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Pineapple production and visions of regeneration – contrasting Costa Rican (agri)cultural paradigms

Producción de piña y visiones de regeneración: contrastando paradigmas (agro)culturales en Costa Rica

Produção de abacaxi e visões de regeneração: contrastando paradigmas (agro)culturais na Costa Rica

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Abstract

In a time when agricultural developments have led to the transgression of multiple planetary boundaries like climate change and biodiversity loss, deeply-rooted transformations in the agricultural sector are urgently needed. Vice versa, those very developments have put many farmers' livelihoods in danger around the world. In the Costa Rican context, the "Desarrollo Sostenible a la Tica" points to the country's well-known "green" sectors, but this paradigm has also caused a stark breach between the green image conveyed ("exceptionalismo verde", en. "green exceptionalism") and the actual social-ecological livelihoods of many rural communities and the state of the landscapes. However, this is not the only paradigm of sustainable development prevalent in the country. Regenerative Development, a term most prominently used in the context of Regenerative Agriculture, offers an alternative vision for Costa Rica's futures encompassing agricultural production and culture in general.

Following the stories shared by a diverse group of Costa Ricans interviewed on sustainable food systems and Regenerative Development, we drew a multifaceted picture of regeneration that includes both agricultural practices, as well as socio-cultural and relational dimensions. Referring to the power of paradigms as important scaffolds for people's beliefs and decision-making in times of deep uncertainty, we thereafter compared the paradigm "Desarrollo Regenerativo" to the paradigm of "Desarrollo Sostenible a la Tica". Putting these two paradigms in a dialogue, we delineated similarities and differences between them, to ultimately discuss possible ways forward: is there room for a (re-)conciliation and bridging of perspectives, or are the discrepancies between them too large, pointing to an unbridgeable gap and the need to fundamentally rethink the story of sustainable development the "Desarrollo Sostenible a la Tica" is currently telling? And what are potential implications for sustainable pineapple production?

Key words: Biodiversity loss, Climate change, Development paradigms, Food systems, Pineapple cultivation, Rural communities, Rural development, Society-nature relationship, Sustainable agriculture, Sustainable development.

Resumen

En una época en la que el desarrollo agrícola ha llevado a la transgresión de múltiples límites planetarios —como el cambio climático y la pérdida de biodiversidad—, se necesitan con urgencia transformaciones profundas en el sector agrícola. A su vez, estos mismos desarrollos han puesto en riesgo los medios de vida de muchas personas agricultoras en todo el mundo. En el contexto costarricense, el "Desarrollo Sostenible a la Tica" hace referencia a los sectores "verdes" por los que el país es bien conocido, pero este paradigma también ha generado una fuerte brecha entre la imagen verde que se proyecta ("excepcionalismo verde") y las condiciones socioecológicas reales de muchas comunidades rurales, así como el estado de los paisajes. Sin embargo, este no es el único paradigma de desarrollo sostenible presente en el país. El Desarrollo Regenerativo, un término que se utiliza principalmente en el contexto de la Agricultura Regenerativa, ofrece una visión alternativa para el futuro de Costa Rica que abarca tanto la producción agrícola como la cultura en un sentido amplio.

A partir de las historias compartidas por un grupo diverso de costarricenses entrevistados sobre sistemas alimentarios sostenibles y Desarrollo Regenerativo, construimos un retrato multifacético de la regeneración que incluye tanto prácticas agrícolas como dimensiones socioculturales y relacionales. Considerando el poder de los paradigmas como andamiajes importantes para las creencias y la toma de decisiones en tiempos de gran incertidumbre, comparamos el paradigma del "Desarrollo Regenerativo" con el del "Desarrollo Sostenible a la Tica". Al poner estos dos paradigmas en diálogo, delineamos sus similitudes y diferencias para finalmente discutir posibles caminos a seguir: ¿existe espacio para una (re)conciliación y un puente entre perspectivas, o las discrepancias entre ellos son demasiado grandes, señalando una brecha insalvable y la necesidad de repensar fundamentalmente la narrativa del desarrollo sostenible que hoy transmite el "Desarrollo Sostenible a la Tica"? ¿Y cuáles son las posibles implicaciones para una producción sostenible de piña?

Palabras clave: Agricultura sostenible, Cambio climático, Comunidades rurales, Cultivo de piña, Desarrollo paradigmas, Desarrollo rural, Desarrollo sostenible, Pérdida de biodiversidad, Relación sociedad-naturaleza, Sistemas alimentarios

Resumo

Em um momento em que os desenvolvimentos agrícolas têm levado à transgressão de múltiplos limites planetários — como as mudanças climáticas e a perda de biodiversidade —, transformações profundas no setor agrícola são urgentemente necessárias. Ao mesmo tempo, esses mesmos desenvolvimentos colocaram em risco os meios de subsistência de muitos agricultores em todo o mundo. No contexto da Costa Rica, o "Desarrollo Sostenible a la Tica" remete aos setores "verdes" pelos quais o país é amplamente conhecido, mas esse paradigma também gerou uma ruptura marcante entre a imagem verde transmitida ("excepcionalismo verde") e os modos de vida socioecológicos reais de muitas comunidades rurais e o estado das paisagens. No entanto, esse não é o único paradigma de desenvolvimento sustentável presente no país. O Desenvolvimento Regenerativo, um termo usado principalmente no contexto da Agricultura Regenerativa, oferece uma visão alternativa para os futuros da Costa Rica, abrangendo tanto a produção agrícola quanto a cultura de modo geral.

A partir das histórias compartilhadas por um grupo diverso de costarriquenhos entrevistados sobre sistemas alimentares sustentáveis e Desenvolvimento Regenerativo, traçamos um retrato multifacetado da regeneração que inclui práticas agrícolas, bem como dimensões socioculturais e relacionais. Reconhecendo o poder dos paradigmas como estruturas importantes para as crenças e decisões das pessoas em tempos de grande incerteza, comparamos o paradigma do "Desarrollo Regenerativo" com o do "Desarrollo Sostenible a la Tica". Ao colocar esses dois paradigmas em diálogo, delineamos suas semelhanças e diferenças para, por fim, discutir possíveis caminhos a seguir: há espaço para uma (re)conciliação e construção de pontes entre perspectivas, ou as discrepâncias entre eles são grandes demais, apontando para um abismo intransponível e a necessidade de repensar fundamentalmente a narrativa de desenvolvimento sustentável atualmente promovida pelo "Desarrollo Sostenible a la Tica"? E quais seriam as implicações potenciais para uma produção sustentável de abacaxi?

