El Colegio de la Frontera Norte
FRONTERA NORTE
e-ISSN: 2594-0260
Revista internacional de fronteras, territorios y regiones / International Journal of Borders, Territories and Regions

VOL. 31, ART. 4, 2019
http://dx.doi.org/10.33679/rfn.v1i1.1988

Technological Evolution and Coffee Growers' Perception of Environmental Quality in El Águila, Cauca Valley, Colombia

La evolución tecnológica y la percepción de la calidad ambiental de los caficultores de El Águila, Valle del Cauca, Colombia

Natali Yesenia Osorio Velásquez[1], Oscar Alberto Pombo[2]

ABSTRACT

The perception of environmental quality among coffee growers in the municipality of El Águila (Cauca Valley, Colombia) is linked to changes in the coffee production process and cultural identity. Although technification has increased productivity in the face of pests and crop diseases, it has also harmed the environment, leading to an increase in deforestation, a decrease in wildlife, and damaged ground. Furthermore, a decline was observed in the number of children and young people taking part in farm work, and in coffee growers' quality of life. This situation, along with the idea of a better life away from the countryside, has driven young people to migrate to urban areas.

Keywords: perception of environmental quality, coffee growers, standard of living, El Águila, Colombia.

RESUMEN

La percepción de la calidad ambiental de los caficultores del municipio de El Águila (Valle del Cauca, Colombia) se relaciona con los cambios en los procesos productivos del café y la identidad cultural. La tecnificación de los cultivos, si bien mejoró la productividad ante las plagas y enfermedades de los cultivos, deterioró el medio ambiente, aumentó la deforestación, disminuyó la fauna silvestre y dañó el suelo. Además, se observó una disminución de la participación de niños y jóvenes en las labores del campo; así como el deterioro de la calidad de vida de los caficultores. Esta situación, aunada a la idea de una mejor vida lejos del campo, incentivó la migración de los jóvenes a la ciudad.

Palabras clave: percepción de la calidad ambiental, caficultores, nivel de vida, El Águila, Colombia.

Date received: July 5th, 2017
Date accepted: February 21st, 2018

[1] Independent researcher, Mexico, laka821@gmail.com
[2] El Colegio de la Frontera Norte, Mexico, oapombo@colef.mx

INTRODUCTION

This study explored the perception of environmental quality with regard to the technification of production processes in coffee growing, and examined the different structural factors that affect the local dynamic, the transformation of the way of life of a traditional culture of production, and how changes in technification processes have impacted the perception of environmental quality.

Quality of life depends on the environment, which in turn is dependent both on the relationship that societies form with nature through models of development and production, and on the configuration of the land itself. The fulfillment of human needs has an impact on the environment, and produces social and environmental externalities that are difficult to resolve in the context of an orthodox economy that is strictly chrematistic in nature (Alguacil, 1998). Technologies are a key aspect in the generation and resolution of environmental problems caused by a homogenizing and impersonal production model that results in the loss of social referents and referents of belonging (Alguacil, 1998).

In addition to providing food, agriculture is a source of ecosystem services (such as carbon sequestration), facilitates basin planning, and helps to preserve biological diversity (World Bank, 2008). Farming practices are an important factor for natural resources as they contribute to the depletion of groundwater, agrochemical pollution, soil depletion, and global climate change (World Bank, 2008, p. 1). All this affects the quality of people's natural environment, in addition to compromising food security.

In Colombia, the National Development Plan 2014-2018 "*Todos por un nuevo país*" ("All for a new country") states that the expansion of agricultural land is one cause of degradation and loss of forests. Furthermore, it estimates that the agricultural sector uses approximately 54% of the country's freshwater and accounts for almost 38% of greenhouse gas emissions.

Colombian environmental policy is currently guided by a model of "sustainable" development that proposes green growth to implement more efficient production processes in the use of resources. The policy seeks to ensure that environmental sustainability becomes a goal across different sectors and territories, "promoting growth, innovation and technology, social inclusion, and national productivity and competitiveness" (National Planning Department, 2014, p. 557).

Such a state policy entails a series of processes that are conceived in the upper echelons of power and come to fruition at a local level, ultimately affecting coffee growers. It acknowledges that the coffee production process produces a series of externalities that affect the quality of the environment, such as residue from agrochemicals, and even wastewater and pulp dumped into water sources (Ministry of Environment, n.d.).

http://dx.doi.org/10.33679/rfn.v1i1.1988

THEORETICAL REFERENCES

The development, innovation, and technification discourse

For over 50 years, the idea of "development" has been fiercely promoted in Latin American, Asian, and African countries (Escobar, 2007). This idea, which originated in Europe and the United States following World War II, entails the cultural and social transformation of the three continents with the goal of bringing developing countries' way of thinking in line with that of "first-world" countries (Escobar, 2007). The key belief was that technology, economics, and planning would bring about a de facto change in these continents' age-old cultures, transforming them into westernized, "first-world" cultures (Escobar, 2007).

However, this dream has not materialized. After 50 years of unquestionable promotion and acceptance, the "receiving" countries of this great idea called "development" are facing a crisis of violence, poverty, and social and environmental degradation as a result of development-oriented strategies devised solely with economic growth in mind (Escobar, 2007).

If development is viewed as a discourse, at least three main schools of thought are identifiable: 1) traditional or orthodox development discourse; 2) heterodox discourse, also known as development alternatives; and 3) alternatives to development, which question the very notion of development and believe that development is not the only way to improve quality of life (Reverón, 2009).

Traditional discourses allude to progress in terms of economic and market growth and its impact on the national economy. The strategies to achieve this progress include innovation, which makes it possible to "improve living conditions for a given population (Marulanda & Tancredi, 2010, p. 5). This strategy has been particularly significant in coffee production[3].

Coffee plantations have been technified at a national level with a view to making them more efficient. To meet its commitments under the quota agreement, the National Coffee Growers' Federation –which heads CENICAFÉ– implemented the Green Revolution model in coffee growing. The model's main strategy to increase yield per hectare was to promote the development of low-growing varieties such as *caturra* and *colombia*[4], which are resistant to rust (*Hemileia vastratrix*); increase sowing density in plantations; introduce a package of agrochemicals to increase productivity; improve phytosanitary conditions; and

[3] The two best-known species of coffee are *Coffea arabica* (arabica coffee) and *Coffea canephora* (robusta coffee). The species grown in Colombia is *Coffea arabica*.

[4] These varieties are from the same species –*Coffea arabica*– but were genetically engineered to acquire the necessary characteristics for production and resistance to disease and pests.

eliminate shade (González, 2015). This model was geared toward increasing productivity for exportation to international markets and did not consider coffee-growing families' self-sufficiency (Gonzáles, 2015).

Guhl (2004) defines the technification process as "a process by which coffee production is intensified, consisting in the transformation of traditional coffee plantations […] into intensive plantations" (p. 32). Technification is characterized by several aspects: 1) traceability; 2) the introduction of high-yielding varieties; 3) differentiation in the production process; 4) high-density plantations; and 5) the use of fertilizers and agrochemicals in general (Arango, 1986, cited in Parada, 2015, p. 112). The key to technification in Colombia has been the renewal of plants to provide young crops and the use of varieties that are resistant to rust (*Hemileia vastratrix*; National Coffee Growers' Federation, 2013). On the other hand, it should be made clear that although technification means planting these resistant, enhanced varieties in direct sunlight (without shade trees), technification does not necessarily mean eliminating shade (Parada, 2016).

Discourses on development alternatives include Amarthya Sen's (2000) human development approach focusing on quality of life and well-being, along with work by other authors like Julio Alguacil (1998), who put forward a theory of development based on quality of life and its components. This study used the development model proposed by Julio Alguacil (1998), which links quality of life to quality of the environment, and theorization and research by Granada (2002, 2007) and Granada and Molina (2015).

