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REVIEW AND SYNTHESIS

Drivers and consequences of archetypical shifting cultivation transitions

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Abstract

1. Shifting cultivation remains an important land system in many tropical landscapes, but transitions away from shifting cultivation are increasingly common. So far, our knowledge on the social–economic and environmental drivers and consequences of such shifting cultivation transitions is incomplete, focusing on certain transitions, drivers, consequences or regions.
2. Here, we use an archetype approach, validated through systematically identified literature, to describe eight archetypes encompassing the transitions from shifting cultivation to (1) perennial plantation crops, (2) permanent agroforestry, (3) regrown secondary forest, (4) permanent non-perennial crops, (5) pasture, (6) wood plantation, (7) non-cultivated non-forested land and (8) restored secondary forest (ordered in decreasing prevalence).
3. We then discuss social–economic and environmental factors favouring and disfavouring each archetype. This reveals that higher expected land rents, resulting from increased market access, crop price surges, secure land tenure and state interventions, are the main drivers of archetypical transitions to perennial plantation crops, permanent agroforestry, permanent non-perennial crops and wood plantation. The prioritisation of other activities, both on- and off-farm, favours transitions to regrown secondary forest and non-cultivated non-forested land, depending on plot-level environmental conditions. Active forest restoration is typically implemented through state or NGO interventions.
4. Turning to the consequences of archetypical transitions for biodiversity, the environment and livelihoods, we find that positive environmental outcomes prevail

for transitions to permanent agroforestry, regrown secondary forest and restored secondary forest. Negative environmental outcomes dominate for four typically economically profitable transitions to perennial plantation crops, permanent non-perennial crops, pasture and wood plantation. Non-income-related social–economic outcomes are heterogeneous within all archetypes and highly context-dependent.

5. Our archetype analysis shows that shifting cultivation transitions are diverse in themselves, in their drivers and their consequences. This calls for a critical and contextualised appraisal of the continuation of shifting cultivation, as well as the transition away from it, when designing land system policies that work for people and nature.

KEYWORDS
archetype analysis, land system science, land-use transition, review, shifting cultivation, slash-and-burn, swidden

1 | INTRODUCTION

Land systems are a key entry point for policies to achieve progress towards the triple challenge of biodiversity conservation, climate change mitigation and human well-being (Turner et al., 2021). One important land system is shifting cultivation (van Vliet et al., 2012), where smallholder farmers apply a cycle of clearing, cultivating and fallowing (Mertz et al., 2009). Shifting cultivation of rice, maize, cassava or other annual or biennial crops covers approximately 280 million hectares across the tropics, particularly in proximity to forest frontiers in Sub-Saharan Africa, South-East Asia, Pacific islands and Latin America (Heinimann et al., 2017). When expanding into old-growth forests (Zeng et al., 2018), shifting cultivation negatively affects forest-based ecosystem services and biodiversity (Gibson et al., 2011; Osen et al., 2021) by creating mosaic landscapes where secondary forests regrow during the fallow period. Subsequent cultivation cycles typically cause no net deforestation at the landscape scale, since secondary regrowth and clearing may be in balance (Mertz et al., 2009; Zaehringer et al., 2015). This rotating nature makes shifting cultivation hard to capture in global studies on drivers of forest loss that tend to confound shifting cultivation with more permanent smallholder farming or commodity-driven agriculture (Curtis et al., 2018). Shifting cultivation may degrade ecosystem services, such as soil fertility, when it is intensified with shorter fallows and frequently repeated cultivation cycles (Styger et al., 2009). Yet other land uses replacing shifting cultivation may have more serious negative effects on the environment, smallholders' livelihoods and socio-cultural aspects (Dressler et al., 2017; Fox et al., 2014; van Vliet et al., 2012).

Shifting cultivation is in decline across the tropics (Heinimann et al., 2017), essentially due to transitions towards other land uses (van Vliet et al., 2012). These transitions typically entail land abandonment with or without secondary regrowth (Mukul et al., 2020) or the establishment of permanently cropped systems (Padoch et al., 2007). In most cases, smallholder farmers will base their decisions on various plot-specific, household-specific, socio-cultural and other contextual criteria (van Vliet et al., 2012) in response to changing circumstances (Lambin et al., 2001). Importantly, each transition also comes with consequences for biodiversity, ecosystem services and smallholder livelihoods (Bruun et al., 2018; Fox et al., 2014; Llopis et al., 2020; Mertz et al., 2021). Understanding these drivers and consequences is key for designing land system policies that promote transitions with positive outcomes for people and nature. Such evidence on the drivers and consequences of shifting cultivation transitions is accumulating on regional scales (South-East Asia: Bruun et al, 2013; Dressler et al., 2017; Li et al., 2014; Mertz et al., 2009; Padoch et al., 2007; Rasul & Thapa, 2003), for specific transitions (Plantations: Bruun et al., 2009; Li et al., 2022; Secondary forest: Mertz et al., 2021; Mukul & Herbohn, 2016; Permanent agroforestry: Raintree & Warner, 1986; Villa et al., 2020) and for certain consequences (Carbon: Bruun et al., 2009; Ziegler et al., 2012). At the pantropical scale, van Vliet et al. (2012) identified drivers and consequences of shifting cultivation transitions. The review found that transitions have commonly been associated with higher incomes, but that other social–economic and environmental outcomes have predominantly been negative. However, van Vliet et al. (2012) did not seek to link trends in transitions with their drivers and consequences in specific transition typologies or archetypes. Doing so could assist scientists and policymakers in identifying hot spots of certain transitions and in devising a more standardised set of policy options addressing the consequences of such transitions. We close this gap by identifying and analysing various types of shifting cultivation transitions using an archetype approach.

