7th International Research Workshop on

Archetype Analysis in Sustainability Research

June 16-18, 2024

College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES)

University of the District of Columbia (UDC)

Washington DC, USA (and hybrid)

A warm welcome to the 2024 Archetype Workshop! The University of the District of Columbia (UDC) and its College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) is pleased to be hosting this year's workshop. The workshop will begin on Sunday, June 16 with a welcome reception at 5:30 PM in the UDC Student Center at 4200 Connecticut Ave, NW, Washington DC, 20008. Please follow signs to Heritage Hall.

The venue is located right next to the Van Ness/UDC metro station on the red line of the Washington DC subway system. The location can be easily reached by metro from Dulles International Airport and Reagan National Airport.

The workshop will be held at 4250 Connecticut Ave. on the 5th floor also referred to as the CAUSES floor. The opening plenary will start promptly at 9:00 AM on Monday, June 17. All break-out session rooms are also located at 4250 Connecticut Ave. on the 5th and 6th floor.

The workshop schedule as well as some practical information regarding remote participation, contact information etc. follows. Please do not hesitate to contact us should you have any questions. We look forward to seeing you at the 2024 Archetype Workshop!

Your local organizing committee: Sabine O'Hara
Andre Coelho
Gayle George
Midas Hampton
Terri Merz
Jaleel Shujath

Contents

Scientific program committee: Responsible for the program

- Diana Sietz, Thünen Institute of Biodiversity, Germany
- Hanna Ekström, Department of Political Science & Centre for Environmental and Climate Science, Lund University, Sweden
- Rimjhim Aggarwal, School of Sustainability, College of Global Futures, Arizona State University, USA
- Matt Williamson, Human-Environment Systems, School of Environment, Boise State University, USA
- Christian Levers, Thünen Institute of Biodiversity, Germany

2 Sessions and presentation formats

Sessions consist of combinations of two types of presentations:

- **Pitch presentations**: each presenter will have 15 minutes in total for presentation and discussion.
- **Full paper presentations**: each presenter will have 30 minutes in total for presentation and discussion.

Facilitators have been identified who will make sure all presenters stay within their allotted time.

Discussants are assigned for each paper (see session tables). Please send your paper to the local team **by 13 June** so that the discussants can read it beforehand.

An exception is **Session 4** entitled 'Testing archetype analysis with artificial data'. This is a topical discussion group and does not consist of presentations. The aim of this session is to set up a "game" in which some people hide archetypes in artificial data and others try to discover them based on the data.

There is also room for **break-out sessions:** These are informal sessions that invite all participants to share their ideas. The format of the breakout sessions will be jointly determined by the participants in each session.

3 Workshop program (all times in Eastern Daylight Time – EDT)

Sunday, 16 June 2024

Time	Session Title	Location
5:30 PM	**Registration + Opening Reception**	UDC Student Center at 4200 Connecticut Ave. In-person only.

Monday, 17 June 2024

Time	Session Title	Location
9:00 AM	Orientation to Archetype Analysis – a panel conversation with established and new archetype researchers	Multipurpose Room, 5th floor, 4250 Connecticut Ave.
10:15 AM	Opening Plenary – Prosperity in Progress: A New Look at Archetypes of Successful Urban Community Development	Multipurpose Room, 5th floor 4250 Connecticut Ave.
11:15 AM	Coffee break	Kirkman library, 5th floor
11:45 AM (in parallel)	Session 1: Archetypes in urban areas I	Room 6340, 6th floor, 4250 Connecticut Ave.
	Session 2: Testing archetype analysis with artificial data	Room 6125, 6th floor, 4250 Connecticut Ave.
12:45 PM	Lunch	Multipurpose Room, 5th floor
2:00 PM (in parallel)	Session 3: Archetypes in urban areas II	Room 6340, 6th floor, 4250 Connecticut Ave.
	Break-Out Session 1	Room 6125, 6th floor
3:00 PM (in parallel)	Session 4: Tropical forests/deforestation/governance	Room 6340, 6th floor, 4250 Connecticut Ave.
	Break-Out Session 2	Room 6125, 6th floor.
4:00 PM	Coffee break	Kirkman library, 5th floor.
4:30 PM	Afternoon Plenary/ Debrief	Multipurpose Room