Palavras-chave: Agricultura sustentável, Comunidades rurais, Cultivo de abacaxi, Desenvolvimento sustentável, Desenvolvimento rural, Mudança climática, aradigmas

de desenvolvimento, Perda de biodiversidade, Relação sociedade-natureza, Sistemas alimentares

Introduction

Pineapple production has become a dominant, shaping force in Costa Rica, both with regard to social and ecological dimensions: on a landscape level, more than 65,000 hectares are devoted to pineapple production, a business that generates a 2,000 million-dollar turnover per year. Costa Rica has become the world leader in pineapple exports, followed by 166-times larger Brazil (Humbert & Braßel, 2016). These significant numbers come with a cost: most pineapples are grown in extensive monoculture systems by few transnational food corporations. Del Monte and Pindeco alone hold a market share of 50%, while only 4% of Costa Rican pineapples are produced by local small-scale farmers (EJAtlas, 2020). Production systems often operate at the expense of local workers, communities, and ecosystems. Working conditions are detrimental in many cases: farms lack safety standards, for example regarding protection against dangerous chemical inputs, and worker rights are ignored. Migrants from Nicaragua have often been contracted under even worse working conditions and wages than Costa Rican rural workers, a practice that exploits their precarious situation (Cuadrado-Quesada, 2020; Humbert & Braßel, 2016).

In addition to the social dimension, Costa Rican pineapple production has numerous detrimental environmental impacts. Large-scale irrigation systems can cause or significantly contribute to water shortages in certain areas of the country. Moreover, the chemical input (fertilizer and pesticides) has spread throughout the landscape and surrounding ecosystems, polluting the groundwater to an extent that makes it undrinkable in several places where pineapple is produced (León Araya, 2021). Deforestation and conversion of intact, at times even protected, ecosystems into plantations, as well as soil erosion, are further negative environmental impacts. The loss of biodiversity, going hand in hand with this environmental degradation, is especially poignant in the light of Costa Rica often portraying itself –and being portrayed in international media and public discourses– as one of the world leaders in sustainability (Brown et al., 2020). However, according to Andrés León Araya (2021),

the model of sustainability most prominently embraced in Costa Rica is "sustainability for profit", rendering the preservation of pristine natural landscapes and the livelihoods of rural populations only a second priority.

Multi-scale effects are an inherent property of agricultural systems globally/in the 21st century: the aforementioned country-level development is intertwined with an increasing social and ecological global interconnectedness of food and land use systems. Global supply chains, trade, and competition have promoted the increasing intensification of agricultural systems to maximize profits, which has shown ripple effects on local realities, as described above in Costa Rica. The industrialization of agricultural production – in sectors like Pineapple production in Costa Rica, and others across the globe – has had detrimental global impacts. Today, agriculture is a major contributor to the transgression of multiple planetary boundaries (PBs), like climate change, biodiversity loss, freshwater change, and biogeochemical flows (Campbell et al., 2017; Richardson et al., 2023). PBs reflect Earth System Processes that are critical for maintaining Earth system stability; therefore, their transgression is alarming.

As a major contributor to these transgressions, agriculture must play a central role in their reversal. The aforementioned background information on pineapple production underlines the systemic character of agricultural production. The choice of a particular farming system, such as a chemical input-based farming system or a biodiversity-based farming system, has tremendous impacts on social-ecological effects (Therond et al., 2017). In fact, farming systems are connected to different paradigms, i.e., lenses through which we perceive and make meaning of the world. Depending upon the paradigm held, sustainable solutions can have different characteristics. For example, the "green growth" paradigm assumes that economic growth can be decoupled from exploitative material consumption so that the current economic model of continuing economic growth can be compatible with environmental sustainability, if suitable measures are implemented (e.g., fostering of a service-based economy) (e.g., Petschow et al., 2018). On the contrary, the "degrowth" paradigm is based upon the assumption that such a decoupling is impossible. Hence, according to this paradigm, sustainability requires the reduction of GDP growth (Paech 2009).

As will be further delineated in the following, Costa Rica also shows different paradigms linked to sustainable development, which become particularly evident in the agricultural sector. The concept of "Desarrollo Sostenible a la Tica" (en. "Costa Rican sustainable development") is connected to the ideas of sustainable development, as put forward in the Brundtland Report of 1987. León Araya explains this paradigm as follows: "The underlying idea in the official discourse of both the government and the [pineapple production] sector is that economic growth through agricultural exports is compatible with the conservation of nature through the creation of conservation areas. This idea is very much in sync with the framework of sustainable development, according to which sustained economic growth can be combined with the conservation of nature, if the proper technological and managerial fixes are applied." (León Araya, 2021, p. 100). On the other hand, the Regenerative Development paradigm offers an alternative vision for Costa Rica's futures encompassing pineapple production, in particular, as well as other parts of agriculture (with respect to agriculture, the Regenerative Development paradigm is commonly referred to as Regenerative Agriculture (RA)) and culture in general (Fischer et al., 2024). In contrast to other forms of sustainable agriculture that have emerged through top-down processes (e.g., conservation agriculture), RA is not as rigidly defined, being regarded as a practitioner-driven, "social movement" of agriculture (Burns, 2020). Despite the lack of a clear definition, both scientists and practitioners, however, seem to agree that "the soil is the base" (Schreefel et al., 2020) of RA, and that, therefore, most RA practices share the common desire to improve soil health.

In this article, we want to analyze these two agricultural paradigms in Costa Rica that claim to foster sustainable development: the "Desarrollo Sostenible a la Tica" (DSAT) and "Desarrollo Regenerativo" (DR). Specifically, the article has two aims: (1) to analyze the differences and commonalities between DSAT and DR using the paradigms concept, and, based upon this analysis, (2) to explore opportunities for their combination or reconciliation. The article is structured as follows: In Section 2, we introduce the concept of paradigms that will serve as an analytical framework to explore and compare agricultural paradigms. In Section 3, the paradigms of DSAT of DR are explained in more detail and contrasted with each other. Section 4 discusses

whether a reconciliation or combination of both paradigms is possible before the article ends in Section 5 with some concluding remarks.