On the other hand, discourses on alternatives to development include but are not limited to:

1) Post-development, which proposes calling into question the very existence of development and underdevelopment by conducting a critical review of the notion of development and the impact that this discourse has had at a cultural, social, political, and economic level in different locations (Reverón, 2009).

2) Participatory action research (PAR), which "moves away from the 'traditional positivism' of the prevailing paradigms of the social sciences and seeks alternatives that challenge the basic pillars of the 'symbolic dominance' they exert" (Reverón, 2009, p. 34).

3) "Good living" or *sumak kawsay*, a concept that has its roots in indigenous communities in Latin America. Framed within the community paradigm, this concept challenges the dualities of the western paradigm, with nature acquiring supreme importance and deserving rights, and the community being seen as a deep living relationship (Mamani, 2010).

http://dx.doi.org/10.33679/rfn.v1i1.1988

Quality of life and quality of the environment

The concept of quality of life has been debated by theorists like Sen and Alguacil. While Sen (2000) emphasizes subjective aspects of quality of life, such as capacity building, Alguacil (1998) recalls the importance of considering the complementarity between objective and subjective aspects, not just in conceptualizing quality of life but also in studying it. Alguacil (1998) presents quality of life as "the consequence of the relationship between objective living conditions and one's individual perceptions of them, the outcome of which is a greater or lessee degree of satisfaction" (p. 70), this being a way to reconcile objective living conditions and subjects' expectations and potential, as assessed by subjects themselves individually or collectively (Alguacil, 1998, p. 71).

For Alguacil (1998), quality of life is divided into three aspects: well-being (objectified conditions), environmental quality (territorial area), and cultural identity (social bonds and relationships). It is in these three aspects that objective and subjective elements of quality of life overlap. The author posits environmental quality as a component of quality of life determined by a territorial scale and associated with housing aspects, residential aspects (local area-neighborhood), and the city-territory (Alguacil, 1998, p. 73-74). Environmental quality is conceptualized from the perspective of the quality of life of human beings, as this is associated with the environment. Thus, two points of view regarding environmental quality can be put forward: 1) the estimated environmental quality, which relates to experts' judgments, taking into account characteristics like a population's health, air quality, and sociocultural values, among others; and 2) the perceived environmental quality, which relates to judgments made by people in a given environment on its positive or negative aspects (Granada, 2002, p. 43).

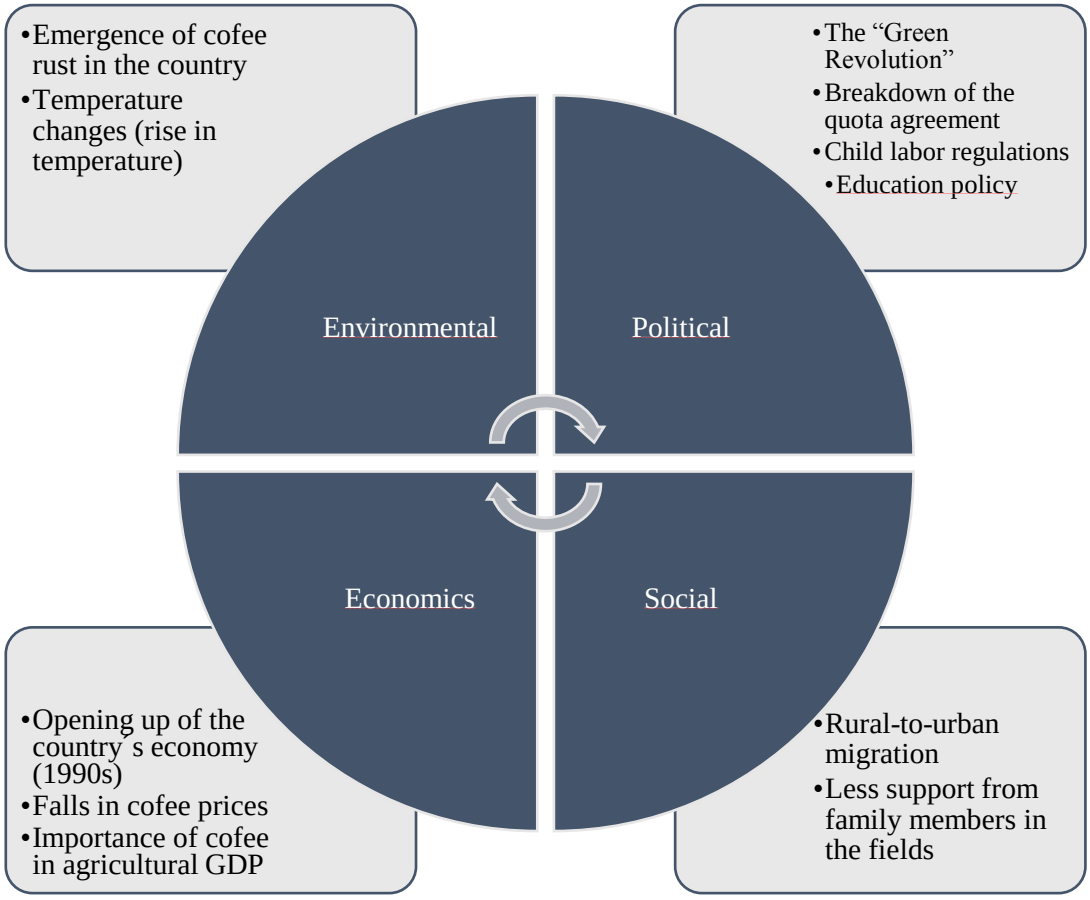
In this article, environmental quality will be considered a component of quality of life. Although in these terms it is possible to restrict environmental quality to an objective overview, what is important is how people perceive these objective environmental conditions in terms of the built environment and the natural environment (Bansart, 2009, p. 21). A subjective review of environmental quality involves reviewing historical and contemporary aspects that make up individuals' perceptions.

STUDY CONTEXT

The technification process and its contextual factors

The transition toward crop technification was not an isolated process. It is possible to identify at least four driving factors of this change toward technification, which can be categorized as environmental, political, economic, and social (see Figure 1).

Figure 1. Study context



Source: Own work.

One notable environmental factor is the emergence of coffee rust (*Hemileia vastratrix*) in Brazil, which began to spread to coffee-producing regions across the continent, leading to experiments to create varieties able to resist this pest. All coffee varieties grown in Colombia derive from the arabica species (*Coffea arabica*). The creation of new varieties began in the 1960s with the introduction of the Caturra variety (*C. arabica* "Caturra"), characterized by its high yield and short stature, making it easier to manage. The 1960s and 1970s saw the greatest change in Colombian coffee production, as the Caturra variety made it possible to adopt agronomic practices that increased crop yield and generated greater income for producers (National Coffee Growers' Federation, 2013, p. 175; Parada, 2016, p. 112).

Later, the Colombia variety (*C. arabica* "Colombia") was introduced, which was characterized by its ability to resist rust and maintain a short stature, its high yield and the quality of the coffee. The introduction of this variety in the mid-1980s coincided with the end of the quota agreement that stabilized international coffee prices; following the

http://dx.doi.org/10.33679/rfn.v1i1.1988

breakdown of the agreement, coffee prices were determined by the international market. In 2002, the Tabi variety was developed (*C. arabica* "Tabi"), which is a high-growing, rust-resistant variety that produces a good yield and cup quality. The Castillo variety (*C. arabica* "Castillo") was produced in 2005, along with its regional variants Naranjal, El Rosario, Paraguaicito, La Trinidad, Pueblo Bello, Santa Bárbara, and El Tambo – with Naranjal becoming the predominant variety in the El Águila municipality region (National Coffee Growers' Federation, 2013; Parada, 2016).