Tuesday, 18 June 2024

Time	Session Title	Location
9:00 AM (in parallel)	Session 5: Agriculture	Room 6340, 6th floor
	Session 6: Climate	Room 6125, 6th floor
10:15 AM (in parallel)	Session 7: Resource governance	Room 6340, 6th floor
	Session 8: Methods	Room 6125, 6th floor
11:15 AM	Coffee break	Kirkman library, 5th floor
11:45 AM	Closing Plenary	Multipurpose room, 5th floor
12:45 PM	Lunch	Multipurpose room, 5th floor
2:00 PM	Fieldtrip	Leave from the 'kiss & ride' behind 4250 Connecticut Ave.
5:30 PM	Return to the UDC campus	

Workshop Abstracts

Session 1: Archetypes in urban areas I

Title	Presenter	Discussant
Pitch: Archetype analysis of urban climate responses using topic modeling of cities' climate adaptation policy documents	Eve Castille	Wenkai Bao
Full paper: Mapping social-ecological system archetypes to reveal archetypical human-environmental interactions in urban agglomerations	Wenkai Bao	Eve Castille

Archetype analysis of urban climate responses using topic modeling of cities' climate adaptation policy documents
Eve Castille

Cities describe their goals and strategies to adapt to climate change in adaptation plans. These plans offer a window into how the cities perceive and plan to respond to climate change. The topics discussed in these plans may be the same or differ from other cities with similar characteristics, such as the city's climate risk and vulnerability, regulatory context, or network membership. We propose that by analyzing the focal topics in the adaptation plans and the cities' characteristics, we may find different archetypes in how the cities plan to adapt and how that relates to their context. Doing this type of analysis at scale presents a challenge. However, recent advances in computational text analysis provide tools for researchers to mine large text corpora. We propose using topic modeling to analyze adaptation plans for the cities that have submitted adaptation plans in English to the Carbon Disclosure Project (CDP)—a subset of the 573 cities, states, and regions that submitted plans in 2022. We will derive key topics in goal-setting statements and strategies. Recent regulations and conventions have made public policy documents available online, presenting novel opportunities to analyze adaptation plans across cities and countries. Topic modeling has been used to generate archetypes from social media and educational and professional data; however, we are unaware of any applications to climate governance archetype analysis. We propose that these innovations may enrich the urban climate governance research agenda and provide a novel way to demonstrate how cities describe their approach to climate change adaptation and which contexts may influence those strategies. This project aims to develop methods to identify (in)congruences between climate adaptation plans and the social, ecological, and regulatory contexts in which they are created.

Mapping social-ecological system archetypes to reveal archetypical human-environmental interactions in urban agglomerations
Wenkai Bao

Scaling up case-based knowledge to understand human-environmental interactions is key to addressing the sustainability challenges we face in the Anthropocene. Mapping social-ecological system (SES) archetypes has emerged as a promising tool in identifying these interactions in a spatially explicit manner and developing transferrable sustainability solutions based on context-specific challenges. However, state-of-the-art SES archetype mapping is mainly bound to administrative borders. Lack of spatial details in SES maps does not always capture the panorama of SES configurations and hidden mechanisms. Empowered by multiple open-access geospatial big data streams, this study mapped two-tier nested SES archetypes at 1 km fine resolution in

the Beijing-Tianjin-Hebei (BTH) urban agglomeration with high validation accuracy. Global SES archetypes derived from top-down rule-based classification revealed broad social-ecological configurations and social-ecological gradients across SESs. Meanwhile, regional SES sub-archetypes generated by bottom-up hierarchical clustering presented detailed SES characteristics that helped to identify location-specific sustainability challenges. Additionally, by scrutinizing the relationships among SES variables, we identified empirical evidence supporting the existence of four archetypical human-environmental interactions in an urban agglomeration area, manifesting as telecoupling between human and environment, human dependence on the environment, human adaption to the environment, and human modification and conservation of the environment. Generally, fine-resolution SES archetypes demonstrate great potential in supporting the recognition of local needs and gaps in existing policies, and further promoting sustainable landscape management in the BTH region and similar regions.

Session 2: Testing archetype analysis with artificial data

Title	**Presenter**
Testing Archetype Analysis with Artificial Data	Open group discussion led by Klaus Eisenack

