only a detached episode. Nevertheless, if considered as spike-events—random peaks of uninterrupted and turbulent airscape—then it is possible to recognize their underlying linkage. This approach is undoubtedly more complex but provides a cultural model capable of reframing Vaia on a historical scale, or better, of inserting the storm of 2018 into a series of entangled atmospheric phenomena. These multiple connections between isolated occurrences can be thought of as a kinship of winds, in which climate change represents an unusual descent rule.

To be absolutely clear, none of the people involved in the research has explicitly used the term "kinship." However, the adoption of this concept (as an analytic frame) has a number of advantages. First, it permits circumscription of a series of local discourses, grasping a "family resemblance" between several representations of past disasters, minor windthrows, and climate alterations; hence, it partially resolves the fragmented representation of disaster in the collective imaginary. Then, too, the concept of kinship is particularly significant in the context of Fiemme, where the social structure is still deeply anchored in the transmission of family privileges. Therefore, in ethnographic engagement with the community the term "kinship" represents a thick and "experience-near" concept (Geertz 1983: 57–58), useful for assembling local environmental knowledge and multiple representations of Vaia and, in a more extensive way, of climate change. Furthermore, the recent reconsideration and reassessment of this concept by Donna Haraway (2016) should not be forgotten.

However, it should be emphasized that my analytical frame is limited to reshaping a perception that already exists in the community, even if in a heterogeneous and uncoordinated way. Thus, introducing the concept of kinship, I sought to outline an emergent perception, which is already quite clear to atmospheric scientists and forestry experts. "We are not the only one" was a phrase frequently repeated during the various conferences and meetings that took place in Fiemme over the last two years. This kind of cultural model for narrating climate patterns and weather anomalies also reflects different modalities of (thinking) nature, redistributing the accountability between human and nonhuman actors. In his famous example of the collapsing granary, Evans-Pritchard (1937) showed how a factual explanation is insufficient to determine why a specific dramatic event has occurred. Facing the inexplicable destructiveness of Vaia, the community of Fiemme sought to rescale its perspective, including climate change as a common substrate among extreme wind storms. Furthermore, the performative dimension of this narration reveals itself in the rethinking of local practices such as forestry. As stated by Andrea Bertagnolli, senior forester:

> Vaia made us remember [the climate change] here in Trentino, but the problem of climate change and the increased frequency of extreme atmospheric events is a much broader issue. . . . There were storms with an order of magnitude twenty or thirty times more significant than Vaia, so it is clear that the problem of climate change is a much larger question than us, single forest owners. Reconstructing the last fifty years' windthrow occurrence, we note how each five, six, or seven years there is one of these events, more or less relevant, and it is a lesson that we forestry technicians have learned. . . . We live in a territory characterized by a certain fragility . . . thus, the question is: are these [forest] structures, these woods, still useful for this incoming climate pattern?[8]

Enhancing the substantial similarity between wind storms represents a way of narrating the traumatic experience of Vaia, which reassembles independent testimonies

8. Andrea Bertagnolli (MCF's forestry technician), unpublished interview with the author, Cavalese (Italy), October 24, 2020.

around the question of climate change. More important, by recognizing this underlying link between winds and windthrows, the Fiemme community chooses to become a witness of climate change.[9]

Despite wind storms occuring at a very local level, the regional warming pattern in the Alps may increase the frequency of this type of extreme phenomena (Lindner and Rummukainen 2013: 111), involving more and more territories. It is hard to foresee the future consequences of the anthropogenic impact on wind patterns, but we are already witnessing the first effects. In the Alpine region, wind storms doubled their frequency in the last fifty years (Usbeck et al. 2010: 50). Over the last century wind storms have been responsible for more than 50 percent of direct damage to European forests, with an increase of frequency and degree of damage in the last fifty years (Gardiner et al. 2010). This damage can be partially related to forest management and the progressive expansion of woods. Future scenarios also show—as a direct consequence of wind storms—the progressive loss of carbon dioxide in the European forests, further strengthening climate warming.

