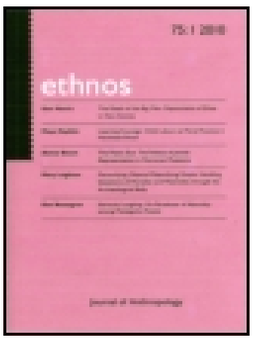

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Becoming 'Wild' at the Intersection of Knowledges: Coffee Rust Crisis in Costa Rica

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ABSTRACT

This article explores the relationship between visualism, practice and knowledge through the specific case of the 2012–2013 coffee rust-epidemic and its repercussions among small-scale coffee farmers in Turrialba, Costa Rica. The article shows how the rust-epidemic marked an alteration not only in farmers and agronomists' perceptions of *roya*, but also in farming practices. The argument of the article is twofold: First, that the perceptual shift of *roya* from being 'calm' to becoming 'wild' involved both top-down and bottom-up processes; and, second, that farmers increasingly combine *looking* and *seeing* in their daily management practices. We illustrate these dynamic interchanges by drawing on Okely's (2001, Visualism and Landscape: Looking and Seeing in Normandy. *Ethnos*, 66(1):99–120) approach to visualism, and argue that an emphasis on interchanges and interconnections between knowledges is essential in dealings with ecological alteration.

KEYWORDS Coffee rust; visualism; knowledge; enactment; experience

On 22 January 2013, Costa Rica declared a state of emergency to battle the spread of a disease affecting coffee plants[1] (Cressey 2013). The disease, also known as coffee leaf rust, or *roya*, is caused by a fungus (*Hemileia vastatrix*),[2] which debilitates the plant, and, in severe cases, may cause premature fall of leaves and death of branches leading to heavy crop losses (McCook 2009). It was first discovered in Sri Lanka (previously Ceylon) in 1869, from where the disease continued its spread to Asia and Africa, reaching Brazil in 1970 and later Central America where it was first discovered in Nicaragua in 1976 (McCook 2006). Costa Rica's first encounter with coffee rust was in 1983. Cultivars susceptible to rust-attacks were planted throughout the Central American region, making the presence of rust particularly distressing. To address the disease, regional and international efforts involving private and public

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organisations established the network PROMECAFE (Programa Cooperativo para la Protección y Modernización de la Caficultura) in 1979. PROMECAFE facilitated training and conducted research on coffee varieties' resistance to rust and on the effectiveness of fungicides (Avelino et al. 2015; McCook 2009). The adoption of recommendations by farmers was very heterogeneous throughout Central America, and some ignored recommendations altogether. Despite a few nationwide epidemics, the region managed to avoid a predicted disaster. Some relate this to the existence of natural biological controls, the complexity of the coffee ecosystem and crop management patterns of the time (Vandermeer et al. 2014; Avelino et al. 2004); conditions which later were altered through processes of 'technification' that aimed at intensifying coffee production (McCook 2006).

The rust-epidemic of 2012–2013 was probably the most severe outbreak experienced in Central America, affecting an estimated 50% of the total coffee cultivating area and leading to an immense production loss of 20% in 2013 alone (ICO 2013: 2–4). In Costa Rica, about 64% of the coffee plantations were affected, that is, more than 60,000 hectares of the total 94,000 hectares planted in the country. The damages and production losses caused by the disease had significant socioeconomic impacts on thousands of the country's coffee farmers, of whom smallholders with fewer than five hectares of cultivated coffee constitute 92%.[3] For *turrialbeño*[4] coffee farmers, the epidemic was another setback that created notions of an uncertain future for the region's coffee culture.

This article explores the relationship between visualism, practice and knowledge in a situation of altering ecologies. It focuses on the specific case of the 2012–2013 coffee rust epidemic and its repercussions in Costa Rica, where Isabelle[5] conducted a six-month fieldwork in 2015 among small-scale coffee farmers[6] and agronomists in Turrialba. In contrast to the body of literature focusing on the biological, economic and historical aspects of coffee rust (Vandermeer et al. 2014; Avelino et al. 2015; McCook 2009; Clarence-Smith & Topik 2003), this article describes the sociocultural dimensions of *roya* by exploring the conceptual efforts involved when coffee farmers and agronomists 'discovered' and initiated attempts to deal with coffee rust.[7] As such, it discusses how different ways of seeing are put into play as different agents, knowledges and practices involved in fighting the disease became integral in *enacting*[8] *roya* as a disease in a conceptual sense. The argument of the article is twofold: first, we argue that the rust-epidemic marked an alteration in both agronomists and coffee farmers' perceptions of *roya* in Turrialba. This conceptual shift involved a view on *roya* from being 'calm' (*calma*), as was the common notion of *roya* among agronomists and farmers prior to the epidemic, to becoming 'wild' (*brava*). This shift involved what we analyse as top-down processes of *enacting roya* as a disease through a scientific perspective and bottom-up processes of farmers' first-hand experiences with *roya*. Second, and despite the predominance of the scientific perspective in 'discovering' and establishing *roya* as 'wild', we argue that farmers nonetheless combine *looking* and *seeing* (Okely 2001) in their quest to gain knowledge about coffee rust and the environment. Recognising this combination of, and interchanges between, *looking* and *seeing* is important in order to approach and understand the complexities of altering ecologies.

What Do We Know and How Do We Know It?

In order to grasp the dynamics in ways of seeing and knowing, we want to take the argument of direct perception (Ingold 1992) a step further by applying Okely's (2001) approach to visualism, which distinguishes between *seeing* and *looking*. For Okely, *seeing* is a way of understanding through an embodied experience that engages all the senses of the body and bodily memories (2001: 103–104). In contrast, she defines *looking* as the distant, commanding gaze of a spectator. Despite this opposition, Okely shows that *looking* is not necessarily limited to these characteristics. For instance, she describes how retired farmers living in urban homes *look* from distance at the rural landscape and relate these glimpses to their time spent working there (Okely 2001: 106). In other words, Okely suggests that you might *look* to *see*; implying that you do not have to be within the immediate environment to *see* it in a more experience-near sense. In this way, physical detachment does not lead to perceptual detachment, as memories of 'dwelling' (to use Ingold's term), have been embodied.