Testing archetype analysis with artificial data

The topical discussion group aims for progress with the methodological toolbox of archetype analysis, including the linking of qualitative with quantitative data-analytic methods. It might contribute to further advance the conceptual understanding of archetypes. The idea is to set up a "game": Some people hide archetypes in artificial data, and others try to recover them from the data. Such exercises have also been used for assessing other methods. The group will discuss how this approach can be put into practice, and whether it has potential for a scientific paper. Such a paper might present artificially generated data set(s) for further use, and report on various experiments of archetype recovery. While invented archetypes would be "designed into" the artificial data, recovering them is only based on the (qualitative/quantitative) data, without further information (e.g., the number of archetypes). Then, various scholars can freely choose their preferred methods (e.g., cluster analysis, network analysis, formal concept analysis, interpretive methods, machine learning), and assess them against these data set(s). The exercise opens several interesting questions. How to generate/simulate artificial data set(s) that mix quantitative and qualitative information, and which admit an archetype analysis? What information about the artificial data needs to be disclosed? How does the choice of the data-analytic method (and the way the data is generated/dis-enclosed) shape the results? Can we sharpen, when generating data, our theoretical understanding about what is actually meant by the “number of archetypes”? Can we improve on how to navigate different levels of abstraction when we feed archetypes at multiple levels into data generation? In the context of the archetype workshop, one advantage of this approach is that we can concentrate on data analysis, and do not need to do empirical research on a shared substantive topic.

Session 3: Archetypes in urban areas II

Title	Presenter	Discussant
Pitch: A data-driven approach to identifying archetypes of farmland loss as a result of population growth and socio-economic development in a rapidly changing agricultural landscape in the western United States	Carolyn Koehn	Matteo Roggero
Full paper: Case-driven archetypes: challenges and potentials	Matteo Roggero	Carolyn Koehn

A data-driven approach to identifying archetypes of farmland loss as a result of population growth and socio-economic development in a rapidly changing agricultural landscape in the western United States
Carolyn Koehn

Approximately 1.5 million km^2 of land has been converted from agriculture to urban and highly developed areas between 1992 and 2018, transforming the global rural-urban continuum. The processes leading to conversion of agricultural lands in rural and peri-urban areas are variable and often highly localized. A better understanding of the different processes of farmland loss and their associated drivers and consequences can advance knowledge of land use changes that alter the rural-urban continuum and inform the development of effective, diverse toolboxes of agricultural lands protection. Idaho's Snake River Plain is an agricultural landscape that is experiencing increasing conversion pressure in the absence of state land protection policy. We hypothesize that this conversion is typified by three distinct, detectable archetypal processes: urban sprawl, industrial expansion, and amenity migration. I will test this hypothesis by using freely available geospatial datasets and archetype analysis to identify five “building block” archetypes for each of the approximately 13 counties with threatened agricultural lands: spatio-temporal farmland patterns, agricultural indicators, socio-economic indicators, land use indicators, and nature’s contributions to people. Insights from these archetypal combinations can then be used to identify appropriate land protection policies for localities experiencing different types of farmland loss. Our analysis will help illuminate farmland loss patterns and protection strategies in our study area, and our workflow can be used in other regions with a rural-urban continuum to describe processes of land use change.

Case-driven archetypes: challenges and potentials
Matteo Roggero

Archetype Analysis aims at the middle way between purely nomothetic and purely idiosyncratic approaches. In a nutshell, it tries to establish a dialogue between the complexity of real-life situations and the need to generalize observations to broader populations. Some advances are available on the topic of validation, providing guidance on how to established a link between archetypes observed and case-level evidence. Validation, however, is a one-way street: it implies that configurations come first, and that a dialogue with case-level evidence is established after the fact. In this talk, we raise the question whether taking the opposite approach also has a merit, and reflect on the challenges and implications this has for building up an archetype analysis. Specifically, we report about two "paper-siblings": two papers addressing emission reductions in cities and based both on (almost) the same data, but focusing on data-driven vs. theory-driven archetypes. Surprisingly, establishing a dialogue between configurations and cases remained a challenge, raising the overarching question whether methodological improvements are still

necessary before case-driven archetypes are feasible, or whether instead future archetype analyses are better off taking configurations as a starting point.

Session 4: Tropical forests/deforestation and governance

Title	Presenter	Discussant
Full paper: Why do forests persist and re-emerge amidst tropical deforestation pressures? Archetypes of governance and impact pathways	Frank Mintah	Karla Vergara Rodríguez
Pitch: Unveiling the Deforestation Frontiers' Dynamics and their relationship with well-being in the Peruvian Amazon	Karla Vergara Rodríguez	Christoph Oberlack
Pitch: Sustainability governance in the coffee and cocoa value chains of Switzerland and Peru: Towards archetypical theories of change	Christoph Oberlack	Frank Mintah

Why do forests persist and re-emerge amidst tropical deforestation pressures? Archetypes of governance and impact pathways
Frank Mintah