A second environmental factor is the increase in temperatures in the municipality, which facilitated the spread of pests and diseases in coffee plantations. As a result, it became necessary to implement control methods (chemical for the most part) and adopt more resistant varieties of coffee.

The political factors have their roots in the breakdown of the quota agreement, which had kept international coffee prices stable for decades. The country was ill-prepared for these new market norms, triggering a crisis in the coffee sector in the 1990s. The National Coffee Growers' Federation then embarked on an intensive process to promote technification and increase crop yield to counter the crisis facing the sector.

Another significant political aspect that has contributed to changes in production processes is linked to two national policies: the ban on child labor and the introduction of compulsory education for all children and adolescents. As a result of this policy, children under 15 were no longer able to take part in production activities on farms, and producers were required to comply with the ban on child labor in plantations in order to receive support from the National Coffee Growers' Federation.

Education was also made compulsory for all children and adolescents, at substantial expense for families from municipalities like El Águila, where access to education is limited for reasons of distance and transportation, as they now had to send their children away to school. Having minor children away led to a disruption in teaching the coffee-growing trade, which children had hitherto begun learning from a young age by helping out in day-to-day tasks in the fields; the close relationship between school and family had enabled children to leave school early during harvest time to help pick the crop.

Formal education became a major part of country life. Coffee producers sent their children to study and live in the city, dissociating them from the work on the plantations. This led to a downsizing of the family nuclei involved in production and the need to hire external labor, increasing production costs. Having smaller family nuclei also impacted crop management as it became difficult for one person to control pests and diseases manually, making agrochemicals indispensable on account of their effectiveness and fast results.

The economic opening that allowed Colombian coffee to compete on a global scale with countries like Brazil and Vietnam in producing soft coffees meant more rigorous standards of production and quality. Technification became the key as it guaranteed crop yield and bean quality to meet the demands of an international market. But the recurrent crises and falls in coffee prices worsened producers' living conditions, in turn reducing investment.

Coffee-growing families have gotten smaller. Today, many producers live on their farms alone or with only their partner, or simply have no support from family. This is not a new phenomenon, nor it is limited to the coffee sector; rural-to-urban migration among young people is due to a negative view of country life as an option for their social or working life (Nates & Velásquez, 2009). The imaginaries of progress among the rural populace have changed due to urban aspirations (ibid., 2009).

The coffee producer's way of life went from being a culture to being a job, due mostly to:

1) The absence of household vegetable plots as a result of the lack of help in the fields and the impact of agrochemicals.

2) The lack of support from family members due to structural conditions that changed the way the coffee-growing trade was taught, and the values associated with it.

3) The need to respond to market logics, and the desire to improve living standards by increasing income and access to education and health opportunities, among others.

The country-to-city migration process

According to the National Coffee Growers' Federation, the coffee trade provides a livelihood for over 500,000 families. Coffee growing is extremely labor-intensive (Amador, Caicedo, Calderón et al., 2012). Labor accounts for around 70% of the costs of coffee production as, unlike other crops that have been mechanized, the topography of coffee-growing regions (with their steep slopes) means that most work on plantations must be performed by hand, in the traditional manner (Nates & Velásquez, 2009, p. 7)

Laborers have gradually aged due to the large-scale migration of producers' children to the cities. This has led to a shortage of labor, and consequently, a rise in the cost of daily wages. The loss of labor is also associated with the lack of opportunities for advancement in the countryside, the armed conflict in Colombia, and centralist policies that have displaced children and youth from the country to the city. Coffee production has been affected not only by the economic crisis, but also by migration flows that have left the grandparents and, at best, parents of the long-renowned rural "coffee-growing families" living alone on farms (Nates & Velásquez, 2009).

http://dx.doi.org/10.33679/rfn.v1i1.1988

The depopulation of coffee-growing areas was further exacerbated by the law on compulsory military service[5], by which Colombian men over the age of 18 were obliged to "define" their military situation in one of two ways: 1) by completing military service in any of its forms[6], or 2) if eligible for exemption on any grounds, by obtaining a reservist card[7] without needing to complete military service.

METHODOLOGY

This study was conducted using a *methodological combination*, with which it was hoped that quantitative method techniques could be introduced to assist and perfect the qualitative analysis (Bericat, 1998, p. 39). In this case, the aim was to address the weaknesses of the qualitative approach with respect to the size of the sample.

A *grounded theory* design was chosen due to its utility when available theories do not cover the phenomenon studied, as is the case with the perception of environmental quality or the perception of risk in the population of interest (Baptista, Fernández, & Hernández, 2010). Furthermore, grounded theory provides a solid understanding of the phenomenon, as it is applicable to the study situation, is backed up by practical and specific research work, is sensitive toward the subjects of the study, and makes it possible to understand the complexity of the phenomenon studied (Creswell, 2009, cited in Baptista, Fernandez, & Hernández, 2010).

Typical case sampling was performed, and subsequently a simple random sample was taken from the population obtained. For the typical case sampling, participants had to meet the following criteria: 1) be coffee producers; 2) be residents of the El Águila municipality; 3) own the farm or land they grow coffee on; and 4) be natives of the municipality, or have lived there for at least a decade. Random sampling was performed on a universe of 1,600 coffee farms, and 100 producers were selected by convenience, given that all the municipality's coffee growers shared homogeneous characteristics and for reasons of

[5] Law 48 of 1993, in Title II, Chapter 1, Article 10. All Colombian males shall be obliged to define their military situation from the date they reach the age of majority, with the exception of high school students, who shall do so upon obtaining their high school diploma.

[6] Law 48 of 1993, in Title II, Chapter 1, Article 13. Forms of compulsory military service. The government may establish different manners in which compulsory military service may be completed. The current forms of military service shall remain in effect: a) As a regular soldier, for 18 to 24 months; b) As a soldier after obtaining a high school diploma, for 12 months; c) As an assistant police officer after obtaining a high school diploma, for 12 months; d) As a rural soldier, for 12 to 18 months.

[7] Law 48 of 1993, in Title IV, Article 30. The reservist card is the document used to prove definition of one's military situation.

distance it was not practicable to access all the properties. The survey was carried out by calling at the first coffee farm along the route; if the owner was not present, the survey was not conducted and the researchers moved on to the next farm. The techniques used during the research process were focus groups, semi-structured interviews, surveys for population characterization, and the application of a Likert-type scale to estimate the perceived environmental quality index.

In total, 100 surveys were administered and ten individual interviews were conducted with producers, along with two focus groups with producers and seven interviews with committee officials. The questionnaire comprised a total of 33 single-answer and multiple-answer multiple-choice questions and open-ended questions. It also included 10 Likert-type questions with a scale with the options "strongly agree", "agree", "neutral", "disagree", and "strongly disagree". The highest possible score in the scale was 50 and the lowest 10.

The results of the Likert-type test and the variables from the categories "standard of living" and "production process" were analyzed with contingency tables using the Statistical Package for the Social Sciences program (SPSS version 18). To calculate the significance of relationships, chi-square (χ^2) and Gamma tests were performed when variables were nominal.

The following categories and variables were addressed with the instruments:

1. Production processes: sowing density, coffee varieties, shade in the plantation, technology, productivity, and production cycle.
2. Perceived environmental quality: water, soil, air, and fauna and flora.
3. Cultural identity: the role of family, values associated with coffee growing, the role of organizations, and traditions.
4. Standard of living: income, socioeconomic stratum, second business activity and access to basic services.

