Coca Cultivation in the Huallaga and VRAE valleys: A Comparative Approach to Productive Systems and the Impact on Forests (1978-2003)

Eduardo Bedoya Garland

https://orcid.org/0000-0002-6218-3602
Programa Estudios Socioambientales, FLACSO
Departamento Académico de Humanidades, Pontificia Universidad Católica del Perú
ebedoya@pucp.pe / ebedoyagarland20@gmail.com

Carlos Aramburú

https://orcid.org/0000-0002-9203-2215
Departamento de Ciencias Sociales, Pontificia Universidad Católica del Perú
caramburu@pucp.pe

Anel López de Romaña

https://orcid.org/0000-0002-8120-6865
Taller Etnológico de Cultura Política, Pontificia Universidad Católica del Perú
al2081@cantab.ac.uk / a20142569@pucp.edu.pe

ABSTRACT

This paper aims to analyze the historical and economic conditions that led to the expansion of coca cultivation for illicit purposes in the Alto Huallaga valley and the tropical Valley of the Apurimac and Ene rivers (also known as VRAE), both located in the upper Peruvian Amazon basin. We explore how this expansion resulted in destructive and inefficient shifting agriculture. Drawing on studies and surveys conducted in 1981 in Alto Huallaga and in 2001 in VRAE, we seek to establish a useful and valuable comparison, despite the twenty-year gap between these cases. This study concerns the two regions of the Amazon that had the largest area of coca plantations in the country. While there was already a more intense social and economic history of integration with the market and modernity in Alto Huallaga when coca cultivation expanded there, the context and socio-environmental histories of each basin differed significantly. Nonetheless, similarities in productive strategies persisted. Coca, whether grown as a permanent crop in relatively small areas, did not replace the itinerant agriculture practiced

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by most Andean settlers in the high jungle (selva alta). Periodically, coca growers abandoned their plantations during periods of declining yields, seeking new lands and fertile soils within their own properties or in more distant areas, thereby perpetuating the slash-and-burn method and significantly impacting the forest.

Keywords: Amazon basin, tropical colonization, shifting agriculture, coca, deforestation

El cultivo de la coca en el Huallaga y en el VRAE: un enfoque comparativo sobre sistemas productivos y su impacto en los bosques (1978-2003)

RESUMEN

Aprovechando dos estudios y encuestas realizadas en el Huallaga en 1981 y el VRAE en 2001, ambas localizadas en la Amazonía alta peruana, el presente ensayo busca relatar y analizar las condiciones históricas y económicas en las cuales se expandió el cultivo de la coca con fines ilícitos en estas zonas. En ese sentido, se describe cómo a partir de tal historia se configura una agricultura migratoria ineficiente y destructiva. Aunque los períodos analizados en cada caso son distintos, con una diferencia de veinte años, la información que disponemos permite realizar una comparación útil y valiosa. Se trata de las dos regiones de la Amazonía que durante el período de estudio tenían la mayor extensión de plantaciones de coca a nivel nacional. Cuando la coca se expandió en el Alto Huallaga ya existía una historia social y económica de articulación con el mercado y una modernidad mucho más intensa que en el VRAE. A pesar de que los contextos e historias socio ambientales de cada cuenca fueron bastante diferentes, las similitudes de las estrategias productivas siguieron siendo significativas al igual que sus efectos a nivel ecológico. La coca, en tanto plantación o cultivo permanente en extensiones relativamente reducidas, no eliminó la agricultura migratoria practicada por la mayoría de los colonos andinos en la selva alta. Cada cierto tiempo, los cocaleros abandonaban sus plantaciones en fase de rendimientos decrecientes, en búsqueda de nuevas tierras y suelos fértiles dentro de sus predios o en zonas más distantes, lo que reprodujo la modalidad de roza y quema e impactó el medio ambiente en los bosques.

Palabras clave: Amazonía, colonización tropical, agricultura migratoria, coca, deforestación

Since the late 1970s and early 1980s, there has been a significant expansion of coca (*Erythroxylum coca*) cultivation (Gootenberg, 2008) in Peru and principally in Alto Huallaga, as a result of the increase in international demand for cocaine and the development of logistics for clandestine distribution from Colombia. This process constitutes one of the most significant and surprising phenomena in the history of Peruvian agriculture. The social, environmental and criminal consequences were considerable. In both the Alto Huallaga valley and the Valley of the Apurimac and Ene Rivers (also known as VRAE), the employment of the main factors of production (labor, land, capital and informal credit) was redirected towards the cultivation of coca, to the detriment of legal crops. A distinctive feature of the two regions was the development of a criminal economy, which was accompanied by the existence of paramilitary and subver-sive anti-establishment groups, who were in open competition with the State for territorial and political control, and who had an interest in benefiting from the income generated by the sale of coca leaves and basic paste. Although such orga-nizations were somehow defeated (Huallaga) or almost kept in check (VRAE), their presence determined the daily life of agricultural producers.

The global effect of the impact of this criminal economy was not limited to economic and political aspects. The cultivation of such a product for illicit purposes promoted the expansion of unsustainable, inefficient and environmentally destructive agriculture. Coca as a permanent crop planted in relatively small areas did not eliminate the destructive nature of the itinerant agriculture practised by the majority of Andean settlers in the high jungle (*selva alta)*. From time to time, the coca growers abandoned their plantations during a period of decreasing yields, in search of new lands and fertile soils within their properties or in more distant areas, where they repeated the slash-and-burn method.

And so, taking advantage of two studies and surveys carried out in Huallaga in 1981 and in VRAE in 2001, this article recounts and analyzes in a compara-tive manner the historical and economic conditions in which coca cultivation

for illicit purposes expanded in both regions (Fundación para el Desarrollo Nacional [FDN], 1981; Bedoya, 2003). Next, it describes how the slash-and-burn agriculture practised by the settlers was created as a result of these historical circumstances. Although the periods analyzed are different, with a difference of twenty years between them, the information available is sufficient to establish a comparison that we believe is very useful. These are the two regions of the upper Amazon that, at the time of the study, had the largest area of coca plantations in the country. When coca expanded in Alto Huallaga, there was already a social and economic history of integration into the market and greater modernization than in VRAE. This characterized and differentiated the two regions, but did not nullify the similarities, especially at the level of the system of production. Despite the differences between the socio-environmental contexts and histories of each basin, the similarities in productive strategies remained important. The article follows a chronological sequence, beginning with Alto Huallaga, then VRAE, and finally comparisons are made between both cases.