Tropical deforestation pressures remain high, but in some areas, forest cover persists, re-emerges, or even expands. Uncovering the driving factors of such a shift has incessantly focused on biophysical and economic development changes, especially at national and regional levels, but evidence on the role of governance remains case-based and inconsistent. This article investigates the role of governance systems and institutional arrangements at the local level in fostering forest re-emergence and their persistence over time. Using an archetype approach, this study conducts a meta-analysis of empirical studies to identify recurrent patterns of institutions and their impact pathways that explain how forest persistence and re-emergence in the tropics occur. In the first analytical step, text segments of selected cases (42 papers) were (double) coded adopting the Combined Institutional Analysis and Development Framework and the Social-Ecological Systems framework (CIS). The coded variables indicating governance elements of the SES framework were exported as binarized Excel data into the R software for hierarchical cluster analysis. This step was used to develop archetypes of institutional arrangements that influence sustainable forest outcomes. The result was visualized with the *pheatmap* package in R. The second analytical step adopted Formal Concept Analysis (FCA) to identify archetypical impact pathways toward forest persistence or re-emergence. The FCA was done using the Concept Explorer software. The FCA therefore helped to build concept lattice from the models coded that showed logical and hierarchical connections between models (objects) and their attributes. The results show that forest persistence and re-emergence can be achieved through four archetypical pathways: collective action, adaptive collaborations, decentralization and recognition of local management, and cultural protection. These corroborate with collaborative institutions, mixed formal and informal institutions, and customary institutions. Chiefly, these institutions and impact pathways emphasize the relevance of local social agencies and institutions, including customary institutions, as precursors for forest re-emergence and persistence, with or without external actors' involvement. Also, collaborative governance systems that are adaptive to local norms of resource governance are more likely to produce sustainable outcomes. Yet, results also reveal that forest persistence and re-emergence, to some

extent, have socio-economic trade-offs. This study provides insights into entry points for restoration governance and interventions amidst deforestation pressures in the tropics. Taken together, the archetype analysis made it possible to trace recurrent patterns across different places. Since case studies are limited in their external validity, this methodological approach enabled the development of aggregated knowledge through the synthesis of patterns that explain the persistence and re-emergence of forests.

Unveiling the Deforestation Frontiers' Dynamics and their relationship with well-being in the Peruvian Amazon
Karla Vergara Rodríguez

Deforestation severely threatens Tropical Moist Forests (TMF) in the Amazon region, including the livelihoods and the well-being of Amazonian populations. Although the Peruvian Amazon is the second largest area of TMF and a hotspot of bio-cultural diversity, research on the impacts of deforestation on social-ecological systems is limited. There is a lack of understanding of deforestation patterns, trends, and social-ecological interactions in deforestation frontiers, highlighting the need for research. Archetypes can be used to analyze deforestation frontiers, as they allow us to identify and understand complex patterns in a multidimensional manner. This work studies the dynamics of recurrent and emerging temporal deforestation patterns in the Peruvian Amazon using archetype analysis (AA). The approach will involve constructing Deforestation Frontier Archetypes (DFA) and Social-Ecological Frontier Archetypes (SEFA) to detect forest loss patterns and critical roles played by various actors and activities over time using nesting typologies. It will also analyze through workshops the influence of these frontiers and their dynamics on the well-being of ecosystems and populations in three regions of the Peruvian Amazon. The study will provide maps and graphics of the dynamics of deforestation frontiers for the Peruvian Amazon through DFA and SEFA. It will identify local perceptions of SEFA, the causes and dynamics of deforestation, and land-use change in selected case studies. It will also assess the relationship between deforestation frontiers and social-ecological well-being. Incorporating AA and people's perspectives is expected to advance our understanding of complex deforestation dynamics and their causes and disentangle its relationship to social-ecological well-being in the Peruvian Amazon. The study takes a transdisciplinary approach to ensure inclusivity and comprehensiveness to inform effective conservation and sustainable management strategies in the Peruvian Amazon that could be replicated and benefit the Amazon region and Humid Tropical Forest.

Sustainability governance in the coffee and cocoa value chains of Switzerland and Peru: Towards archetypical theories of change
Christoph Oberlack

Companies, cooperatives and other private-sector actors experiment with diverse governance strategies to contribute to sustainable development. Certification schemes, inclusive business and solidarity economy belong to the most pertinent strategies. Many of them are underpinned by theories of change, i.e., causal statements explaining how and why certain activities trigger certain outcomes and impacts for sustainable development. Different theories of change are partly incompatible with each other. However, the precise complementarities and antagonisms of multiple theories of change behind sustainability governance strategies remain elusive. Therefore, we aim to identify archetypical theories of change that explain how, why and under which conditions private sustainability governance can overcome deforestation and poverty traps. Empirically, we draw on semi-structured interviews to elicit theories of change with n=15 companies and cooperatives along all stages of cocoa and coffee supply chains in Peru and Switzerland. Our results show that the strategies differ significantly in terms of key actors,

activities and their underlying rationales. Despite this diversity, we find archetypical causal mechanisms that explain how and why particular strategies generate particular outcomes. We identify reinforcing and counteracting dynamics in theories of change. Thereby, we aim to contribute to advance theoretical foundations of contemporary sustainability governance.