In summary, wind storms are part of a dynamic, turbulent airscape shaped by the anthropogenic emission of carbon dioxide, an evident sign of a profound mutation in our relation to the world (Latour 2017: 8). Considering the kinship that links several European wind storms is a good exercise of the "deterrestrialization of thought" (Howe 2015). Now we have to examine how wind has materialized itself across lives and, particularly, among forest and the community that lives in Fiemme.

Sharing the woodland

Forest and mountain regions occupy a growing body of global change research (Huber, Bugmann, and Reasoner 2005; Baudo, Tartari, and Vuillermoz 2007; Kolström et al. 2011), thanks to the recognition of their critical role in the functioning of the global geosphere. Mountains are hot spots of biodiversity, contain the primary terrestrial resources of carbon, and the supply of 30–40 percent of the Earth's freshwater. In this regard, forests represent ecological buffers, capable of stabilizing regional weather patterns (Moran and Ostrom 2005). Also, woods can be described as biotic communities dominated by tree species, characterized by different temporal scales and rhythms (Randolph et al. 2005). Thus, the forest landscape is the result of the centuries-old entanglement between humans, trees, other nonhuman species (Mathews 2018), and, of course, climate. It is worth remembering that Eduardo Kohn, in his ontological approach to the forest (Kohn 2013), seeks to explore this intrinsically semiotic engagement: it is not a matter of *thinking through* trees or animals, but rather *living with* them.

The Capitalocene marks a new phase for these dynamics, which moreover risks threatening the livability of living beings seriously. The warmer temperatures in the Alps are increasing hazards, with relevant damage to woods, crops, and infrastructures (Beniston 2005). In the Fiemme valley, despite having damaged only 5 percent of forests, Vaia caused the fall of about 800,000 cubic meters of trees, almost ten times the annual cutting quota (APT 2020: 3–4). From the environmental point of view, the valley includes around 30,000 hectares of forests, corresponding to 60 percent of the territory. Most of the trees are *Pinaceae*, among which the Norway spruce (*Picea abies*) represents at least 80 percent.[10]

It becomes quite evident, observing the damaged slopes, how this particular species composition contributed to the catastrophic impact of the storm Vaia.

9. The close relationship between Vaia and other extratropical cyclones finds support in the scientific literature: a comparison between the eleven most destructive European storms revealed many similarities between their patterns and their ecological repercussions (Gardiner et al. 2010: 46–70). The extratropical cyclones are mainly concentrated in the North Atlantic Ocean, from where they cross Europe, especially during winter. However, anthropogenic climate change affects cyclone activity: the Mediterranean basin is significantly affected (Ulbrich, Leckebusch, and Pinto 2009: 126), with an increase of frequency and intensity of these storms, also during autumn, as in the case of Vaia. This tendency appears evident if we consider the climatic data for specific regions. For instance, comparing winter storms in Switzerland in the last hundred and fifty years, Usbeck et al. (2010) underline a warmer temperature (+2 C°), a higher precipitation rate, and an increase of the maximum gust wind speed.

10. Woodland species composition can be considered a reflection of historical ecology. In the lower zones larches (*Larix decidua*) are mixed with spruces, while Scots pines (*Pinus sylvestris*) occupy the driest areas near Tesero, in a land strip that is almost totally damaged. Also, stone pines (*Pinus cembra*) are situated at high altitudes. Silver fir (*Abies alba*), widely diffused in the lower part of the valley, is the second most prevalent species, after the Norway spruce. By contrast, broad-leaf species are sporadic, present only in orchards, and inhabited areas.

The anthropogenic effects, in a way, are embedded in bodies, no matter whether human or not. Interfaces (and interferences) among disaster's scales are represented and experienced by communities (Hastrup 2013; Bougleux 2015: 70). In this regard, the forest represents a parallel biotic community with which human inhabitants of Fiemme share the same territory, living together. Forestry is a specific cultural practice to negotiate this coexistence but, nevertheless, reciprocally binds the two communities. For this reason, the alteration of temporal scales due to disasters changes the resilience[11] level both of the environment and human society (Oliver-Smith 2004: 24).