By applying Okely's analytical terms, we aim to fill what we identify as a conceptual gap in Ingold's (1992, 1993a) approach to visualism and ways of acquiring knowledge. Compared to Okely, to whom experiential *seeing* does not rely on continued attachment; Ingold's approach requires attachment in order to enable an absorbing and sensorial way of knowing. For Ingold, different modes of engagement lead to different perceptions by people living in similar environments. He presents *local* and *global* perspectives of the environment as nonhierarchical modes that embrace different means of apprehension. The former is based on being-in-the-world, a practical and lived experience, which enables a person to conceive from within. The latter is based on a distant observation of the world detached from life, perceiving the world as a globe (Ingold 1993a: 216). According to Ingold, the two modes of perceiving do not exclude one another as each contains the potential of the other. Although Ingold tries thus to moderate the differences, we believe the distinction may blur important interconnections and interchanges in ways of seeing and knowing. As such, the distinction instead reproduces dichotomies of science versus local knowledge; dichotomies that may be problematic if assumed apriori (Knudsen 2009).

This article combines Okely's (2001) approach to visualism with Latourian constructivism (Latour & Woolgar 1986). While Okely focuses on subjectivity and experience in exploring ways of seeing (thus opening up for ways of knowing), Latour seeks to comprehend how scientific knowledge is produced. An advantage of Latour's approach is his emphasis on generalised symmetry; he avoids Euro-American dichotomies of nature-culture and subject-object by exploring how phenomena come into being through an analysis of a horizontal network in which statements, objects, 'facts', devices, institutions and agents find themselves at the same level (Latour & Woolgar 1986). Along similar lines, Okely rejects a divide between body and mind in arguing for experiential perception. By applying Okely's concepts, we argue that coffee farmers and agronomists combine *looking* and *seeing* in their attempts to know and categorise their environment. Although farmers and agronomists' knowledges can be associated with either *local, seeing* and *technique* on the one hand or *global, looking,*

and *technology* on the other, they can neither be equated with nor restricted to either category. Rather, our point is to illustrate the complex dynamics of how people gain knowledge of their environment in the context of a coffee-rust attack that emerged as particularly aggressive.

Coffee in Turrialba

Turrialba is the city of the canton by the same name located in the Cartago province. Coffee farming expanded in Turrialba at the end of the nineteenth century when the construction of a railroad route from the Central Mesa to the Caribbean port of Limón connected Turrialba to the national market. The railroad line contributed to the canton's agricultural development by introducing and expanding commercial cultivars, such as banana, sugar cane and coffee (Araya 2003). By the mid twentieth century, Turrialba had developed an extensive coffee market.

The revolution in 1948 removed the coffee elite from the direct political power they had exercised since 1870. The developmentalist agenda promoted after José Figueres-Ferrer came to power included production diversification to minimise the national economy's dependence on the coffee and banana sectors (Picado & Prieto 2007: 14). As to support the shift to diversification, restructurings in the institutional organisation of the country's agricultural research ensued at the end of the 1940s. This opened up for a research structure specific for crops (Picado & Prieto 2007: 26). The developmentalist ideology also involved a transformation of the coffee economy through credit, sponsorship of smallholder cooperatives and technical assistance (Paige 1997: 254). Established in 1933, the Office of Coffee (today ICAFE)[9] promoted a technical development programme in line with the political agenda that intended to 'modernise' the coffee industry, increase yields and thus spur national economic growth (Paige 1997). This 'technification' of coffee (i.e. intensifying coffee production to maximise yield, and thus, profit) expanded national coffee production more than a sixfold, and yields more than tripled between 1950 and 1980.

However, national political processes that promoted nontraditional production, the crash in prices of traditional export crops in the late 1970s, and Costa Rica's reliance on foreign financing for national development, eventually led to economic collapse in the 1980s. In Turrialba, the socioeconomic situation altered drastically from 1985 onwards and several *beneficios* (coffee processing factories) had to close. The situation was exacerbated by the failure to reach a new agreement with the ICO (International Coffee Organization) in 1989, which subsequently led to a drop in coffee prices from USD 140 to USD 70 per 46 kg (100 lb), before rebounding to only USD 80 (Paige 1997: 261). International prices remained low in the 1990s. To this day, *turrialbeño* coffee farmers receive an inferior price for the coffee they produce, as the quality is perceived to be lower compared to the high-altitude coffees of other regions in the country. Without viable alternatives to coffee and sugar cane, *turriableño* smallholders therefore find themselves particularly vulnerable to fluctuations in price as well as diseases and epidemics such as that of 2012–2013.

Top-Down Processes: Enacting Roya

Initiatives to Combat Roya

Following the declaration of a state of emergency due to *roya*, the Costa Rican government launched the idea of *fideicomiso cafetalero,* a programme intended to support coffee farmers who harvested less than 100 *fanegas*[10] of coffee berries a year. In 2014, an agreement to donate 37.2 million USD from the national budget to finance this social assistance was signed by the Ministry of Finance, the Ministry of Agriculture and Livestock, the Costa Rican Bank, the Institute of Joint Social Assistance, and the Costa Rican Coffee Institute (ICAFE) (Arias 2014). Consequently, farmers were given economic relief of approximately 558 USD to cover the basic needs of their respective families. Another 27.9 million USD were distributed to four credit programmes to help smallholders get back on their feet. Among these were low-interest loans tailored to pruning and renovating coffee plantations (Barquero 2014). Furthermore, ICAFE and the State Phytosanitary Service together contributed with 3720 USD to purchase fungicides which they donated to farmers in an attempt to control *roya*. For smallholders, purchasing inputs were complicated by low coffee prices in 2011–2013, which '[…] fell sharply by 55% … from 274 to 126 USD per 46 kg (100 lb) of green coffee' (Avelino et al. 2015: 307).

According to farmer-interlocutors, they had never before received economic aid from national institutions. Even when coffee prices plummeted in the 1990s, governmental support for small-scale coffee farmers was absent. The latter was arguably a stronger shock to farmers' economy, causing many to leave cultivation altogether according to local farmers. When smallholders finally were provided with economic support and fungicides to fight the rust-epidemic, it marked an unusual situation for coffee farmers that added to the sense of an exceptional situation. In retrospect, the declaration of state of emergency, in particular, together with the measures taken on a national level, contributed to create a sense of acuteness in which farmers, agronomists and, among other institutions, ICAFE were urged to take action. In fact, following the epidemic, ICAFE held regular *charlas* (informal talks) about the disease and how to best control it from a scientific point of view. In this process of concerted effort by governmental and scientific actors to identify and deal with the epidemic, *roya* was established as 'wilder' than before from a scientific perspective of *looking*. The increased amount of attention and talk about coffee rust, then, provided a framework in which *roya* could emerge as a 'wild' disease.