Session 5: Agriculture

Title	**Presenter**	**Discussant**
Pitch: Exploring Pedagogical Archetypes in Agroecology Initiatives of the Global South	Michelle Bonatti	Tomas Vaclavik
Full paper: Farming system archetypes help explain the uptake of agri-environment practices in Europe	Tomas Vaclavik	Michelle Bonatti

Exploring Pedagogical Archetypes in Agroecology Initiatives of the Global South
Michelle Bonatti

Agroecology is a transformative paradigm that seeks to change agricultural practices by incorporating ecological principles and social equity. Education plays a central role in this transformation process, requiring an understanding of how individuals learn and the most effective pedagogical pathways to foster agroecological principles. Although pedagogical models are critical to the agroecological transformation process, the literature lacks information on the diversity and effectiveness of these educational approaches, especially in the Global South. This study aims to bridge this gap by identifying and analyzing the archetypes of pedagogies applied in agroecology initiatives in Colombia, Peru, and Brazil. The aim is to gain a nuanced understanding of the educational landscapes in these regions. The research methodology employs a mixed-methods approach, including a literature review, semi-structured interviews (n 60), and participatory workshops with farmers. Preliminary findings reveal the emergence of three distinct pedagogical archetypes. Living Pedagogies, which emphasize experiential learning and community engagement; Resistance Pedagogies, which focus on the empowerment and mobilization of farmers against oppressive agricultural practices; and Formal Education Pedagogies, which integrate agroecology into traditional educational frameworks. This study adds to the current knowledge by establishing a fundamental comprehension of the pedagogical models that form the basis of agroecology in the Global South. This provides valuable insights from archetype analysis to understand how educational practices can be improved to promote sustainable agricultural transformations

Farming system archetypes help explain the uptake of agri-environment practices in Europe
Tomas Vaclavik

The adoption of agri-environment practices (AEPs) is crucial for safeguarding the long-term sustainability of ecosystem services within European agricultural landscapes. However, the tailoring of agri-environment policies to the unique characteristics of farming systems is a challenging task, often neglecting local farm parameters or requiring extensive farm survey data. Here, we develop a simplified typology of farming system archetypes (FSAs), using field-level data on farms' economic size and specialisation derived from the Integrated Administration and

Control System in three case studies in Germany, Czechia and the United Kingdom. Our typology identifies groups of farms that are assumed to react similarly to agricultural policy measures, bridging the gap between efforts to understand individual farm behaviour and broad agri-environmental typologies. We assess the usefulness of our approach by quantifying the spatial association of identified archetypes of farming systems with ecologically relevant AEPs (cover crops, fallow, organic farming, grassland maintenance, vegetation buffers, conversion of cropland to grassland and forest) to understand the rates of AEP adoption by different types of farms. Our results show that of the 20 archetypes, economically large farms specialised in general cropping dominate the agricultural land in all case studies, covering 56% to 85% of the total agricultural area. Despite regional differences, we found consistent trends in AEP adoption across diverse contexts. Economically large farms and those specialising in grazing livestock were more likely to adopt AEPs, with economically larger farms demonstrating a proclivity for a wider range of measures. In contrast, economically smaller farms usually focused on a narrower spectrum of AEPs and, together with farms with an economic value <2 000 EUR, accounted for 70% of all farms with no AEP uptake. These insights indicate the potential of the FSA typology as a framework to infer key patterns of AEP adoption, thus providing relevant information to policy-makers for more direct identification of policy target groups and ultimately for developing more tailored agri-environment policies.