The power of paradigms

Paradigms are a suitable concept to explore the relations between humans and nature, as they link concrete sets of practices (e.g., agricultural practices) with cognitive aspects, such as the selective perception of environmental problems. Human-nature relations give rise to and manifest in dynamic feedback processes, as human activities influence environmental processes, which can lead to sustainability issues, such as land degradation or water pollution. Environmental degradation, in turn, has an impact on human livelihoods and wellbeing, which might require corrective action or even transformative change.

The interaction between humans and nature can be conceptualized as a management process to harmonize socio-economic interests with the protection of nature and its contributions to people. In the case of agriculture, this management process can be analyzed at a farm level of the farmer interacting with the land. However, processes at the farm level may not operate in isolation but are often influenced by higher-level dynamics (e.g., through environmental legislation or subsidization schemes).

A management paradigm is defined by Pahl-Wostl (2011) et al. as "a set of basic assumptions about the nature of the system to be managed, the goals of managing the system and the ways in which these goals can be achieved" (Pahl-Wostl, 2011, p. 840). Halbe et al. (2013) derived three dimensions from this definition to operationalize the analysis of paradigms: (1) system perspective (on which parts of the system is the paradigm focusing?); (2) solution strategies (what are the specific measures within the paradigm to manage the human-nature interaction?); and (3) risk and uncertainty management (how is the paradigm dealing with an inherently dynamic environment?).

In this article, we aim to explore different sustainable agriculture paradigms in Costa Rica by employing the concept of paradigms. Table 1 provides an overview of how

the three dimensions are applied to investigate and scrutinize sustainability paradigms in the agricultural sector.

Table 1

Three dimensions of sustainable agriculture paradigms.

Dimensions	Application to agricultural paradigms
System perspective	At which level or scale is the paradigm focusing (e.g., a farm level, sectoral level)? Which sustainability dimensions are considered (i.e., social, ecological, economic)?
Solution strategies	Which agricultural practices are included? Are there further practices to address social-ecological interactions? How shall a balance between economic, social, and environmental sustainability be achieved?
Risk and uncertainty management	How are uncertainties and risks framed (e.g., as a control problem, a resilience issue)? What strategies are in place to deal with uncertainties and risks?

The *system perspective* captures the level or scale at which the paradigm addresses the topic of sustainability. The term "level" refers to different social levels, such as the level of an individual, a household, a farming business, or an economic sector. The term "scale" is linked to the spatial scale, which could be a local scale (e.g., the area of a single farm), a landscape scale (to also include the area around the farm), or a global scale (to include international value chains). The system perspective can also be specified through different sustainability dimensions. For example, a paradigm could focus exclusively on economic sustainability or alternatively have a broader scope that also includes social and ecological sustainability.

The dimension of *solution strategies* can be analyzed by focusing on the specific agricultural practices that specify the interactions between farmers and the land. However, there might also be further practices that shape social and ecological

interactions, such as local networks to foster cooperation between farmers (a social practice) or practices that promote biodiversity (an ecological practice).

The risk and *uncertainty management* dimension is addressed by analyzing the framing of uncertainties and risks. These can be framed as an issue of control or, alternatively, of acceptance by using an adaptive management approach. A further aspect pertains to the specific strategies that are considered to deal with uncertainties, such as the heavy use of inputs to control pests and nutrient management or the proactive protection of ecosystem services.

The following section presents the general description of the two paradigms "Desarrollo Sostenible a la Tica" and "Desarrollo Regenerativo" before the paradigm concept is applied to compare both paradigms.

Delineating two sustainability paradigms in Costa Rica

Desarrollo Sostenible a la Tica – Costa Rican Sustainable Development

As already sketched in the introduction to this special issue, the DSAT, associated with the "exceptionalismo verde", is the central current regime in Costa Rica, and the paradigm's strong rootedness in a certain image of agro-economic production and development is the main topic of investigation in this contribution. Again referring to León Araya (2021), the Costa Rican government and pineapple production sector currently operate under an interpretation of sustainable development that assumes that economic growth and nature conservation are generally compatible, given that appropriate technology and management measures are in place.

This basic understanding has led to the emergence of a development model whose primary objectives include economic growth, establishment of nature reserves and reforestation, as well as decarbonization. The political focus centres on economic benefits for Costa Rica, particularly emphasizing job creation. Meanwhile, this political discourse dismisses environmental concerns regarding the impacts of the extractivist development model, neglects rural populations and livelihoods, and disregards

traditional lifestyles. As León Araya frames it: "by moving the discussion away from issues such as health, nature, and labor, and towards technological fixes, sustainable development renders invisible the stories of the people and landscapes upon which the pineapple activity has expanded" (León Araya, 2021, p. 100).

In a study on prevalent environmentalist discourses in Costa Rica, Anja Nygren (1998) introduces four forms of environmentalism: for nature, for profit, alternative environmentalism, and for the people. Among these four, according to Nygren, it is environmentalism for profit that is most prominently endorsed and economically supported by the Costa Rican government. This has led to the geographical differentiation of landscapes, creating "a set of fragmented landscapes in which the experience, and thus the understanding of the country is profoundly differentiated along class and location lines, with a clear fracture between the urban and the rural" (León Araya, 2021, p. 105). The image of Costa Rica, painted from an urban perspective, is conveyed as a dichotomy between an urban service economy and a rural landscape, which either manifests as pristine natural reserves and eco-tourism enclaves (Sustainability ~ Natural Parks) or high-performance / high-tech export-oriented plantations (Monocultures ~ Profitability, high-tech development). What this image does not contain, however, are the realities and livelihoods of the rural Costa Rican population, as well as the potential for sustainable governance of landscapes beyond the "environmentalism for profit" discourse (Nygren, 1998).

In conclusion, the coexistence of seemingly contradictory events in Costa Rica's development strategy is facilitated by the contemporary sustainable development framework. Decarbonization plans generate abstract cosmopolitan images, detached from the actual locations impacted by pineapple cultivation. Traditional landscapes and human-environment relationships are often portrayed as outdated and inefficient within this paradigm.

Desarrollo Regenerativo – Regenerative Development

However, the DSAT is not the only paradigm of sustainable development prevalent in the country. During different research projects, we got in touch with a much broader and more diverse set of perspectives on sustainable development in the

context of Costa Rican food and land use systems circulating in the broader public, largely outside the political arena. Following Müller Castro (2022), we propose that those perspectives can be referred to as an alternative paradigm of "Regenerative Development".