RESULTS

The study found hybridization between traditional and technified crops, a decline in family support in farm work, a negative perception of environmental quality associated with technified crops, and a positive assessment of environmental quality in the municipality. The main quantitative findings include:

1. Hybridization of crops, with coexistence between traditional and technified practices, which are associated with producers' standard of living.

2. The decline in family labor.

3. The perception of the impact on environmental quality becomes higher as socio-economic stratum increases.

http://dx.doi.org/10.33679/rfn.v1i1.1988

4. The perception of the impact on environmental quality decreases as producers' income increases.

5. Large producers have a higher perception of the impact of negative cultivation practices on environmental quality than medium-sized and small producers.

The main qualitative findings include:

1. There is a perception that technified crops harm environmental quality more than traditional crops.

2. Producers have a positive perception of the environmental quality of their land.

3. There has been a change in the way the trade is passed on in coffee-growing families as a result of educational, political, and economic factors.

Characteristics of coffee plantations and coffee producers' living conditions

Characterization of plantations

The following indicators were taken into account to characterize plantations: coffee variety, sowing density, technology used, weed and undergrowth management technique, and intercrops in coffee.

Most producers surveyed (about 60%) reported sowing densities above 4,500 or 5,000 plants per hectare, followed by producers with sowing densities below 4,500 (21%), while only a small proportion of producers reported 3,000 plants per hectare. Most producers surveyed used varieties like Castillo-Naranjal and Supremo. These varieties are resistant to rust (*Hemileia vastratrix*) and are usually planted in densities of at least 5,000 plants per hectare.

It is clear that producers are technifying crops, as technification involves using resistant varieties and a sowing density of 5,000 plants per hectare or more. It was observed that over 50% of producers only grew rust-resistant varieties on their plantations. Over 30% of producers had both resistant and non-resistant varieties on their plantations, and a minority (under 10%) only had less resistant varieties such as Caturro, Colombia or Catimore.

Most coffee producers use a range of technologies on their plantations. About 80% apply some kind of agrochemical, whether herbicide, pesticide, or fungicide. It was also noted that around 50% of producers surveyed made use of the soil analyses provided by the National Coffee Growers' Federation (FNC) for fertilization. Most producers used vats under cover for the coffee pulp, with outdoor vats being used to a lesser extent. About 50% use dry pulping machines, with the remainder continuing to use water for pulping. A small

number of producers have reactors to handle wastewater, or drying silos. Only 10% have adopted more than five technologies in their production process. This may be due to low income (which limits their ability to invest), low confidence in technological systems, or even resistance to change. A low uptake of technologies was observed, despite the fact they have been heavily promoted by the Coffee-Growing Committee.

Over 50% of producers surveyed grow crops in some form of shade, with a smaller proportion growing crops in direct sunlight. The study noted that weed management on coffee plantations was mostly performed using a machete, scythe or herbicides. Few producers weed by hand or with a mattock or hoe. It should also be noted that most use two or more of these techniques simultaneously, meaning that mixed techniques are used to manage weeds or undergrowth.

A high use of herbicides was recorded, and this kind of agrochemical was identified by producers as the main factor in the decline of fauna and flora in the municipality. The use of pesticides was also linked to the lack of household vegetable plots, due to the harm that exposure to herbicides causes to vegetables.

Characteristics of technified plantations

a) Increased sowing density.
b) A reduction or elimination of shade: crops in direct sunlight, technified shade or shade from another business activity – for example, bananas being grown as a substitute for shade.
c) Shorter renewal periods. Crops are renewed every 5 years instead of every 10 years.
d) The use of resistant varieties, at present the low-growing and rust-resistant Castillo-Naranjal.
e) Stricter agroecological conditions. Control over the externalities of the production process (management of pulp and wastewater, among others).
f) High yield. Although yield per tree is lower compared to traditional crops, the increase in sowing density and the exposure to direct sunlight increase production.
g) Short production cycle that has gone from two harvests a year to pickings every month, with production peaks twice a year.
h) Adoption of a range of technologies: dry pulping machines, drying silos, reactors or biodigesters to treat coffee wastewater, vats under cover for the pulp, soil analyses prior to fertilization, and the use of agrochemicals as fertilizers, herbicides, pesticides, and insecticides, among other kinds.

The differences in the transformation of coffee crops reveal a transition from traditional to technified production. The current state of crop management suggests that technification

http://dx.doi.org/10.33679/rfn.v1i1.1988

is at a "halfway point", meaning that the technification process is not absolute, but nor is crop management fully traditional. It was noted that the technification process has merged with traditional methods of crop management, with producers selecting the aspects of technification that they believe suit their needs, or are able to afford.

Business activities and income

It was found that 53.5% of those surveyed earn a monthly income below the legal minimum wage in force (*salario mínimo legal vigente*, or SMLV), while 30% receive an income equal to the SMLV and 15.1% earn between one and two times the SMLV. This situation shows that 83.8% of producers support themselves on income equivalent to or below the SMLV, an amount intended to cover basic needs.

Most producers believe they do not earn enough to cover basic household expenses (57.5%), followed by those who believe their income is sufficient (41.4%), with just 1% believing their income is more than sufficient to cover basic household expenses. Food is one of the greatest expenses reported by producers (40%), which may be linked to the limited number of household vegetable plots (6.6%) to complement the food supply.

Reasons for the lack of household vegetable plots include the additional work involved in tending them, limited family support at home, and the use of insecticides and herbicides. The lack of vegetable gardens means that no food is being grown for household consumption, and consequently the food has to be purchased from outside sources and becomes another household expense.

The second main expense identified by producers is labor. This is due to the shortage of labor in the fields and limited family support. The cost of daily wages has increased due to the reduction in both the number of day laborers and the family support available. The growing demand for help in plantations has increased the cost of daily wages. This has had a negative impact on producers, who must either perform all the work themselves or pay costly daily wages to carry out the tasks required.

Division of labor

Traditionally, coffee farms were worked by small producers with plots of land of around 3 hectares or less. Coffee was grown by groups of family members, who took part in the entire production process (Nates & Velásquez, 2009). This is especially important in the municipality of El Águila, where small producers predominate and almost 15% have support from two or three family members (but never more). This points to a transformation of the "coffee-growing family" characterized by a group of family members engaging in cultivation work.

Our data shows that spouses and children are most likely to assist with work in the plantations, followed by siblings or a parent. However, 40.4% of those surveyed reported receiving no help from family members, meaning they must take on the work involved in the production process themselves, or hire labor. On larger farms owned by medium-sized producers, frequently a live-in assistant or administrator manages the farm, while the owner lives in the city.

An analysis of family groups shows that most (54.4%) are made up of less than four people, followed by family groups of four people (24.4%) and those with five or more people (20.2%). Some producers live alone, or their families live away from the farm (12.1%). Other producers live with just one family member, whether a spouse, parent, or in some cases, a child or sibling (22.2%). There are also three-person households (20.2%) made up of producers living with two other people, either their parents or wife and child. The makeup of family groups paves the way for discussion of the downsizing of coffee-growing families, rural-to-urban migration, and the decline in family support in farm work.