In order to understand this process through which *roya* came to be perceived as 'wild', we find it useful to analyse in particular four scientific statements regarding the causes of the recent epidemic. Drawing on Latour & Woolgar's (1986) approach to how a phenomenon comes into being, we contend that the statements were integral in *enacting roya* as 'wild', together with various inscription devices.[11] The four statements are: 'Coffee rust is a consequence of climate change', 'There are new rust-races', 'Coffee rust must be controlled with chemical inputs' and 'Coffee plantations must be renovated'. It is worth noting that none of these, however, touches economic

factors such as low coffee prices and their intimate correlation with rust-epidemics in the sense that low prices complicate investment in agrochemicals, and, in turn, facilitate an expansion of *roya* (Avelino et al. 2015). Nor did they relate to how previous recommendations of 'technification' furthered a simplification of coffee landscapes, which has led to the loss of biodiversity and natural biological control mechanisms, and the proliferation of pests and diseases (Perfecto et al. forthcoming). Despite their importance for understanding the recent prevalence of rust, such factors were downplayed in ICAFE *charlas*. Instead, *charlas* emphasised the purchasing and application of expensive agrochemicals, despite their hazardous and contaminating effects on human health, terrestrial ecosystems, and the environment (Aktar et al. 2009). One might speculate whether companies selling agrochemicals, who benefitted economically on *roya* becoming 'wild', was a driving force in ICAFE's promotion of chemical input. As we will show later, this emphasis was also part of a wider national modernising scheme of farming practices.

The following four statements were frequently repeated in interviews with agronomists, in regional ICAFE *charlas* for coffee farmers, and in Costa Rican newspaper articles and television. We argue that the scientific *look* and practices that produced knowledge about coffee rust were imperative in constructing statements about the disease which, together with various state-initiatives aimed at combating rust, created a conceptual rupture; i.e. that *enacted roya* as 'wild'. By analysing the statements and how they emerged, we aim to show how these are embedded in a larger network of regional, national and international agents, institutions and practices, which were drawn upon to provide the statements with 'weight' (i.e. credibility), thus adding to the sense of 'wildness'.

Statements

'Climate Change'

The first statement – 'Coffee rust is a consequence of climate change' – was presented as one of the main causes of the epidemic. The phrase *cambios climáticos* (climate change) has two meanings in Spanish. First, it can refer to daily changes in weather. Turrialba's tropical climate leads to frequent changes in weather, and the nearly continuously wet and humid climate abets the progression of coffee rust (Avelino et al. 2015). Secondly, there is climate change as consequence of global warming. Following the epidemic, both agronomists and farmers switched between the terms *calentamiento global* and *cambios climáticos* to explain the emergence of less defined dry and wet seasons and more frequent and intense changes in weather. Avelino et al. (2015) argue that an earlier rainy season in 2012, combined with abnormalities in rainfall, temperature and sunshine duration, were vital to the emergence and magnitude of the recent epidemic. Indeed, mentions of climate change in its second connotation have also received attention by Costa Rican media; e.g. mentions of the meteorological impact of an intensified *El Niño*[12] and connections between *roya* and climate change (Miranda 2015: 18A; www.nacion.com). Links between *roya* and climate change were also conveyed to farmers in persuasive manners at ICAFE *charlas* attended by Isabelle.

In one *charla,* an agronomist from the National Research Centre for Coffee (CICAFE) showed a figure with curves that illustrated annual variations in the progression of *roya* from 2010 to 2014. Based on studies conducted by CICAFE, she explained the different curves according to meteorological factors (e.g. rainfall, humidity and temperature), recent increases of which provided ideal conditions for the disease's rapid development in 2012–2013. The status of the agronomist (and of the scientific knowledge she represents), together with the status of scientific studies by the prestigious national institution CICAFE, provided statements connecting climate change and coffee rust with 'weight'; first, because such studies are based on information collected through inscription devices, or *technology*, which Ingold (1993c) describes as context-independent, explicit, objective and discursive. The usage of the statistical curves contributes to an image of scientific knowledge (or interpretation of data) as objective and 'detached' from the social realm. Paradoxically, however, the interpretations are deeply intertwined with the social realm; they only appear distinct through what Latour (1993) labels the work of 'purification' (i.e. categorising and distinguishing natural and social phenomena into domains of 'humans' (subject) and 'non-humans' (object)). Scientific concepts of 'anomalies' and 'irregularities' in meteorological patterns further enhance this image. Second, the 'weight' of the statement must be understood in relation to, and as embedded within, a wider network of pre-existing statements already established as true (or 'facts'), as well as tools, practices, institutions, and agents (Latour & Woolgar 1986; Foucault 1972). Pre-existing statements that are generally recognised as established facts include: 'Climate change exists', 'Scientific knowledge is the 'correct' knowledge', and 'Technology is objective'. According to Latour, it is this network that is drawn upon to provide a statement with 'weight' (i.e. credibility) and persuasive power. Lastly, these statements and the following statement of new rust-races were complementary in the sense that each supported the credibility of the other, and in so doing underpinned an idea of *roya* as 'wild'.

'New Rust-Races'

The second statement – 'There are new rust-races' – was conveyed in the presentation described above. The agronomist used a PowerPoint slide entitled 'New races?' followed by figures and numbers illustrating the magnitude of coffee rust in Costa Rica before, during and after the epidemic. She mentioned the 'discovery' of new races by an international centre for coffee rust research (*Centro de Investigação das Ferrugens do Cafeeiro* (CIFC)) in Portugal. Locally known ICAFE agronomist Adolfo Martínez Guillén explained in an interview that once the magnitude of the disease was recognised in Costa Rica, samples of rust were extracted from coffee regions in the country and sent to CIFC for analysis. Based on this analysis, CIFC recognised two new races, which were allegedly more pathogenic than those known since the arrival of rust in Costa Rica. Like the statements describing 'new rust-races', we must understand these 'discoveries' – made in laboratories rather than within the context of coffee plantations – not as isolated phenomena, but as interconnected with pre-existing statements about differing degrees of resistance to coffee rust.

In an appearance on the national news channel, Teletica, technical manager of ICAFE, Jorge Ramírez, said that the new rust-races had the ability to affect other coffee varieties in addition to those varieties that *roya* had affected initially (Teletica 2013). Plant pathologist Jacques Avelino explained this during an interview with a key-lock analogy, the key being a virulent gene (with the ability to induce disease) and the lock as a resistant gene. The new races had more keys, i.e. they were more complex than those already known in Costa Rica. With more keys, infection would be delayed and less severe compared to those with fewer keys, as the more complex rust would take longer to find the correct key to unlock the resistance gene. Interestingly, Jacques was almost certain that these races were not the cause of the epidemic, but rather the result of mutations (changes that occur in genes during cellular divisions). He referred to the discovery of two new rust-races in Guatemala distinct from those found in Costa Rica, claiming that it was highly unlikely that the intensity and severity of the epidemic in the two countries could be explained by different races in each case. Although Jacques supposed that the new rust-races was the result rather than the cause of the epidemic, the statement about new rust-races was repeated in *charlas*. This is likely to be related to scientists' initial speculations on whether the new rust-races had caused the recent rust-epidemic (Avelino et al. 2015). It could also suggest particular ideological interests which we will discuss later.