Regenerative Agriculture – Ecological perspective

Agriculture is the sector most prominently associated with Regenerative Development, which is why the interrogation of the paradigm of regeneration will begin with its application to the food and land use system. Regenerative Agriculture (RA) is proposed as an agricultural model that can be regarded as an alternative to conventional agriculture, which is still dominant at the global scale.

As described above, while lacking a clear definition, many scholars and practitioners agree that the improvement of soil health lies at the heart of RA. Since the ecological preconditions to fortify soil health are very different in temperate, continental climates, such as in Central Europe, compared to tropical climate conditions, such as Central America, RA discourses acknowledge that soil regeneration practices are highly context-dependent and have to be adapted to local conditions. Practices frequently mentioned include permanent soil coverage, mulching, minimum soil disturbance (no-till), crop rotations, intercropping (companion planting), agroforestry, etc. (Schreefel et al., 2020).

Beyond soil health, discourses of RA often include developments at larger scales, situating farm-plot regeneration within a much broader context. Especially in the Costa Rican discourse on this alternative form of agriculture, the transgression of Planetary Boundaries (PBs) were often referred to as a motivation to apply RA practices by interviewees.

Further interpretations of RA shed light on other diverse dimensions of potentially large-scale impact: Soil carbon sequestration through RA practices, contributing to the global carbon sink (climate change mitigation), is often taken up by the stream of RA practitioners self-ascribing as Climate or Carbon Farmers. Greater water efficiency, especially in times of climate change and biodiversity loss-induced extreme events, is another common motif to introduce RA practices. Soils with high levels of soil organic carbon have enhanced abilities to store water in the landscape.

This way, agricultural ecosystems are more resilient to extreme events, like prolonged drought periods and heavy rainfalls. Lastly, the dimension of landscape regeneration, in the sense of designing farms as healthy agro-ecosystems and putting a special emphasis on agro-biodiversity, is increasingly suggested as a decisive pillar of RA.

From a purely ecological point of view, RA can therefore be understood as an approach to agriculture that transcends the idea of "agriculture reducing harm", which manifests in dominant discourses of sustainable agriculture, like for example in the "organic agriculture" label guidelines (also: technical systems design). In contrast to the reduction of potential detrimental impacts of agriculture, regenerative approaches intend to improve the ecological / natural conditions in which agricultural systems are embedded, including the dimensions of soil health, water retention, climate change mitigation and adaptation, as well as agro-biodiversity creation.

Regenerative Agriculture – Social perspective

Many practitioners (and some scholars) increasingly understand RA as being aimed not solely at the regeneration of the natural, but also the social systems intertwined with agriculture. Impacts of agriculture on social systems are manifold and include farmer livelihoods, impacts of certain agricultural practices on rural populations (on the production side), malnutrition, and global food production (on the consumption side).

Communities of practice and networks linked to RA offer guidance for farmers who aim to adopt RA, which often considers dimensions of personal and emotional well-being, mental health, sense of community, but also financial security and sustainability of a business model as integral components of a "Regenerative Agriculture" operation.

"The first is ecological and second is personal well-being and third is financial. So we, we would look at it from a more holistic view that it's not like a farmer that would be super ecologically good but not financially sustainable, that wouldn't be Regenerative Agriculture or a farmer that makes a lot of money, but has to work a lot and doesn't have time for his family or her family. It's not Regenerative Agriculture so it's really these three. (EU_Network, Pos. 80)".

Similarly, some regenerative operations consider not only the farmer and his or her family, but additionally the (social, but also ecological) community the farm is embedded in as the frame of reference when considering social regeneration. Protecting and improving human health by non-exposure to agrochemicals, as well as by the provision of nutritious and diverse produce, is one dimension of this extended scope of consideration. The re-focusing on local value chains and the strengthening of communities, which in turn contribute to local cooperation and ultimately regional resilience, is another element considered in the regeneration of rural livelihoods beyond the individual farmer.

These points are closely linked to the provision of food security in general. Resilient farming systems, sketched above as one of the potential ecological impacts of RA, are the central basis for the provision of food security, both locally/regionally, as well as globally: In Costa Rica, the expansion of RA was triggered by the COVID pandemic causing severe food insecurity, especially in rural areas that previously depended on income from tourism. As an "emergency agriculture" program and response to these food shortages, the initiative "Costa Rica Regenerativa" has established many RA farms and gardens. This approach explicitly centres on the empowerment of rural communities that previously had neither contact with agriculture nor self-subsistence skills through capacity-building.

> But then COVID came. The Guanacaste area, as you know, depends on tourism, and tourism was shut down overnight. And those people don't have bank accounts, don't have savings. And didn't produce food. So we started doing emergency agriculture. (CR_Network_Lead, Pos. 17)

The theme of food security is also of pivotal importance in larger-scale RA projects that are not built towards provision of local food security but are instead embedded in larger supply chains. Globally, one of the largest challenges for agriculture will be the adaptation to rapidly-changing ecological, as well as social landscape developments. Regenerative agricultural systems are better adapted to withstand adverse farming conditions, and thereby to contribute to stable global food security. This covers different dimensions: ecologically, regeneration takes place through the consideration of healthy and resilient agro-ecosystems, that can buffer extreme

events, and socially, regeneration can unfold through business models that can withstand geopolitical shocks and regime developments, like fluctuation in fertilizer prices, or changes in legislation impacting agricultural gasoline taxes.