Perception of environmental quality associated with living conditions and production processes

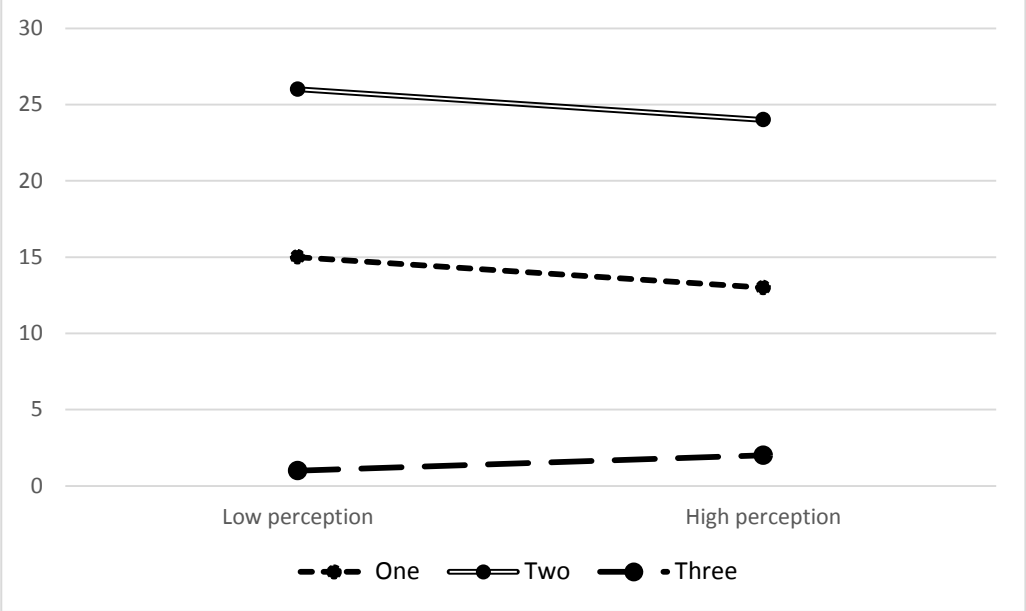
To explore the connection between standard of living and perception of environmental quality, this study examined the relationship between, on the one hand, the perception of environmental quality and the impacts of practices identified as detrimental to environmental quality and, on the other, three indicators of standard of living: the home's socioeconomic stratum, producers' monthly income, and type of producer.

The socioeconomic strata follow a national classification system used by the National Administrative Department of Statistics in Colombia, in which stratum 1 is lower-low, stratum 2 is low, and stratum 3 is upper-low. The Gamma value reveals the existence of a relationship with an approximate significance level of 0.70 between the perception of environmental quality with respect to the impact of harmful practices in production

http://dx.doi.org/10.33679/rfn.v1i1.1988

processes and socioeconomic stratum, the dependent variable being perception and the independent variable being the socioeconomic stratum.

Graph 1. Perception of environmental quality associated with production processes and socioeconomic stratum

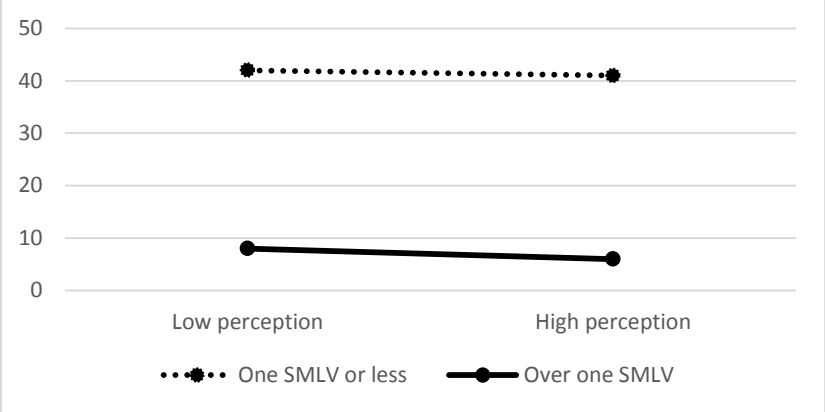


Source: Own work based on data from the characterization survey.

The data shows that the higher the socioeconomic stratum, the higher the perception of the impact on environmental quality. The perception is lower in strata 1 and 2, where socio-economic levels are lower, whereas the higher stratum 3 reports a high perception.

As part of the analysis of the relationship between standard of living and perception of environmental quality with respect to the impacts of harmful practices in production processes, the association with producers' monthly income was also explored. Monthly income was defined with respect to the legal minimum wage in force (SMLV), with the study taking into account those earning below one SMLV and those with income above one SMLV.

Graph 2. Perception of environmental quality associated with production processes and income



Source: Own work based on data from the characterization survey.

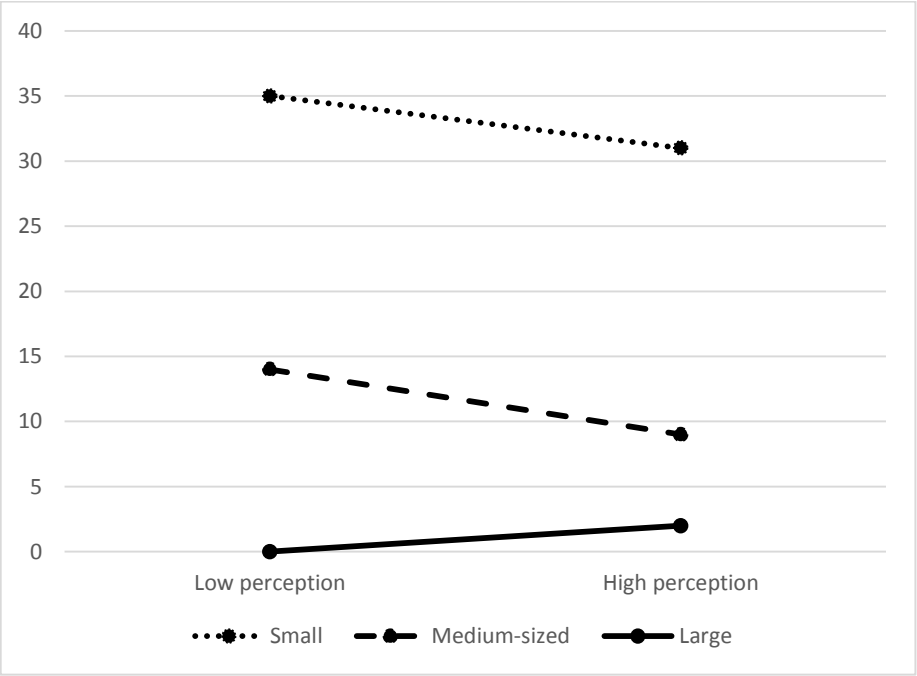
The Gamma value shows a relationship with a significance level of 0.65 between producer income and perception of environmental quality with respect to the impact of production processes. This relationship suggests that as income increases, perception is lower, and vice versa (see Graph 2).

The relationship was also explored based on the type of producer. Producers were classified according to the number of hectares in their coffee farm. The small producer category included those with 5 hectares or less, the medium-sized category included farms with an area between 5.1 and 35 hectares, and the large producer category covered farms over 35 hectares. Most of those surveyed fell into the small producer category, followed by medium-sized producers. Only two respondents were large producers.