MIGRATIONS TO THE ALTO HUALLAGA VALLEY

The Alto Huallaga region constitutes a special case among the colonizing experiences of the Upper Amazon in Peru, resulting from the explosive expansion of coca cultivation for drug trafficking purposes in the 1980s and early 1990s. Alto Huallaga is located in the northern central high jungle, between 600 and 1200 meters above sea level and within the provinces of Leoncio Prado in Huánuco and Mariscal Cáceres in San Martín. It has an area of 1 050 000 hectares. The region was occupied by various Amazonian ethnic groups, but over the years they were displaced by high Andean colonizations within the department of Huánuco and Aguaytía in an easterly direction, closer to Ucayali (Bedoya, 1993).

Coca has always been a colonizing crop in Alto Huallaga. According to John Murra (1972), the first period of migration from the High Andes to Huallaga happened during the 16th century and extended through colonial times. Andean migrants attempted to occupy a maximum number of altitudinal ecological levels. Such migrations were related to coca cultivation and continued during the colonial period. Between the mid-19th century and the beginning of the 20th, coca attracted more migrants to the area from places as distant as the central and northern highlands (Aramburú & Bedoya, 1987). Later, from the 1930s and 1940s, private enterprises were established in the form of modern tea *(Camellia sinensis)* or coffee (*Coffea arabica)* plantations (Werlich, 1968). The large

coffee and tea plantations coexisted with medium-sized coca plantations, where more traditional agricultural practices were employed, attracting the seasonal migrants (Centro Nacional de Capacitación e Investigación para la Reforma Agraria [CENCIRA], 1974). Between 1950 and 1960 there was an intensification of the massive colonizations of Andean farmers who worked as wage earners in the tea and coffee plantations. Nevertheless, there was always an interest in working on the coca farms.

Coca was, and still is, immersed in a complex circuit of non-monetary exchanges with a strong symbolic, ceremonial and sacred component, characteristic of Andean reciprocity (Mayer, 2004). Coca cultivation practices were traditional, based on the natural fertility of the soil and without major environmental impact. It was grown in association with other crops, such as cassava (*Manihot esculenta*) and corn (*Zea mays L*)**,** as well as some species of trees which belonged to the *Inga* genus. Such trees created shade, protecting the young plants, and thus preventing erosion (Jacobi *et al.*, 2018). After successive trips to the jungle, numerous *campesino*s from the Andes chose to settle in the tropics and started their own agricultural plots, which included the cultivation of coca (Bedoya, 1993). In those years, the population grew from 11 000 to 45 000 inhabitants. Various logging companies and sawmills were subsequently established, with the aim of taking advantage of fine wood in the region (Ministerio de Hacienda, 1941; INEI, 1961).

From 1960 to 1975, the immigration of highland Andean *campesinos* continued to grow thanks to governmental support. Fernando Belaúnde's government (1963-1968), promoted the so-called Tingo María, Tocache and Campanilla (Alto Huallaga) Colonization project, receiving investment worth millions from the Inter-American Development Bank. The project resulted in the settlement of 4000 families, who began to transform over 100 000 hectares of primary forest into medium-sized agricultural farms. The State assumed a central role in this scenario of colonization. Medium-sized properties of between 10 and 30 hectares were titled (CENCIRA, 1974). Much of this was due to the spontaneous migrations of highland *campesinos*, encouraged by the same colonizing project and by a perceived abundance of available land, unaware of the nutrient poverty of the Amazonian soils and of the fragility of the tropical forest ecosystem (MINAM *et al.*, 2015). Belaunde then promoted the construction of a highway (Carretera Marginal de la Selva), a route designed in parallel to the eastern Andes. This route facilitated the arrival of tens of thousands of new migrants (Aramburú & Bedoya, 1987). Consequently, by 1972, the Alto Huallaga basin became the most developed and economically diversified in the entire Peruvian high jungle

(Lesevic 1985). Until 1974, State investment in Huallaga exceeded S/. 2 billion (Martinez 1990).

During such years, coffee (*Coffea arabica)* became the other colonizing crop. Although bananas were the main regional agricultural product, coffee brought more income to *colonos*, even though prices were not always favorable. Compared to bananas, coffee is a non-perishable crop, and it is easy-to-manage, so it was also expanding in other areas of the high Amazon such as Satipo and Chanchamayo (Santos & Barclay, 1995). In Alto Huallaga, throughout the 1950s and 1970s, coffee plantations expanded from less than 200 hectares to almost 5000 (Durham, 1977). As a result, between 1972 and 1981, Alto Huallaga's population continued to grow, from 79 000 to 108 000 inhabitants (INEI, 1972; INEI, 1981).

Between the late 1970s and mid-1970s, the military government of Juan Velasco (1968-1975) implemented an agrarian reform in which the former private plantations in the Alto Huallaga region were transformed into agricultural cooperatives. The reform led to the departure of the former plantation owners, who, although absent, had their administrative or managerial structures exerting political and economic influence in the area, especially in Tingo María. Eventually, a sector of the cooperatives created by the agrarian reform experienced a financial crisis, resulting from misguided decisions related to the introduction of heavy machinery for deforestation, which compacted the soils and depleted their natural fertility (Bedoya, 1981). As a consequence, numerous cooperatives went bankrupt and divided their lands among their members. Additionally, in the mid-1970s, the State began to withdraw, with the completion of the Tingo María Tocache-Campanilla colonization project further deepening the institutional power vacuum (Paredes & Manrique, 2021).

