Development through commodification: exploring apple commodity production as pesticide promotion in the High Atlas

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Abstract
Global development initiatives frequently promote agricultural commodity chain projects to improve livelihoods. In Morocco, development projects, including the Plan Maroc Vert (PMV), have promoted apple production in rural regions of the country. In order to access domestic markets, these new apple producers often use pesticides to meet market standards. Through situated ethnographic inquiry and commodity chain analysis, using a combination of surveys (n=120) and interviews (n=84) with apple wholesalers, government officials, along with farmers, this paper works to critique the PMV’s development approach that implicitly values commodification. By exploring interconnected processes of commodification, I link subsidized apple saplings and cold storage infrastructure to the dependence on pesticide usage, which has become a part of daily village life. This has important implications for community health and riparian ecosystems. Alternatively, I propose how we can imagine different development trajectories that decommodify livelihoods by focusing on local knowledge creation and diversification strategies.

Keywords Pesticides · Commodification · Political ecology · Agrarian change · Africa · Plan Maroc Vert · Green revolution

Introduction
In past decades, the African continent has become the focus for Green Revolution-type development initiatives (Luna 2020; Moseley et al. 2017). As a part of this trend, the government of Morocco proposed Plan Maroc Vert (PMV), also known as the Green Morocco Plan, in 2008 to modernize agriculture following two pillars. Pillar I prioritizes private investments to improve export production with a focus on gross domestic product growth and employment. Pillar II directs public investments to modernize rural economies by developing infrastructure and promoting marketable crops. While these pillars have key differences in investment approach (i.e. public versus private), geographic focus (i.e. “prime agriculture areas” versus “harsh regions”), and agricultural styles (i.e. commercial versus peasant), they both promote a market-oriented farming model based on commodification (Faysse 2015). Under the second pillar, the promotion of commodity fruit production, including apples, has led to socio-ecological shifts in mountainous regions through the adoption of pesticides that threaten human health and ecologies.

In this paper, I focus on the development of the apple commodity chain and pesticides because it provides unique insights into the interstices between global–local and political–ecological connections. In Morocco, apple production is transitioning from a domestic crop to an export crop through investment in production and storage technology that is in part supported by the PMV. Since apples are uniquely adapted to high altitude climates, they are prioritized as a cash crop to boost economic value of agricultural production in some of the most rural or, in the language of PMV, “harsh” regions. It is important to note that for local farmers increased income
can have tangible benefits. However, in order to produce a commodity that meets global standards of quality, namely having skin without blemishes, farmers are compelled to use pesticides to grow their apples.

Drawing upon Galt’s (2014) work on pesticides in “Food systems in an unequal world,” I critique how Morocco’s development approach promotes pesticide use among rural farmers who are adopting apples as cash crops. I combine ethnographic data collection in a community of farmers and other actors along the commodity chain to connect social and political drivers to patterns of pesticide use. For apple production in remote and rural regions, many people I spoke to residing in cities imagine agrochemicals to not exist, including government officials and middlemen who buy and sell produce. Global pesticide use is an overlooked and perhaps unintended consequence of development that promotes agrarian capitalism (Shattuck 2021). As such, this study captures and connects the use and impacts of chemical application on community health, which may not be obvious to urban consumers or even government officials, to external pressures and influences. In this endeavor, I expand upon political economic analysis of commodification by emphasizing nature, which in this case includes fruit quality traits and the biophysical conditions needed to produce them (Castree 2003; DuPuis 2000; Kloppenburg 1988).

In order to explain how strategies of development via commodification promote pesticide use and impact the health of local communities, the remainder of this paper is divided into seven sections. First, I elaborate on my political ecological theoretical and methodological framing, introducing commodity chains and commodification in order to analyze development approaches that could lead to pesticide use. Second, I provide a context for development, describing broader processes of neoliberalization and coinciding trends of pesticide adoption in the region. Third, the section on empirical methods explains the ethnographic and survey techniques used to answer the questions: What are the local impacts and motivators of pesticide use? What are the external factors the drive pesticide use? The fourth and fifth sections answer these questions by, first, establishing pesticide use and its impacts at the study site, and second, tracing the commodity chain to understand the larger context of agricultural production and development. In the sixth section, I return to discuss how commodification explains local pesticide use and impacts on community health. To conclude the article, I explore how development approaches can be reimagined, or de commodified.

**Theoretical and methodological framing: a political ecological towards commodification**

Political ecology is a broad field of environmental inquiry based on theoretical commitments to critical social theory and post-positive scholarship, methodological commitments to in-depth field work, and political commitments to justice (Perreault et al. 2015). Early scholarship focused on development discourse (Peet and Watts 1996) and “concerns of ecology and a broadly defined political economy” (Blaikie and Brookfield 1987, p. 17). Early on, political ecology was used as a theoretical framework to explain agrarian change, ecology, peasants, and the state (Bassett 1988). This study continues this lineage through these commitments of providing alternative explanations of ecological and landscape change related to peasant political economies, with deeper considerations of material processes. This body of work has deepened considerably in the last few years in understanding pesticide use among smallholder and peasant farmers in Africa (e.g. Anderson and Isgren 2021; Isgren and Andersson 2020; Luna 2020). For the remainder of this section, I first elaborate on the methodological approach of commodity chains before theorizing on the processes of commodification as an alternative explanation for pesticide use.

**Commodity chain approach and development through value chains**

Commodity chains were first introduced into academic discourse by Hopkins and Wallerstein (1977) as a part of world systems theory to connect and organize actors and activities across space and time that participate in the production and consumption of commodities. Sidney Mintz (1985) famously studied a single commodity, sugar, examining the international power relations involved with its global distribution. Political ecologists have adopted this methodology to do similar studies defetishizing other internationally traded commodities. For example, scholars have looked at the production of fresh fruits and vegetables in the Global South for export to the Global North often by airplane, connecting the habits of consumers to the material conditions of production (i.e. Fischer and Benson 2006; Cook 2004; Freidberg 2004).