The leading forest owner of the Fiemme valley is undoubtedly the Magnificent Community of Fiemme (MCF), a medieval institution created in the twelfth century and still existing (Giordani and Morandini 2008). Although it is no longer possible to reduce the community of Fiemme to only the MCF, it remains a foremost stakeholder, especially concerning heritagization of forests and environmental policies. In the aftermath of Vaia, while the regional government substantially provided emergency repair services, the MCF sought to improve its capacity for protective (and preventive) actions. Over the past year, I dealt closely with this institution and its activities, also participating in some of them, such as public conferences, visits to reforestation sites, and technical surveys. The Magnificent Community is an essential interlocutor for any research in the valley, bearing in mind that this institution had literally shaped the landscape of Fiemme. The MCF is administratively composed of eleven municipalities, known in the past as *Regole* (Rules), which now hold their part of the woodland. For nine centuries the collective rights of the *vicini* (neighbors)—the members of the MCF—have been confirmed by the political entities that have dominated the region, from the Prince-Bishopric of Trento to the Italian Republic.

Since the late sixteenth century the MCF has established the *ordeni dei boschi* (laws of the woods), a formal arrangement for the collective management of woods, which determined the forest plans for centuries. This regulation allowed the maintenance until the nineteenth century of the *Gazi*, banned portions of forest similar to the German *Bannwald*. It was possible because the MCF's woodlands represent a common-pool good, governed by a common-property regime: an institutional arrangement for the shared use, management, and ownership of natural resources, to obtain long-term benefits (McKean 2000). The Gazi have ensured precious natural reserves over the centuries, even during the periods of the worst deforestation and indiscriminate exploitation. This arrangement is frequently found in community forestry, in which woods resources are exploited for social and economic benefits, through ecologically sustainable policies (Charnley and Poe 2007: 303); for that reason, since the early 1980s, community forestry has attracted the interest of scholars as a possible alternative to counteract growing deforestation and forest degradation. More recently, new community forestry has arisen—notably in Asia and South America—due to the struggle of indigenous people to find a valid social model to manage natural resources (Charnley and Poe 2007: 305–307). This approach actually implies an equitable sharing, access, and distribution of the forest resources, and the redistribution of profits from commercial activity.

Nevertheless, in community forestry, there are commonly internal conflicts between local power elites and democratic principles. These contrasts often concern the cost-benefit balance of forestry, a fundamental aspect for the institutions involved in woods management (Gibson, McKean, and Ostrom 2000). Of course, the commercial exploitation of forests is compatible with sustainable forestry, as in the timber harvesting in Fiemme. After 1987 the management strategy changed, increasing forest extension: silvicultural interventions became more intensive and dynamic, favoring natural regeneration instead of planting (Morandini 1996). Forest certifications endorse this coexistence between economic and ecological issues. The MCF was the first institution in Italy and the Alpine region to conform its forest management to the Forest Stewardship Council standards (FSC®) in 1997. About ten years later, the woods of Fiemme have obtained a second certification of sustainability, released by the Programme for Endorsement of Forest Certification schemes (PEFC™). The certifications were reconfirmed in 2019, to recognize the MCF's struggles to restore its forests after Vaia.

The context of Fiemme is an excellent example of how a greater local control over woods management can result in more ecological forestry. Through sustainable utilization, community forestry has remarkable

11. Although there are manifold definitions of this concept (Ballard, McDonnell, and Calandra 2020: 10; Lazrus 2012: 292; Norris et al. 2008), everyone agrees on the adaptive function of resilience, especially in the aftermath of disasters (Thomas et al. 2019).

benefits: first of all, an improvement of its territory's livability and safety. In this sense, the centuries-old existence of the MCF demonstrates that the community of Fiemme has implemented a series of suitable strategies. For this reason, the Fiemme valley records an annual increase of its woods (one hundred hectares per year), in a trend counter to the global loss of forested land.

Among the various strategies to face the aftermath of disasters, planting and rebuilding green represent an ecological and resilient approach (Barrios 2017a). AsTidball (2014) suggests, trees are socioecological symbols, capable of enhancing the engagement between living elements, community resilience, and green policies after disasters. Plantation also represents a highly symbolic practice, a social ritual used to restore the landscape and enforce community identity. In the Fiemme valley, for instance, during planting a stone is placed at the base of each new plant's roots: it is an ancient practice with a strong symbolic value, which forestry technicians continue to perpetuate over time.