By the early 1980s, the aforementioned processes had resulted in medium-sized properties becoming predominant in the Alto Huallaga region. This was due to the colonization policies of the 1960s and early 1970s, as well as to a dynamic of land fragmentation within the former cooperatives that had gone bankrupt. A study conducted by the Foundation for National Development (FDN, 1981) indicated that two-thirds of the properties in the surveyed areas had dimensions ranging between ten and 30 hectares (FDN, 1981) . The average land area per property in 1981 was around 27 hectares. In summary, State colonization projects, along with the aforementioned institutional fragmentation of cooperatives, facilitated the consolidation of medium-sized agricultural units (Ibid.).

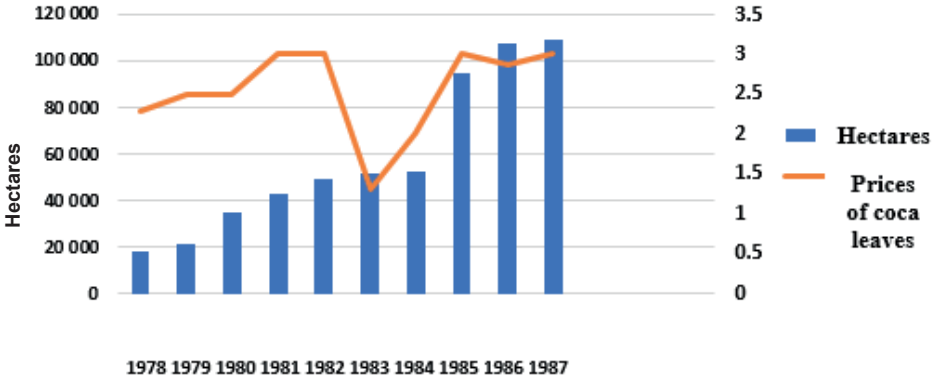
Since the second half of the 1970s, another series of events deepened the regional crisis and culminated in the rise of coca during the following decade. Family coffee agriculture began to show environmental limits caused by soil exhaustion, resulting from cultivation on steep terrain, in addition to the aging of the plantations themselves, reflected in low levels of yield per hectare (Bedoya, 2023). Similarly, the structural adjustment policies suggested by the International Monetary Fund in 1976 affected farmers in the Huallaga region, as costs doubled. Between the late 1970s and early 1980s, there was an increase in international demand for cocaine in North America and Europe, leading Huallaga settlers to redirect their traditional coffee and banana agriculture towards the illicit cultivation of coca (Gootenberg, 2008; Gootenberg, 2003). Although the prices of dried coca leaf were fluctuating, seasonal, and dependent on variables such as regional or international oversupply, they were attractive enough for Huallaga farmers. The economic growth and spectacular expansion of the agricultural frontier during the 1970s were conditioned by environmental, institutional, structural, and international factors. In this context, coca plantations increased.

Coca, which grew in poor soil located on steep terrain (FDN, 1981), expanded from 18 000 hectares to an approximate minimum of 40 000 in 1981 and then to an estimated over 100 000 in 1987 (Figure 1) (De Rementería, 1991; Paredes & Manrique, 2018). Family and hired labor shifted towards this crop at the expense of other crops. In 1986, a total of 63,8 % of the labor demand in the field came from coca plantations (Bedoya & Verdera, 1987).

During the coca boom, two distinct types of coca producers emerged. On one hand were those situated in registered areas accessible via the Carretera Marginal (Marginal Highway), blending legal agriculture with coca cultivation, constituting one-third of coca growers. Typically, these producers managed coca plantations averaging one hectare in size. Unlike traditional cultivation methods, where crops were often intermixed, coca was typically grown in separate plots (Aramburú & Bedoya, 1987). Our fieldwork calculations indicate that 40 % of their monetary income stemmed from the sale of dry coca leaves for drug trafficking, with the remaining 60 % sourced from other crops such as coffee, corn, and bananas.

On the other hand, there were migrants who settled in the most remote areas, on land with steep slopes and who planted exclusively coca monocultures. It was a floating population of young men who settled without a family and in precarious conditions. Their main plots were located in the high Andean communities or within the indicated cadastral territories in the Upper Huallaga (Aramburú & Bedoya, 1987; FDN, 1981). (Aramburú & Bedoya, 1987; FDN, 1981). This group

Figure 1. *Prices of dry coca leaf in US$/kg and hectares of coca plantations in Alto Huallaga, 1978-1987*



Note. The prices are based on field information collected between 1978 and 1987, mainly in the areas of Aucayacu and Tingo María. The total hectares was adapted from De Rementería (1991)

constituted two-thirds of coca growers, with their plantations often exceeding one or even two hectares (Econsult, 1987). In this scenario, income derived from coca leaf sales typically accounted for 90 % of their total monetary earnings.

However, there was significant variability in the income related to coca cultivation. This depended on whether the coca leaf was sold or processed and transformed into basic paste, which generated considerably higher incomes. It is estimated that by the mid-1980s, approximately US$900 million per year entered Huallaga as a result of the sale of coca leaf or primarily from the commercialization of basic paste. This amount greatly exceeded the US$19 million derived from legal crops. Coca plantations in Huallaga continued to expand in the second half of the 1980s (Figure 1). During those years, many coca growers were not as interested in its high relative price; rather, since prices were dollarized, it offered them protection against the hyperinflation of Alan García's first government (1985-1990).

The growth of coca cultivation and pre-existing crops such as coffee, bananas, cocoa, as well as livestock, had an environmental impact. Our current estimate is that by 1981, the deforested area, as part of dynamic land-use change and agricultural frontier expansion, amounted to approximately 180 000 to 200 000 hectares representing approximately a minimum of 17 % and a maximum of 19 % of Alto Huallaga territory. The successive booms in rubber, timber extraction, and coffee since the second half of the 1970s and early 1980s, as well as the

expansion of coca plantations, left a significant ecological footprint, including forest destruction and fragmentation, loss of ecosystem services, and biodiversity (Bernex, 2009; Dourojeanni, 1989).