Outside of scholarship, this concept has become central to organizing development initiatives. In a report authored to the UN’s Industrial Development Organization, Gereffi (2015, p. 7) writes: “Today virtually all major bilateral and multilateral donor agencies use value chain analysis as
an instrument of private sector development.” In this UN report, certified Fair Trade and organic coffee is an example of how a socially and ecologically sustainable commodity can increase incomes for producers. By upgrading products using certification standards or infrastructure improvements, global value chains can create competitive opportunities to enhance income for farmers (Maertens et al. 2012; Thorpe 2018; Werner et al. 2014). In this way, commodity chains evolve from being a driver of inequality to a mechanism for social-ecological reform (Bush et al. 2015, p. 16), becoming central to “green” and “sustainable” development discourse (Luke 2005). However, the prospects of commodity chains driving positive outcomes for subjects of development is less than certain in practice and is subject to the global political economy that often suppresses prices for commodities (Patnaik and Patnaik 2016). In the next section, I unpack some different processes that are involved in constructing agricultural commodity chains.

**Development through commodification**

Commodification describes the transformation of food systems into the production of commodities through a set of six different processes (Table 1). First, commodification is the “extension of the commodity form to new spaces,” (Kloppenburg 1988, p. 8), which happens when something is assigned a quantifiable monetary value. Second, producers of commodities have to meet certain quality standards. In order to produce a commensurable commodity for sale, product characteristics have to match those of the same commodity that is produced elsewhere (Freidberg 2004; West 2012). Important for this study, apples have the particular standardization requirement of being blemish free or “clean”. Third, commodification includes industrialization, which effectively turns agricultural production into an assembly line, in which farms are just one element of a sequence (Troughton 2002, 1986). Through this process, farmers become consumers as they become reliant on off-farm inputs often produced by large agro-companies and specialized plant breeders (Trauger 2017). Reliance on inputs moves knowledge and power from the agricultural producer to the *input* producer. Fourth, as a result, commodification causes loss of local environmental or biocultural knowledge through further dependence on input technology (Flachs and Stone 2019; Morgan and Murdoch 2000; Wagner et al. 2016). Fifth, commodification involves ongoing technological advancement, otherwise known as the technological treadmill. Once certain production schemes are adopted, farmers are effectively “locked-in” to specific infrastructure or input needs that require constant upgrading to compete with other producers or adhere to commodity standards (Gibbon 2001; Stone and Flachs 2018; Wagner et al. 2016; Wilson and Tisdell 2001). For example, breeders

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**Table 1** Six general processes associated with commodification

| Process            | Definition                                                                 | Example for Apples                                           |
|--------------------|----------------------------------------------------------------------------|--------------------------------------------------------------|
| “Primitive” commodification | Assigning quantitative value to things, resources, and systems (i.e. seeds, labor, water) | Creation of markets for apples                               |
| Standardization    | Making products more commensurable for markets                            | Demand for similar size and appearance                       |
| Industrialization  | Turning the farm into one component of production requiring inputs such as agrochemicals and plant materials | Use of insecticides and nursery plant stock                  |
| Assimilation       | Losing of biocultural knowledge, livelihoods, and agrobiodiversity         | Loss of other means of production and subsistence            |
| Modernization      | Upgrading production through input substitution or new infrastructure      | Adoption of biopesticides                                    |
| Specialization     | Creating distinguishable features from other similar commodities          | Production certifications, geographic distinctions or marketing of varieties |

1 Commodification is also situated as one of the two fundamental historical processes associated with capitalism alongside primitive accumulation (Kloppenburg 1988, p. 8). Castree (2003) breaks this process of commodification into six aspects: privatization, alienability, individualization, abstraction, valuation, and displacement.

2 This paper avoids the term *commodification*, which for many refers to the process of increasing interchangeability (i.e. Kopytoff 1986). However, others use commoditization similar to this paper’s use of the term. For example, Harriss (1982, p.22) writes that the “process of commodification...or the linking of rural household producers with capitalist production in various ways...is perhaps the dominant process of change in contemporary agrarian societies” (see also van der Ploeg 2010). This is highly similar to Kloppenburg’s (1988) spelling of the term, commodification.

3 Commodity of food is never a complete process because it can be termed an “uncooperative” commodity (Bakker 2004). Legun (2016, p. 138) perhaps explains the apple as an “uncooperative” commodity best: “The apple tree is never fully committed to the commodity project, and perhaps this positions it as a perfect character of our contemporary economic moment.” This refers to the tendency for blemishes from pests and other ecological relations.

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Footnote 2 (continued)
have developed the Artic Apple through genetic modification to eliminate browning in cut apples. This is an attempt to "freshen up the face of food" by altering biological pathways to make products more appetizing to consumers (Le Heron 2002, p. 83). Finally, producers might want to distinguish their product as special by developing new quality standards or certifications. While the latter process might work against uniform global standards, it still fits into the larger set of processes associated with commodification as more and more products seek to fit within a single specialty distinction in order to establish a unique brand (Lotti 2010).

In this study, apples serve as an example of a commodified horticultural crop that demonstrates how processes of commodification interact and contribute to pesticide use. Apples are notably produced and marketed largely based on appearance (Jaeger et al. 2018; Mackintosh 1977); therefore, consumers create expectations of taste based on appearance and color standards. Specifically, the color of apples denotes what it should taste like, green suggesting sour and red signifying sweet (Legun 2016; Harker et al. 2003). Unlike coffee or other local specialty products of Morocco, such as argan and saffron that rely more heavily on local knowledge and ecologies rather agrochemical inputs, apples require "clean farming" techniques that feature agro-industrial inputs to produce "clean" fruit, which involve highly technical and rapidly evolving external knowledge to produce effectively (Leopold 1966 from Luke 2017). Moreover, the global distribution of fruit crops means a correlative distribution of pests and diseases, requiring growers to constantly upgrade plant stock to maintain production (Gergerich et al. 2015).

Lastly, evolving consumer quality preferences influence material conditions of production, resulting in farmers needing to upgrade plant stock based on consumer trends (Hartwick 1998; Jarosz and Qazi 2000; Legun 2016).

Commodification as a driver of pesticide use

By using the processes of commodification to explain development outcomes, this paper addresses gaps in previous literature on the politics of pesticide use. Previous explanations of pesticide use in the Global South have focused on the availability of banned pesticides (Weir and Shapiro 1981) and the need to produce non-traditional agricultural exports that appeal aesthetically to Western consumers (Fischer and Benson 2006; Freidberg 2004). However, these do not explain pesticide use for domestic horticultural markets. Galt (2014) associates domestic pesticide use with local aesthetic concerns and ecological pressures but these findings prompt the question of whether there are still global connections to local pesticide use for non-export production. Moreover, who should be accountable for the environmental injustices suffered by farmers who expose themselves to pesticides in order to make a livelihood (Guthman and Brown 2016; Guthman 2017; Harrison 2011)?