Session 6: Climate

Title	**Presenter**	**Discussant**
Pitch: Suiting the remedy to the case: Archetypical patterns of national climate mitigation action	Yujie Zhu	Mimi Gong
Pitch: Unveiling complementarities between mangrove restoration and global sustainable development goals	Mimi Gong	David Bernal Hoyo
Full paper: Archetypes of vulnerability in rural Spain: Understanding the dynamics of climate change, depopulation and globalization impacts	David Bernal Hoyo	Yujie Zhu

Suiting the remedy to the case: Archetypical patterns of national climate mitigation action
Yujie Zhu

This study aims to explore how diverse national interests lead different types of countries to reduce carbon emissions, to provide theoretical support and practical references for better motivating various countries to realize the global collaboration of climate governance during international climate negotiations. Based on the joint effects of economic, political, social and natural factors, this study adopts methodological systemism of archetype analysis and extracts 7 archetypes from the practices of carbon emission reduction (CER) in 145 sample countries, identifying the national interests underlying nationally determined contributions (NDCs), including elite interest, economic vulnerability, green economy opportunity, socioeconomic request, sustainable development risk, national competence and green and low carbon. Each archetype elaborates upon the mechanisms by which multiple factors jointly determine the national interests of CER and its practical actions.

Unveiling complementarities between mangrove restoration and global sustainable development goals
Mimi Gong

Mangrove forests have been acknowledged for their rich ecosystem services in combating climate change with high carbon storage capacity, conserving biodiversity, supporting livelihood, etc. As a significant and distinguished ecosystem, current mangrove conservation policies focus on expanding its habitats for a cascading positive effect on the nearby environment. However, mangrove restoration has a low success rate in non-mangrove habitats, and overexpansion may impede overall sustainability. To uncover the other potential policy pathways considering both mangrove forests and overall sustainability, we can construct a 'Mangrove-SDG-climate space' and conduct a network analysis to unveil the complementarities in the nexus. The space can be constructed following the 'product space' method in economics by assessing each pair of interaction's comparative advantage and their co-occurrence. We can then measure the interaction archetypes by community detection in network analysis, which can provide insights into the similar interaction's functionality through the complementarity clusters in the space. The last step is to synthesize these interaction archetypes through case studies to enhance understanding of particular phenomena for tailoring policies and actions in case-by-case contexts.

Archetypes of vulnerability in rural Spain: Understanding the dynamics of climate change, depopulation and globalization impacts
David Bernal Hoyo

Climate change, globalization of agricultural markets, and depopulation jointly impact rural areas in Europe by intensifying weather extremes, disrupting local farming practices, and contributing to rural decline. Some policies have addressed these stressors separately with mixed results. For example, measures to intensify agriculture have contributed to the competitiveness of family farms in the global market context but also reinforced rural migration and dependence on water resources as well as undermined social capital. In the past decades an increasing volume of researchers have addressed interactions between climate change and social environmental stressors, such as market liberalization, or global pandemics. Still, there is a noticeable lack of attention to depopulation dynamics. Depopulation is not only an endemic problem but also a key component of self-reinforcing processes of economic and environmental degradation in rural Europe. Furthermore, there is a clear gap in the development of generalized computational complex adaptative system models, grounded in local knowledge. Such models have the potential to facilitate scenario exploration, fostering local dialogue, and aiding in the formulation of strategies that are contextually relevant. Bridging these gaps is crucial for a more holistic understanding of the complex interplay between socio-demographic changes and environmental stressors, ultimately informing resilient and locally tailored strategies. Our study contributes to this literature by employing an archetypes analysis over models derived from local discourses. We conducted 12 focus group interviews across four rural entities, engaging with stakeholders from the primary sector, agrifood, tourism, and immigrant communities. These groups were selected through local action groups and administrations to ensure a comprehensive understanding of sector-specific challenges. Our methodology sought to elicit detailed insights into the perceived effects of climate change, globalization, and depopulation on local practices, incorporating specific instances such as wildfires and soil erosion to deepen our inquiry. The transcription and subsequent analysis of these interviews employed qualitative methods to extract key variables and their causal interconnections, culminating in the creation of 12 causal loop diagrams. From these, we distilled key feedback loops and the narratives that describe and

explain the core dynamics and stressors covered by each loop. Through this process, we not only elucidated the individual and collective impacts of the stressors but also highlighted the interdependencies between the loops, offering nuanced insights into the adaptive challenges and opportunities facing rural sectors in Spain. Our findings reveal recurrent patterns connecting the three stressors. Notably, certain archetypes highlight how globalization reinforces climate change vulnerability, mediated by depopulation trends. Other archetypes suggest the potential for mitigation strategies. This study contributes to the growing body of research emphasizing the need for comprehensive, integrated policies and paves the way for more targeted and effective interventions. Further research shall validate the identified archetypes in other contexts by exploring their recurrence and the mechanisms that justify them.