However, planting is not a neutral practice. As Tsing demonstrates, it represents a form of ecological simplification, in which living beings such as trees, for example, are converted into resources by detaching them from their life-context (Tsing 2016: 4). Plant nurseries are at the very center of an industrialized machine of replication, which transfers not only plants but also microorganisms and pathogens, globalizing tree diseases (Tsing 2016: 12). Monocultures are another example of ecological simplification (Besky 2020), historically applied both to agriculture and European forestry. The landscape of Fiemme is the result of spruce monoculture plantation. As suggested by James Scott, scientific forestry entails a "radical reorganization and simplification of [Alpine] flora" (Scott 1998: 2), but Venetian rational forestry during the Renaissance anticipated this modern approach (Appuhn 2000). The scientific standardization of forests in the eighteenth century (Scott 1998: 11–21) has its roots in Venetian wood management and markets, which profoundly influenced the Fiemme valley.

During the Capitalocene, new logics of exploitation of natural resources are taking shape, and also new kinds of standardization: forests are being rethought as significant carbon sinks, involving these nonhuman actors in the global carbon market. The commodification of carbon has come up as a key question after the Kyoto Protocol, which established parameters to evaluate the human impact on the atmosphere. The commodification process transforms carbon dioxide's materiality into intangible financial objects, such as the carbon credit. The certification of emissions—as in the case of a forest—represents a process of defining carbon as a cultural object (Dalsgaard 2013). As suggest by Oliver-Smith (2004: 21), commodities can be seen as functioning ecologically.[12]

Strategies of decarbonization are an important subject of study in climate anthropology (Dalsgaard 2013; Karlsson 2016; O'Reilly et al. 2020). An example is the REDD+ initiative for reducing carbon dioxide from deforestation since forest biomass represents a potential reserve of carbon (Bugmann, Zierl, and Schumacher 2005; Dalsgaard 2013: 93). These silvicultural programs often failed as empowerment of the communities—which cannot be separated from the government of woodlands—because they underestimate two crucial recommendations: to recognize the historical ecologies of community, and to ascertain the practices that enhance the disruptive effects of disasters (Barrios 2017a: 253–60).

As we have seen, Vaia highlights several unsuspected weaknesses of Fiemme forestry management (Manfriani 2018), leading to a revaluation of these historical approaches from the perspective of climatic change (Corona 2019). Every property regime (private, public, or shared) can design successful forestry strategies, but the competitive coexistence of two different regimes can undermine the strength of the forest (Moran and Ostrom 2005). The actual species composition of woodland in the Fiemme valley is the result of such a situation. After the late sixteenth century some private commercial companies, in business with the Republic of Venice, began to take over the wood market in Fiemme. In some cases, these companies had the support of influential families within the MCF. The commercial competition with these new economic players led to an intensification of the cuts and the massive plantation of Norway spruces, the most profitable species. Over the centuries this trade-driven

12. The forest processes of fixation and liberation of carbon dioxide in the atmosphere and soil have a vast influence on the global carbon cycle (Randolph et al. 2005: 112–13). European mountain vegetation, for instance, seems to be carbon-saturated: a practical exposure of four years to a high level of carbon dioxide had not induced a change in plant biomass at high altitude (Körner 2005: 369–71). Also, one of the crucial criteria for evaluating the ecological impact of wind storms is the decrease in carbon accumulation (Gardiner et al. 2010).

management imposed two species of fir (*Picea abies* and *Abies alba*) on the valley ecosystem.

The impact on biodiversity is quite evident. While in the past silver firs were uprooted because of their lower commercial value, recently MCF has been promoting this species due to its root system, which ensures more excellent slope stability. This choice appears particularly significant in the light of the Vaia storm. One of the factors that amplify the impact of wind is the Norway spruce's root system, which remains more on the surface compared to other species. Of course, wind gusts up to two hundred kilometers per hour can shatter every type of tree, despite its anchoring in the ground. However, the massive presence of Norway spruce in the valley makes the forests of Fiemme more vulnerable to extreme wind phenomena. These woods were standardized through a centuries-old silvicultural method, resulting in stands of even-aged trees of homogeneous types, an example of how past choices could have repercussions in the future.