The strongest association was found between perception of environmental quality with regard to the impact of harmful practices in production processes and the type of producer, with a Gamma coefficient of 0.91. It was found that large producers have a higher perception than medium-sized and small producers with respect to the impact of farming practices that harm environmental quality. Medium-sized producers have a higher perception of the impact on environmental quality than small producers (see Graph 3).

http://dx.doi.org/10.33679/rfn.v1i1.1988

Graph 3. Perception of environmental quality associated with production processes and type of producer



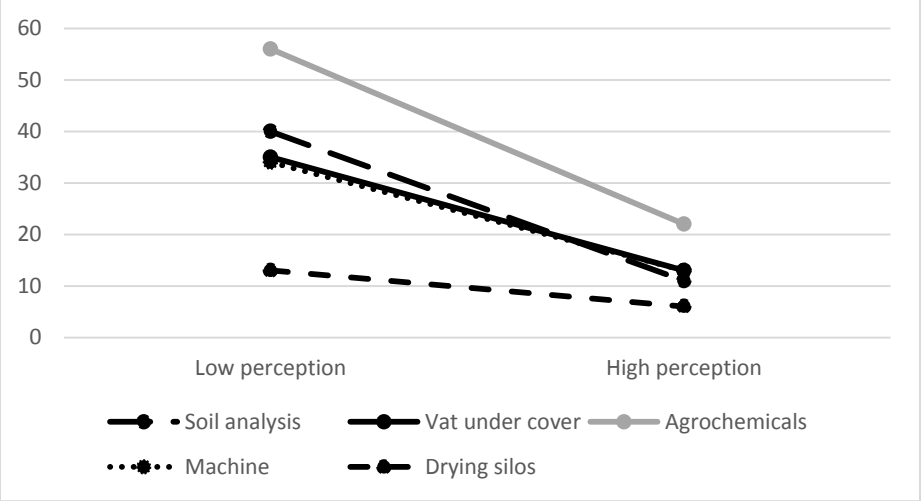
Source: Own work based on data from the characterization survey.

To explore the relationship between perception of environmental quality (with respect to the impact of harmful practices in production processes) and crop technification, the following indicators were taken into account: technologies used in plantations and sowing density.

The relationship exhibits a significance level of 0.90 using the chi-square ($\chi 2$) statistic, which shows that the more technologies producers use, the lower their perception of environmental quality. Furthermore, Graph 4 shows that as technology use decreases, perception of environmental quality is higher. The "reactor" and "outdoor vat" options were not included in this analysis as both exhibited expected values below 5, precluding the possibility of applying the chi-square ($\chi 2$) test.

Sowing density is taken into account as an indicator of the level of technification in coffee plantations. Greater density is an indicator of a higher level of crop technification. The contingency table below explores the relationship between perception of environmental quality (with respect to the impacts of harmful practices in production processes) and sowing density.

Graph 4. Perception of environmental quality associated with production processes and technology adoption



Source: Own work based on data from the characterization survey.

The Gamma coefficient of 0.86 indicates a significant relationship between sowing density and the perception of environmental quality with respect to the impact of harmful practices in production processes. Most producers with sowing densities below 3,000 plants per hectare have a higher perception than those with sowing densities above 3,000 plants per hectare.

Perceived environmental quality and coffee plantations

For the most part, producers perceive environmental impacts on soil and fauna as a result of technified crops, and specifically the use of agrotoxins like herbicides and insecticides and tree felling to eliminate or reduce shade within plantations. The significance of the impacts observed on the soil can be explained by farmers' experience working the land. Producers are in direct contact with the land on a daily basis, and their livelihood and sustenance depend on it.

In rural areas close to woodland, where even today farmers live in close contact with nature, there has been a clear decline in species diversity over time, along with a decline in bird and bee populations – pollinating species that are vital in sustaining plant life in the region.

The main downsides to traditional production are linked to the impact on water, as in traditional cultivation, water is used for coffee processing, and wastewater is dumped into

http://dx.doi.org/10.33679/rfn.v1i1.1988

rivers and streams. Perceptual accentuation plays a key role here, as water is a valuable resource for producers using the traditional production process.

Producers' general perception is that technified cultivation causes greater harm to environmental quality, although environmental impacts are acknowledged in both production processes (see Table 1).

Table 1. Perception of environmental quality associated with production processes

Element of nature	**Perception of impact from traditional cultivation**	**Perception of impact from technified cultivation**
Land	Identified (erosion from the use of mattocks or hoes for weeding and clearing)	Identified (loss of vegetation cover, erosion from the use of herbicides, loss of yield from intensive use)
Water	Identified (wet processing and dumping of wastewater)	Not identified
Air	Identified (gas from pulp fermentation)	Identified (from the use of herbicides)
Fauna	Not identified	Identified (from fumigation, use of herbicides and elimination of shade. Mainly birds and bees)
Flora	Not identified	Not identified

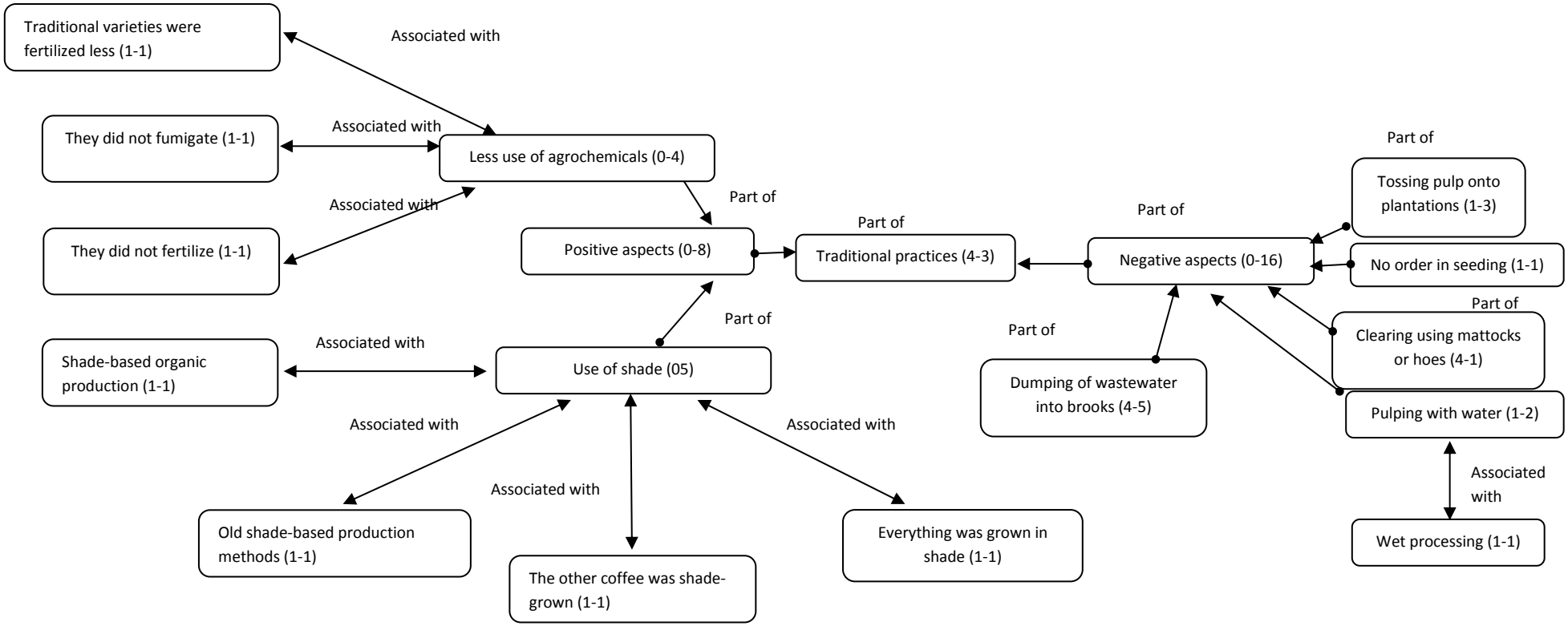
Source: Own work based on focus groups and interviews with producers, 2015.

Table 1 shows that no damage to flora is perceived in any form of cultivation. This was not explored further, providing an opening for future research. Land is perceived to be affected in both kinds of cultivation, but technified cultivation is perceived to have a greater impact. On the other hand, traditional cultivation is seen as having a greater impact on water due to its use in coffee processing and the dumping of wastewater into water sources. Technified cultivation is seen as more harmful for fauna due to the elimination or reduction of shade, fumigation, and the use of herbicides.