The prevalent statements of new rust-races and references to the investigation centre not only provided the statement about the aggressiveness of *roya* with more 'weight'. The figures, numbers and status of the speakers connected to national and international networks also supported the credibility of the statement. The drawing on this apparatus of various inscription devices, practices, institutions and other statements thus contributed to the *enactment* of a different 'wild' type of *roya*. This 'wildness' had, in turn, implications for approaches to coffee management. The fact that the magnitude of destruction caused by coffee rust was greater than before – expanding in both higher altitudes and affecting new additional varieties – eventually led to statements of the third and the fourth type: 'Coffee rust must be controlled with chemical inputs' and 'Coffee plantations must be renovated'.

'Chemical Control'

It has been argued that variation in local effects of *roya* suggests that coffee management is an important factor in explaining the epidemic (Avelino et al. 2015). As part of such management, ICAFE agronomists consistently conveyed statements that emphasised the importance of applying fertilisers and fungicides, explaining that a lack of chemical control was one of the main reasons why the disease had spread.[13] In this view, well-fertilised plants have better natural defences and a greater chance of surviving fungal attacks (Miranda 2013: 46). In the *charla* described above, the agronomist also illustrated the importance of applying fungicides by showing a graph with different curves, and the degrees to which coffee rust developed on plantations with and without the application of fungicides. The curve depicting no chemical control showed high incidences of rust, whereas the curve showing use of chemical control indicated less aggressive development. A parallel between the aggressiveness of the two new

races of the fungus and lack of fumigation was frequently drawn to stress the importance of fumigation, which, in turn, not only strengthened the credibility of each statement but also reinforced an idea of *roya* as 'wild'. This emphasis on use of chemicals must be understood in light of farmers' management practices prior to the epidemic. Among 22 farmer-interlocutors, ten did not use fungicides, five applied them once or twice a year, and seven applied them irregularly – some sprayed every second year, whereas others fumigated periodically (i.e. when they could afford it). As to change these practices, ICAFE arranged several *charlas* and practical activities intended to educate and engage farmers in which products to apply, when and how to apply them and how to achieve optimal coverage, while the real issue for smallholders was high cost agrochemicals and volatile coffee prices. One such activity was a *día de campo* (day in the field) at CATIE's[14] coffee plantation. The following is an extraction from fieldnotes.

Before the activity, everyone gathered in *la Casona*, a house in the botanical garden of CATIE, where ICAFE agronomist Adolfo and CATIE agronomist Carlos talked about optimal conditions for fumigating, contending that knowing when to spray is challenging in a tropical zone such as Turrialba. Climate change, they said, complicate this, due to increased rainfall. Upon arriving at the lush plantation, Kevyn[15], an agronomist who was leading the activity, handed out a three-page document including a table that was to be used to gather samples of coffee rust. As the document exemplified, Kevyn explained that the goal of the activity was to calculate the amount of liquid used when spraying manually and with motor-driven pumps (e.g. ratio of chemicals and water used per hectare, per pump or per barrel). He divided farmers into two teams, who would all spray either with a manual pump (a type used by most smallholders) or a motor pump. Each time a farmer had sprayed an allocated row of coffee plants, Kevyn measured how much liquid was wasted by both teams. He then registered the numbers on a whiteboard in a table similar to that of the table in the document everyone had received. At the end of the activity, Kevyn concluded, based on his calculations, that the motor pump wasted less liquid than did the manual type. However, he explained that uneven topography and differing individual application techniques were also possible factors of influence. He said that many farmers tend to blame ineffective products, rather than seeing themselves as responsible by using incorrect amounts of chemical products and water, application techniques, and times of application. Back at *la Casona*, Carlos summarised the day by reminding the attendees how the climate has changed, and continues to change, and that diseases are continuously emerging, saying, 'Times are changing and we have to change accordingly', referring to the need to renovate plantations.

'Plantation Renovation'

In addition to the short- and medium-term effects of chemical control, local agronomists highly recommended farmers to renovate their plantations by replacing older, more susceptible coffee varieties with younger rust-resistant varieties, which they presented as a long-term approach for the management of the disease. Adolfo estimated that 70–80% of the coffee plants cultivated throughout Costa Rica exceed the age of 25 years. According to a study conducted by ICAFE, he explained, the productive life of a coffee plant is a

maximum of 20–25 years. After this age, the plant is no longer profitable because it produces fewer coffee berries. Agronomists referred to the same study in several ICAFE *charlas*, thus adding to the sense of acuteness in having to take action to combat *roya*.

Statements about plantation renovation can be seen in light of the 'technification' programme that was promoted by the Office of Coffee (today ICAFE) after the 1948 revolution (Paige 1997). This programme was in line with the predominant developmentalist and economic paradigm at the time, which among other efforts aimed at maximising profitability by transforming coffee agriculture into a more technical and agro-industrial process.[16] 'Technification' meant adopting certain technologies and practices inspired by the Green Revolution.[17] It involved plantation renovation bolstered by the introduction of new varieties (e.g. *Caturra* and *Catuaí*)[18] which produced up to three times more than the traditionally used plants (e.g. *Típica* and *Borbón*), and which were intended to minimise the economic impact caused by the feared *roya*. This transformation in turn increased use of and dependence on expensive fertilisers and other agrochemicals that rust-susceptible *Caturra* in particular required in order to maintain high productivity (McCook 2009). Statements that now recommended farmers to replace rust-susceptible varieties (e.g. *Caturra*) with resistant types then, indicated that farmers would be relieved of the economic burden of purchasing costly fungicides that rust-susceptible varieties require. In other words, plantation renovation was intended to strengthen smallholders' position in the battle against *roya*.

Now, let us summarise some central factors that led to the enactment of *roya* as 'wild' both in official discourse and in interactions with farmers. In our opinion, the declaration of a state of emergency, together with the *fideicomiso cafetalero* economic support and the donation of fungicides, created a framework in which 'talk' about coffee rust increased in Costa Rican newspapers, television news and, in particular, ICAFE *charlas.* Embedded in such talk was an emphasis on the four statements discussed above, the credibility of which was strengthened by the status of the agronomists connected to institutions in national and international networks, to which they often referred, thus lending the statements more 'weight'. The interconnectedness of the four statements effectively meant that each supported the validity of the other. The PowerPoint presentation with its numerous curves and figures (the specific information was only accessible to its makers) and the classroom-like setting in *charlas,* during which agronomists appeared to have the power to define 'reality', also contributed to the *enactment* of *roya* as 'wild'.