This sort of forest monoculture is particularly evident on the Lagorai mountain range, which delimits the valley on the south. In the last century its slopes have been deeply transformed by human activity: in the photos from the 1930s pastures that reached almost two-thirds of the altitude are still visible. Walking through the trails above Ziano, located in the central area of the valley, I found several signs of this ancient landscape, which is now completely hidden by the forest. Dry stone walls, old paths, and boundary stones still emerge among the roots, and in the clearings created by Vaia. With the progressive abandonment of pastures in the last eighty years, the municipality of Ziano and the MCF have favored the spread of Norway spruce. In some areas, forest stands have a geometric disposition, thanks to reforestation interventions.

Right above Ziano, Vaia has torn down a large portion of this fir forest, but the remarkable thing is that some trees have resisted. Amid the carpet of flattened Norway spruce, a few larches stand out, having survived the extreme wind. They weren't planted intentionally, and their deep roots allowed them to resist where the Norway spruce fell. Now, like all catastrophe survivors, these larches are the best nonhuman witnesses to storm Vaia. They testify that forest monoculture is coresponsible for the disaster and that the territory of Fiemme is still fragile due to its cultural heritage. The human community has been given the lesson of larches, which is why this species is mostly used in recent reforestation.

To reestablish the woods in the aftermath of Vaia, the Forestry Department of Fiemme implemented a plantation plan inspired by other European examples. During 2020, about seven thousand larches were planted, covering three hectares of damaged slopes. Another fifty thousand larches will be planted in the next years, but most of the areas will be left to natural renovation. The decision was taken after comparison with similar contexts on the other side of the Alps: one year after Vaia, the MCF organized a visit to the Canton of Grisons, a territory that in many ways is the Swiss analogue of the Fiemme valley. The municipality of Disentis/Mustér, which hosted the Italian delegation, experienced the same catastrophic effects during the passage of Vivian, thirty years before Vaia. This example demonstrates how the relationship between disaster-affected communities could be productive for the future, by sharing knowledge and strategies to deal with new extreme wind storms, such as selective reforestation.

However, any adjustment of the forestry paradigm requires tens of years before it could affect the woodland's structure and composition. The slow-growing rhythm of spruces introduces a temporal phase-shift, which explains how the forest management set in the sixteenth century could have impacted today. Norway spruce takes at least a hundred years to mature, an inertial period that has now led the MCF to rescale its practices. As the forest warden underscored:

> The forest has its own times. The effects of the choices we make about the planted species will be seen in a hundred years. The wood we cut now is the result of choices made a century ago. In the upper zone over Predazzo, in the mature woods, the average age is two hundred, two hundred and fifty years.[13]

This is an excellent example of what it means to *correspond with the* environment, but also how complex synchronization between temporal scales is. Climate change further complicates the connections between small-scale causes and large-scale consequences. In this regard, microevents and community practices, like forest management, have to be evaluated as active agents of complexity (Bougleux 2015: 71). Several measures were adopted in European woodland management to face climate change (Kolström et al. 2011), even though

13. Interview with forest warden of the MCF, Predazzo (Italy), February 20, 2020.

anthropogenic impact induces context-driven responses: in the Alps, for instance, the warmer climate could increase the growth of vegetation at a higher altitude, and the advance of the treeline upslope (Körner 2005), influencing the carbon dioxide percentile absorbed by woodlands.

Forest transpiration of carbon dioxide, oxygen, and water-vapor represents a fluid link between earth and sky, which makes trees inhabitants of the "weather-world" (Ingold 2011: 115). Thus the woodland is an intermediary space created by the interactions between soil, airscape, and trees, such as the delta landscape analyzed by Morita and Jensen (2013). The example of the Chao Phraya flood shows similar dynamics with the storm Vaia, because of the land-shaping forces involved: water in the Thailand delta, wind in the Alpine forest, with the same necessity of rescaling the perspective (Morita and Jensen 2013: 115). Taking into account this intermediary dimension of the forest may lead to an "atmospheric cultivation" of regional climate patterns (Howe 2015). Such an example underlines how inhabiting the world means joining in its formation process, together with other living beings (Ingold 2010: 6).