Perception of environmental quality, traditional crops and technified crops

Producers perceive both negative and positive aspects in traditional cultivation practices. Negative aspects include practices such as tossing pulp onto plantations, uneven seeding, clearing using a mattock or hoe, wet pulping or processing, and dumping wastewater into water sources, affecting the environment. Positive aspects, on the other hand, include the reduced use of agrochemicals and the use of shade within the plantation (see Figure 2).

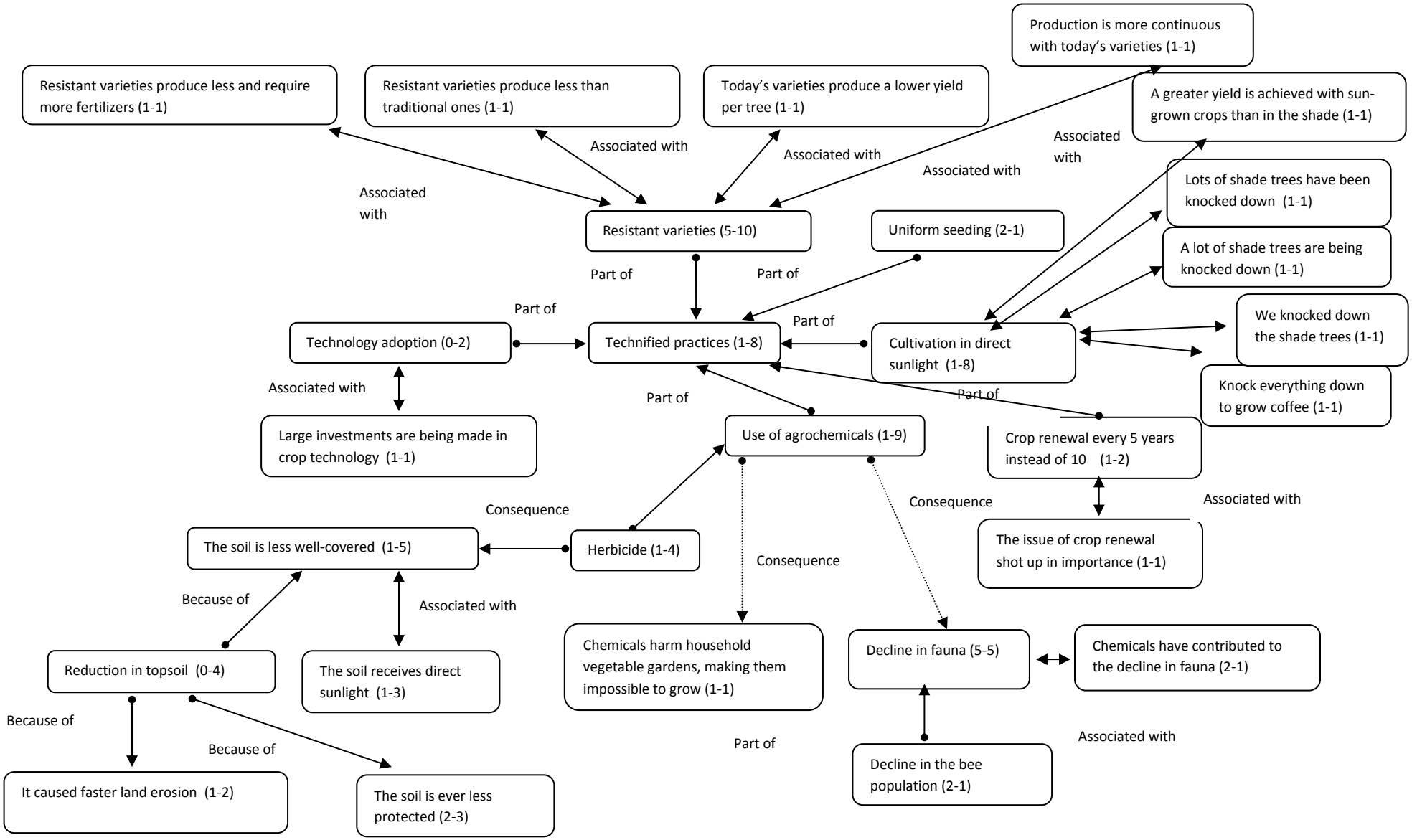
Figure 2. Semantic network: traditional practices



Source: Own work based on research data.

http://dx.doi.org/10.33679/rfn.v1i1.1988

Figure 3. Semantic network: technification practices



Source: Own work based on research data.

http://dx.doi.org/10.33679/rfn.v1i1.1988

Producers' perception of traditional coffee production is that despite being more environmentally friendly, it does involve practices perceived as harmful to the environment, including 1) pulping with water, 2) dumping wastewater into water sources, 3) using mattocks or hoes to control weeds or undergrowth, and 4) the improper handling of coffee pulp. Technification, on the other hand, is seen as a way to improve productivity and fight pests and diseases on coffee plantations. Aspects of technification identified by producers include the use of resistant varieties, technology adoption, uniform seeding, cultivation in direct sunlight, the use of agrochemicals, and the renewal of coffee plantations. Resistant varieties are associated with a lower yield compared to traditional varieties. Sun-grown crops entail a loss of shade and tree felling. The use of agrochemicals is linked to a decline in fauna, the absence of household vegetable plots, and the loss of topsoil. However, no negative impact was associated with uniform seeding or crop renewal (see Figure 3).

This analysis of the perception of technified cultivation, while acknowledging that it improves productivity, also identifies a link with impacts on environmental quality, such as deforestation, the effects of improper use of agrochemicals, a decline in fauna, and damage to land, such as erosion and a loss of yield.

DISCUSSION

Coffee production has undergone a clear transformation over the years in the municipality of El Águila. Children no longer learn the trade by helping out on the plantations from a young age. The implementation of national and institutional policies with no regard for the consequences for farmers' lives, the reduced study and health opportunities, and a technification process spanning several decades have led to a pessimistic perception of the business, and therefore migration to cities or other rural areas in the country is viewed as a better alternative.

The hybridization of traditional methods with technified methods in coffee cultivation is a response to a context of economic hardship, poor investment capacity (in addition to a growing need to increase family income), and a lack of faith in a technification process that in the past had significant negative effects both on the environment and producers' finances, and which remain unresolved. This is not limited to Colombia, as analogous examples can be found in other coffee-producing countries on the American continent (Barradas, Cervantes, Nava-Tabalada, & Ruelas-Monjardín, 2014; Granados Ledezma & Picado, 2009; Gómez-Cardona, 2012). At the same time, the growing awareness of the environmental impacts of both forms of crop management has encouraged producers to

http://dx.doi.org/10.33679/rfn.v1i1.1988

adopt environmentally friendly practices. As a result, technological hybridization is also a response to local logics that seek to leverage the advantages of technification, such as increased productivity and the simplification of labor, while maintaining the environmental benefits that come with traditional crop management.

There is however a positive side to producers' perception of environmental quality in their acknowledgment of the natural wealth in the region and their efforts to put in place environmentally friendly practices. There is also the perception that production practices – both in traditional and technified crop management – have a negative impact on environmental quality. Traditional practices were the result of ignorance and cultural roots (as is the case with wet pulping), whereas technification responded to the need to implement production systems that enabled producers to increase their income and simplify their work, even when they had a better understanding of the systems' impacts.

There is strong dissatisfaction with the technification process promoted by the National Coffee Growers' Federation and the National Coffee Research Center (CENICAFÉ), which is perceived as harmful for environmental quality yet beneficial for productivity. The idea of technification was launched years ago as part of the global Green Revolution, which spurred processes that were ultimately harmful for the environment (the use of agrochemicals and sun-grown coffee cultivation, among others). The opposition to the technification process is, in part, the result of a lack of trust in the organizations promoting it, which stems from negative experiences in the past that have still not been resolved.