I contribute to the political ecological scholarship on pesticides by examining the processes of commodification described above in the context of the Moroccan PMV development initiative in order to reimagine global–local and political–ecological connections. For example, can we re-draw global connections materially through agricultural industrialization (i.e. use of agrochemical inputs) and immaterially through standardization (i.e. need for blemish free product)? Commodification thus explains pesticide use beyond import and export framings (see Fig. 1). In the next section, I provide context for studying commodification and pesticide use in Morocco.

Historical and regional context for neoliberalization and pesticides

In this section, I will provide a brief introduction to the regional and national context, highlighting both neoliberalization as it is related to agriculture and the coinciding rise of agrochemical use. Prior to the establishment of the PMV in 2008, Morocco has both a history of neoliberal reform and pesticide use. Neoliberalization, similar to commodification, is a set of social and economic processes (Davis 2006), which include promoting free competition (liberalization), reducing the role of the state (deregulation), selling off the public sector (privatization), modelling the public sector off private sector, and lowering tariffs along with other barriers to international trade (Jessop 2002). Neoliberal policies have allowed for new forms of imperialism that suppress prices for produce and, therefore, incomes of rural producers (Patnaik and Patnaik 2016). In addition, commodification can also be associated with neoliberalization (Malin 2014), as the promotion of international trade and foreign investment is related to the use of agricultural inputs from foreign corporations, international marketing standards to allow for export, and loss of local knowledge. Moreover, privatization favors the entrepreneurial “spirit” (Oubenal and Zeroual 2017), replacing more collectively oriented subsistence strategies and furthering the commodification of land, water, and labor. Processes associated with both neoliberalization and

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4 Here, “clean” is referring to without blemishes rather than without chemicals. It should be noted that much of pesticide use is to achieve apple commodity standards rather than to maintain yields. Based on a study on apples in North Carolina, Babcock et al. (1992) concludes that “fungicides are shown to reduce both yield and quality degradation, while insecticides are shown to reduce quality damage. Quality considerations account for all insecticide use and up to 15% of profit maximizing fungicide use. Both insecticide and fungicides appear to be applied in greater amounts than profit maximizing amounts, even when quality considerations are taken into account" (171).
commodification are often packaged and fetishized as being a monolithic and deterministic “ism”, when in fact they are diverse, interlinked, but messy processes that describe trajectories of certain capitalistic interests (Bakker 2005; Heynen and Robbins 2005; Davis 2006).

The beginnings of neoliberalization were initiated in Morocco during the post-independence period in the 1960s with loans from the World Bank to support the production of export-type crops, such citrus and vegetables, de-resourcing production of staple crops and husbandry (Davis 2006; Pennell 2000). This included the World Bank and the US Department of Agriculture assisting in writing agriculture law in 1969 (Davis 2006). These reforms continued the disruptive colonial legacy of dismantling longstanding food systems, which included the enclosure of collective lands in order to promote production for the international market during the French Protectorate (Davis 2006). The more formal neoliberal era was marked by structural adjustment loans and policies that ran from the 1980s to the 1990s, promoting growth of the private sector and thereby limiting the role of civil society (Akesbi 2014). Moreover, scholars have noted the broader trends towards neoliberalization in North Africa and throughout the Arab world during this period (Ayeb and Bush 2019; Ajl 2021).

While some of the more invasive policy practices have subsided, the European Bank for Reconstruction and Development (EBRD) has recently provided support for export crop production, while the national agricultural bank, Crédit agricole du Maroc, is promoting rural land investment (North Africa Post 2020; Dumpis 2021). This aligns with the broad push for a modern version of the Green Revolution in Africa, which is characterized by donor support for privatization of land and modernization through agrochemical inputs (Moseley et al. 2017, Luna 2020).

Relatedly, chemical pesticides were introduced into Morocco during the twentieth century. The earliest use of pesticides involved organochlorines pesticides (OCP), such as dichlorodiphenyltrichloroethane (commonly known as DDT) and heptachlor, that were used initially for disease control and later for crop production from 1939. From the 1970s into the 1990s, increasing amounts of OCPs were donated or exported, sometimes illegally, to Morocco and other African countries, as these agrochemicals were being banned or heavily regulated in the countries that produced them (Manyilizu 2019). OCPs are still found today in samples of human plasma cells, ground water, aquatic habitats in Morocco (Agnaou et al. 2017; Benbakhta et al. 2014; Daoudi et al. 2014; Henríquez-Hernández et al. 2016). Starting in the 1960s, newer pesticides, such as organophosphates, were introduced into the African market (Manyilizu 2019), and, by the 1973, companies were regulating the imported pesticide market by monitoring and deterring non-regulated products and businesses (CropLife Maroc 2016).

Many scholars have focused on farmer behavior and use of pesticides in Morocco, highlighting the lack of training and knowledge along with the health risks, such as cancer (Berni et al. 2016, 2021; Sine et al. 2021). While pesticide resellers generally have post-secondary diplomas or degrees along with pesticide training, farmers using pesticides have little formal educational background (Maldani et al. 2017). Generally, there are not enough public policy or programs on
pesticide training in the Global South that can lead to pesticides misuses (i.e. Pretty and Bharucha 2015). Raada et al. (2019) describe the patterns of “massive use of pesticide applications” on 23 farms that they surveyed in the Middle Atlas region of Morocco. While there have been efforts to train farmers to use pheromone traps in controlling for a major apple pest, the codling moth (Cydia pomonella). These trainings have been ineffective partially because farmers could not place traps at the right time but also because hot summer temperatures led to less pesticide persistence requiring more frequent spraying (Iraqui and Hmimina 2016). This study offers alternative explanations to pesticide use that look for more structural drivers beyond the common diagnosis of the lack of training and education around pesticide application. In the next section, I explain the methodology used to trace and analyze the apple commodity chain and its commodification.

Empirical methods

This research relies upon a farmer survey, ethnographic research, and document analysis to understand interacting social and political drivers for pesticide use and impacts. Field work was carried out in the summer of 2018 in Toubkal Commune, which is located in the eastern High Atlas mountains, just below Jbel Toubkal (4167 m), the highest peak in the High Atlas (Fig. 2). The commune is in the Taroudant Province of the Souss-Massa-Draa region, comprised of 44 villages and 8500 inhabitants. While apples are cultivated throughout the study site, the primary production areas are at higher elevations with ample access to agricultural water.