MIGRATIONS FROM THE HIGH ANDEAN COMMUNITIES TO THE VALLEY OF THE APURÍMAC AND ENE RIVERS (VRAE)

The other significant case related to the expansion of the demographic and agricultural frontier in the Peruvian Amazon is the Apurímac and Ene Rivers valley, (VRAE). Today, VRAE stands as Peru's primary coca-growing region. Situated in the high jungle, at the convergence of the Cusco, Ayacucho, and Junín departments, this valley is characterized as a subtropical high jungle, ranging between 500 and 1500 meters above sea level (MINAM *et al.*, 2009). It spans an area of 1 486 077 hectares. VRAE is inhabited by Quechua-origin farmers who cultivate coca plantations primarily intended for the illicit drug trade, alongside legal products such as cocoa, coffee, maize, and bananas (Bedoya, 2003). Notably, along the right bank of the Ene and Apurímac rivers lie protected natural areas where indigenous populations of the Ashaninka and Machiguenga ethnicities still reside.

Campesino migrations began in the Apurímac Valley during the colonial period. Such population movements were always linked to coca cultivation. In the early 19th century, there were around 700 coca haciendas (plantations) owned by indigenous Andean and Spanish populations in this valley (Sala i Vila, 2001). Some landowners from the highlands mobilized *campesinos* from high-altitude communities through labor recruitment to work on their estates located in the jungle, harvesting coca, coffee, sugarcane, and other products (Ibid.). By the end of the first decade of the last century, the State office of the "Mountain Land Delegation" was established in the town of San Francisco, where Ayacucho settlers went to legalize the land they had deforested. Between the 1920s and 1930s, there was another push for colonization with the free allocation of 20 000 hectares to *campesinos* from Huamanga, La Mar, and Huanta, who cleared and opened small and medium-sized plots to grow tropical products such as fruits, coffee, and coca, the latter on relatively small plots of land (Durand Guevara, 2005).

During the same period there were communal colonization efforts from the high part of the La Mar province, as was the case with several communities in Chungui. These settlements were financed by coca tax funds and happened through

hikes along mule trails, accompanied by pack animals (Ibid.). Initially, the occupation of tropical lands had a seasonal character, as it occurred while agricultural fields in the Andean communities were resting. Such periods coincided with the months of greater activity in VRAE. Such colonizations thus moved between two ecological niches —highland communities and tropical lands— a frequent phenomenon in other parts of the high jungle (Sala i Vila, 2001; Collins, 1988; Aramburú, 1984; Bedoya, 1993).

In 1961, during the second government of Manuel Prado (1965-1962), the state-sponsored colonization project was established in the district of Pichari, aiming to relocate a total of 500 families and allocate a total of 18,710 hectares of land to them. The project successfully settled a number of families but was overshadowed by spontaneous campesino migrations that utilized new roads and paths for their movement to the valley (Martínez, 1990). By 1974, State investment totaled S/. 100 million (Ibid.), twenty times less than public investments in Alto Huallaga. Finally, in the 1970s and 1980s, cocoa (*Theobroma cacao*) expanded, and by the mid-1980s, population migration to the Apurímac Valley was revitalized, encouraged by the opportunity to cultivate and harvest coca, a consequence of the increasingly growing international demand for narcotics (Gootenberg, 2008). By 1981, the population of the lower tropical areas of La Mar reached 74 000 people, a significant increase from 1972 when the population was 47 000 (Ministry of Finance, 1941; INEI 1961, 1972, 1981).

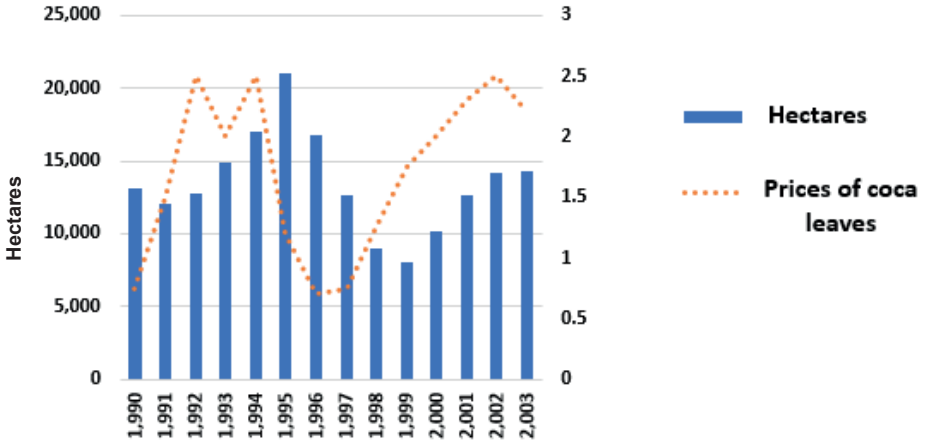
In a hyperinflationary context, such as during the first government of Alan García from the years 1985 onwards, VRAE experienced an explosive boom in coca production. *Campesinos* who migrated to VRAE protected themselves from inflation by resorting to a dollarized crop like coca. Subsequently, the price boom between 1990 and 1994 facilitated this growth. By the early 1990s, coca plantations occupied approximately 32 000 hectares under production out of a total of 80 000 hectares in agricultural production. At one point, it represented over 90 % of the gross value of regional agricultural production (Glave & Valcárcel, 1998), due to the stark income difference between coca cultivation and other legal commercial crops, such as coffee (*Coffea arabica)* and cocoa. Coca dominated the regional agricultural landscape, covering 40 % of the cultivated area (Ibid.).

The prices of coca leaf experienced a decline between 1994 and 1996, followed by a recovery from 1997 until early 2002 (Figure 2). The reasons behind this were, on one hand, the interruption of the air bridge between Peru

and Colombia, and on the other hand, the decision of Colombian cartels to increase coca leaf production in their own country (Mendoza and Leyva, 2017; Macroconsult, 2011). During these years, the expansion of coca plantations saw a slow recovery, accompanied by a new expansion of legal plantations, such as coffee and cocoa (Ibid.). By early 2001, coca plantations amounted to a total of 27 600 hectares. However, there were only 12,600 hectares in production and the rest were abandoned or in wastelands due to the overuse of land and the excessive use of modern inputs to increase productivity (Glave & Valcárcel, 1998). These were tired lands reflecting what is known as the fallow crisis (Bedoya *et al*., 2017). Despite the environmental crisis and as a consequence of rising prices, VRAE experienced new growth in coca plantations, leading to a new wave of primary forests destruction. By 2003, VRAE surpassed Alto Huallaga in the number of hectares cultivated with coca and became the country's leading coca-growing region, although still far from the scale experienced by Huallaga in the 1980s and 1990s.

