

The Resilience Compass: A New Method for Navigating Community-Scale Transition Pathways

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Abstract: To address the implementation gap in community-scale Transition Design (TD), this paper introduces the Resilience Compass, a novel card-based facilitation method integrating Social-Ecological Systems (SES) resilience principles with TD backcasting. Iteratively developed through urban garden workshops in Shanghai and Auckland in 2025/26, the tool translates complex sustainability principles into accessible, localized prompts. It scaffolds non-expert participants through both imaginative visioning and subsequent action-planning. The primary contribution is methodological: providing a tangible, practice-ready artefact that empowers grassroots practitioners to operationalize systemic transitions. Ultimately, this research advances TD by demonstrating how theoretical ecological frameworks can be synthesised into generative, community-led design interventions.

Keywords: Transition Design, Design Methods, Backcasting, Social-Ecological Resilience, Co-Design, Community-based Transitions

1. Introduction

We are living in a period of profound systemic change, where intertwined social-ecological crises, including climate disruption and persistent social inequality, present complex and often intractable challenges (Berkes et al., 2008; Ceschin & Gaziulusoy, 2019). Addressing the climate crisis requires navigating complex systemic challenges through diverse approaches. While top-down, centralized environmental agreements remain essential components of global governance, a reliance on these mechanisms alone has often proven inefficient in driving timely, meaningful change (Meadows et al., 2004). This limitation highlights the necessity of complementing macro-level policies with localised, grassroots strategies that are highly responsive to their specific contexts (Baron, 2025; Seyfang & Smith, 2007). In response, Transition Design (TD) has emerged as a critical approach that aims to



catalyse long-term, systemic transformations toward more sustainable futures (Irwin, 2020; Kossoff et al., 2022). Still, TD's practical application is hindered by a recurring difficulty when designers attempt to operationalise it at the community scale (Gaziulusoy & Öztekin, 2018). We conceptualize this as the *abstraction gap*: the challenge of making long-term visions of social-ecological transformation applicable for neighbourhoods, volunteers, and local stakeholders, whose expertise is grounded in the places they inhabit rather than in abstract theoretical languages. This approach often leads to community disenfranchisement and low engagement. Without community support, the solutions are unsustainable, short-lived, and usually fail to address local needs fully (Baron, 2025; Campbell, 2021 & 2013).

The abstraction gap is particularly relevant in small social-ecological systems such as urban community gardens, where ecological processes (soil fertility, biodiversity, water cycles) are tightly coupled with social processes (volunteer turnover, neighbourhood trust, governance routines) within a lived-in place (Krasny & Tidball, 2015; Barthel et al., 2010). These micro-scale systems enable grassroots actors to drive sustainable transitions meaningfully, but in order to align their efforts with scientific advances, they might need expert facilitation support. Existing socio-ecological tools, however, tend to follow an expert-driven discourse, often too-complex to operationalize at a grassroots level, leaving these grassroots groups underserved in terms of practicality (Campbell & Brand, 2012). Additionally, participatory design methods enable communities to imagine desirable futures but rarely equip them to test whether those futures are systemically robust (Irwin, 2020; Kossoff & Irwin, 2021). Frameworks from sustainability science, including the seven principles for enhancing Social-Ecological Systems (SES) resilience (Biggs et al., 2012; SRC, 2015), offer analytically rigorous criteria but were not developed for participatory, design-led settings. Community practitioners are thus left with either imaginative TD methods that lack ecological grounding or rigorous ecological frameworks they may cannot readily put to work.

Backcasting, one of TD's signature processes, offers a productive entry point. It is a normative planning approach that begins with a desirable future vision and works backward to identify the actions necessary to connect that future to the present (Lambe et al., 2022; Kossoff et al., 2022). While effective for community engagement in urban community gardens, backcasting alone does not enough to equip non-specialist participants to ensure that the futures they envision are ecologically and systemically sound. The substantive grounding required to close that gap, we argue, can be provided by the SES resilience principles: diversity and redundancy, connectivity, slow variables and feedback, understanding SES as complex adaptive systems (CAS), learning and experimentation, broadened participation and polycentric governance (Biggs et al., 2012; SRC, 2015).