The farmer survey (n = 120) was conducted with 10 randomly selected farmers in 12 villages, which were purposively selected to vary in terms of elevations (1600–2300 m) and apple cultivation. Therefore, they survey addressed a range of climatic conditions and producer strategies. The survey contained questions concerning farm management decisions and more specific questions pertaining to pesticide application and reported health impacts (see also Goldberg et al. 2021). For example, one question asked the participant if they observed certain health symptoms, providing a list of pre-selected symptoms and space for additional symptoms at the end. The survey did not include questions on labor, although through interviews, I gained a limited sense of the labor economy around pesticide applications and agricultural operations.

Qualitative data involved focus groups in half the villages surveyed (n = 6) and semi-structured interviews (n = 84). The interviews included 53 farmers, 15 apple wholesalers, 10
government officials, and 6 pesticide dealers. The 53 farmer interviews mostly included participants from the survey but also farmers in other villages in Toubkal and a neighboring commune. Interviews also took place in other cities and towns across southern Morocco, where key agricultural offices and wholesale markets are located. I interviewed 15 apple wholesalers in Marrakech and Agadir, along with pesticide dealers in Marrakech, Agadir, Taroudant, and Toubkal. The 10 government interviews were with officials at the national, regional, provincial, sub-provincial, and commune levels.

The qualitative methods used in the research reveal patterns of pesticide use among smallholder farmers. Quantitative survey data provided information on pesticide application practices based on the 71 farmers who used pesticides in their agricultural production scheme and the subset of 60 farmers who responded that they were responsible for applying pesticides themselves. Transcriptions of interview and focus group recordings along with field notes were coded in Atlas.Ti software. Iterative coding helped to identify key patterns and themes that were used in the analysis.

**Results: impacts and motivators of pesticide use**

Ordarssn elle Ifeker nkhotoura ndwa, ertfkern gher adznezen

They don’t have thoughts about the danger of pesticides, they think just to sell their products.

In this section, I describe the drivers, use, and impacts of pesticides for apple production in the study site based on survey and ethnographic data. While there are no official pesticide businesses in the Toubkal Commune, pesticides and application equipment are commonly found throughout the communities. In storefront displays, I saw backpack sprayers next to children’s toys and pesticide bottles adjacent to toothpaste. The backpack sprayer, used weekly by men who tend to apple trees, is a common sight in homes, cafes, and public spaces (Figs. 3 and 4). In the survey, 84% of the 82 people who grew apples and 97% of the farmers who produced apples for market sprayed pesticides (Table 2). Most farmers sprayed apples at least six times per year, while five farmers did report that they only sprayed one or two times. The majority (87%) of these farmers treated apples with pyrethroids (i.e. deltamethrin and lambda-cyhalothrin) that are produced by Bayer and Syngenta, while five farmers reported use of organophosphates (i.e. chlorpyrifos-ethyl, dimethoate, and malathion) (Table 3).

Pesticide use exposes farmers’ bodies and communities to harmful compounds even when wearing personal protective equipment (Garrigou et al. 2020; Pimentel et al. 1992),

which is the last option according to occupational hazard models but often the first promoted by industry and government (Andrade-Rivas and Rother 2015; Murray and Taylor 2000). Nonetheless, protection when applying pesticides is not taken seriously. This is a similar finding to other studies of pesticides in Morocco and elsewhere in Africa (e.g. Benaboud et al. 2014a). While most farmers reported using some protective gear, less than half reported wearing eye covering or gloves in the survey (Table 4). Common forms of protection were covering the face with a cloth and wearing a jump suit (Table 5). One farmer explained that he sprays pesticides just as he was dressed during the interview, in common clothing, gesturing that he also wraps a cloth over his mouth. The same farmer also reported skin irritations. Another farmer reported that after spraying: “Poisoning lasts 24 hours. My eyes hurt but then it goes away.” In fact, the survey revealed that almost all farmers interviewed report acute health impacts. When they were given a list of symptoms, farmers responded yes to an average of 3.1 symptoms (Fig. 5).

Interviews in the study area revealed more severe cases of poisoning due to spraying but also accidental spills and children drinking from pesticide bottles.³ An older farmer described a poisoning incident from a previous

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³ Most pesticide poisoning is serious problem in the Global South. Investigations in the 1990s estimated that 25 million people suffer from acute poisoning in non-industrialized countries (Jeyaratnam 1990). These populations use 20% of global agrochemicals yet are sites for 99% of pesticide poisoning deaths from unsafe handling and application (Jeyaratnam and Chia 1994). Moroccan Anti-poisoning and Pharmaco-vigilance Center tracks pesticide poisoning in urban and agricultural regions, but there is no data for mountain regions, such as Tifnout.
year, when he accidentally spilled a half of a bottle of Karate (lambda—cyhalothrin) on his right leg that he had been carrying in his pocket while he was spraying. Experiencing discomfort in his eyes and throat, he initially just took a shower. Three months later, he went to see a doctor in Casablanca for eye irritation, dizziness, and coughing. During the hospital visit, he recalled the incident and was prescribed medicine and instructed to exercise his lungs. Following the doctor’s visit, the farmer decided pesticides were dangerous and stopped spraying his trees, letting children pick them instead of harvesting them for market. He reported that he doesn’t get close or even look at sprayed apple trees anymore.

There is evidence that such incidents are part of an ongoing trend from conversations with the local health worker, who spoke on more recent poisonings:

I received four people who got sick…There are some people who could not breathe […] There may be a lot [more] but these are guaranteed […] There might be other people who got affected but do not visit the doctor or even know that they are sick. The farmers wait till they get sick to go to the doctor and then hire someone to spray pesticides for them.

This health worker advises such patients to use protective eyewear and gloves, reminding them of the importance
of protection given that people above the age of 45 can get sick from pesticide exposure easily and that younger people may not feel the health effects until later. Detection of health problems, especially chronic ones, due to pesticides is difficult due to limited health services and knowledge of the hazards associated with pesticide use.