Archetype analysis has recently gained traction as a useful tool in sustainability science (Oberlack et al., 2019; Piemontese et al., 2022; Sietz et al., 2019). The methodological approach uses archetypes, which are typical examples of a situation, that is, a model, as a way of grouping and making sense of various cases that show recurrent patterns (Oberlack et al., 2019), for example, complex social–ecological (land) systems (Oberlack et al., 2019). Archetype analysis can bridge gaps between the local and the global, by synthesising cases while acknowledging their specificity in time and space (Oberlack et al., 2019). In land system science, archetype analysis has been applied to recurrent large-scale land-use patterns in remotely sensed data (Sietz et al., 2017; Václavík et al., 2013), to smaller land units and their associated ecosystem services (Karrasch et al., 2019) and to patterns and processes of large-scale land acquisitions (Messerli et al., 2016). Archetype analysis has also been used to synthesise existing case studies published in the literature (Batista et al., 2018; Messerli et al., 2016; Oberlack et al., 2016; Thorn et al., 2021), which is the approach we apply here to shifting cultivation. In contrast to most previous research using archetype analysis for land systems, we apply the approach to transitions between systems, that is, shifting cultivation to other land systems, thereby studying 'archetypical transitions' rather than steady-state or scenario archetypes. Such archetypical transitions have previously been investigated by Levers et al. (2018), who developed archetypical change trajectories of land systems in Europe based on gridded data. In contrast, our study synthesises published cases investigating transitions, representing a novel contribution to archetype analysis. Importantly, this approach makes no inference about the permanence of the resulting archetypes.

Here, we review the literature to identify, describe, validate and analyse eight archetypes of shifting cultivation transitions across the tropics. We then elaborate on the drivers and consequences of each transition, highlight knowledge gaps and discuss how policy may favour certain shifting cultivation transitions and may steer others towards more favourable outcomes for people and nature.

2 | METHODS

2.1 | Identification of archetypes

To identify, describe, validate and analyse archetypes of shifting cultivation transitions, we used a three-step approach with a methodological emphasis on archetype validation (Piemontese et al. 2022). With this approach, we aimed to meet the four quality criteria of archetype analysis (Eisenack et al., 2019), namely to '(1) specify the domain of validity for each archetype, (2) ensure that archetypes can be combined to characterise single cases, (3) explicitly navigate levels of abstraction and (4) obtain a fit between attribute configurations, theories and empirical domains of validity'. In the first step, we (the author team) conducted an inventory of transitions from shifting cultivation to other systems, based on our in-depth knowledge and long-term experience with studying shifting cultivation transitions in different world regions, and settled on a list of eight candidate archetypical transitions. In a second step, we validated these candidate archetypes using a systematically identified body of literature, representing the core methodological element of our approach. In a third step, we reviewed the literature to identify common drivers and consequences of each archetypical transition. This last step also helped us to specify the domain of validity of the archetypes (Piemontese et al. 2022) and to identify research gaps.

2.2 | Literature-based validation approach

To validate the eight candidate archetypes, we conducted a systematic literature search. This was to ensure that single cases can be combined to characterise archetypes (Eisenack et al., 2019), that is, each archetype should be represented by more than one case. The approach also allowed us to assess the relative prevalence of all eight archetypes in the literature (Figures 1 and 3). We searched the databases covered by Web of Science (Core collection, subscription of the University of Bern) with a search string encompassing shifting cultivation and synonyms (*'shifting cultivation' OR 'swidden' OR 'slash and burn' OR 'slash & burn'*; dashes and other special characters are ignored, so 'slash and burn' also includes 'slash-and-burn') on 11 May 2021. We searched for papers in English published between 01 January 2010 and 11 May 2021 to focus on recently happening transitions. This broad search led to 1373 papers (duplicates, corrections, non-peer-reviewed literature and papers without abstract excluded) for which we screened abstracts. After abstract screening, only 452 of the papers had potential to meet our criteria and qualified for a full-text screening. Based on this full-text screening, we found that 271 papers described transitions. Of these, 204 papers described a single transition (i.e. were associated with a single archetype) while 67 papers described multiple transitions (i.e. were associated with at least two archetypes). In total, the final set of 271 papers described 374 transitions (see Supporting Information for more details, including Figure S1, which provides a flow diagram with the reasons for exclusion).