Forests as embedded witnesses

In the previous paragraphs, I have outlined the entangled life of Vaia, which partially overlaps the cultural dimension of disasters (Meiner and Veel 2013). This storm represents, in a way, the catastrophic interlacing between different offshoots of capitalist-driven practices: on the one hand, industrial carbon emission, carbon commodification, and the alteration of extreme wind patterns and, on the other, the standardization of forest composition and selective plantation since the seventeenth century. From this perspective, the disaster appears as contradictory and conflictual connections between a series of historical events. Thus disasters mark not only a lack of correspondence, as we have already suggested, but also its excess: an overmatching correspondence between capitalist offshoots and geophysical forces. In other words, capitalism amplifies cyclical rhythms of atmospheric processes, until this oscillation reaches a breaking point, what is called in physics "forced resonance" or resonance disaster (Spatz and Theckes 2013: 67; Alonso and Finn 1980: 376–79).

Having presented the texture of interference and interactions that entangled the Vaia storm, we can now merge the different temporal scales to appreciate some of the leading repercussions on the landscape of Fiemme. Over the short scale, the breakage of trees has compromised the stability of the topsoil, heightening the risk of avalanches during the winter season. This has led the community to speed up some recovery practices, from removing fallen trees to selective plantation to reinforce the slopes near inhabited areas. In terms of the medium-scale standpoint, the wind storm creates an "empty" space, promoting the settlement of a variety of species in this new ecological niche. Smashed trees were ordinarily degraded by bacteria and fungi, which in these circumstances find an ideal terrain. However, global warming and industrialized plantation may enhance the diffusion of dangerous microbes, damaging healthy trees. Finally, from the long-scale perspective, the increase of extreme wind storms will rebound on the Alpine woodlands, making the communities more vulnerable, and further reducing the overall accumulation of carbon dioxide. Over time, the forest will adapt to this new climate pattern, changing its biotic composition and landscape coverage. As Andrea Bertagnolli said:

> Vaia was the trigger element. Because even the Magnificent Community [of Fiemme] has realized that for the future, it will be difficult to manage the forest heritage, carry out cultivation interventions, continue reforestation. In short, "cultivate" the forest, an activity that our community has done for a thousand years.[14]

This awareness puts into question Fiemme inhabitants' centuries-old experience of forestry, looking for new management strategies (Manfriani 2018; Corona 2019; Valinger, Kempe, and Fridman 2019; APT 2020). The ecological sensibility of this community should not be exaggerated, since it is far from being a green utopia in perfect harmony with the forest. Nevertheless, they are experimenting with new ways of inhabiting the territory together with the forest. As stated by Bertagnolli: "It is beyond doubt that forests represent our best allies to mitigate the climatic crisis. Managing them taking into account all the ecosystem services and enhancing multifunctionality is fundamental" (Gabrielli 2019: 12). Two years after Vaia, many steps have been taken in this direction: certification of ecosystem services, enhancement of carbon storage, use of local ecotypes for plantation. During 2020, the MCF alone reforested more than forty hectares of land. However, the accountability of this

14. See note 9 above.

Figure 1: Southern slope of Mt. Cornon, above Ziano di Fiemme (Italy), with evident damage caused by Vaia (September 2020). Photo by author.

global transformation has to be redistributed among the territories and their inhabitants, entwined by the same turbulent airscape. Each realistic climate model has to make allowance for the "viscous" (Boulton 2016: 778) and pervasive qualities of the atmosphere.

Air is the material medium in which both humans and trees are immersed, and which outlines the possibilities of establishing correspondences between living beings. As Ingold states: "If we consider, too, that the character of this particular tree lies just as much in the way it responds to the currents of wind . . . then we might wonder whether the tree can be anything other than a tree-in-the-air" (Ingold 2010: 4). More precisely, air-streams do not *connect* any global network; they *are* lines of an inhabited

Figure 2: Forest worksite in the Cavelonte Valley (October 2020). Photo by author.