It might be even more difficult to understand the full extent of ecological impacts of pesticide use. Despite little record of the endemic riparian species that existed in the past, Crawford (2008, p. 34) notes the abundance of fireflies and frogs in a similar region to my study site. However, the absence of such biodiversity was apparent during my stay in Toubkal (although I was only there during the dry hot summer season). In fact, frogs only came up once during an interview with a previous president of the commune:

"This year I didn't hear one frog. Before, you find many frogs in the valley (making frog sounds) all night. The French people can tell why because they eat them. I don't eat frogs and just remark that there are no frogs perhaps because of the pesticides. But the other farmers don't observe that we don't have frogs. For them, the frogs are the frogs. Without frogs or with frogs, there is no problem. But you have to think, there is no frogs, there is no, for example, bees. There is no more. It is very bad for myself, for my life, but you have to know the result of these signs."

Coming from the city, this former resident speculated on the potential effects of pesticides on frogs, while suggesting farmers may not notice the impacts because frogs are not as relevant to their lives. In other interviews and focus groups, bees and walnuts were most commonly cited as being affected by pesticides (Table 6). One focus group of women discussed possible impacts on birds, bats, and other insects (e.g. cicadas). Interviews with individuals allowed for more diverse opinions, including the belief that pesticides cause no harm. These also revealed variation in farmer awareness.

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**Table 3** List of known pesticides found in Toubkal in order of reported usage on all crops

| Pesticide             | Type     | Class      | Brand names (distributor)                  |
|-----------------------|----------|------------|--------------------------------------------|
| Deltamethrin*         | Insecticide | Pyrethoid  | Decis Fluxx (Bayer), Dextra 110             |
| Lambda—Cyhalothrin*   | Insecticide | Pyrethoid  | Karate 5EC (Syngenta)                      |
| Chlorpyrifos-Ethyl*   | Insecticide | Organophosphate | Kemaban, Dursban 4 (Dow), Paraban Appat    |
| Malathion*            | Insecticide | Organophosphate | Malathion 50                              |
| Dimethoate*           | Insecticide | Organophosphate | Promethion (Promagri), Likoroate 40, Roxion |
| Penconazole           | Fungicide | Triazole   | Topas 100EC (Syngenta)                     |
| Hexaconazole          | Fungicide | Triazole   | Hexa 5SC                                   |
| Fenazaquin            | Insecticide | Quinazoline | Pride 200SC                                |
| Bifenthrin            | Insecticide | Pyrethoid  | Talstar 10EC (BASF)                        |
| Cypermethrin          | Insecticide | Pyrethoid  | Delta 2.5**                                |
| Permethrin            | Insecticide | Pyrethoid  | Perkill                                    |
| Cyhexatin             | Insecticide | Organotin  | Pennsty 600 Flow***                        |
| Imidacloprid          | Insecticide | Neonicotinoid | Safort 20SL                                |
| Abamectin*            | Insecticide | Lactone    | Numectin 1.8EC, Rometine, Megamec,         |
| Copper Sulfate****    | Fungicide | Metalic    | Copas                                      |

*Was reported to be used on apples in the survey. **Likely just used for animals and domestic purposes. ***Likely not in distribution. ****Listed last because use was not quantitatively analyzed and was reported to be used on apples in the survey.
of pesticide risks based on age, education, and exposure. While the evidence is inconclusive, limited observation suggests that both the health and ecological impacts of pesticide use may in fact be serious and warrants alarm.

While there is a diversity of livelihood strategies in Toubkal, such as growing saffron or working in tourism, apples are the preferred agricultural cash crop because they are well adapted to climatic conditions and generate the most amount of money (Table 7). In this context, many people explained that farmers do not care about the potential impacts of pesticides as long as they help to generate income. For example, one farmer admitted that he and other farmers are concerned more about selling their products than about the danger of pesticides. These considerations suggest that the preference of livelihood, specifically the generation of income, supersedes human and ecological risks (Guthman 2017). Interestingly, many of the other cash crops commonly produced in the region—cherries, walnuts, almonds, iris, or saffron—do not require any pesticides. Walnuts, for example, have been produced in the region for centuries and require little input other than harvesting and processing; however, walnut production has diminished recently, which could be the result of changing climate patterns or possibly even ecological dynamics related to pesticide use.

Patterns of pesticide use and their potentially harmful human and ecological impacts should not be taken for granted. As will be further discussed in the next section, it is often assumed that agricultural production in the “harsh”

![Fig. 5 Acute symptoms reported by farmers (n=60). *Reported as an "other" symptom and therefore unable to report a percentage](image)

| Impact            | Quotes | Example quotes                                                                 |
|-------------------|--------|--------------------------------------------------------------------------------|
| Human health      | 8      | “The eyes are most affected because they don’t cover their *eyes* […] One time a twelve-year-old *girl* drank half bottle of Karate, vomited, fainted, and taken to the hospital. She was OK.” |
|                   |        | “I don’t bring grass after spraying because I am afraid of getting sick. I heard other farmers talk about the dangers of pesticides and also learned from my consciousness” |
| Bees              | 18     | *Bees* are affected because apples are sprayed when flowering. The bees that go to apples die but the ones that go to wild plants survive. Fifteen percent of the bees die every year. *Woman* are always going to the farm and are not affected.” |
| Crickets          | 1      | “This year I didn’t hear about one *frog*. Before you find many frogs in the valley all night. […] In French, they call it *cigale*. You find more than olives […]This year, I don’t see any from Marrakech till here. In very hot weather, I don’t know why. […] *Crickets*, crickets, this year I don’t think there are any.” |
| Cicadas           | 1      | *Frogs* |
| Walnuts           | 5      | “Pesticides affect walnuts and bees. Pesticides are poison. Pigeons are also not here, along with other birds’ |
| General           | 9      | “[I] used to use Decis but has powerful health effects, now I use Karate” |
| No harm           | 3      | “There is no one in this place, people or animals, that have been affected.” |

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mountains, which is less mechanized than in “prime” agricultural areas, does not utilize agrochemicals. Importantly, this research demonstrates that pesticide use is prevalent in the High Atlas and associated with the standardization of commodity apple production. In the next section, I will use a commodity chain approach to map out external influences, including how government investment in infrastructure and cultural displays reinforce apples as the major cash crop in the region instead of other crops that are less dependent on agrochemical inputs.