2.3 | Literature review to identify drivers and consequences of shifting cultivation transitions

We based the identification of drivers and consequences of shifting cultivation transitions predominantly on papers identified through the systematic literature search. This review focused on reviews and meta-analyses when these were available on a certain transition, driver, consequence or region, some of which were not captured by the search and thus included additionally. In the Supporting Information, we collate findings from the review, including examples for each archetype (Table S1), and provide an annotated list of the 271 papers used for validation (Table S2).

3 | RESULTS AND DISCUSSION

We identified eight archetypes of shifting cultivation transitions (Table 1, Figure 1), which were all represented by multiple cases in the validation (Figure 3). These archetypes are the transitions from

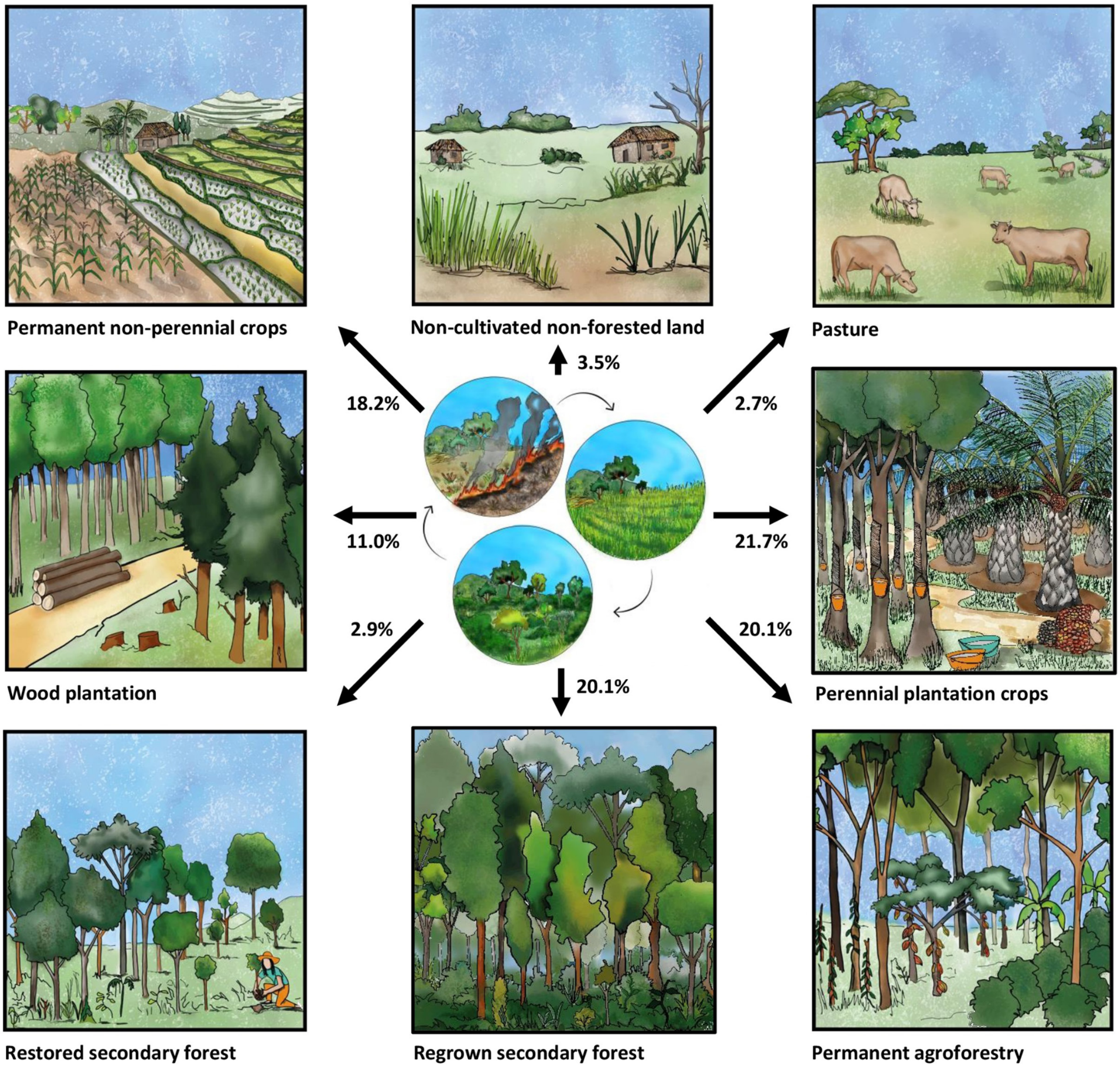

FIGURE 1 Illustrations of the eight identified archetypical transitions from shifting cultivation (in centre) to permanent non-perennial crops, non-cultivated non-forested land, pasture, perennial plantation crops, permanent agroforestry, regrown secondary forest, restored secondary forest, and wood plantation (clockwise) with their prevalence in the validation set of studies.

shifting cultivation to (1) perennial plantation crops, (2) permanent agroforestry, (3) regrown secondary forest, (4) permanent non-perennial crops, (5) pasture, (6) wood plantation, (7) non-cultivated non-forested land and (8) restored secondary forest (ordered in decreasing prevalence). Transitions are particularly common or better researched in countries where shifting cultivation is declining rapidly (Figures 2 and 3), especially in South-East Asia (Heinimann et al., 2017; Mertz et al., 2009). Across archetypes, spatial biases in terms of research intensity are limited, except that the transition to pasture is more commonly studied in Latin America and that transitions to perennial plantation crops and wood plantation are more commonly studied in South-East Asia (Figure 3).