Regenerative Development – Holistic socio-cultural perspective beyond agriculture in a Costa Rican context

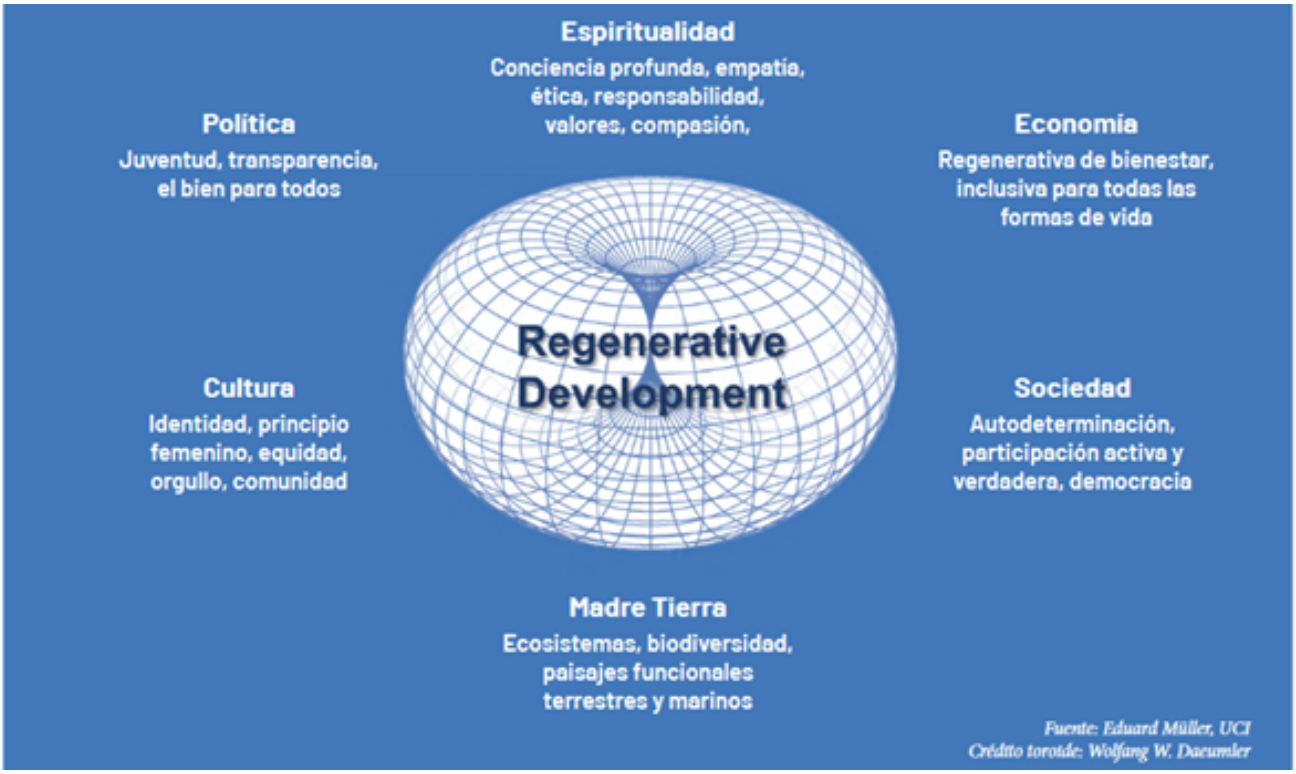
The use of the term Regenerative Development reflects the stance that "regeneration" can be interpreted as a cultural development paradigm that transcends agriculture and its direct entanglements. Interpretations of this understanding can be found in regenerative discourses globally, but the term is especially shaped as a Costa Rican cultural vision by the Initiative "Costa Rica Regenerativa", founded by Eduard Müller Castro.

> So for me, if you would put it in one sentence, it's about increasing the life-holding capacity of a place. And you cannot do that without building community. So it is necessarily also socio-political and you can also not regenerate the landscape without regenerating yourself. Um. It's all about life, of course. So it's all about facilitating life, but not of life that excludes humans. Human inclusive ecology. (Dutch_Farmer, Pos. 41)

Regenerative Development is concerned with a socio-cultural regeneration of a broad spectrum of elements that constitute the fundamental fabric of society (See Figure 1). This transformation rests on six pillars of regeneration: Mother Earth, Society, Economy, Spirituality, Politics, and Culture.

Figure 1

Six pillars of Regenerative Development (from Müller Castro, 2022)



Source: Müller Castro (2022)

In this understanding, the regeneration of agro-ecosystems is embedded in a conception of Madre Tierra, Mother Earth, which, in addition to the inclusion of diverse ecosystem health measures (as described above), draws attention to a different way of relating to the ecosystem considered. The terminology implies a stance of kinship, and a non-anthropocentric understanding of life in general.

The aspects of society, culture, politics, and economics sketch a different way of how societies could be organized. Economic systems should benefit individuals, communities, and enterprises along the entire value chain, as well as rest on solidarity and cooperation instead of individual enrichment and competition. A shift of cultural values towards family, community, and cooperation, as well as equity and post-patriarchal principles, are regarded as preconditions for regenerative cultures.

Political structures should be guided by the aim to make democracy a transparent, participatory process, working towards the well-being of all, instead of the profits of some. This results in an image of an active society, composed of empowered members that perceive themselves as interrelated and interdependent in their well-being and flourishing, with each other but also with non-human entities and ecosystems.

Lastly, the spiritual dimension ascribed to Regenerative Agriculture can be described as a "collective individual" mindshift towards a more caring, and kin-/stewardship-based relation that humans cultivate towards their surroundings, both natural and social.

> Speaker 3 [00:50:21] deep consciousness, understanding that we are nature, understand that we are one. Ethics, values, principles. I mean, connectedness to life. (CR_Network_Lead, Pos. 50)

Noteworthily, as our work revealed, ideas in the direction of Regenerative Development are not only put forward by members of "Costa Rica Regenerativa" but also find substantial support in other parts of the population (from farmers to researchers in academia). As part of a research project aimed at identifying diverse visions for environmentally sustainable and socially just (agricultural) food systems present in the Global South and Global North (Halbe and Janssen, 2023), in Costa Rica we got in touch with rich and colorful perspectives on sustainability that to various extent depart from the country's current paradigm (i.e., DSAT) in putting heightened emphasis on relational values and endorsing the idea of "nature as culture" (cf. Pereira et al., 2020). The concept of "nature as culture" captures the stance that people and nature cannot be separated, but are inextricably linked. Accordingly, a good quality of life is conceptualized as maintaining and nurturing these relations among people and between people and nature, e.g., by (jointly) engaging in traditional, cultural, and spiritual practices in and with nature, conserving (culturally) important landscapes, and fostering social cohesion. Clearly, the "nature as culture" concept shares striking similarities with the aims of Regenerative Development, such that one might say that Regenerative Development may be a potential pathway along which the vision of "nature as culture" can be realized.