This paper introduces the *Resilience Compass*, a tool built around a set of seven cards that operationalises this integration. The cards are embedded into a four-step backcasting flow (Figure 1), where they function as guidelines that orient participants through the cognitive work of diagnosing the present and imagining the future without prescribing the answers. The tool was developed across an initial pilot

workshop and two subsequent iteration workshops, in Shanghai, China, and Auckland, New Zealand, over 2025-2026.

The contribution of this paper unfolds across three levels. The first concerns the methodological integration of TD backcasting and SES resilience: through this operational tool, TD gains substantive ecological grounding while SES resilience gains a design-led pathway into community practice. The second concerns the design logic of the cards: their dual-coded format, their symmetric present-future question structure, and the metaphorical strategies used to render scientific concepts tangible. The third concerns how the tool was tested and refined across two community workshops, in ways that reveal what design decisions are universal and what must be localised. Taken together, these threads offer other designers an artefactual prompt for embedding social-ecological thinking into community-scale transition work, and contribute to the TD framework a tangible example of what Irwin (2020) describes as "new ways of designing".

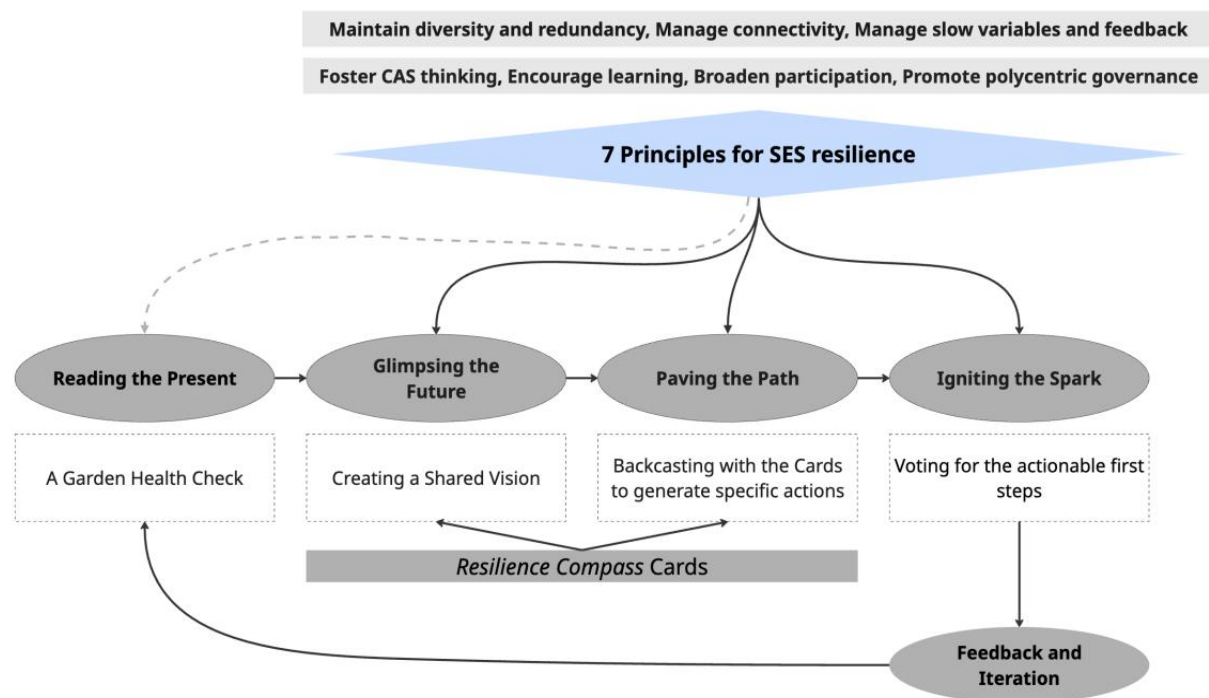


Figure 1: The four-step backcasting flow, adapted by the author from the seven principles model of enhancing SES resilience (Biggs et al., 2012; SRC, 2015) and a backcasting-led process by Kossoff et al. (2022).