3.1 | Common social–economic drivers across archetypical transitions

Our study reveals that higher expected land rents after transition represent a common social–economic driver of shifting cultivation transitions across archetypes (Figure 4). This is the case for five archetypical transitions: to permanent non-perennial crops (Hepp et al., 2019), pasture (Sharma et al., 2015), permanent agroforestry (Martin et al., 2022; van der Meer Simo et al., 2020), perennial plantation crops (Fox et al., 2014) and wood plantation (Fantini et al., 2017). This is in line with a regional synthesis from South-East Asia (Dressler et al., 2017). Such expected differences in land rents

TABLE 1 Characteristics, examples and relative prevalence for each of the eight identified archetypes of shifting cultivation transitions

Archetypes of shifting cultivation transitions	Characteristics of shifting cultivation transition	Examples	Prevalence in validation
Perennial plantation crops	Tree or palm monoculture plantations with focus on non-wood yield of trees or palms	Rubber plantations, oil palm plantations, fruit tree plantations, coffee plantations	81/374 21.7%
Permanent agroforestry	Woody perennials and agricultural crops or livestock on the same plot (FAO, 2017, here only as in permanent agroforest, i.e. crops or livestock and woody perennials on the same plot at the same time. Represents an open-land derived agroforest (Martin et al. 2020)	Vanilla agroforestry, coffee agroforestry, cardamom agroforestry, clove agroforestry, cocoa agroforestry, cashew agroforestry, tea agroforestry, alley cropping, mixed fruit orchard, mixed betel nut–rubber–cashew agroforest	75/374 20.1%
Regrown secondary forest	'Spontaneous' passive forest recovery with natural regeneration	Naturally regenerated secondary forest	75/374 20.1%
Permanent non-perennial crops	Permanent fields cropped for a number of years	Maize monoculture, paddy rice, sugar cane, cassava	68/374 18.2%
Wood plantation	Tree monoculture plantations with focus on use of timber, wood or pulp	Teak timber plantation, Eucalyptus plantation, Pine plantation	41/374 11.0%
Non-cultivated non-forested land	Land that is not cultivated, not forested and not intended for further cycles of shifting cultivation	Bare land, invasive plant cover, (Bracken) fern cover, urban, abandoned	13/374 3.5%
Restored secondary forest	Active forest restoration where the principal goal is not the use of trees	Actively restored secondary forest	11/374 2.9%
Pasture	Pasture with permanent or temporary livestock grazing	Cattle pasture	10/374 2.7%

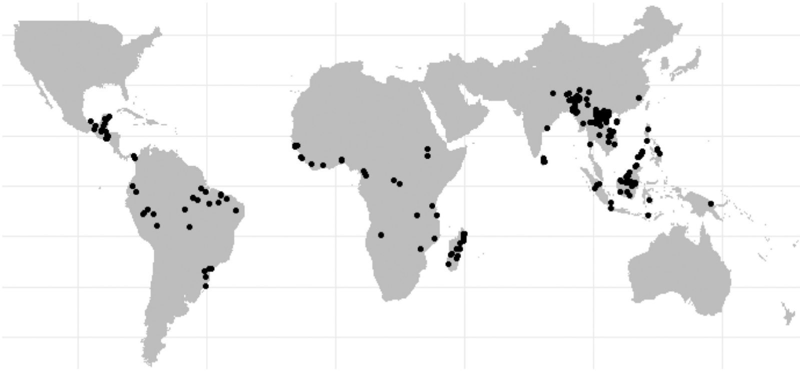

FIGURE 2 Map of the approximate locations where data for papers used for validation were collected (except regional and pantropical reviews). All coordinates are available in Table S2.

are driven by contextual as well as plot- and household-specific costs and benefits of shifting cultivation and alternatives such as land tenure security (Harwood, 1996; Lestrelin et al., 2019), market access (Sandewall et al., 2010), access to farming inputs (Hepp et al., 2019), access to microcredit (Bruun et al., 2017) and crop prices (Llopis et al., 2019). However, direct state interventions, for example, outright bans of shifting cultivation (Bruun et al., 2017; Ducourtieux et al., 2006; Padoch et al., 2007) or monetary incentives (Bose, 2019; Vongvisouk et al., 2014), are also key drivers of transitions. Furthermore, the burden of arduous work in shifting cultivation has been identified as a motivation to focus on other land uses (Fantini et al., 2017; Llopis et al., 2022).