The coca boom stimulated the land market and led to the fragmentation of land ownership. From the mid-1980s to the early 1990s, numerous coca growers sold off portions of their land. In 2001, according to a study conducted by the Consortium for Economic and Social Research (CIES) with the support of

Figure 2. *Prices of dried coca leaf in US$/kg and hectares cultivated in activity in VRAE. 1990-2003.*



Note. Adapted from Figure 8 and Figure 13, from United Nations Office on Drugs and Crime (UNODC), 2004; Table 11, Pariona, 2015; Bernex, 2009; Novak *et al.*, 2009.

Winrock[1], in the district of Santa Rosa and the Palmapampa area, district of San Miguel, province of La Mar, Ayacucho, 61 % of producers managed plots smaller than five hectares, and 27 % managed plots between five and ten hectares per family unit[2] (Bedoya, 2003; Bedoya and Ramírez, 2001; Ramírez, 2001). For all the interviewees, the average size of the estate was 5,58 hectares, and among those managing plots of less than 5 hectares, the average was 2,74 hectares. This indicated that they were indeed small Amazonian farms (Barclay and Santos, 1991). Given the nutrient-poor nature of Amazonian soils, plots of less than five hectares were not extensive enough to sustain medium and long-term commercial agriculture based on soil rotation and sectoral fallowing. Additionally, it is worth noting that a third of the farmers managed plots in the highlands, which were cultivated by family members or close neighbors (Bedoya, 2003). In summary, at the beginning of this century, VRAE was an established frontier area that had experienced successive waves of migration, and where smallholdings of less than five hectares were widespread (Bedoya, 2003)[3].

Close to 50 % of farmers' monetary incomes stemmed from coca, with the remainder coming from other crops and small-scale livestock (Ramírez, 2001; Bedoya & Ramírez, 2001). This significant portion of income was earned from an average of just 0,35 hectares of coca. In certain instances, the substantial monetary gains from coca were a result of its conversion into coca paste and subsequent trade within the drug trafficking network. Coca sustained family subsistence expenses for 4 to 6 harvests annually, covered maintenance costs for plantations like coffee or cocoa, funded children's education, and even enabled investment in local grocery stores in highland communities, among other uses. Despite the volatile and seasonal pricing of coca (Glave & Rosemberg, 2006), it didn't substantially alter the living standards of coca producers. In 2006, five years post-study, VRAE's population exhibited the lowest human development

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1 The study was conducted in February 2001 in the valleys of the Apurímac and Ene rivers (VRAE), at the request of the Consortium for Economic and Social Research (CIES) and Winrock (the institution responsible for alternative development efforts in VRAE), with the support of USAID. Economist Walter Ramírez played a prominent role in the research. During a subsequent visit, anthropologist Zulema Burneo participated in fieldwork. However, the ethnographic information gathered in this latter study was not included in the present article.

2 The research covered 120 producers, of which 83 were coca growers and the remaining 27 did not have coca plantations.

3 A study conducted by the United Nations in VRAE in 1997 revealed a land tenure distribution identical to that found in the 2001 research: 61 % of farmers owned five hectares or less (UNOPS, 1997).

indices in the southern region and the nation, with poverty levels surpassing 75 % and significant rates of chronic malnutrition and illiteracy (Li Suárez, 2009). This demographic represents a rural community with limited economic resources, where coca was viewed by settlers as a means of survival amidst their precarious economic circumstances.

Deforestation in the region was notably intense and continuous, particularly from the mid-1970s to the 1980s. Initially, this was driven by the expansion of coca cultivation and the accompanying annual crops planted for subsistence. Later, starting in the 1990s, cocoa cultivation emerged as an alternative to coca, yet its early farming methods were rudimentary and contributed to deforestation (Bedoya *et al.*, 2017). By 2001, an estimated 255 000 hectares of primary forest had been cleared in the VRAE valley, occurring at varying rates since the 1970s. In that year alone, the deforestation rate reached 7424 hectares annually, amounting to 17 % of the entire VRAE territory, mirroring the situation in Huallaga. Some researchers suggest that approximately two-thirds of this deforested area was allocated to cocoa and annual crops, with the remaining third attributed to coca cultivation (MINAGRI, 2012; Bedoya *et al.*, 2017). However, when considering other aggregated sources concerning regional land-use dynamics, it becomes evident that coca acted as a significant indirect catalyst for deforestation due to the broader economic activity it stimulated (Dourojeanni, 1989). Deforestation in VRAE remained consistent, particularly during the last 35 years of the previous century.

SLASH-AND-BURN OR SHIFTING AGRICULTURE AMONG COCA FARMERS IN ALTO HUALLAGA AND VRAE: SIMILARITIES AND DIFFERENCES

A surprising aspect of the farmers in VRAE in 2001 was the similarity with the rural producers of Huallaga regarding the impact on the forest and biodiversity, as well as the ways of occupying the frontier and using the land. To account for such similarities, we turned to the aforementioned study of 1981 by the Foundation for National Development (1981) in Huallaga and compared it with that of Bedoya and Ramírez (2001), conducted twenty years later in VRAE. It is worth noting that the surveyed farmers of Alto Huallaga were located within the Proyecto Especial del Alto Huallaga (Special Project of Alto Huallaga). That is, they were residents within the registered areas. Similarly, in VRAE, the study

was conducted in relatively accessible places. In both basins, the predominant method was slash-and-burn agriculture, based on rainfall patterns and soil rotation, where annual crops were combined with permanent plantations of cocoa, coffee, and, of course, coca.

In both basins, the family-owned plots with coca plantations acted as economic magnets due to their relatively high profitability. Consequently, the utilization of family labor revolved around this cultivation. In both regions, settlers nearing the age of 35 or older could rely on family assistance (teenage sons/daughters) in agriculture (Bedoya, 2003; Aramburú & Bedoya, 1987). Coca conditioned the productive and labor life cycle of families in both areas. Maximizing family labor efforts meant concentrating on this lucrative crop, which yielded income throughout the year due to multiple annual harvests, thus optimizing the use of family labor.