In this regard, it is worth noting the themes not mentioned in *charlas*; economic dimensions and the implications of 'technification'. While shade may increase humid conditions favourable to rust, some scholars suggest that the elimination of shade, and landscape deforestation in general since the late 1980s may have facilitated dispersal of rust-spores through wind currents, eventually becoming an effective driver in an emergent rust-epidemic (Avelino et al. 2012; Vandermeer et al. 2014).[19] Ironically, a consequence of the epidemic was the further simplification (i.e. 'technification') of the coffee landscape; many farmers renovated their plantations with new rust-resistant varieties and some reduced shade. Perfecto et al. (*forthcoming*) argue that such simplification can lead to future outbreaks with higher frequency. They point to the evolution

of rust and how it is already starting to affect resistant varieties, some of which are also susceptible to *ojo de gallo* (*Mycena citricolor*), another fungal disease. In short, the 'technification' has led to environmental and economic instabilities by altering coffee landscapes that in different ways may favour the dispersal of rust (among other diseases), which in turn may affect yield and profit that is required to purchase costly agrochemicals intended to enhance yield. The drop in international coffee prices between 2011 and 2013 added to farmers' economic concerns, as did the rise in costs for fertilisers and fungicides. Despite having indirectly contributed to such vulnerabilities, the scientific *look* and knowledge prevailed in ICAFE *charlas*. In the following, we will elaborate further on the efforts made to teach farmers 'how to *look*'.

Teaching Farmers How to Look

The *día de campo* described earlier illustrates one of several efforts to teach farmers how to *look* (i.e. adopting scientific methods and practices, such as taking samples, calculating rust levels, measuring liquid ratios) rather than relying solely on *seeing* (i.e. using the body and physical senses to figure out when one should spray). Being more than merely an attempt at controlling *roya,* the donation of fungicides together with the statements in ICAFE talks and activities convey how the emphasis on chemical control and renovation of plantations were part of what we believe to be a national agenda of 'modernising' the small-scale coffee farmer, who several agronomists referred to as 'traditionalist in culture'. Indeed, the agronomists interviewed used the term 'modernising' with reference to the need to adopt particular technologies, especially in terms of applying fungicides. Such notions of modernisation derive from the modernisation discourse beginning with the 1948 revolution. Picado and Prieto argue that '[…] there was an outstanding connection between the arrival of José Figueres-Ferrer to power (government) and the discourse's progress on policies for the agricultural sector' (2007: 14). Another central driver behind the modernising scheme that has pushed for 'technification' of the coffee industry have been various national and international actors: Government-run agricultural institutions, national commercial banks, the US Agency for International Development (USAID), and transnational chemical companies. For instance, in order to qualify for loans intended to renovate plantations, banks require farmers to adopt a certain technical package, which in turn, benefits the strong economic interests of the former (Rice & McLean 1999: 24).

In other words, policies and national and international actors opened up for 'technification' and in doing so, offered a scientific *look* in a sector that since its establishment had approached the environment in a more sensorial manner of *seeing*. According to McCook (2006) however, it was not until the 1970s that several coffee farmers in Latin America started to 'technify' their fields in response to the threats of *roya* and coffee berry borer (*Hypothenemus hampei*).[20] With the increase of coffee rust in Central America in the 1970s, Rodolfo Quirós Guardia at the Costa Rican Ministry of Agriculture explicitly stated that this was a good opportunity to 'technify' the country's coffee culture (McCook 2009). The rust-epidemic in 2012–2013 then, provided optimal conditions to further enhance the 'modernisation' scheme. The

significant change in fumigation practices among farmer-interlocutors who all started applying fungicides regularly after the epidemic suggests an acceleration of the modernising process. Nonetheless, and despite the expansion of the 'technification' programme, smallholders manage their fields through an interchange between *looking* and *seeing*.

Bottom-Up Processes: Experiencing Roya as Brava

Although Ingold's (1993a) notion of the global and detached perspective could perhaps have explained how the scientific *look* named and categorised *roya* as 'wild' compared to previous incidences, and thus creating a conceptual rupture with the past, we will in the following show that his concepts fall short in explaining how this *look* did not erase other ways of *seeing*. Indeed, farmers had observed how the disease has grown in magnitude and scope over time. They did so primarily by approaching the environment through a bodily and sensorial manner of *seeing*. Although their discovery takes a different form than that of scientists, we will illustrate how farmers interchange between the *looking* perspective often associated with science and *seeing* in their daily management practices. Their use of the *looking* perspective was pushed forward first with the 'technification' programme and the arrival of coffee rust in Central America in the 1970s, and later again during the 2012–2013 rust-epidemic and its aftermath.

According to local agronomist-interlocutors, coffee rust has existed in Turrialba for nearly 40 years. The majority of farmer-interlocutors however, claimed it had been present in the region up to 15 years, and describe the pre-epidemic *roya* as 'calm'. When talking about *roya*, many farmers repeated: 'Before, there were no diseases'. Defining 'before' proved difficult. Farmers generally referred to a time when yields and prices were high, when their ancestors used a *machete* to maintain the fields, and when the application of agrochemicals was limited or nonexistent. Many farmers related the increased prevalence of disease with climate change, which according to 68-year-old farmer Daniel, had started about 40 years earlier when his father was forced to adapt to more frequent weather changes and shorter summer seasons by quitting production of certain crops that could not adapt to the changes. According to local agronomists and farmers, dry and wet seasons have increasingly become less defined, and the frequency and intensity of changes in weather magnified, causing them to think of climate change as a central factor in causing the sudden rust-prevalence. None of the diseases that farmers described, including the 'previous' *roya*, had caused destruction and yield losses like that of the recent rust-outbreak, suggesting that a disease does not qualify as such until doing significant damage. Several farmers simply contended that *roya* did not exist in Turrialba prior to recent epidemics. Despite a rust-epidemic in 1989–1990 in Costa Rica, the general perception of *roya* as manageable ('calm') prevailed until the 2012–2013 epidemic (Avelino et al. 2015). Avelino et al. explain that the biennial production rhythm of coffee plants meant that most diseases went unnoticed; high yielding plants usually produce low yields in

alternate years, regardless of the presence or absence of coffee rust. Such fluctuation might explain previous experiences of *roya* as 'calm' (2015: 304).