For the archetypical transition to regrown secondary forest, the prioritisation of other activities is the main driver of transitions (Jakovac et al., 2021). Land users focus on other parts of their land holdings (Ramcilovic-Suominen & Kotilainen, 2020), off-farm activities (Castella et al., 2013) or work in urban centres (Ducourtieux et al., 2006), which promise a higher return per unit of labour compared to shifting cultivation, leading to abandonment and spontaneous forest regrowth (Jakovac et al., 2021). Similarly, such prioritisation can also lead to an archetypical transition to non-cultivated non-forested land (Styger et al., 2007; Wagner et al., 2015) if plot-specific conditions (see below) do not allow for spontaneous secondary forest regrowth. Also transitions to pasture may be driven by such prioritisation, since labour input per unit area is comparatively low (Fantini et al., 2017). In contrast, the transition to restored secondary forest is predominantly motivated by governance arrangements and necessitates secure land tenure (Löfqvist et al., 2022; Mansourian, 2021; Mclain et al., 2021). It may also be directly implemented by external actors, such as NGOs (Ota et al., 2020).

The breadth of drivers highlighted here should, however, not obstruct from the circumstance that the access to opportunities

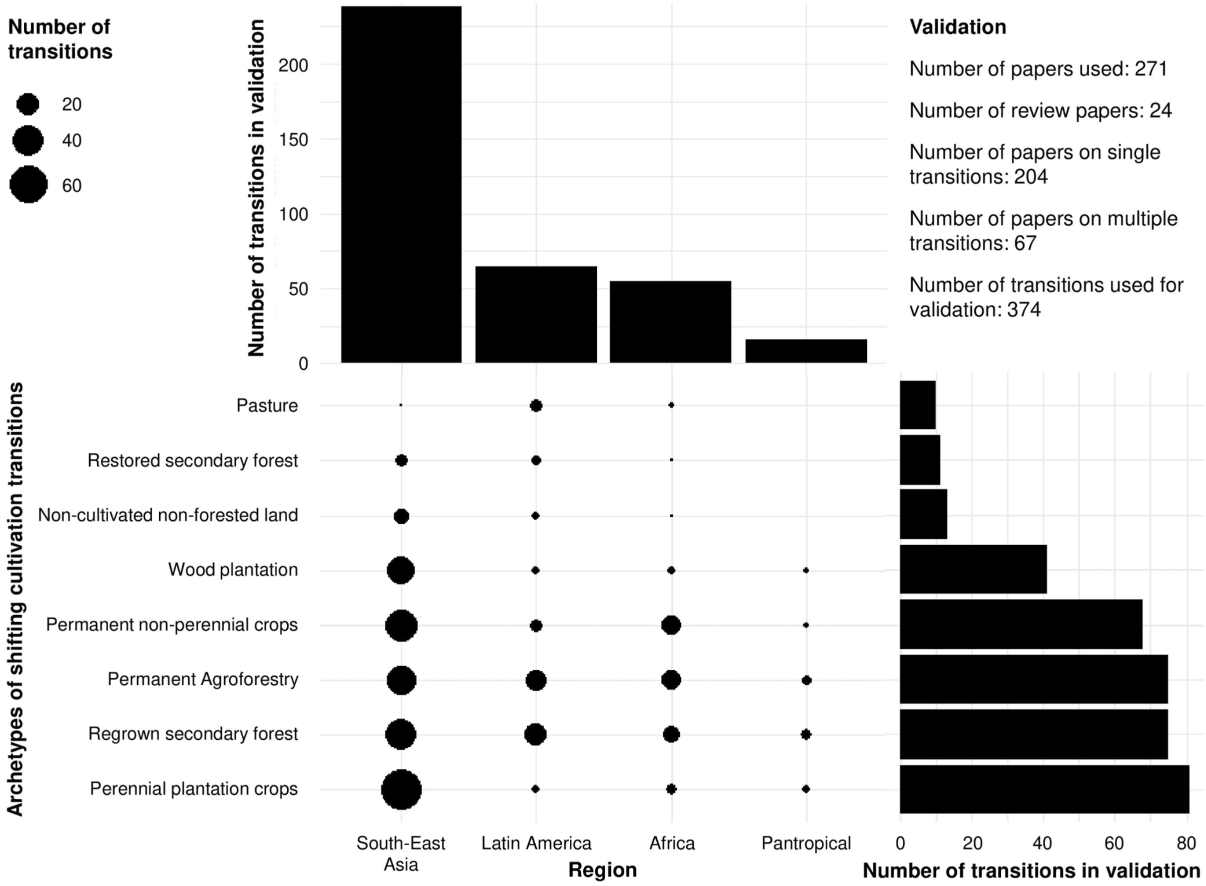

FIGURE 3 Overview on validation set of studies (top right), number of transitions for each archetype (bottom right) and region (top) and pairs between archetypes and regions (bottom left). Note that a study may describe more than one transition and that transitions are classified as pantropical if they investigate cases across at least two regions. Data are available in Table S2.