**Exploring development as promotion of pesticides**

**Plan Maroc Vert’s (PMV) use of commodity chain**

Commodity chain development is the PMV’s strategy to modernize agriculture. While the government reduced its involvement in agriculture when adopting structural adjustment policies, the PMV effectively tripled the budget of the Department of Agriculture and Marine Fisheries to implement projects (Akesbi 2012). Moreover, the PMV was developed in the neoliberal context, where national research programs that focused the local needs of farmers were inadequate and foreign expertise was more valued (Ajl 2021). As noted by Faysse (2015), the focus of the PMV is to develop and upgrade commodity chains:

Rather than attempting to change the land status or be directly involved in farm management with the aim of creating new farming models, it chooses to focus on agricultural value chains and to identify stakeholders with the capacity to become leaders to coordinate the development of the chains, and especially to support small-scale farms. The plan thus views the agricultural sector as a set of value chains. (Faysse 2015, p. 625)

While ignoring agricultural needs such as soil management or farmer health, the PMV articulates commodity chain upgrades through the stated goals of increasing the value of agricultural products, amount in weight of exports, area under drip-irrigation, amount in weight of fertilizers, and amount of certified seeds (Bardaoui and Dahan 2010). For rural producers, the PMV’s goals are accomplished through partnerships between the government and local farmers’ associations (Bensaid 2011 from Faysse 2015).

Local farmer associations are charged with the task of promoting particular supply chains for their geographic region, such as that of apples in Toubkal. While the PMV does recognize the importance of local context for production, it is primarily concerned with output and thus ignores important processes involving local knowledges and ecologies. In the case of Saffron in Tallioune, a nearby region renown for production of this valuable spice, the focus on production means investment in irrigation technology and land acquisition by powerful elite, while largely ignoring local assets of skilled labor and specialized agricultural knowledge (Dessein 2015). For apple production, investment has meant upgrades to supply chain infrastructure.

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**Table 7 Comparing important cash crops**

| Crop   | Quotes                                                                 | Example quotes                                                                 |
|--------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Apple  | 15 “Apples are important because of money. There is not a lot of work here.” | “Apples get you money and more effective than growing barley and maize.”           |
|        | “I’d grow apples because they are beautiful. In the past, I preferred sheep but now I like the product (apple).” | “Apples are more adapted to the weather, people say apples from here are better than apples from other places.” |
|        | “Apples bring the most money in because of the weather and soil. […] Apples get best price unless you transport to Marrakech.” | “I grow almonds, walnuts and apples. I like them all but prefer apples because they give good fruits [with] high price and lots of money.” |
| Cherry | 5 “I benefit from cherries the most[…] because the money is fast. […] Cherries give products in the times the financial situation is very difficult in April and May. […] At that time the barley is finished and need to buy barley and work is not available.” | “Apples and cherries are the ones that work best with the soil and weather of this place and produce a lot more than other plants.” |
| Walnut | 4 “I also plant walnuts every year. They are important because they don’t need a lot of work.” | “I would plant more almonds because they don’t need a lot of water, are durable in conditions, and don’t need to be sprayed.” |
| Almond | 2 “People plant more cherries than apples because money spent on pesticides. There are some people who regret planting apples and come back to plant cherries and iris.” |                                                                                     |

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6 Increasing jobs is a sixth goal of PMV but does not fit neatly into the commodity chain analysis.
**Promotion of apples and pesticides in the High Atlas**

Part of the general strategy of the PMV is to promote the horticultural sector through fruit tree production, which can generate income for smallholder farmers and, perhaps more importantly, expand agricultural exports. Among the 325 projects planned or implemented by the Agency for Agricultural Development (ADA) as of 2011, 64% focused on commodity fruit and vegetable production (Benzina 2012 from Faysse 2015). While citrus and olive are the main crops of interest of the ADA, apples are also a considerable crop of importance. At the 2019 National Apple Fair in Midelt, the Minister of Agriculture, Aziz Akhannouch, noted that Morocco produces 400,000 tons annually. Before the PMV was implemented, national apple production was estimated at 120,000 tons (Hatim 2019). Over the course of the implementation of the PMV, apple production has doubled from 404,310 tons in 2007 to 820,547 tons in 2017 (FAO n.d.). In our study region, the government proposed to double apple production from 9000 to 18,000 tons produced per year by 2020 through seedling and “intensification” projects (ADA n.d.a). Seedling projects involve an organization that is contracted to plant seedlings in a nursery before they are distributed to farmers (Faysse 2015). “Intensification” projects include building concrete reservoirs and canals that can store water deep into the summer months and direct irrigation to terraced apple orchards.

An important “intensification” project for Toubkal is the recent construction of the community frigo, which is the common name for cold storage facilities, or refrigerators, that are built in apple-producing communities. The Toubkal community frigo was officially launched in October 2019 during the three day “Festival of Apples” (Figs. 6 and 7). The aim of this project was to encourage the community to take control of the distribution and marketing of apples. With a functioning refrigerator, apple producers can harvest and store their apples in stable climate giving them a longer period to sell their apples. If they can transport the apples to Agadir or Marrakech, they can enter wholesale markets and allow wholesalers (Type 1) to sell their produce based on commission (Fig. 8). This circumvents the more common way people in Toubkal sell their apples (Type 2) by selling the fruits to the wholesaler jmlah (completely) right off the tree, rather than by box or kilo. Because Toubkal is perhaps one of the most remote apple-producing regions, it attracts less buyers than other regions, which drives down prices.

The promotion of apples is challenging in a place that has little competitive advantage compared to more established regions and companies. Toubkal does have the distinct advantage of altitude, which ensures the adequate climate (i.e. amount of cold winter days) for apple growing. This is important considering the threats of climate change are already impacting production in the other regions such as Asni. However, Toubkal’s position in the eastern High Atlas makes it extremely inaccessible to markets compared to other apple producing regions that have better

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7 This contradicts data from the United Nations Food and Agriculture Organization (FAO), which reports that apple production has doubled from 404,310 tons in 2007 to 820,547 tons in 2017 (FAO n.d.).

8 The “Festival of Apples” also promoted new varieties of apples for the purpose of upgrading fruit quality to the latest marketable standard. One wholesaler that I spoke to discussed his preference for darker and consistent red color. Starking Delicious is perhaps the most popular variety in Morocco and was originally selected in the United State because it was more red than Red Delicious (Legun 2016).

9 In some circumstances, this wholesaler visits the farms in the spring when the trees are flowering and sends people who spray pesticides throughout the summer until the products are ready to harvest in the fall.