2. Research Methodology

This research takes the form of a design-led inquiry into how TD backcasting can be operationalized at the community scale through a card-based tool. The study was conducted between 2025 and 2026 across three urban community gardens, two in Shanghai and one in Auckland, and unfolded in three sequential phases that together produced and refined the *Resilience Compass* (Figure 2). The research

received ethics approval from the University of Auckland Human Participants Ethics Committee (Reference: UAHPEC29089).

2.1. Research design

The research design follows a pilot-then-iteration logic characteristic of design research that develops practical artefacts through situated use (Hyysalo et al., 2019; Sanders & Stappers, 2008). Phase one, conducted in August 2025 at Garden A in Shanghai with seven participants, comprised a pilot workshop that ran a backcasting process without any structuring tool. The pilot was not intended to test a hypothesis but to clarify, through direct observation, what kind of tool would be needed at the community scale and what work such a tool would have to do. The empirical findings of this pilot and the design brief they generated are presented in Section 3.1. Phase two, conducted in March 2026 at Garden B in Shanghai with seven participants, was the first iteration workshop of the *Resilience Compass*; the cards were co-designed in advance with the garden's organizers and refined during and after the workshop. Phase three, conducted in May 2026 at Garden C in Auckland with eleven participants, was the second iteration workshop, in which insights from Garden B were incorporated into the tool and new facilitation conventions emerged. Across all three phases, the toolset was treated not as a fixed prototype to be evaluated but as a designed artefact whose form was continuously reconstructed in response to use.

2.2. Site selection

The three community gardens were selected through a combination of desktop research and contextual fit with the study's objectives. Each was chosen for its operational maturity, the diversity of its stakeholder collaborations, and the presence of innovative approaches to food production, social engagement, and ecological restoration, factors that suggested each site could meaningfully engage with a discussion of long-term resilience. The selection of Shanghai and Auckland as the two urban contexts was theoretically and empirically motivated. Both cities are undergoing rapid urbanization and socio-ecological change, and both feature growing networks of urban community edible gardens that function as experimental sites for sustainability transitions (Liu et al., 2022). Working across two distinct socio-cultural and ecological contexts also serves a methodological purpose: a tool that holds up across different community settings carries stronger evidence for its applicability and flexibility than one tested in a single context. Participants were recruited from each garden's existing community of practice. They included garden coordinators, management staff, volunteers, and resident members, with ages ranging from those in their twenties to those in their seventies. Two criteria guided recruitment: participants were either directly or indirectly involved in the garden's daily activities, and they held some working knowledge of one or more aspects of garden planning or sustainable management. Where possible, each workshop included members of the garden's core management team, whose targeted domain knowledge balanced the perspectives of less-informed participants and helped to ground discussions in the garden's specific circumstances. Informed consent was obtained from all participants prior to each workshop, in accordance with the approved ethics protocol.