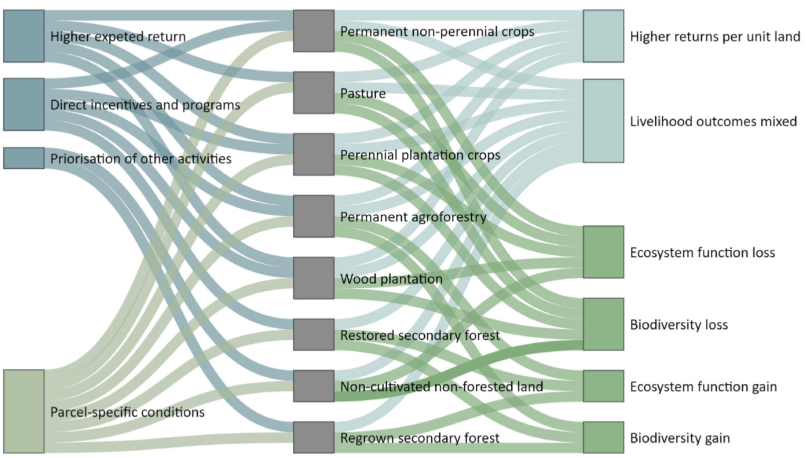

FIGURE 4 Sankey diagram summarising social–economic (blue) and environmental (light green) drivers of archetypical shifting cultivation transitions (grey boxes) and their social–economic (light blue) and environmental (green) consequences identified through a literature review. Note that the 'flows' are not weighed based on importance or strength of a driver or consequence.

for transitions away from shifting cultivation are highly unequal across smallholders, both within (e.g. Castella et al., 2013; van der Meer Simo et al., 2020) and between communities (e.g. Castella & Phaipasith, 2021; Hepp et al., 2019). This is further evidenced by ongoing (Heinimann et al., 2017) or even expanding (Zeng et al., 2018) shifting cultivation across multiple contexts.

3.2 | Common environmental drivers across archetypical transitions

We find that while shifting cultivation transitions are predominantly driven by social–economic factors, environmental drivers matter as well (Figure 4). These are mainly plot-specific conditions that lower the land rent expectations from shifting cultivation or increase land rent expectations for the stage following the transition. Declining yields on a plot caused by invasive species (Wagner et al., 2015) or soil depletion and erosion (Negrete-Yankelevich et al., 2013; Styger et al., 2007) may cause abandonment and transitions to non-cultivated non-forested land (Styger et al., 2007; Wagner et al., 2015), regrown secondary forest (Mukul et al., 2020) or pasture (Negrete-Yankelevich et al., 2013). Locations with fertile soils close to water sources, roads and villages are often favoured for transitions to permanently cropped archetypes (Bruun et al., 2017; Castella & Phaipasith, 2021), since land users expect higher productivity and lower labour input.

3.3 | Common social–economic consequences across archetypical transitions

The social and economic consequences of the identified archetypical shifting cultivation transitions are diverse and multidirectional (Figure 4). Higher returns per unit land after transition compared to shifting cultivation lead to increased incomes for land users (Perennial plantation crops: Fox et al., 2014; wood plantation: Hansen et al., 2007; non-perennial permanent crops: Hepp et al., 2019; agroforestry: Rahman et al., 2017; pasture: Sharma et al., 2015). However, non-monetary outcomes are more mixed; on the positive side, transitioning to more permanent land uses such as wood plantations or agroforestry can improve land tenure security (Rahman et al., 2017) and income diversification (Wood et al., 2016). On the downside, land users may lose access to timber and non-timber forest products derived from shifting cultivation fallows (Ramcilovic-Suominen & Kotilainen, 2020). Additionally, transitions to perennial plantations crops, wood plantations, permanent non-perennial crops or pastures may lead to a loss of traditional crops, socio-cultural values and associated knowledge (Fantini et al., 2017; Jepsen et al., 2019), increased gender inequality (Bose, 2019) and decreased food security (Behera et al., 2016; Ickowitz et al., 2016).

These diverse and multidirectional outcomes are not only apparent between archetypes, but also within archetypes, highlighting the importance of considering the local context in which transitions occur. One context which strongly alters consequences is the set of actors instrumental for the transitions. Most transitions we reviewed were led by the people who previously practiced shifting cultivation (i.e. smallholder farmers) on the same land. In these cases, positive outcomes are more common thanks to agency over land-use decisions (Ota et al., 2020). In contrast, social and economic outcomes were predominantly negative in those cases where large-scale land acquisition led to transitions to perennial plantation crops and wood plantations (Scheidel & Work, 2018), or where government-promoted transitions led to elite capture (Bose, 2019). In this context, active forest restoration projects also bear risks if they are not designed and implemented with local communities (Barr & Sayer, 2012; Löfqvist et al., 2022; Ota et al., 2020).