By allocating the workforce to coca farming, the levels of attention and land use intensification for this crop were high, while they were lower for other crops (such as coffee, bananas, among others). This allocation of time by family workers contributed to the perpetuation of shifting agriculture, as it led to an over-intensification of coca plantations, resulting in soil erosion and extensive land use for other crops. These aspects are further analyzed below.

Shifting agriculture, land availability, and deforestation

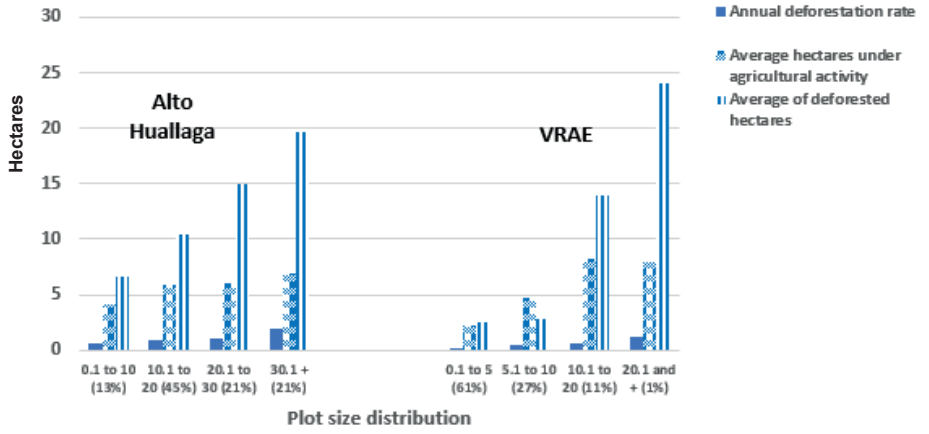
An indicator of slash-and-burn agriculture in both basins was the practice of soil rotation within the plots by settler farmers. They abandoned depleted soils and cleared primary or old secondary forests to introduce new annual crops or permanent plantations, following a practice known as sectoral fallowing (Aramburú & Bedoya, 1987; Bedoya, 2003; Wachholtz, 1996). This practice varied depending on the availability of land; larger estates had more room for sectoral rest, leading to a higher annual deforestation rate (Figure 3)[4]. Consequently, this resulted in inefficient and destructive agricultural practices, with deforested hectares often outnumbering those under cultivation on medium and large estates.

In Alto Huallaga, the prevalence of medium-sized properties or agricultural units resulted in low-intensity land use in the areas registered within Alto Huallaga

[4] In the 1981 Huallaga survey, 21 families were excluded from the annual deforestation rate calculation because they purchased plots that had been subdivided for sale and had already been cleared.

Special Project (PEAH). This resulted in a rather extensive occupation of land (Figure 3). Sixty percent of the properties had more land left fallow than actively used for agriculture (Bedoya, 1987). Conversely, the remaining 40 % of farmers with less than ten hectares were compelled to intensify land use by reducing fallow areas.

Figure 3. *Annual deforestation rate, active agricultural hectares, and total deforested hectares according to plot size distribution in Alto Huallaga (1981) and VRAE (2001).*



Source: FDN, 1981; Bedoya & Ramírez, 2001.

A distinct scenario unfolded in VRAE due to the prevalence of small plots of less than five hectares, resulting in different resource management and environmental challenges (see Figure 3). Ninety percent (90 %) of settlers had more land under cultivation than fallow (Bedoya *et al.*, 2017; Bedoya & Ramírez, 2001). For these farmers, the option of crop rotation was limited due to the lack of additional land availability. Soil utilization was more intensive and fertility recovery periods were shorter, except in cases where the land was severely degraded, leading farmers to abandon it for longer durations. This pattern was observed among both coca and non-coca growers. Their primary alternative was to intensify soil use, particularly in coca plantations known for their profitability. Consequently, coca growers in VRAE resorted to increasing plant density per hectare. In the mentioned basin, a significant number of VRAE producers utilizing advanced technology achieved 320 000 coca plants per hectare, contrasting with other regions with traditional methods such as the La Convención Valley in

Cusco, where only 25 000 plants/Ha were cultivated (UNOPS, 1997; Glave & Valcárcel, 1998). In 2001, the average coca leaf yield in VRAE was 2200 kg per hectare. In other words, 2,75 times more than Alto Huallaga, which was 798 kg that same year (UNODC, 2001).

This is what Geertz (1963) defined as agricultural involution in Indonesian farming. It signifies a "change without change," albeit with increased productivity (Ibid.). Such a strategy of intensification through densification of coca plantations was also prevalent among producers in Huallaga. However, in VRAE, it represented an urgent and necessary production need due to the smaller size of their plots. In contrast, in Huallaga, this phenomenon occurred differently. While these practices were widespread in VRAE, densification in coca plantations was more noticeable as the plots were located farther from roads or transportation routes.

In both basins, the densification of coca plantations was accompanied by an excessive use of modern inputs. In VRAE, as per interviews and field observations in 2001, all farmers employed large quantities of various inputs for their coca crops, resulting in adverse effects on both soil and the ecosystem (Celis-Tarazona *et al.*, 2020). In order to sustain coca productivity and attain optimal economic returns, coca growers resorted to disproportionately applying nitrogenous fertilizers. This led to increased insect proliferation and the emergence of resilient weeds, ultimately harming the crop and causing general degradation due to the loss of the chemical, physical and biological properties of the soils (CDVRAE and Project AD/PER/939-UNDCP/UNDOPS, 1996).

In Huallaga, the use of fertilizers and pesticides in coca plantations varied depending on the distance from communication routes and depending on the area. The percentage of use of such inputs ranged between 50 % and 75 %. In any case, its application was higher than in coffee and cocoa plantations (ECONSULT, 1987). After a few years, due to overuse of the soil and excessive use of inputs, returns diminished in both basins and farmers had to abandon their plots and restart the cycle by practising slash and burn in primary or secondary forests (Wachholtz, 1996; Aramburú & Bedoya, 1987). Hence, the coca plantation system was immersed in migratory slash-and-burn agriculture.