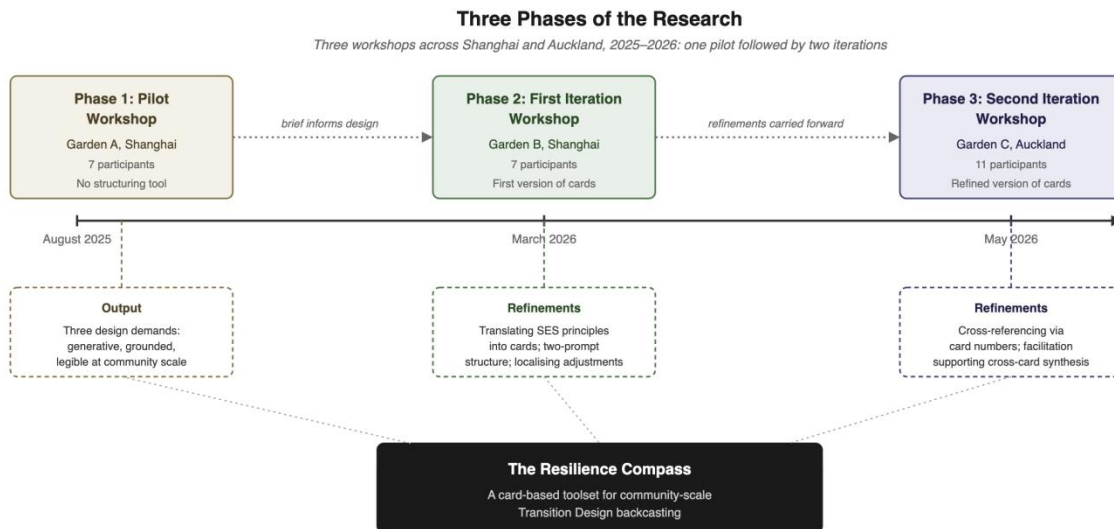


Figure 2: Three phases of design and refinement that produced the Resilience Compass: a pilot study followed by two iteration workshops in Shanghai and Auckland (2025–2026).

3. Grounding the Tool: Empirical Insights and Theoretical Foundations

3.1. Empirical insights and design brief

The development of the *Resilience Compass* began with an initial pilot study at Garden A, a community garden in Shanghai in August 2025. The workshop was run without a guiding tool to explore what would happen when backcasting was applied in a community-scale setting on its own. Three key observations emerged.

1. While backcasting successfully engaged participants, discussions frequently became unfocused, with participants struggling to make trade-offs between competing ideas.
2. A key observation was the difficulty participants faced in translating their long-term visions into coherent pathways of near-term action, suggesting that without specialized knowledge or structuring tools, co-created pathways may struggle to attain the systemic robustness associated with sustainable transitions. A detailed discussion of these findings is provided in Hu et al. (2026).
3. The designer's role in the workshop shifted continually between content expert and facilitator, suggesting that some of the work the designer was doing implicitly could be encoded into a facilitation tool.

These observations clarified three criteria that future tools developed for this setting would need to meet. The first is that the tool must be generative, helping participants imagine futures they have not yet imagined rather than evaluate options already on the table (Irwin, 2015; Kossoff et al., 2022). The second is that it must be

systemically and scientifically grounded, ensuring that the futures it helps produce hold up to questions about ecological, social, and governance dimensions of resilience (Biggs et al., 2012). The third is that it must be legible at community scale, with a cognitive load that fits the rhythms of volunteer-driven, neighbourhood-embedded practice (Hyysalo et al., 2019; Hu et al., 2026). These three criteria were then conceptualized into a design brief that the *Resilience Compass* was developed to meet, and frame the remainder of this section of the paper.

3.2. Enabling a two-way synergy between TD and SES resilience principles

TD proposes that designers can play a role in catalyzing long-term, multi-level transformations toward more sustainable futures (Irwin, 2015; Kossoff et al., 2022; Ceschin & Gaziulusoy, 2019). For the *Resilience Compass*, what TD contributes is, first, a tried and tested future-oriented generative posture. TD treats the imagined future not as a forecast but as a designed artefact in its own right, something to be co-created and worked toward (Irwin, 2020). The cards carry this orientation, framing their question prompts not as questions about what is true now but as questions about what could be. Second, TD contributes the backcasting cognitive structure. Kossoff et al. (2022) articulate backcasting as a movement between three temporal positions, including the present problem, the long-term future, and the transition pathway that connects them, within which co-design happens. In alignment, the proposed cards are embedded into a four-step flow that implements this movement, with each card designed to be useful across all three positions rather than at only one. Third, TD carries an expectation that tools should hold multi-level systems thinking accessible to non-experts. The compass metaphor, with its capacity to point in multiple directions at once, renders this expectation into a single artefact.