Session 7: Resource governance

Title	**Presenter**	**Discussant**
Full paper: Innovative governance approaches to the provision of ecosystem services: revealing archetypal dynamics	Stefan Sorge	Rongyu Wang
Pitch: Network configurations of linked action situations: Towards network archetypes of infrastructure, resource, and value chain governance	Christian Kimmich	Stefan Sorge
Pitch: Formal-concept based archetype analysis of environment and natural resource governance: Procedure and metrics	Rongyu Wang	Christian Kimmich

Innovative governance approaches to the provision of ecosystem services: revealing archetypal dynamics
Stefan Sorge

In times of increasing climate change and biodiversity loss, forest management approaches need to be adapted to ensure the sustainable provision of forest ecosystem services (FES) as contributions of ecosystems to human well-being. This research presents findings from the application of a structured yet flexible systems-based analytical approach for identifying drivers of societally demanded forest management innovations, the SETFIS analytical framework (Sorge et al. 2022). Forestry systems are conceptualized as socio-ecological-technical systems that provide specific conditions for novel governance approaches. Accordingly, we analyse these contextual conditions in five different regions in Europe and Colombia and study how they influence the emergence and development of governance approaches. Examples include novel payment schemes and compensation approaches for biodiversity restoration and offsetting tourism activities, as well as new actor alliances and networks linking local businesses with local providers of FES. The results show that the governance approaches studied are strongly influenced by the context in which they emerge, and vice versa. While we observe common patterns in influencing factors that seem to play a key role across cases, our research also integrates the exploration of archetypal dynamics within forest governance innovations. By examining the underlying archetypal patterns that govern the emergence and evolution of governance approaches, our aim is to uncover deeper insights into the systemic drivers that shape forest governance. Through this lens, we explore how archetypal dynamics interact with influencing factors to shape the design and implementation of novel governance strategies, culminating in the development of a topology of archetypes. These archetypes emerge through

various identified processes between the subsystems of actors, institutions, innovation processes, forest management and the ecosystem within governance innovation development. This research provides a nuanced understanding of the complex interplay between these influential factors, which can inform more effective approaches to sustainable forest management in the face of environmental challenges.

Network configurations of linked action situations: Towards network archetypes of infrastructure, resource, and value chain governance
Christian Kimmich

More than 30 case studies have been published in the last two decades that use a network perspective on linked action situations. There is considerable network heterogeneity between the cases, but many situation types are recurring. Do we find monitoring situations in all cases? How are they usually linked to other situations? When and how are discourse situations embedded in a network? Understanding such recurring patterns would improve the diagnostic procedure of tracing networks of action situations (NAS) considerably. While research on situation archetypes is already developed, including game-theoretic archetypes or the canonical distinction between provisioning, appropriation, or monitoring, for example, there is currently no work that studies NAS archetypes across applications. Conversely, recurring network patterns are a cornerstone of social and social–ecological network analysis, namely, the study of motifs. Motifs such as two-star, three-star, reciprocity, transitive triad, cyclic triad, and four-cycle offer different network configurations of how social actors, policy venues, and ecological entities are connected in one-mode, bipartite, and multilevel networks. Motifs are associated with governance challenges and related hypotheses have been tested already in the cases of CPR governance, social–ecological fit, or polycentric governance. Motif analysis uncovers interdependent processes of network formation and actors' behavior. Before interrogating archetypal NAS configurations, we discuss insights on network motifs in relation to archetypes research. Then, we first aim to match the empirical situations in each case study with archetypal situations that have been proposed in the literature. Second, we aim to study configurations of situations within larger networks to identify recurring motifs of linked situations. In a third step, we compare all existing samples of whole networks, and identify similarities and differences between these networks. For each archetype layer, we draw conclusions for situation analysis, the analysis of configurations and motifs, and the analysis of complete networks.

Formal-concept based archetype analysis of environment and natural resource governance: Procedure and metrics
Rongyu Wang

Research on the governance of land-use and natural resources increasingly employs archetype analysis, but still requires some methodological advances. One gap we address are rigorous procedure and metrics for generating the appropriate number of archetypes by formal concept analysis (FCA). This study thus proposes a general, orderly and replicable procedure to enhance standard FCA to firstly treat attributes and outcomes independently, and then to choose the appropriate number of archetypes by combining formal concepts of attributes and outcomes based on the metrics. Some steps can be done with conventional software packages, while other steps are qualitative. We illustrate the procedure by replicating the data analysis part of previously published archetype analyses of environment and natural resource governance. This admits to delve into the particularities of each step, show how to circumvent some possible pitfalls, and assess the strengths and limitations of the procedure. Our potential findings are as follows: 1) the archetype extraction by FCA is a four-step procedure that generates initial formal

concepts with complicated attributes, refines formal concepts based on quantitative metrics and by removing the replaceable attributes according to the implication rules, selects candidate suites of archetypes from the refined formal concepts based on quantitative metrics, and identifies archetypes from the candidate suites based on qualitative metrics; 2) the quantitative metrics include consistency, coverage, lift and richness; 3) the qualitative metrics concern theoretical and practical coherence. In conclusion, this study suggests that archetype analysis reveals robust casualties and depicts leading mechanisms of social-ecological interactions. FCA is supposed to continuously approach a balance between explanatory and applicable powers by setting a proper diversity level of attributes. Thus, more empirical study efforts are required to improve the quantitative and qualitative metrics of archetype identification.