In VRAE, cocoa cultivation held a secondary position in terms of attention compared to the extensive efforts dedicated to coca plantations. Merely 5 % of producers applied pesticides and fertilizers to their cocoa crops (Ibid.; Bedoya, 2003). Just as in the Huallaga region, the increase in land use for legal crops did not correspond with a significant rise in input application. The utilization rates

of inputs hovered around 30 % and 7 %, with exceptions for producers situated near State technical support centers (ECONSULT, 1987, tables 19 and 20).

The production system of settlers in the Huallaga and VRAE regions relied on a cyclical pattern: initial deforestation, followed by intensive land use for coca cultivation, soil erosion, land abandonment, and subsequent deforestation once again. Several studies revealed that after years of intense coca farming, the land became so depleted that it required extended periods of abandonment for recovery (Bedoya *et al.*, 2017). Consequently, the social repercussions of this unsustainable agricultural practice, as well as its environmental impacts, became apparent.

As a consequence of such practices, smaller plots experienced soil erosion and degradation of natural resources. In the jungle, a property of less than five hectares is a smallholding with all the environmental consequences this entails (Barclay & Santos, 1991). This was particularly evident in VRAE. In Huallaga, widespread environmental issues included deforestation on medium and large plots. However, soil degradation was especially evident in older agricultural units. Faced with these challenges, both in Huallaga and VRAE, there was always the option to migrate to other remote frontier areas where primary forests still existed. This allowed farmers to restart their production cycle by clearing the forest and reproducing their family economy. As described by Blaikie and Brookfield (1987), shifting agriculture served as a strategy to evade soil degradation rather than control it *in situ*.

The tragedy of private coca growers and deforestation

For reasons of security and risk evasion, coca farmers in both basins did not expand coca plantations but did so with cocoa and coffee plantations (Bedoya, Aramburú & Burneo, 2017). However, there were numerous differences between the two regions. In Alto Huallaga, in 1981, the average extent of coca cultivation was 1,05 hectares, whereas in VRAE, in 2001, it was 0,35 hectares. That is, exactly three times more. One reason, as already mentioned, was the difference in access to land resources. In Huallaga, medium-sized properties predominated, while in VRAE, smallholdings prevailed.

As the strategy of coca cultivation didn't involve expanding the number of hectares, the cultivation itself didn't cause as much deforestation as other crops with more extensive technological practices (Bedoya, 2003). The direct destructive effect was not considerable, given that it was planted in relatively small exten-

sions. However, if we add up the number of productive units that burned the forest to plant coca and include collateral damage, then the environmental impact was indeed significant. Such indirect effects were observed in all activities associated with this crop, for example, annual subsistence crops to feed the family and hired workers. These transitory crops required enough land to carry out continuous soil rotations. Another accelerator of deforestation was the construction of airports for small plane landings. Altogether, these factors could multiply the overall impact in terms of deforestation caused by the opening of coca plantations by four times (Dourojeanni, 1989). Lastly, deforestation was also a consequence of the continuous migration of coca farmers in search of more remote lands (Dávalos, 2018; Dourojeanni, 1989).

One way to assess the short and medium-term impact on forests resulting from the agricultural practices of producers in both basins is depicted in Figure 4. The data included are eloquent in that they describe and reflect the drama of deforestation in both regions, including the Amazon region as a whole. The figure can be interpreted as a chronological sequence of what happened over time with producers in Alto Huallaga in 1981, as well as in VRAE in 2001. Newly formed plots were mainly located in recently occupied border areas or at the end of forest trails; whereas older ones were situated near urban centers, main roads or highways.

Although the difference between one basin and another stands out regarding the annual rate of deforestation as well as the extent of deforested hectares, the general trends were similar. These are comparatively low annual deforestation rates compared to those practised by large agricultural enterprises. Likewise, on the one hand, in both basins the rate of deforestation was characterized by a downward trend among the oldest properties and, on the other hand, as the years passed there was a cumulative effect of forest and biodiversity destruction. Over the years the total hectares deforested were usually greater than the cultivated or active lands. This happened because the number of years during which the land was left fallow exceeded the years in which the soil was cultivated, which is a characteristic feature of shifting agriculture practised by settlers from other areas of the Amazon (Gómez de la Torre *et al.*, 2017). An utterly inefficient agriculture that, combined with a relatively low global annual deforestation rate, ultimately led to massive environmental destruction (Bedoya, 2016; Bedoya *et al.*, 2017).

The lack of capital and technical knowledge, coupled with a misguided perception of abundant high-quality land, along with ignorance about the poor

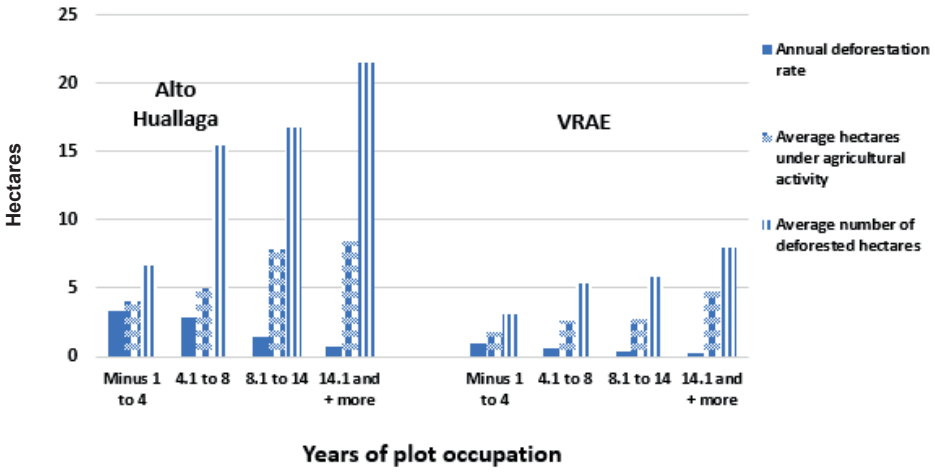
quality of Amazonian soils, led to extensive land use in Huallaga and more intensive use in VRAE. However, this did not preclude the development of shifting agriculture. The origins of this phenomenon were not only limited to structural conditions or institutional problems but also to the political context experienced by settlers in both basins during those years. The violent nature of both coca-producing regions and the presence of various paramilitary groups had an impact on natural resource management. In Alto Huallaga, the extreme violence generated by Shining Path (Sendero Luminoso)[5], which coexisted with that of drug trafficking (at times coordinated and at other times openly confrontational), hindered the smooth operation of the State in providing technical support and transforming destructive agricultural systems into more sustainable ones (Bedoya, 2016; Bedoya *et al.*, 2017). The State's strategy of combating drug trafficking and fighting Sendero Luminoso separately and as distinct and uncoordinated fronts also proved ineffective (ECONSULT, 1987). Consequently, the margins of autonomy or maneuverability of coca farmers were widened, as they continuously exploited the contradictions and limited effectiveness of the State's strategy to adapt and seek logistical support from one of the two groups (Sendero or drug trafficking), depending on the degree of influence each had in various circumstances. Meanwhile, settlers continued to cultivate coca and other products while also practising slash-and-burn agriculture.