Figure 3: Large clearing near Ziano (Italy). In the background are visible few larches that survived the windthrow (May 2020). Photo by author.

global airscape. Rather than a network of interacting entities, the wind is the material frame of a meshwork of living beings mutually entangled. The anthropogenic augmentation of extreme wind storms testifies with clarity that the agency of humans and forests *animates* the atmosphere. For instance, forests synthesize just under half of global oxygen, while human societies are the leading producer of carbon dioxide. These gas emissions are footprints of living beings' agency imprinted on the atmosphere. Air, as a viscous material medium, traps in global air-streams oxygen, water vapor, carbon dioxide, and other gases, influencing local conditions of liveability thanks to its pervasiveness.

These aspects do not concern only the Anthropocene. Current climatic conditions, such as the essential presence of oxygen, have been reached over billions of years by the unintended and unpredictable effects of microorganisms and vegetation. But organisms do not merely adapt to their environment; they make it up. Living beings create life conditions for their own and, through their unforeseen consequences, also for other species. Today, these dynamics become even more crucial:

> The multicellular organisms that produce oxygen and the humans who emit carbon dioxide will multiply *or not* according to their success, and they will win exactly the dimension that they are capable of taking. No more, no less. . . . For better or for worse, we have entered into a *postnatural* period. (Latour 2017: 142)

It would be pointless to morally judge oxygen production by forests, just because it improves air quality and contains carbon emissions. Indeed, in a way, humans and trees are competitive actors in shaping global weather. The environment is the historical outcome of evolution, growth, and mutual interaction of living beings, composed by the juxtaposition of varying temporal scales. For example, a forest landscape bears the footprints of climate patterns and human forestry: dendroclimatology is concerned precisely with interpreting these traces. With respect to the "golden spike" that geologically distinguishes the Anthropocene epoch, ice-coring and rock chemical composition are also, properly speaking, involuntary records of the anthropogenic impact (Baudo, Tartari, and Vuillermoz 2007).

The forests of Fiemme have not limited themselves to this passive registration. The horizontal reconfiguration of woods in Cavelonte Valley and Lavazè Pass is more than a temporary adaptation to extreme winds. Of course, thousands of trees have died, but the forest still exists and is slowly imposing a new arrangement on the territory. The larches that survived—as in the clearings above

Ziano—will disperse their seeds without competition from the Norway spruce, changing the percentage of the species. New plants are already growing among the uprooted stumps, accelerating the formation of an unevenly aged and mixed forest. This structure favors trees dampening oscillations, reducing the excessive resonance caused by extreme winds (Spatz and Theckes 2013). Thus, these patches of trees are the direct result of the entanglement of anthropogenic airscapes, capitalist-driven plantation, and nonhuman agencies; in other words, they embed witness of Vaia.

The disaster of 2018 represents a historical turning point for the community, which seeks to rethink its way of inhabiting the valley through reformulating forestry. Or, to be more precise, to cohabit it together with the forest, reaching a new correspondence. In this sense, the slopes of Fiemme are the ideal ground for cultivating *sympoiesis* (Haraway 2016), as coordinated practices of reconstruction of the territory. Trees are the best candidates for mediation in the intricate meshwork that binds humans, Alpine territories, and regional climate patterns. Can we consider this silvicultural turn as the first step toward an "assembly of things" (Latour 2017: 261–63)? The experience of the Fiemme community shows how witnessing climate change is possible only through involving nonhuman actors, through a conscious assemblage of human and nonhuman testimonies.

Through consciously pursuing forestry, the community of Fiemme is shaping the landscape, making allowance for that underlying entangled dimension pointed out by Vaia. Woodland is being rethought to better *correspond with* the new turbulent airscape that is gradually emerging. Carbon storage is not just a physical process: in a broad sense, it is an embodiment of cultural traces that pervade the climate. Disasters like Vaia remind us that our anthropogenic footprints are not blueprints, as we sometimes deceive ourselves. We have to recognize that, like every living being on this planet, our ways of inhabiting have unforeseen consequences.

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