> **Coffee farmer:** 'It's a very curious disease. It started 10–15 years ago with small yellow spots on the undersides of the leaves. These spots have grown continuously larger throughout the years. It didn't do much damage before. But the last three years have been fatal, because that's when it became wild. I was left with hardly any coffee and I had to cut those plants that could not be saved.'

Similar accounts about the disease were expressed in interviews with other farmers. 'Before we could live with *roya*'; 'The other one did not fuck up that much'; 'It might well be another type of *roya,* a more serious one.' Common to these narrations was a distinction between *roya* before as calm, weak or normal, whereas the recent *roya* was depicted as wild, fatal and catastrophic. Another important characteristic was the increasing rate of spread and coverage, previously being slow – infecting only parts of the plantation – whereas the more recent was rapid, contaminating the entire plantation. Moreover, the adjectives that farmers used to differentiate between *roya* 'before' and 'now' ascribed static characteristics to previous episodes compared to the latter's dynamic features. Contrary to 'Euro-American thinking', which scholars have criticised for a tendency to contrast nature and culture, treating nature and landscape as passive (Ingold 1993b; Humphrey 1995), *turrialbeño* farmers talked about the recent *roya* as having its own 'will' or agency. Indeed, they commonly referred to *Doña Roya* (Miss Roya) or *ella* (her).[21] The perceptual shift of *roya* as something static with no agency to a dynamic force with its own 'will' and agency is related to farmers' first-hand experiences of not only the disease itself, but also more general changes within the environment. These changes have also led farmers to speculate upon the causes of the recent rust-epidemic.

The Ambivalence Towards Chemical Products

While several smallholders have altered their practices since the rust-epidemic, there is still some discrepancy between statements of '*Roya* is best controlled with chemical inputs' and farmers' beliefs and actions regarding such inputs. The use of chemical products (fungicides, fertilisers, herbicides) was a controversial theme among smallholders. Not every farmer used all of the promoted agrochemicals, except fertilisers, which most believed to be safe for the environment. Yet, all farmer-interlocutors agreed that chemicals would affect the environment negatively if used incorrectly or in excess. In talks about fungicides, several farmers expressed ambivalent opinions, whereas others took a more positive attitude. Most of the former believed chemical products was an important factor in explaining the rust-epidemic.[22] This seems paradoxical, since certain chemicals are supposed to combat diseases. Why are farmers so ambivalent towards these products? The answer may lie in farmers' experiences with chemicals.

> **Luis:** 'Nowadays coffee plants don't get as old as they did before. They're worn out more easily and lose their strength. Just like humans. I think this is because of all the chemicals we consume. Vegetables are full of these and food additives. I believe people get diabetes and cancer because of this. When it comes to coffee, it's exactly the same issue. Before people didn't use chemical products, and they didn't have *roya.* Now, people are accustomed to chemicals, and we have serious problems with *roya. Roya* is like a cancer for the coffee plant, just as cancer is for the human body.'

Like Luis, farmers referred to chemicals as not natural, and they consider that chemicals might therefore produce negative effects on the environment. Such ideas can be linked to what Latour (1993) labels the work of purification of nature and culture. Chemicals do not 'belong' in the category of nature, thus they may be perceived as 'matter out of place' and potentially dangerous (Douglas 1979). Despite this, farmers nonetheless rely on chemical products to enhance coffee yield and keep diseases at bay, as one farmer explained: 'Nowadays we use a great deal of chemical products. All chemicals are harming the environment and one's personal health. But what's a person to do? We're dependent on them to continue cultivating coffee.'

Several farmers attempted to keep a balance between chemical approaches and long-established practices to maintain their plantations, especially regarding weed removal. The purpose of removing weeds is to allow air circulation, thus minimising humidity. To maintain balance, farmers such as Alejandro switched between using herbicides and established techniques with a *machete*. He claimed that herbicides not only removed *malezas* (bad things, i.e. weeds), but also *buenezas* (good things). To avoid losing *buenezas*, Alejandro used a small amount of herbicides in the middle of the 'streets' between the coffee plants. In this manner, he would not come too close to the thin and white roots on the surface of the soil, located in the proximity of the coffee plants, which farmers referred to as the 'future' and 'life' of the plant. Most agreed that excessive or incorrect use of herbicides (or what they called 'poison') would 'burn' the plants' life, and sterilise the earth by 'stealing' its nutrients. Alejandro switched, therefore, between herbicides and *chapea* or *palea*. The latter are different *techniques* – or what Ingold (1993c) refers to as context-dependent 'knowledge how' – for cutting weeds using a *machete* or spade respectively. Alejandro would then use the weeds as organic fertiliser, by distributing cut weeds over the small roots, providing 'food' and, indirectly, life to the plant. However, these *techniques* are very time-consuming and weeds return within weeks, whereas herbicides keep weeds at bay for a couple of months, claimed farmers. For this reason, Alejandro and other smallholders often combine *chapea/palea* with herbicides.

Some farmers complained, however, that herbicides produced a type of weed that could only be removed manually. They discovered this by engaging their senses and body in removing the weed by hand, and in this way, *seeing* how the chemicals were affecting the environment. The fact that the product that was supposed to remove weeds actually encouraged another type of weed may explain why farmers believed that increased use of chemicals produced the sudden rust-epidemic. Ambivalent attitudes towards chemicals also explains the reliance of farmer-interlocutor Daniel on *technique*-based knowledge in the following example.

A couple of years prior to the rust-epidemic, Daniel experienced unusually low coffee production in one area of his farm. He noticed that numerous coffee leaves were yellow. Unsure of the cause, he asked some agronomists to visit his plantation. During the visit, they took soil samples for analysis. The results led the agronomists to conclude that the soil lacked certain nutrients. To solve this, they gave Daniel a list of recommended agro-chemicals. Daniel, however, did not believe that chemicals were the solution, nor was he interested in purchasing expensive products. He had noticed the presence of a certain type of weed that he claimed only grows in humid areas and concluded that the

problem could simply be very humid soil. He started digging channels, as his father had taught him to do. Despite being a more time-consuming method than that recommended by the agronomists, who had 'located' the problem through inscription devices by running soil analyses, Daniel relied on his father's *technique* to save money (and avoiding the use of environmentally damaging chemicals). Upon digging, as he had suspected, a great volume of water came pouring out. After some time, the coffee plants recovered. The agronomists were surprised to learn that Daniel had solved the problem without applying chemical products.