The continuous programs of forced eradication of coca plantations in Huallaga also failed to modify the productive strategies of farmers. The settlers eradicated in the southern areas of the basin always looked for other more distant lands to continue planting coca fields and annual and permanent crops for both self-consumption and for sale.

In this sense, both in Alto Huallaga and in VRAE, the settlers' itinerant agriculture was the productive counterpart of an economic and political context that was unfavourable to the sustainable and efficient use of natural resources. Coca farmers operated as private actors managing forest and territorial resources in the public domain, the use of which for commercial purposes depended on the authorization of an absent, ineffective, and sometimes even hamstrung State. The cases of Alto Huallaga and VRAE demonstrate that the State failed to consolidate its presence, and as a result, the common resources of the forests were

[5] The Shining Path was an insurgent group with Maoist ideology that unleashed a dynamic of widespread violence and terrorism throughout Peru in the 1980s.

Figure 4. *Annual deforestation rate, agricultural hectares in activity and total deforested hectares according to years occupying the plot, in Alto Huallaga (1981) and VRAE (2001)*



Source: FDN, 1981; Bedoya & Ramírez, 2001.

managed by rural producers as if they were open-access resources, regardless of the requirements of existing forestry or environmental legislation (Bedoya, 2016).

A different situation occurred in VRAE, where eradication was almost nonexistent. By 2003, a relatively small eradication campaign had already been suspended (Paredes & Pastor, 2021). In VRAE, a policy of permissiveness was practised, contrasting with the zero-tolerance policy in Alto Huallaga. This was made possible through agreements between State institutions and local actors aiming to curb the expansion of subversion, consolidate State power, and enhance its local legitimacy (Ibid.). In this context, until the early years of this century, farmers in VRAE achieved a certain degree of autonomy. Attempts to cultivate cocoa in VRAE as an alternative to coca were successful, but they did not stop slash-and-burn agriculture and, consequently, deforestation (Bedoya, 2003).

FINAL THOUGHTS

It is clear that when coca for drug trafficking purposes expanded in Alto Huallaga, there was already a social and economic history of integration with the market and modernity that was much more intense than in VRAE. On the one hand, the

Huallaga basin was the target of considerable investments aimed at promoting colonization by Andean farmers, building roads and highways, and establishing private plantations for the agro-industry of tea, coffee, and oil palm. On the other hand, VRAE also experienced public investments aimed at promoting colonization processes, but the amount was comparatively smaller. VRAE has a social history based on the existence of traditional estates, some with absentee owners, and whose relationship with the national and global markets was notably inferior to that of Alto Huallaga. In Alto Huallaga, the presence of the State with large investments, first through the Tingo María, Campanilla, and Tocache colonization project in the 1960s and 1970s, and later with the Proyecto Espacial Alto Huallaga, established a land tenure regime based on medium-sized properties. In VRAE, in contrast, the lower presence of the State led to small-scale farming with plots smaller than five hectares. This led to extensive land use in Huallaga and notably more intensive use in VRAE. In the latter, the spaces within the plots for sectoral fallowing were smaller.

Both in Huallaga and in VRAE, coca redirected the main factors of production (labor, credit, capital, and land), leading to neglect of legal crops and an increase in their maintenance and production costs. Focusing on coca cultivation was an efficient way to maximize the use of family labor, land, and the family's productive unit. Similarly, due to its dollarization, coca leaf protected farmers from the hyperinflation that particularly occurred in the late 1980s. Lastly, coca as a permanent crop planted in notably small extensions did not eradicate shifting agriculture practised by most Andean settlers in the high jungle. In both regions, the predominant method was slash-and-burn agriculture, based on rainfall patterns and soil rotation, combining annual crops with permanent plantations of cocoa, coffee, and, of course, coca. Coca plantations were intensively planted, but after about six or eight years they were abandoned during the declining yield phase in search of new lands and fertile soils within their plots or in more distant lands which replicated the aforementioned slash-and-burn method time and again. The strategy of evasion and lack of control over degradation was a prominent characteristic in both basins. As environmental historian Donald Hughes argues, simple technologies such as shifting agriculture practiced by colonists in contexts with access to large territories can cause serious and long-lasting environmental damage over time. In general, as defined by Blaikie and Brookfield (1987), ecosystem degradation in the two coca growing basins had social, economic and political connotations.

Finally, the historical comparison between Huallaga and VRAE allows us to draw a series of useful conclusions. The convergence of several factors, such as a context of exhausted, eroded, or degraded soils; the deterioration of terms of trade between the countryside and the city; the increase in international demand for cocaine; the lack of capital and widespread poverty conditions; an inflationary economy, as occurred during the first government of Alan García; an institutionally weak State; and, lastly, the presence of anti-systemic and anti-market armed groups in the context of a regional political power vacuum, facilitated the expansion of illicit economies in both basins at the time. This convergence of processes and factors led to the growth of the coca economy and the corresponding environmental externalities.

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