What TD does not readily provide is a substantive grounding for examining whether a co-created future would actually cohere as a social-ecological system. That gap can be filled, in principle, by the seven principles for enhancing SES resilience (Biggs et al., 2012; SRC, 2015), which were distilled from the resilience literature through a structured process (Biggs et al., 2012; Walker et al., 2004). The principles are organized into two categories: three key SES properties to be managed (diversity and redundancy, connectivity, slow variables and feedbacks), and four key attributes of the governance system (understanding SES as complex adaptive systems, learning and experimentation, broadened participation, polycentric governance) (Biggs et al., 2012). Two features of this framework matter for the toolset. First, the principles provide a substantive scaffold for resilience discussions that would otherwise rely on intuition. Biggs et al. (2012) are themselves careful about the strength of the evidence behind each principle, noting that connectivity, slow variables, and participation are relatively well-supported, while learning and CAS understanding rest on thinner empirical foundations. Taken together, however, the seven principles represent the current consensus on the conditions under which the resilience of ecosystem services is enhanced. When the tool helps navigate a workshop discussion through these conditions, it routes it through the most carefully assembled set of checkpoints the resilience field currently offers. Second,

the principles are framed as directions for management and governance rather than as fixed targets. The instruction to manage connectivity does not prescribe how much connectivity, of what kind, or with whom; the instruction to broaden participation does not specify who must be included. Biggs et al. (2012, p. 440) emphasize that, "none of the principles are universally beneficial, and all require a nuanced understanding of how, when, and where they apply." This open formulation makes the principles well-suited to use as open-ended, generative prompts in design facilitation, provided that they are translated out of academic register and into language a non-specialist can use. Biggs et al. (2012) note in addition that the seven principles are interconnected and interdependent, a property the source authors acknowledge but leave to subsequent refinements to operationalize. How this property became a concrete design problem, and how it was eventually addressed in the toolset, is discussed in Section 3.3.

4. Designing the *Resilience Compass* Cards

The *Resilience Compass* tool was tested and refined across two workshops, one in Shanghai Garden B and one in Auckland Garden C (Figure 3) during 2026. This section presents the main design decisions emerging from their use. Below we discuss the choice of cards as a facilitation tool and how each principle is translated, on a single card, from theoretical concept into a community-usable artefact. Finally, we explain how the interdependence between principles, a property that Biggs et al. (2012) themselves indicates and we found in the pilot workshop, is made visible during workshop use. Each design decision was refined in response to workshop insights.



Figure 3: Participants engaging with the Resilience Compass Cards in garden C, photograph by author.

4.1. Cards as the toolset's form

Translating the seven SES resilience principles into a workshop-ready artefact required a format that would lower the entry barrier for non-expert participants without missing the core scientific messages. We chose a deck of seven cards, with each card carrying one principle. Card-based design tools have a substantial history in participatory and co-design practice, as Roy and Warren's (2019) review of 155 card decks demonstrates: their tactile, modular form invites handling, their boundedness makes them tractable in time-limited workshops, and their game-like associations lower the perceived stakes of engagement. For a community garden setting, where participants range from horticultural experts to occasional volunteers, these qualities mattered. The choice was also informed by what cards do as *objects of thought*. Klemmer et al. (2006) argued how physical artefacts support a mode of cognition they call “thinking through doing”, in which manipulation, arrangement and re-arrangement of objects becomes part of the reasoning process itself rather than an external aid to it. A deck of cards offers this affordance. Participants can spread the cards out, group them, set some aside, draw two together, or work with one at a time; each of these movements is a form of inquiry made tactile. In a community garden context, where the underlying principles are conceptually entangled, this affordance allows the structure of SES resilience to be held in the hand and worked with rather than only spoken about. Card-based formats also have precedent within transition co-design. Tangible co-design toolsets also have precedent within transition work. Hyysalo et al. (2019) developed a mid-range pathway creation toolset for accelerating sociotechnical transitions, in which magnetic elements arranged on a large board allow multi-stakeholder participants to construct pathway steps between a long-term vision and the present. Our work differs in two aspects. First, our tool takes the form of cards, and draws its content from sustainability science: by encoding the seven SES resilience principles, the cards engage with the inherent dynamics of social-ecological systems. Second, our cards are applicable for community-scale interventions with non-expert participants, rather than only for the frontrunner stakeholders.