In line with this argumentation, the visions we collected entail several notions that too are central themes to the socio-cultural regeneration delineated by Eduard Müller Castro (see Figure 1). Various kinds of networks, for example between farmers or connecting local producers and consumers, are essential constituents to the envisioned food systems. Or, to give another example, participation and empowerment of farmers and marginalized communities in political decision-making are emphasized, as is the revaluing of nature and its contributions to people's life. When describing how, from their point of view, a sustainable food system can be brought into life, the interviewees emphasized furthermore the need to return to and re-value traditional and indigenous knowledge that, once widespread and cherished, in modern times got forgotten and increasingly discredited in favor of rigorous scientific reasoning. In our interviews, people expressed the belief that this knowledge –still present in some elders and remote cultural groups, and encoded in certain cultural practices– holds significant wisdom that can be leveraged for a sustainable future. A Regenerative Development then also entails the regeneration of knowledge.

Comparison of the two paradigms

Table 2 shows a synthesis of the information provided in the previous sections on the DSAT (Section 3.1) and the DR (Section 3.2). The paradigm concept is applied to systematically sort the information into different categories, including the systems perspective, solution strategies, and risk & uncertainty management (see Section 2). The systems perspective is further categorized to address more specific aspects, including the societal level (at which level is the paradigm focusing?), the spatial scale (which scales are predominantly addressed?), as well as the consideration of different sustainability dimensions (i.e., economic, environmental, and social sustainability). Solution strategies are further categorized into agricultural practices, economic practices, environmental practices, social practices, and approaches to balance the different sustainability dimensions. Risk & uncertainty management is addressed by looking at their framing (how are risks and uncertainties perceived?) and specific strategies to mitigate or deal with them.

Table 2

Comparison of the DSAT and DR paradigms.

Category	DSAT	DR
	Systems perspective	
Level	The DSAT focuses on companies (i.e. organizations) that operate in international value chains.	DR focuses more on the community level and the embedment of farms in the regional context. Sometimes, multi-level and -scale interconnections and entanglements of local agricultural activities with global developments (climate change, biodiversity crisis, planetary boundaries) are considered.
Scale	Focus on national scale (national economy) and agriculture production areas.	Broader landscape scale that includes the farm in its social-ecological context. The paradigm of regenerative agricultural development does not necessarily presuppose a certain farm size. However, in the Costa Rican / Guanacaste case, currently, it mostly manifests in diversified, smaller-scale community farms.
Economic sustainability	CR is embedded in international value chains, which require a high competitiveness of the economic sector. Thus, a focus is devoted to economic growth and associated indicators like GDP, creation of jobs, strengthening of export industries (like pineapple).	Explicitly considered as a shift in mainstream economics to reflect more diverse criteria, for example the valuation of diverse Nature's contributions to people (NCP) (Pascual et al., 2017) through true pricing mechanisms, a consideration of well-being beyond a country's GDP, including the whole production value chain and the embedded communities, financial stability and resilience, and farmer livelihoods. Products are currently especially sold in local/regional markets; however also a strong focus on self-sufficiency and food sharing within communities.

Category	DSAT	DR
	Systems perspective	
Environmental sustainability	Environmental sustainability is achieved by limiting the external effects of agriculture. A land sparing approach is promoted by separating natural reserves and parks from a highly profitable agricultural sector. Land grabbing and contamination of ecosystems surrounding plantations are a huge issue, so the separation between farming and nature should be rather understood as "the picture painted" than as the actual reality. Generally, plantations are not regarded as ecosystems even capable of supporting biodiversity.	The primary focus lies on the creation of agrobiodiversity, i.e., the support of biodiversity within agricultural landscapes. A land sharing approach is promoted (embeddedness of social and ecological systems, nature as culture).
Social sustainability	Sustained economic growth is linked to social progress and well-being. A strong national economy is furthermore linked to a modern and high-performance health sector and social security programs.	Explicit re-focusing on well-being and livelihoods of the rural population. Economic well-being and prosperity are also included as a measure of economic stability, but the understanding of well-being by far transcends a purely financial stance. The creation of strengthened, empowered communities, local value chains, a feeling of embeddedness, interconnectedness (with social and ecological community), and well-being arising from a different way of relating to each other are central components of well-being derived from Regenerative Development.

Category	DSAT	DR
	Solution strategies	
Agricultural practices	The large-scale monoculture plantation acts as the blueprint of production in the DSAT paradigm. Some "sustainable" initiatives exist (although the share of organic (one of the best known sustainability labels globally) pineapple in Costa Rica is still small) and try to reduce the negative environmental impact of production. However, the basic assumption that doing agriculture necessarily entails an exploitation of natural resources (that one can only try to reduce) remains.	In contrast to the (uttered) aims to "improve" conventional agriculture / pineapple production (in the sense of reducing negative impact), Regenerative Agriculture takes the stance that agriculture can be done in cooperation with the natural environment, and therefore that "human intervention" can be of reciprocal, positive nature. Intercropping, often practiced in agroforestry systems, is a central agricultural practice to foster NCP, allowing for a diverse diet and promoting resiliency.
Economic practices	Economic development through the creation of jobs in large, export-oriented agro-corporations.	The target group(s) of current Costa Rican's RA can be described as "enlarging circles surrounding the farm": First, a share of the produced goods directly contributes to the farm families' own varied, healthy diet. Then, usually, local communities are being considered. Vegetables can be sold to individuals through (self-established) direct marketing possibilities, as well as by cooperating with other local businesses, like restaurants. A crucial challenge for fruit and vegetables produced in this model of RA is the lack of markets (beyond what is sketched above) that are "ready" to take up regenerative products. Ultimately, Regenerative Development aims for economic development through the empowerment and strengthening of local and rural communities, improving their livelihoods, farm income diversification, collaboration, and the establishment and strengthening of local value chains.

Category	DSAT	DR
	Solution strategies	
Ecological practices	Creation of certain protected natural conservation reserves, like parks, that can (1) serve as a foundation for eco-touristic activities (i.e., environmentalism for profit) and also (2) contribute to Costa Rica's promised contributions to reforestation and climate change mitigation (cosmopolitan, large-scale perspective on environmental protection).	Multi-level perspective with a primary focus on the creation of agrobiodiversity, so the fortification of biodiversity within agricultural landscapes (see also systems perspective: environmental sustainability above). Practices target the cooperation with and learning from the landscape.
Social practices	Central Idea: providing and ensuring people's well-being through economic growth and performance. However, thus far it is largely disregarded that not all people may equally benefit from economic growth and profits.	Fostering and promoting cooperation between diverse farmers and between farmers and consumers.
Balancing sustainability dimensions	Weak sustainability: justification of environmental degradation through economic gains.	Strong sustainability: ecological sustainability is the foundation of social and economic sustainability.