3.4 | Common environmental consequences across archetypical transitions

The environmental consequences of shifting cultivation transitions differ strongly among archetypes and are overwhelmingly positive for some transitions and similarly negative for others (Figure 4). The ecosystem services with the strongest evidence across shifting cultivation transitions are related to carbon storage (Ziegler et al., 2012), soil quality (Dressler et al., 2017; Mertz et al., 2021) and biodiversity (Mertz et al., 2021; Rerkasem et al., 2009). In secondary forests (archetypes regrown secondary forest and restored secondary forest), carbon stocks and biodiversity exceeded those of agricultural land, including shifting cultivation, while soil characteristics were comparable (Mertz et al., 2021). Similarly, the meta-study by Ziegler et al. (2012) found higher average above-ground carbon biomass in secondary forests, rubber plantation cropping and wood plantations than in various forms of shifting cultivation, but data show large overlaps in recorded carbon stocks between all these systems, highlighting context dependency. In contrast, five out of eight transitions away from shifting cultivation erode ecosystem services: the transitions to non-cultivated non-forest land, pasture, permanent non-perennial crops, perennial plantation crops and wood plantations typically result in reduced carbon stocks (except rubber and wood plantations compared to short fallow systems; Ziegler et al., 2012), worse water regulation (wood plantation; Ribolzi et al., 2017) and impoverished soil quality (Dressler et al., 2017). For biodiversity, the replacement of shifting cultivation with pastures or permanent cropping systems (archetypes permanent non-perennial crops, perennial plantation crops and wood plantation) generally result in losses of biodiversity (Negrete-Yankelevich et al., 2013; Rerkasem et al., 2009), while secondary forests show increasing numbers of tree species and biodiversity value over time (Chazdon et al., 2009; Jakovac et al., 2021; Karthik et al., 2009). For the transition to permanent agroforestry, relatively few papers explicitly compare agroforests established on open land previously under shifting cultivation with shifting cultivation, since many investigate forest-derived agroforests or misleadingly compare open-land-derived agroforests to forest (Martin et al., 2020). However, those that do make the direct comparison find similar (Raveloaritiana et al., 2021) or higher (Martin et al., 2022; Osen et al., 2021; Siebert, 2002) levels of biodiversity in permanent agroforestry than in shifting cultivation.

3.5 | Implications for land system science in shifting cultivation landscapes under transition

The identification of eight archetypes of shifting cultivation transitions comes with several implications for science and policy. A key finding is that the high number of possible transition outcomes, which may occur in parallel, reflects the flexibility which land under shifting cultivation offers to land users. This 'option space' represents an important advantage of shifting cultivation and must be considered as one of the reasons for its persistence despite low agricultural productivity compared to other land uses (Martin et al., 2022).

Going beyond the plot scale, we note that transitions at one location may also cause change elsewhere. In Vietnam, the replacement of shifting cultivation by coffee plantations led to the expansion of shifting cultivation into forest margins (Meyfroidt et al., 2013). Such transition-induced displacement of shifting cultivation into primary forests, which diminishes forest-based ecosystem services and biodiversity, needs to be recognised and mitigated. In addition, policies aimed at promoting certain shifting cultivation transitions may make the transition so profitable that expansion into primary forests occurs (Angelsen, 1995; Zeng et al., 2018), jeopardising any possible benefit for the environment due to such rebound effects (Meyfroidt et al., 2018). Together, this suggests that avoiding expansion of shifting cultivation and other land uses into primary forest and promoting a mosaic of land uses, including shifting cultivation and various transitions, would maintain flexibility and maximise the resilience of landscapes.

Looking at the percentage of studies in the validation that describe transitions to certain archetypes (Figures 1 and 3), we find that transitions to regrown secondary forest (20.1% of transitions) are seven times more commonly studied than those to restored secondary forest (2.9% of transitions), highlighting that passive forest regrowth on land previously used for shifting cultivation may—so far—be much more important, economically more attractive (Morton et al., 2020) and less complex (Chazdon et al., 2009) than active forest restoration. Furthermore, the low prevalence of studies describing transitions to non-cultivated non-forested land (3.5% of transitions), which include 'degraded land', suggests that shifting cultivation results in degraded land only under specific conditions. This is in contrast to popular belief but consistent with meta-studies on shifting cultivation systems (Mertz, 2002; van Vliet et al., 2012). However, these numbers represent a relative prevalence within the set of studies used for validation and thus depend on the applied search string, searched catalogues and regional or topical biases in the literature base. Therefore, the numbers can only serve as the best available proxies for the prevalence of actually happening transitions.