The cards are two-sided. The front carries an illustration that renders the principle as a visual scene. The back carries text: the principle's name, a one-sentence tagline in everyday language, and two question prompts. Similar to the *mental model cards* developed by Baron (2025), the visual register of the illustrations draws on the iconography of Tarot cards. Tarot here is not adopted for its mystical associations but for what Michelson et al., (2024) described as its capacity to scaffold “modes of personal and collective growth” through symbolic imagery. Their interview study of Tarot cards creators shows how the form invites reflection and speculative engagement rather than analytical assessment (Michelson et al., 2024) while they also encourage participants to tap into more endogenous knowledge and reflection (Baron, 2025), a register suited to the visioning phase of backcasting in community gardens. Tarot's combination of local symbolic density, illustrative richness and futural orientation fit the work the cards needed to do. The front therefore primes imaginative engagement, while the back supports analytical work. This division

reflects the cognitive demands of backcasting, where visioning rewards divergent thinking and action planning rewards convergent thinking (Brown, 2009).

4.2. Translating each principle into a card

The principles, as written and summarized by Biggs et al. (2012) and SRC (2015), offer abstract and analytical complex claims about SESs. As observed during the pilot workshop (without the tool), community gardeners found it hard work directly with SES principle concepts. For example, the sentence "manage connectivity in social-ecological systems" was too abstract for the participants. We therefore decided to reword, illustrate and break the concept down into contextual questions that participants can engage with more easily. For instance, Card 2's front (Figure 4) depicts a central cluster of flowers whose root system extends outward to a bookshop, a school, a local store, and other neighbourhood institutions. The image translates the principle of localized connectivity, a technical concept about links between nodes and information flows (Biggs et al., 2012), into questions about which local *neighbours* the garden does or does not reach. A participant who would not engage with the technical definition is better able to visualize the concept through the illustration. The back side of Card 3 (Figure 5) demonstrates the written prompts we placed on the reverse of every card. This card carries the tagline "*Pay attention to the slow, invisible things that matter most, and listen to what the garden is telling us in return,*" followed by two questions. The first, titled "*Reflecting on the Present*", asks: "*What are the invisible but crucial things quietly changing in our garden over time?*" The second, titled "*Envisioning the Future*", asks: "*Moving forward, how can we sustainably track and nurture these slow, quiet changes?*" The two-prompt structure asks the participant to perform, at the scale of a single principle, the same present-to-future cognitive movement that the full workshop will perform at the scale of the garden as a whole.



Figure 4: The front side of Card 2 - Manage Connectivity

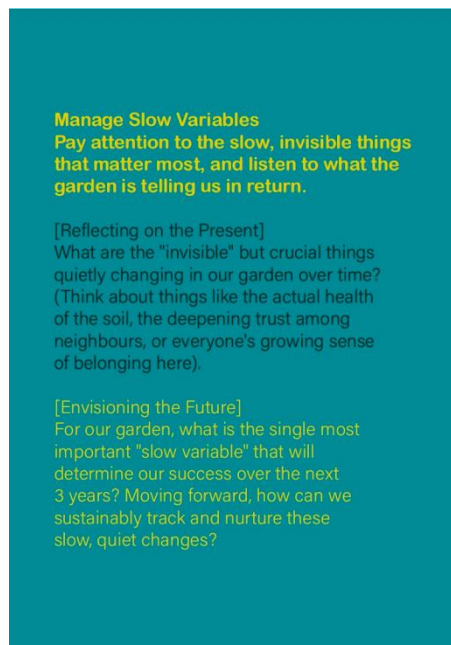


Figure 5: The back side of Card 3 - Manage Slow Variables

This two-prompt structure was not part of the initial card design. In the pilot workshop in Garden A, the back of each card carried prescriptive examples intended to make the principle concrete: scenarios drawn from typical community garden situations. During the pre-workshop co-design conversation with the organizers of the Garden B, this approach was flagged as constraining. The organizers collectively suggested to provide more open-ended prompts to inspire more autonomous future visioning. Examples that were intended to scaffold thinking risked supplying answers before participants had imagined their own. Also, drawing on the vision-action gap identified in earlier empirical work (Hu et al., 2026), the back-side content was rewritten as the two open questions of the refined version. The shift moved the cards from prescriptive toward generative without abandoning their substantive grounding: the questions still route and guide the discussion through the principle, but they ask rather than prescribe.