> **Daniel:** 'Although they're agronomists, they don't always know best. They read and study books, but they don't learn by experience like we do. I picked up much knowledge from my grandparents and my father, but more importantly from experimenting with the plants and different varieties of coffee for decades. The plant itself teaches you a great deal, which is why they [agronomists] sometimes make mistakes.'

By having observed and now imitating his father's and grandparents' management *techniques* in cultivating coffee, the knowledge and manner of relating to the environment has become an embodied practice, or way of *seeing* (Okely 2001). Moreover, Daniel's account illustrates a personal awareness that practical knowledge or *technique* can only be learnt by doing: Not only did his ancestors teach him such knowledge, but the coffee plants responded differently to different management practices (suggesting that plants too taught Daniel). By 'reading' signs in the environment (yellow leaves and a type of weed), using his body and senses to *see* indications of high humidity, he was also *seeing* a distant past, based on embodied experiences, by which he learnt how to locate problems of humidity. Like Daniel, other farmers also claimed to *know* the cause of problems by 'reading' signs in the environment. Yet, most would also ask local institutions like ICAFE for soil analysis, and in doing so, ask for a more distant view. By interchanging between *looking* and *seeing,* using both *technology* and *technique* in order to understand what is going on in their plantations, farmers might find alternative solutions rather than relying exclusively on chemicals.

The Coffee Plant as Human

When farmers explained processes of coffee cultivation and talked about diseases such as *roya,* they commonly used the human (both in physical and emotional aspects) as a referential framework. During an interview, when Isabelle asked 58-year-old farmer Diego about management practices, the conversation took an unexpected, but intriguing, turn. He said that he would normally invest in fungicides and fertilisers. But after continuing to experience yield losses in the years following the epidemic – especially during 2013–2014 when he lost about 30–40% of his total yield to *roya* – he did not intend to invest in fertilisers.

> **Diego:** 'If there's no harvest, then it's just stupid. Why invest in something that doesn't give anything in return? A neighbour of mine did this, and he still has just as little harvest as he did before he started fertilising his plantation [He paused]. You know, an ill person doesn't eat.'

> **Isabelle:** 'Could you explain?'

> **Diego:** [He paused] '*Roya* is like a strong flu. You see, the plant has a fever inside that it needs to get rid of by taking medicines to regain its strength. Only then can it start to eat normally again, just like us when we are ill. That's why I plan to fumigate this year, to get rid of the fever, and then start feeding the plants again next year, God willing.'

Farmers often spoke of *roya* as a fever and ascribed human-like feelings and behaviours when talking about 'Miss Roya'. The pauses he (and other farmers) took before explaining *roya* using human analogies might indicate that he was searching for words to describe a phenomenon to which he related daily. Unlike farmers, agronomists have a vast array of established scientific concepts. Considering that farmers engage with the environment and coffee rust on a daily basis through *technique*-based practices that often are 'tacit' knowledge, the conversion of this knowledge into language is not always ready-at-hand. For farmers, the language spectrum for talking about a disease 'whose behaviour' suddenly had changed might be limited. This leads to a search for words and concepts in a more familiar domain which is connected to bodily experience. For instance, Johnson (1999) argues that, through 'embodied reason', bodily experience and practice create a foundation for metaphors, mental images and concepts as we engage in our world. Because of farmers' experiences in acquiring knowledge with the body and using their body actively in everyday management practices, the body functions as a familiar domain which they draw upon to make sense of what is a relatively unfamiliar phenomenon, like the 'wild' *roya*.

The human analogy enables a better understanding of the ambivalent attitudes towards chemicals. Farmers' experiences with certain fungicides and their own bodies' reactions to them provide farmers with a good indicator of how these might influence the coffee plant. On several occasions, agronomists and farmers told stories of how fungicides in the past were very poisonous for humans. These highly toxic fungicides were eventually prohibited because of the risks to human health and the environment, according to Alejandro. Still, the products used to date are not free of toxins. When fumigating, the fumigator is required (by the instructions on the bottle) to use protective gloves, a mask and goggles. If humans should shield themselves from such products, it might be reasonable to think that coffee plants should too. 'The plant is like oneself,' farmers frequently said. If it receives excessive amounts of food or medicine, the plant will die, just like any human, they claimed. The embodied reason and human analogy did not, however, prevent farmers from using chemicals nor from ways of *looking* when dealing with disease, such as when Diego took a step back by comparing yield from year to year and in doing so attempted to *look* at the plant as an isolated object in order to assess its condition.

Interchanges at the Intersection of Knowledges

Having seen how farmers switch between *looking* and *seeing* in their daily management practices, we now return to agronomists' procedures in getting to know the environment. We will show how they learn not only from books (as Daniel claimed), nor do

they rely solely on inscription devices. Their actions may not differ as much from those of farmers as one might initially expect.

> As Isabelle accompanied a doctoral agroforestry student and his two assistants on visits to *fincas,* she observed some of the methods they applied. At each farm, they had marked eight coffee plants with numbers, and the condition of these was examined on more or less every visit. The assistants observed and touched each plant's leaves and picked some off to get a better feel for their texture as well as to check for signs of diseases underneath. They bent branches to see whether they cracked or remained in place and counted the dead branches that broke. The number of dead branches gave them an indication of future yield. As they proceeded, they registered information for each plant and, based on what they had found, measured what they called 'dieback' on a scale from one to four, where four indicated a severe degree of disease. On two plants, there was a white plastic cup hanging upside-down by a steel thread with a sensor inside. These sensors measured humidity and temperature, providing detailed information about the microclimate. The student used a densitometer to measure and calculate shade percentage in the plantation.

These procedures show that they were not exclusively dependent on technological tools such as the sensor and the densitometer. Rather, like farmers, they were *seeing* by engaging their senses (watching and touching leaves, feeling and hearing dry branches crack) and using their bodies and senses to some degree, to estimate the condition of coffee plants. The sound and feeling of the crack of a dry branch was a sign that a plant was affected by *roya.* Various colours and textures of a coffee leaf could also indicate a lack of certain nutrients, they contended. Upon returning to some of these plantations, Isabelle would learn that the doctoral student and his assistants had taken analyses of the soil – before and after the visit described. In this sense, they were also *looking* at distance through the scientific device of soil analyses, to confirm what they had been *seeing* in the labelled plants. Similarly, Harvey and Knox (2015) argue that engineers combine two modes of engagement in their quest to resolve localised issues evoked by infrastructural projects; that of a distant view and a more processual engagement. In doing so, they criticise Ingold's (2000) contention that dissociates engineers with the dwelling perspective.