3.6 | Limitations in reviewed literature, study limitations and avenues for further research

Given the dynamism of shifting cultivation, empirical studies often struggle to determine what stage of shifting cultivation to compare the transitioned land use against; some studies compare against the land under cultivation (e.g. Miah et al., 2014), and many against young or old fallows (e.g. Tanaka et al., 2009; Terefe & Kim, 2020). Some also compare against multiple stages within the shifting cultivation system (e.g. Bruun et al., 2021; Raveloaritiana et al., 2021), or against an average across stages (e.g. Bruun et al., 2018; Morton et al., 2020). Given how different these stages can be in terms of ecosystem services, biodiversity, land rent and other characteristics, the choice of the baseline stage will determine the results of any analysis (Martin et al., 2020; Ziegler et al., 2012). For example, by comparing teak plantations to shifting cultivation plots under cultivation, Miah et al. (2014) find that plantations have higher soil moisture and organic matter content; a finding that would likely not hold if they would have compared to shifting cultivation fallows or indeed an average across a whole cycle of shifting cultivation (Ribolzi et al., 2017). In this context, we also note that very few time-series studies on shifting cultivation transitions are available since most use a space-for-time design (De Palma et al., 2018). However, such time series along with interdisciplinary landscape-scale studies (Castella et al., 2013; Hurni et al., 2013; Martin et al., 2022) are necessary to capture complex environmental and social–economic dynamics across shifting cultivation cycles and transitions.

In addition to the limitations within the underlying literature, we acknowledge that validation processes are prone to confirmation bias, that the archetype approach cannot replace a systematic review (as done previously for trends, drivers and impacts of shifting cultivation; van Vliet et al., 2012) and that the identified archetypes have a limited domain of validity (Eisenack et al., 2019; Piemontese et al., 2022), that is, they are only validated for tropical shifting cultivation transitions within the reviewed period (2010–2021). Further promising research avenues are spatio-temporal analyses, which could reveal which shifting cultivation transitions dominate pantropically and in specific regions, and quantitative syntheses and reviews focusing on specific archetypes, drivers or consequences. Lastly, more transdisciplinary studies are needed that build transformation knowledge (Schneider et al., 2019) on how to achieve shifting cultivation transitions that generate co-benefits for people and nature across contexts. This is particularly important since drivers and consequences of shifting cultivation transitions also vary widely within each archetype.

3.7 | Implications for archetype research and level of aggregation within archetypes

By applying an archetype approach to research synthesis in land system science, we chose a little practiced approach with advantages and limitations. By identifying archetypes of shifting cultivation transitions rather than archetypes of fixed states, the results may be most relevant for land-use policies aiming at steering transitions towards sustainable land systems. The archetype approach also offered the opportunity to examine common drivers and consequences, without missing the importance of local context since we did not consider all cases within an archetype 'the same'. However, our archetype analysis, like others, can be criticised on the level of aggregation, that is, the diversity of cases forming an archetype (Oberlack et al., 2019). Here, combining regrown secondary forest and restored secondary forest into a single archetype (secondary forest) would have been an option which we disregarded due to very different drivers. Similarly, combining perennial plantation crops and wood plantation into a single archetype (perennial plantations) would have been possible. A further level of variation which we discuss here but which we did not explicitly include in the archetypes is a separation of archetypes based on actors (local people vs. large-scale investments) since outcomes may vary strongly. Here, a hierarchical approach where each archetype is further split into subtypes could elucidate how various pathways result in the same archetype; an approach that may, however, be limited by a lack of empirical studies for some archetypes.

4 | CONCLUSION

By identifying eight archetypes of shifting cultivation transitions (permanent non-perennial crops, pasture, permanent agroforestry, perennial plantation crops, wood plantation, non-cultivated non-forested land, regrown secondary forest and restored secondary forest), we highlight the diversity of land systems following shifting cultivation. This deepens our understanding of shifting cultivation: shifting cultivation practitioners potentially have a myriad of options if they wish to change the use of the plots under shifting cultivation. This highlights that shifting cultivation, as a land system, provides a wide 'option space' to land users. However, specific conditions may need to be in place to enable certain transitions, particularly in terms of value chains for diverse products. The consequences of shifting cultivation transitions largely depend on the archetype, but are predominantly positive in economic terms, mixed for social outcomes and largely negative for environmental outcomes in most archetypes, with the exception of transitions to permanent agroforestry, regrown secondary forest and restored secondary forest. In sum, the archetype approach showed that shifting cultivation transitions are diverse in themselves, in their drivers and in their consequences, suggesting the need for a critical and contextualised appraisal of the continuation of as well as the transition away from shifting cultivation. We hope this understanding will enable the design of land system policies that promote beneficial transitions, disincentivise unsustainable transitions and strive for the best possible outcomes within transitions. This could lead to co-benefit between preserving biodiversity and mitigating the climate crisis while improving human well-being in shifting cultivation landscapes.

AUTHOR CONTRIBUTIONS

Dominic A. Martin devised the initial concept, led the archetype identification and validation and wrote the first draft. Dominic A. Martin, Jorge C. Llopis, Estelle Raveloaritiana and Oliver T. Coomes conducted the validation. All authors participated in discussions, reviewed papers, revised writing and approved the final version.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The manuscript does not include data. In the Supporting Information, we collate findings from the review including examples for each archetype (Table S1) and provide an annotated list of the 271 papers used for validation (Table S2).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supplementary Material: Notes on exclusion criteria for validation.

Table S1: Characteristics, examples, prevalence, drivers, and consequences of shifting cultivation transitions for each of the eight identified archetypes.

Table S2: List of 271 studies used in the validation including archetype classification.

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