10 The high altitude also makes growing apples highly precarious due to spring frost that can decimate the whole season.
road infrastructure or are closer to cities. While this might not be the case in the future as access improves through road improvements, Toubkal will still need to compete against producers and distributors who can more easily access export markets and offer more premium products in domestic markets. Examples of this include producers who market based on geographic distinction, such as Midelt, which is the most famous place of apple production. There are also distributors, such as Arbor and Zniber, that have large warehouses, trade networks, and financial capital which facilitate export while offering their lesser but still premium products to domestic markets. In the future, farmers in Toubkal may be able to promote a more distinct or specialized apple product through careful varietal choice and market development. Other future marketing options include value-additions, such as vinegar production. Nonetheless, for the time being and near future,
pesticide application is the primary approach adopted by farmers to create a viable apple commodity.

While the frigo along with the Apple festival is intended to support farmers in Toubkal, such investments primarily serve to enhance the apple commodity chain and, therefore, promote agrochemical use that is required to produce marketable apples. In my search to find apples that met commodity standards without the use of pesticides, I was referred to nearby region, where I met farmers who both sprayed and did not spray. One farmer explained to me that he had sprayed in the past but could no longer afford to purchase pesticides. Another farmer that I spoke to in a wholesale market in Marrakech told me:

I visited my friend in Ouarzazate. On his farm, he has natural trees. The first year, he got quality fruits but then I think the sickness came. There are also farmers that are natural because they don’t have the money to buy pesticides.

These anecdotes suggest that in the early production years growers sometimes produce fruit that meets the standards for commodity markets without spraying pesticides. However, they quickly resorted to pesticide use afterward to produce fruit that conforms to standards due to pest pressure if they had the financial capacity.

PMV and beyond: considering various influences of pesticide use

Beyond the promotion of commodity chains, the PMV has more generally promoted the production of non-traditional exports that use more pesticides than staple crops, such as wheat and barley (Watson 2018, p. 152). Since the implementation of the PMV, pesticide use has increased by 50% during a period when global pesticide use has stabilized (FAO n.d.; Zhang 2018). Regionally, Morocco has become one of the most intensive pesticide users in Africa, applying 9.9 kg ton per hectare (Benaboud et al. 2014b; Mansour 2009). These figures are likely taken from data on industrial farming that does not take into account agriculture in rural mountainous regions. However, these regions should not be assumed to be an exception and are likely a part of this trend that is driven by changing labor arrangements, crop management strategies, commodity chain development, and simplified ecological relations (Shattuck 2021).

At the same time as the government has promoted horticulture production, there has been limited public investment in pesticide regulation, despite ongoing research (i.e. Benaboud et al. 2014a; Berni et al. 2021). The Office National de Sécurité Sanitaire des produits Alimentaires (ONSSA), established in 2009, is an agency tasked with pesticide regulation. At the time of research, ONSSA was developing a pilot program to monitor pesticide use on farms. This initial phase was focused on larger producers that are also located more conveniently to government offices. These programs mostly regulate pesticides for agricultural exports, which was described as a major government priority by a regional ONSSA director. Meanwhile, there has been little attention given to pesticide use among peasants in the mountains and no training on pesticide use to new apple growers. In interviews conducted in urban markets and offices, it was commonly assumed that farmers in the mountains do not use pesticides. However, when I brought up fruit production, wholesalers, government officials, and pesticide dealers were more willing to accept the fact that there is pesticide use in the mountains. A horticulture expert who used to work for the government admitted that “the quantity of pesticides and the number of companies were increasing but the government wasn’t controlling any of this.” In short, regulatory and oversight capacity has largely remained the same, while pesticide businesses have grown.

Finally, it is important to bring attention to the growth of the global pesticide industry (Shattuck 2021). Pesticides were introduced in the High Atlas before the implementation of the PMV. Early growers of apples have been using pesticides for decades without the assistance of large development projects. One pesticide dealer discussed that the most popular brands, which are owned by Syngenta and Bayer: “Karate and Decis are old names. People come from the mountains and ask for the name.” While in recent years there has been rise of generic pesticides produced in China and India that have driven down pesticide prices (Shattuck 2021), these premium brands were launched in the 1980s (Collins 2003; Houssset and Dickmann 2009) and continue to be popular among smallholder farmers. Half of Syngenta’s overall sales come from emerging markets, where about 90% of farmers are considered smallholders (Syngenta n.d.). In Morocco, 35–45% of pesticides are distributed in small packages that are less than 1 L (ADA n.d.; El Ouliani 2011). Interestingly, this figure comes from two sources that are both in English. One is from CropLife, an agro-industry interest group. The other is a government document written for foreign investors. One idea held by Akesbi (2011) as well as a government agronomist that I interviewed about PMV, is that the plan is written by and for the international community to encourage foreign investment. Watson (2018) gives us more insight:

In addition to the enthusiastic endorsement of pesticide use by an assortment of UN and associated institutions, individual national governments in developing countries continue to support the use of pesticides in their agricultural development plans. The rationale for the support of industrial agriculture centered on: increasing political and financial pressures to improve food self-sufficiency; the need to reduce import depend-
ency; and conversely, the need to generate foreign income from agricultural exports. (152)

The PMV does not explicitly use this logic and mostly does not promote the use of pesticides; rather it focuses on fertilizer and other inputs. Nevertheless, the connection between these references alludes to the possibility that promoting pesticide investment in Morocco is implicit to the PMV. Although there is no evidence that pesticide companies are doing market research in the mountains, or even know where their products end up, they are packaging products that make it easy to distribute in the mountains. Moreover, the evidence in this paper suggests that some of the most reliable buyers of these products are rural apple producers. As one dealer put it, “You [Americans] first need to stop, and then we can stop,” calling out transnational corporations for pesticide production and distribution in Morocco. This is also a critique of the outcomes of neoliberalization that allows for new forms of imperialism to penetrate rural agrarian communities (Ajl 2021).

In summary, there are several external pressures to use pesticides. By mapping out the commodity chain, I suggest that the government supply of apple seedlings and storage infrastructure can be understood as supporting the use of pesticides. The lack of regulatory capacity for domestic agriculture and the subsequent international embrace of pesticides are also important drivers of agrochemical use. Now that we have explored the dynamics of pesticide use and its external drivers, I return to discuss processes of commodification and their implications for community health.