Category	DSAT	DR
	Risk and Uncertainty management	
Framing	Control of nature through chemical inputs (e.g., fertilizers or pesticides).	Minimize risks through diversity, e.g., intercropping to be resilient to climatic changes.
Strategies	Heavy use of input factors (e.g., fertilizers)	Utilization and support of NCPs.

Discussion

Our goal was to provide a nuanced picture of two contemporary prominent sustainable development paradigms, the DSAT as the approach endorsed by the Costa Rican government, and the DR as an alternative, and contrast both

paradigms with each other. Building upon our analysis, in the following, we explore whether, and under which conditions, we see a reconciliation or combination of both paradigms possible.

As the analysis in Section 3 has revealed, the DSAT and DR show some similarities, but also profound differences. Using the paradigm perspective has proven to be a helpful lens by allowing us to dissect underlying system perspectives, solution strategies, and approaches for risk and uncertainty management, thereby contributing to a differentiated view on both sustainable development approaches. Specifically, this approach has enabled us to demonstrate that the differences between the DSAT and DR are not simply linked to different approaches for food production, but are rooted in deeper epistemic differences about what is considered as part of the food and agricultural system and how to deal with uncertainties, which can be of epistemic nature (i.e., more research would be helpful to reduce uncertainties) or ontological nature (i.e., uncertainties cannot be reduced by further research due to inherent variability).

During our analysis, we noticed that what at first glance may present itself as a similarity between the DSAT and the DR, often decomposes into conflicting perspectives once diving into deeper levels of analysis. For example, while we found that both paradigms refer to the sustainability concept, the underlying perspectives, strategies, and risk and uncertainty management differ profoundly. Furthermore, on the surface, both paradigms are rooted in the socio-cultural context of Costa Rica. However, the DSAT, even though referring to the "exceptionalismo verde", is actually not compatible with the green image of Costa Rica. The DR, on the other hand, shows several synergies with the tourism sector and could substantiate the credibility of the "exceptionalismo verde". In light of those findings, the opportunities for a reconciliation of the two paradigms seem rather low.

This tentative hypothesis is further substantiated when accounting for the even more palpable differences between the DSAT and the DR. Perhaps the key difference lies in the sustainability definition endorsed by the two paradigms, respectively: Whereas the DSAT follows a weak interpretation of sustainability, the DR builds on the strong sustainability reading. On the one hand, the DSAT aims at the maximization of environmental, social, and ecological sustainability, while trade-offs between the

sustainability dimensions are possible. For example, it is assumed that high economic gains can outweigh deficits in environmental and social dimensions. On the other hand, economic sustainability in the DR is seen to be grounded in environmental and social sustainability. Hence, a bargain between sustainability dimensions is not possible due to the fundamental role of ecosystem health and societal well-being.

A further fundamental difference between the DSAT and the DR is whether economic growth is seen as a means to achieve social well-being (as in DSAT) or whether it is seen as a byproduct of paying attention to and nurturing other dimensions of well-being, such as connectedness (as in DR). Moreover, in the latter case where economic flourishing is a byproduct of fostering social connectedness, one can imagine that economic benefit may be more evenly distributed than in cases where attention is primarily focused on supporting the economic growth of some selected farming enterprises such as large-scale pineapple producers (see table 2 in section 3.3, part "Solution Strategies", row "Social Practices", column "DSAT")

Next to a different perspective on sustainability per se, and pathways to economic sustainability in particular, the DSAT and DR also differ in their view on environmental sustainability: The ecological dimension differs profoundly between a land sparing approach (DSAT) and a land sharing approach (DR). DSAT promotes intensive agriculture to produce high yields on a limited piece of land, in order to allow for strict nature protection in other areas. RA, by contrast, espouses practices to allow for biodiversity and environmental protection on agricultural sides, which can, however, be associated with a comparatively lower yield, especially during transition periods. In addition, a distinction with regard to temporality in the two paradigms becomes evident: On the one hand, DSAT continues to build on a system whose (ecological and social) foundational stability has begun to falter, e.g., with increasing extreme weather events, like droughts, or socio-political shocks affecting the availability of necessary artificial inputs like fertilizer. On the other hand, RD aims to restructure agricultural systems to become more resilient to such shocks in the future. Weaning the land from an input-dependent management system to establish a more self-sustaining, regenerative system, and the temporal possible accompanying productivity losses are regarded as an investment into future farm viability.

Nevertheless, the differences in focus on selling to the world market (DSAT) and supporting regional economies (DR) make a comparison between both paradigms futile. The world market satisfies demands for agricultural products that are external to Costa Rica. This demand shows the trend to be continuously growing for products as pineapple, which results in a similar trend for land consumption of the agriculture sector.

Moving to social sustainability and potential links to green tourism, we revealed that while the DSAT shows limited compatibility with the tourism sector, the DR could even complement green tourism in national parks with a socio-cultural dimension. This aspect was also raised in an interview with a Costa Rican farmer who recommended establishing more opportunities for green tourism on farms, meaning that non-farming people get the chance to spend a day or several days on a farm, actively participating in farming tasks. Thereby, the visitors would get the chance to gain more in-depth insights into the reality of farmers' lives and a better understanding of the amount of time and effort it takes for a plant to grow and eventually harvest the food that nourishes them. Ultimately, such on-farm-tourism would, on the one hand, provide farmers with an additional source of income, supporting their livelihoods, while on the other hand, it would potentially also lead to a greater appreciation for food among the visiting tourists (which, in turn, may reduce food waste), and a greater sense of connectedness with farmers and with nature. Even though the interview partner sketched these ideas with respect to farmers and their surrounding communities, the basic idea can be easily extended to people from across the country and even international tourists. Linking back to what has been noted above for the DR take on pathways to economic sustainability, we again see a strengthening of the economy through a strengthening of the community (social connectedness).