Session 8: Methods

Title	Presenter	Discussant
Full paper: Archetypes in a changing world Dynamic Archetype Analysis for sustainability research	Richard Orozco	Stefan Partelow
Full paper: Synthesizing archetypes of social-ecological systems: identifying common building blocks	Stefan Partelow	Richard Orozco

Archetypes in a changing world Dynamic Archetype Analysis for sustainability research
Richard Orozco

Archetype analysis has been used to study changes in a wide range of social-ecological systems. However, it is still an open question how to address the dynamic aspects of archetypes, considering changes of archetypes over time and their underlying drivers. By being able to capture change and dynamics in archetypes, we would be better equipped to theorize about causality in sustainability transitions. While seeing the concept as a community effort to be expanded and developed, here we conceptualize dynamic archetype analysis based on four categories: as an approach to identify patterns of change, as temporal building-blocks of stages, as snapshots of trends, and as mechanisms behind dynamics. Empirically, we see dynamic archetype analysis being concerned with patterns of variables, cases, or behavior over time, as well as feedback loops, triggers and thresholds. By approaching the concept through various methods, potential aims could be to reconstruct, explain or theorize on temporal observations, case histories and narratives, simulations, longitudinal or panel data from the past, but also to predict possible futures of cases. The aim of the current study was to develop our understanding of how archetypes evolve over time, and to explore possible methods to recognize dynamic aspects. This requires developing new approaches and advancing known analytical tools. We experimented with a portfolio of quantitative methods, inter alia, cluster analysis, causal loop diagrams and dynamic time warping. As case studies, we used data from the shared socio-economic pathways (SSPs), their supporting qualitative narratives and their three main drivers: population, urbanization, and gross domestic product. The data is available as time series including a historical data set, year 1980-2010, and future projections until year 2100. Spatially, the data was analyzed based on countries, regions, and aggregated macro regions. Our results showcase promising methods for generating dynamic archetypes, and empirical insights gained from the different approaches. In identifying mechanisms of change for SSPs in UK, we derive varying degrees of likelihood of transitioning between different SSPs. Looking globally at clusters of countries following similar SSP pathways, that countries differing in observed historical pathways share future projected SSP patterns of change. Building on our experience, we make a proposition for how to expand the eight core principles for archetype analysis to also

cover dynamic archetype analysis. To conclude, we review the lessons learned, suggest purposeful methodological choices, outline remaining challenges, and provide recommendations on how to further develop a formal dynamic archetype analysis. This is a milestone to better understand system changes over time and to develop resilience and adaptation mechanisms to an ever-changing world.

Synthesizing archetypes of social-ecological systems: identifying common building blocks
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A growing number of studies have applied the social-ecological systems (SES) framework with its standardized set of variables to examine place-based variables and outcomes of environmental governance. Yet, due to the wide diversity of social-ecological systems, a general theory about how variables interact and systems can be governed lacks empirical support. Despite many case studies, knowledge cumulation is hindered by data heterogeneity, and by the difficulties to synthesize a large number of cases into middle-range theories, possibly understood as repeatedly occurring patterns of the larger theoretical puzzle of environmental sustainability, in a manageable way. Thus, this paper aims to cumulate knowledge by identifying repeated configurations across 71 models from SES framework case studies using archetype analysis. We identify eight archetypes, each characterized by a triad (configuration of three variables), an explanation of this configuration, and qualitative example cases from the coded literature. The triads relate to, for example: shared operational agency; small remote households; property and accountability; or formal investment conditions. Further, we re-visit several cases to illustrate how multiple archetypes can be combined like building-blocks. We argue that identifying these recurring archetypes advances the field because it allows scholars to focus their theorizing and empirical research around a known set of triads. A relatively small set of triads can be combined in various ways, like building-blocks, to represent the diversity of SES. More broadly, the paper contributes to advancing empirically supported claims about SES and environmental governance, and techniques for knowledge cumulation using archetype analysis.