Okely's (2001) concepts then, grasp the dynamics that Ingold's (1993a, 1993b) approach fails to grasp in its totality. The concepts help us grasp how the doctoral student and his assistants could *look* to *see* in a two-way process without having to be permanently inside the immediate environment; despite being physically distant (from the coffee plantations), their body and senses could arguably remember the crack, the rubbery feel of the leaves that indicated lack of nutrients (which the soil analyses might have confirmed). From this perspective, agronomists also interchange between *technology* and *technique*, *looking* and *seeing,* using them as complementary methods in order to gain knowledge about the environment.

Combining Perspectives in Times of Altering Ecologies

The argument of this article has been twofold. First, we have argued that the *enactment of roya* as 'wild' involved both top-down and bottom-up processes. The scientific *look* contributed to name and categorise *roya* as 'wild' compared to previous episodes, and in turn, set in motion an apparatus of inscription devices, agro-industrial technologies, statements,

national and international institutions and actors that all contributed in *enacting roya* as disease. The 'wildness' versus 'calmness' of *roya* not only reflects the yield losses caused, but also the amount of 'talk' and attention it has been given on national and regional levels through state-initiatives, media and in ICAFE *charlas*. Statements and attention on the national level were supplemented by bottom-up processes of farmers' first-hand experiences of the disease. These experiences were in turn 'confirmed' by ICAFE agronomists who had the power to define reality in 'diagnosing' *roya* as 'wild' by 'discovering' two new races of coffee rust. Second and related to the first aspect; while the conceptual rupture of *roya* from being 'calm' to 'wild' was created by science and not farmers, this did not erase other ways of *seeing*. Rather, we have argued that *turrialbeño* farmers increasingly combine *looking* and *seeing*, *technique* and *technology*. In other words, we have exemplified that Ingold's concepts (1993a) fall short in showing how the adoption of one perspective does not necessarily eliminate the other. We have also illustrated how agronomists made similar interchanges in their quest to produce scientific knowledge. The example with the doctoral student illustrated how Okely's (2001) concepts help us grasp the dynamics that we believe are limited by Ingold's (1993a, 1993b) approach, namely one which would require direct engagement with the environment in order to conceive it from within. We have provided a more dynamic understanding by exploring the interchanges and interconnectedness between *looking* and *seeing*, and how this may be a two-way process in getting to know the environment.

In light of the environmental crisis generated by an agro-industrial system, many scientists have since the 1990s become more concerned with ecological and economic sustainability (McCook, 2006). This has eventually led to calls for a paradigm shift towards agroecology and the promotion of diversified agroecological systems in efforts to reduce use of chemical inputs and revive natural synergies and ecological complexity (IPES-Food 2019: 61). This shift also implies moving the focus from productivity to more nuanced understandings of precarious interactions between humans and their environments. Based in participatory, practical research and experimentation, agroecology opens up for dialogue between different ways of knowing and seeing. Understanding the dynamic interchange and interconnectedness between *looking* and *seeing* then, is imperative as it may unveil localised complexities that the globalised approach to the environment tends to mask or simply devalue. If we give emphasis to ways of *seeing* and *looking*, and their interconnectedness, we may inform the global discourse on altering ecologies with the multiple aspects of sociocultural life-worlds that are affected by changes in them. Indeed, while altering ecologies is a global phenomenon, it is also always local, playing out in particular ways in particular places. Therefore, an understanding of interchanges and interconnections between knowledges is essential, in order to open up established ways of *looking* to localised ways of *seeing*.

Notes

1. Most literature concerning coffee refers to 'coffee *tree*'. We prefer the term coffee *plant* because it is a more suitable translation for the Spanish phrase '*mata de café*'.
2. We refer to the disease as 'coffee rust', 'rust' and '*roya*'.

3. http://www.icafe.cr/nuestro-cafe/estructura-del-sector/ We refer to small-scale coffee farmers as 'farmers' and 'smallholders'.
4. A *turrialbeño* is a person from Turrialba.
5. Supervised by Cecilie V. Ødegaard.
6. Farmers' names are anonymised.
7. Upon making the final changes to the article, we were made aware of a forthcoming special issue in which Tsing et al. (*forthcoming*) use the case of coffee rust as an example to explore a 'patchy Anthropocene' and how forms of simplification and proliferation are reshaping human and nonhuman life in radically new ways.
8. This term is used to suggest that phenomena such as *roya* are *enacted* through practice, and that they are not investigated in isolation from the practices in which they are *enacted* (Mol 2002).
9. *Instituto del Café de Costa Rica*.
10. A *fanega* is equal to 400 litres of coffee berries.
11. An inscription device is '[…] any item of apparatus or particular configuration of such items, which can transform a material substance into a figure, or diagram which is directly usable by one of the members of the office space' (Latour and Woolgar 1986: 51).
12. *El Niño* is an interplay between the ocean and the atmosphere in the Pacific Ocean that creates global effects on weather patterns (Britannica Academic).
13. Chemical control is but one of many practices involved in managing coffee. Others include coffee pruning, shade management, and weeding to name some. By removing nonproductive old stems and branches, pruning facilitates light penetration in the plantation and minimises humid conditions that *roya* favours. Yet, it also increases fruit load, making the plant more susceptible to rust-attacks (Avelino et al. 2004: 543–544).
14. The Tropical Agricultural Research and Higher Education Center located in Turrialba (CATIE) is an internationally acknowledged institution with scientists working on agricultural related issues.
15. Kevyn is a pseudonym.
16. 'Technification' must be seen in light of the international context of high coffee prices in the second half of the 1950s (McCook 2006).
17. Beginning around the 1960s, though at different times in different places, the Green Revolution refers to a set of research and technology transfer initiatives that aimed to intensify agricultural production (Clarence Smith and Topik 2003; McCook 2006). In Costa Rica, research in agriculture increased during the 1950s and 1960s. This, and influential agriculture-related institutions, facilitated agricultural expansion in the 1960s–1970s (Picado and Prieto 2007: 28).
18. All the mentioned coffee varieties belong in the category *Coffea Arabica*.
19. Correlations between shade and coffee rust are multiple yet contested and will not be discussed here.
20. By 1990, Costa Rica had 'technified' 40% of its coffee plantations (McCook, 2006).
21. Several adjectives used to describe *roya* end with an –a (*brava, calma, catastrófica*), with feminine connotations in Spanish. Repetitive accounts of 'She's [*roya*] very wild' seem to be associated with notions of Mother Earth, which connects the feminine with nature and its wild and uncontrollable powers.
22. Anderzén (2015) also found that farmers in Chiapas, Mexico, considered agrochemicals to be related to the rust-epidemic.

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