Discussion

This case study contributes to scholarship on politics of pesticide use by examining local implications to domestic and global development of commodity chains. Previous scholarship has linked production practices in the Global South to consumer preferences in the Global North via tracking commodity chains from one country to another (i.e. Fischer and Benson 2006). However, this study is different in that it follows domestic commodity circuits, namely apples in Morocco, that are connected to wider circuits of agricultural inputs. In this case, large multinational agrochemical companies do not easily disclose where agrochemicals come from and where they go, while agricultural products like apples can travel through many hands across short distances even within a single country. \(^1\) Still, global consumer expectations shape demand for “clean” apples produced in remote regions for domestic consumption through complex cultural flows (Dixon 1999; West 2012). While this did not come out in the analysis of interviews, evidence of this can traced through representations of apples depicted in public artwork, such as the one on the side of the Frigo (Fig. 7), which imitates a European still life.

Commodity chain analysis does establish some clear linkages between diverse actors across scales and allows us to connect urban consumerism to injustices on the periphery. Notably, the frigo is an example of a development “intensification” project that promotes the apple commodity chain through industrialization. Without the frigo, apples are a fairly popular crop amongst farmers already, both for subsistence and the market. With the frigo, commodity apple production stands to become even more popular because cold storage more easily allows them to meet quality standards of the domestic market. However, since these farmers cannot access export markets because their apples still do not meet the appropriate standards, there is little oversight of pesticides.

While the commodity chain approach can partially explain pesticide use, there are some limits of tracing only material elements. Previously, this approach has traced pesticide inputs from the international agrochemical producer to the smallholder farmer and then the agricultural commodity back to the global consumer (see Fig. 1). Counter to this seemingly unidirectional commodity chain, however, apples do not always find their way to the Global North, so we need to reconceptualize global connections to consider a wider array of influences on why farmers spray pesticides.

By understanding commodification as an interconnected set of associated processes involved in development of commodity chains, we can more fully explain pesticide use. Specifically, standardization is an important process that brings in cultural values of representation that are important in commodity production (Freidberg 2004; Dixon 1999). By looking at processes of standardization (i.e. need for “clean” apples) and industrialization (i.e. cold storage and agricultural inputs) together, this study links local consumers, global consumers, and input producers to rural apple producers, creating new currents of circular flows in the commodity chain. Moreover, through this commodification analytic, I argue that promoting tree planting and subsidizing infrastructure within the apple commodity chain also enables pesticide dependence. While agrochemical adoption could be an unintended consequence, this outcome has important consequences for the health of both human and ecological communities where pesticides are sprayed.

While this study strived towards a holistic approach linking the causes and impacts of pesticide use, more robust empirical analysis of socioecological dynamics is warranted. This should include soil and water sampling, along with comparison of insect and amphibian populations.

\(^1\) Interestingly, Dannenberg and Nduru (2013) find informal pathways for fruits and vegetables to enter highly standardized export chains.
among different locations within the ecoregion. Moreover, more in-depth ethnographic work into labor roles and values around pesticides could better articulate why farmers decide to use pesticides and the responsibility of the larger agrarian economy (Stein and Luna 2021; Senanayake 2021). Nonetheless, the value of this study is in capturing testimony from community members of the harm from and resistance to pesticide use. This came from people who have experienced acute pesticide poisoning and those who retained memory of past methods of production and biodiversity. It is my hope that by centering these impacts on community health, I provide evidence of the far-ranging impacts, (non) responsibility, and environmental injustices of marketing firms, agrochemical companies, and other global actors that promote agrarian capitalism and its reliance on pesticides (Shattuck 2021).

While this section focused on industrialization and standardization as crucial processes in promoting pesticide use, there are other processes of commodification occurring. For example, apple production results in the commodification of labor relations as harvesting and pruning are frequently contracted out. Chemical fertilizer has also become an important and common input throughout the study area for apples and other crops. There is also evidence that water and land tenure are also affected by circuits of commodification. These changes should not be ignored and have major implications for mountain livelihoods. Through dual processes of industrialization and assimilation farmers are becoming reliant on agro-inputs, agronomic trials, and centers of breeding, while traditional knowledges, systems, and practices are increasingly marginalized. I will not argue that commodification is entirely bad, as it likely provides some benefits (i.e., dietary diversity); however, there are enough risks involved with it to prompt consideration of alternative approaches to development.

**Conclusion: development through decommodification**

I now turn to the possibility that policy can promote decommodification, which then would facilitate environmental justice by reducing dependency on toxic inputs and returning power to the farmer. As Ajl (2021) notes the many blind spots of scholarly work, especially anglophone, on agroecology and food sovereignty in the Arab region, this research furthers critical research on agrarian change and, subsequently, the need for work on agroecology and regional food systems linking local producers with consumers (i.e. Hollings and Marsden 2011). This involves integrating and supporting subsistence as a component of cash crop production, while promoting knowledge and ecological production that requires less inputs and infrastructure. Instead of investing in the commodity chain of a single commodity, a decommodified development trajectory involves diversifying agricultural production and increasing the entanglements between producers and consumers that would reduce the importance of standards. This approach should also account for the local and regional political economy, which includes paid and unpaid labor relations locally along with remittances from labor migration. The latter of which is often important for maintaining agricultural traditions and biodiversity (Rignall 2016; Zimmerer 2014).

A decommodification framework favors approaches that redefine power relationships in food system and focus on regaining control over genetic resources and means of production (Rossi et al. 2019). Moreover, while development agendas should promote high prices for farmers, a decommodified strategy works toward long-term and participatory relationships with consumers rather than appealing to the highest bidders, who are often retail outlets or corporations that exercise disproportionate power. However, it is also possible that certain downstream commodification strategies, such as promoting agritourism, could effectively resist pressure to standardize products and create greater autonomy for peasant producers to diversify agricultural systems (van der Ploeg 2010). The frigo, for example, can be understood as downstream infrastructure, which can be easily converted to serve different communal purposes. By supporting and valuing alternative livelihood strategies that involve less commodified forms of production, communities and external stakeholders can achieve more just and sustainable development outcomes.

This paper investigates the development of the apple commodity chain in rural Morocco as a case study of the ramifications of development through commodification, namely the impacts of pesticides. Through a commodification analytic that traces material commodity chains while considering immaterial components of standards and knowledge, I demonstrate how development initiatives focused on expanding commodity chains empower global actors like agrochemical companies and global consumerism, rather than farmers. This dynamic leads to the promotion of pesticide use and resulting environmental injustices for communities in the High Atlas. Through a critical analysis of development via commodification and commodity chains, we can imagine alternative development pathways that move from dependence on inputs and the pressures of producing the “perfect fruit” towards decommodifying livelihoods in a way that supports the health and ecologies of peasant communities.

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