Reflecting on the specific agricultural practices that are viewed as conducive to sustainability across all three dimensions, we found that in the DR, tailoring practices to the specific needs and characteristics of local ecosystems and also of the respective social communities is seen as key for bringing about changes and establishing practices that are sustainable in the long run. Developing such case-specific solution strategies is seen to significantly benefit from the inclusion of local (including traditional and indigenous) knowledge. Such an inclusion of

local communities in the design of farming strategies does not only allow for the incorporation of the wealth of knowledge on the specifics of their respective environment (there is virtually no one who knows, e.g., the local soil conditions better than the farmers having cultivated it for sometimes decades). It also presents a bottom-up, emancipatory decision-making process, which may support the uptake of the developed practices and increase the sense of agency of the local communities involved (see also Schilling-Vacaflor and Ortland, this edition). By contrast, in DSAT, situated knowledge does not seem to play an important role or be emphasized at all. As the idea is rather to protect nature by separating it from agricultural enterprises, there is little reason for considering differences in the needs and characteristics of certain ecosystems when developing farming strategies. In our analysis, we could not find any indications for the DSAT taking nuances in local biophysical and/or social circumstances into consideration. Rather, there appears to be a general belief in the existence of one-size-fits-all strategies, e.g., the assumption that technological innovations are an effective approach to resolving sustainability issues across (biophysical and social) contexts.

When it comes to knowledge and uncertainty, another major difference may lie in what is seen as valuable sources of knowledge for transformation. In the DSAT, emphasis is clearly put on Western "scientific" knowledge to address epistemic uncertainties, particularly focusing on technological innovations. In the DR, by contrast, we noticed several notions referring to the (re-)appreciation of local and traditional knowledge, embodying a much broader definition of what eligible knowledge is. Here, transformation and sustainable futures are seen to be supported by knowledge from both practice and research (ontological). Additionally, our interviews revealed alternative ways to deal with the ontological uncertainties of nature through a higher resilience based upon crop diversity and protection of nature's contributions for people.

Overall, considering the broader sustainability visions painted by the respective paradigms, one might say that while the DR promotes nature's relational values and pictures a future in which people and nature (and their respective well-being) are deeply intertwined, the DSAT rather emphasizes what Pereira et al. (2020) have coined the "nature for nature" and "nature for society" lens. That is, in the DSAT

emphasis is put on nature's instrumental values satisfying people's needs ("nature for society"), while it is assumed that the best way to protect nature's intrinsic values is to separate people from nature ("nature for nature").

Contemporary pineapple production is a symptomatic example of the negative effects of the sustainability approach taken by the DSAT. Accordingly, an interesting question is how pineapple planting could look under the DR paradigm. Following the core theme in RA of safeguarding and promoting biodiversity and soil health through intercropping systems, one can immediately see that the currently established pineapple monocultures would no longer be tenable.

In accordance with the DR's focus on local value chains and the strengthening of local communities, contemporary sales channels of pineapples too would need to shift with far more emphasis put on local markets and consumption. As a potential downside, on a larger scale, this would likely shrink the exports of pineapples and linked economic gains. However, such a step would also increase the credibility of the "exceptionalismo verde". Economic losses may also be counteracted through fostering agroecological tourism, which might become another unique selling point of Costa Rica. As we have illustrated above, this type of tourism would support local communities and might also nurture changes in people's relations to each other and to nature.

To support the development towards more regenerative agricultural systems, fostering exchange between governmental actors, civil society, and farmers is indispensable. Already implemented regenerative agriculture operations can serve as central learning opportunities. Civil society organizations can support this process by fostering knowledge integration across different contexts and operationalize knowledge collected across multiple farm contexts. Multiple such farmer-led alliances for RA exist. In Costa Rica, the Costa Rica Regenerativa (CRR) initiative bundles national efforts to scale RA and supports cooperation and learning opportunities between and for government officials, extensionist services, and farmers.[1] The European Alliance for Regenerative Agriculture (EARA) has recently proposed several policy recommendations, for example, the coupling of governmental agricultural subsidies

1 https://en.costaricaregenerativa.org/

to positive agroecological farm performance to foster climate change resilience (EARA, 2024).

Our analysis is based on the comparison of two distinct agricultural systems through a paradigm lens. Most insights on the DR paradigm were based on different case studies of regenerative agricultural systems conducted by part of the author group. The analysis is mainly based on the Costa Rican DR context. To further develop our analysis and its scope, the inclusion of a broader study base would be beneficial. A systematic comparison of RA systems in diverse contexts (within Costa Rica, as well as cross-culturally) is currently missing and could greatly benefit our understanding of RA. Given by the lack of empirical studies on RA systems, knowledge synthesis and theory-building around the DR paradigm are, so far, missing in the research field.

Conclusions

Sustainability has a special importance in Costa Rica as exemplified by the "exceptionalismo verde" which is a central part of the country's national identity. However, sustainability can be interpreted differently. In our contribution to this special issue, we explored two such interpretations of sustainability and their approach to pineapple production: (1) the DSAT which focuses on sustainability through economic growth and promotes agricultural production with high yields for the world market; and (2) the DR which presents a more nuanced and diverse approach to agriculture, also including socio-cultural aspects and focusing on the strengthening of regional economies.

To disentangle the complexity of both sustainability approaches and reveal more subtle facets, we applied the paradigm concept. This allowed us to compare both approaches and explore similarities and differences between them. Overall, we could find only limited commonalities. The differences appeared to be profound though, crossing diverging perspectives on the meaning of sustainability in general and pathways to economic, environmental, and social sustainability and their interlinkages in particular. Ultimately, the DSAT and the DR embody two very different sustainability visions, for pineapple production in particular and agriculture in general.

But also regarding the relationship between Costa Rican people and nature, both paradigms seem hardly reconcilable. Notably, it is only the DR that can effectively accommodate green tourism in the agricultural landscape. From our point of view, linking RA and tourism shows a high potential as it could simultaneously promote local livelihoods as well as offering novel ways for people to connect with each other and nature. To clarify the specifics and explore efficient strategies to such a combination of RA and green tourism, more research is needed, e.g., identifying already existing initiatives in CR in this direction and analyze the specific approaches taken.

Our research underlines the need to go beyond practical dimensions of sustainability, such as a particular practices and solution strategies, towards also addressing the underlying epistemological, ontological and value dimensions. Uncovering the roots of sustainability paradigms promise a deeper understanding of conflicting worldviews and strategies to deal with uncertainties. The RA paradigm thereby opens new pathways towards dealing with current polycrises through more resilient solutions.

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