Low income limits producers' ability to invest in order to adopt technologies, diversify, or upgrade their production processes. At the same time, the increase in production costs due to the shortage of labor and lack of family support are challenges still to be overcome in reshaping the coffee sector. In this sense, the technification process in its present form (with greater concern for the environment) must be implemented taking into account the cultural and social implications of changing production practices, and with an understanding of producers' economic rationale and needs. Developing an understanding of farmers that goes beyond technical and formal knowledge will enable the combination of traditional knowledge and new techniques, which in turn will help to establish processes that benefit farmers' work.

The appropriation of land for coffee production as a backbone for culture, society, the economy, and family life is gradually being lost, with coffee-growing becoming just another industry. In this sense, local and regional development should be oriented in accordance with changes that have taken place among the rural populace, which has little by little changed its perspective on life.

Policies and programs launched need to take into account aspects like the downsizing of rural families, the disappearance of family support and help from children in the fields (which was the basis for training future generations), and limited access to opportunities (in

terms of education and health), all of which have gradually transformed coffee growers' mindset and actions. Similarly, a need has arisen to research women's development in rural areas, as women have been gradually excluded from agricultural work. The reasons behind this phenomenon, and the ways in which women could play a meaningful role in reconstructing country life, are certainly worth exploring.

Translator: Joshua Parker

REFERENCES

Alguacil, J. (1998). *Calidad de vida y praxis urbana: nuevas iniciativas de gestión ciudadana en la periferia social de Madrid* (Doctoral dissertations). Universidad Complutense de Madrid, Facultad de Ciencias Políticas y Sociología, Madrid.

Amador, J., Calderón E., Caicedo E., Cano, G. & Vallejo, C. (2012). El mercado mundial del café y su impacto en Colombia. *Borradores de economía*, (710), 1-56.

Banco Mundial. (2008). *Informe sobre el desarrollo mundial 2008: reseñas de políticas* [archivo PDF]. Recovered from :http://siteresources.worldbank.org/INTWDR2008/Resources/2795087-1191440805557/4249101-1197050010958/04_ambiente.pdf

Bansart, A. (2009). *Ecosocialismo*. Caracas: Fundación Editorial el perro y la rana.

Baptista, P., Fernández, C., & Hernández, R. (2010). *Metodología de la investigación*. Mexico: McGraw-Hill.

Barradas V., Cervantes J., Nava-Tabalada M.E. & Ruelas-Monjardín L.L. (2014). Importancia ambiental de los agroecosistemas cafetaleros bajo sombra en la zona central montañosa del estado de Veracruz, México. *Revista Madera y Bosques*, *20*(3), 27-40.

Bericat, E. (1998). *La integración de los métodos cuantitativo y cualitativo en la investigación social: Significado y medida*. Barcelona: Ariel.

Departamento Nacional de Planeación. (2014). Bases para el Plan Nacional de

Desarrollo 2014-2018 "Todos por un nuevo país" Capítulo X: crecimiento verde. Recovered from: https://colaboracion.dnp.gov.co/CDT/PND/PND%202014-2018%20Tomo%202%20internet.pdf

Escobar, A. (2007). *La invención del Tercer Mundo: construcción y deconstrucción del desarrollo*. Caracas, Venezuela: Fundación Editorial el perro y la rana.

Federación Nacional de Cafeteros de Colombia. (s.f.). Guía ambiental para el sector cafetero. Colombia: *Federación Nacional de Cafeteros de Colombia.* Recovered from: http://www.federaciondecafeteros.org/caficultores/es/servicios_para_el_cafetero/documentacion/

Federación Nacional de Cafeteros (FNC) y Centro Nacional de Investigaciones de Café (CENICAFÉ). (2013). *Manual del Cafetero colombiano: investigación y tecnología para la sostenibilidad de la caficultura*. Bogotá: LEGIS.

Gómez-Cardona, S. (2012). Las tensiones de los mercados orgánicos para los caficultores colombianos. El caso del Valle del Cauca. *Cuadernos de desarrollo rural*, *9*(68), 65-85.

Granada, H. (2002). *Psicología ambiental.* Barranquilla, Colombia: Uninorte.

Granada, H. (2007). *Representaciones sociales de la calidad ambiental del hábitat urbano: el caso de Guadalajara de Buga Valle Colombia*. Cali, Colombia: Universidad del Valle.

Granada, H., & Molina, C. (2015). Conocimiento y valoración de la calidad ambiental de la reserva forestal Bosque de Yotoco: Perspectiva psicoambiental. *Psicología desde el Caribe*, 32(3).

Granados R., Ledezma, R. & Picado, W. (2009). *Territorio de coyotes, agroecosistemas y cambio tecnológico en una región cafetalera de Costa Rica. Revista Historia*, (59-60), 119-165.

Gonzáles, A. A. (2015). Valoración de la sustentabilidad de los policultivos cafeteros del centro occidente y sur occidente colombiano. Universidad Tecnológica de Pereira, Pereira, Colombia. Recuperado de https://www.researchgate.net/profile/Alejandra_Gonzalez23/publication/282981082_Valoracion_de_la_sustentabilidad_de_los_policultivos_cafeteros_del_Centro_y_Sur_Occidente_Colombiano/links/5625839e08ae4d9e5c4bb701.pdf

Guhl, A. (2004). Café y cambio de paisaje en la zona cafetera colombiana entre 1970 y 1997. *CENICAFÉ*, *55*(1), 29-44. Recovered from: https://www.cenicafe.org/es/publications/arc055%2801%29029-044.pdf

Ley N° 48. Congreso de la República, Bogotá, Colombia, 3 de marzo de 1993.

Mamani, F. H. (2010). *Buen Vivir/Vivir Bien. Filosofía, políticas, estrategias y experiencias regionales andinas*. Lima: Jr. Carlos Arrieta 1049.

Marulanda, N., & Tancredi, F. (2010). *De la innovación social a la política pública: Historias de éxito en América Latina y el Caribe*. Santiago de Chile, Chile: Comisión Económica para América y el Caribe (CEPAL).

Ministerio de medio ambiente.(2017). Federación Nacional de Cafetaleros de Colombia. *Guía ambiental para el sector cafetero. segunda edición*. Recuperado de

https://www.federaciondecafeteros.org/caficultores/es/servicios_para_el_cafetero/documentacion/

Nates, B., & Velásquez, P. (2009). Territorios en mutación Crisis cafetera, crisis del café. *Cuadernos de Desarrollo Rural*, *6*(63), 11-33. Recovered from: http://revistas.javeriana.edu.co/index.php/desarrolloRural/article/view/1181

Parada, P. J. (2015). *La cultura del trabajo en el campesinado cafetero colombiano: el caso de Caldas* (Tesis doctoral). Universidad de Sevilla. Departamento de Antropología Social, Sevilla, Spain. Recovered from: https://idus.us.es/xmlui/handle/11441/39069

Reverón, C. A. (2009). *Acción sin daño y reflexiones sobre prácticas de paz: Una aproximación desde la experiencia colombiana*, *Módulo 3* "*Los daños en nombre del desarrollo: enfoques y perspectivas".* Bogotá, Colombia: Universidad Nacional.

Sen, A. (2000). *Desarrollo como libertad.* Madrid, España: Editorial Planeta.

Unidad Municipal de Asistencia Técnica Agropecuaria. (2012). *Plan Agropecuario Municipal*. El Águila, Colombia: Alcaldía Municipal de El Águila, Valle del Cauca.