A further adjustment localized the substantive scope of the cards. The localizing adjustments were inspired by the forms of knowledge that Sanders and Stappers (2008) and Campbell (2017) explore regarding the authentic contributions of participants in co-design: the experiential knowledge accessible only to those who inhabit a given situation. Therefore, the *Diversity* card was extended to include human diversity (roles, experiences, and modes of participation among gardeners) alongside ecological diversity. Additionally, the *Complex Adaptive Systems* card was extended from physical disturbances such as extreme weather to also include organizational dynamics such as volunteer turnover. Both suggestions came from the Garden B organizers, whose accumulated practice gave them a sharper sense than the designer could have of which facets of each principle pressed on their

garden's lived realities. Diversity in their setting was not mainly a question of plant species; but about who came, who stayed, and who carried which kinds of responsibility. Complex adaptive systems thinking, similarly, was not only about ecological shocks; but we observed that key consequential disturbances were of social nature, including the loss of long-serving volunteers. These adjustments are small in their textual footprint but methodologically consequential. They mark the points at which the tool's design depends on knowledge the designer cannot supply, and are co-created with participants during the testing of the tool. Each new community deployment is liable to require comparable local adjustments, not because the principles change, but because which aspects of a principle matter most, is a valuable contextual adaptation. The final card design is presented in Figure 6 below.



Figure 6: The Resilience Compass cards as ordered, designed by the author.

4.3. Making interdependence visible through facilitation

The third design criteria addressed a property of the seven principles that Section 2 introduced: their interdependence. Biggs et al. (2012, p. 440) state that the principles "are interconnected and interdependent." The cards alone, treated as a deck of seven discrete units, risk implying the opposite. The first hint of how to address this came from the first iteration workshop. During the workshop in Garden B, while developing actions in the backcasting phase, participants did not work card by card. They reached for two or three cards together, finding that the action they wanted to propose was inspired by several principles at once. The initial plan had been to follow Hyysalo et al.'s (2019) colour-coded convention, with each principle assigned its own color, so that each proposed action could be tagged to a single principle. In practice, this convention was set aside in response to what participants were doing. After this insight, the subsequent workshop (in Garden C) formalized

this practice into a deliberate facilitation strategy. Participants were asked, when writing a proposed action on a sticky note, to add the number of the *card/s* that had inspired it. An action sparked by both the Learning card (5) and the Broaden Participation card (6) would carry "5 & 6" in the corner of the note. The instruction was framed for participants in concrete terms: *"Our garden isn't a list of separate tasks. It's a network. Each action plays into more than one part of resilience at once."*

The adjustment appears minor, but its design significance is highly relevant. Cards combined on a single sticky note materialize the interdependence that Biggs et al. (2012) describe in their research and was observed in our workshops. When the notes are placed on the backcasting timeline, the pathway becomes more legible as a web of systemic actions, each linking back to multiple principles. A property of the underlying theory, otherwise visible only to those familiar with the academic literature, is materialized by the community. In the second iteration workshop in Garden C, for example, an action called: *"Create an ideas board where community members can suggest ideas, ask questions, and as an initial connection point with passers by"* (Figure 7) was attributed by participants to Cards 3, 5, and 6, drawing slow variables, learning, and participation into an integral proposal in a way that maybe single-card attribution would not have captured.

This adjustment also reshapes the role of the facilitator. With cross-referencing in place, the facilitator's task shifts toward enabling synthesis: prompting participants to articulate why they reached for several cards at once, supporting them in tracing how the principles converge in a single action, and resisting the urge to disentangle what they have brought together. This shift is consistent with what Light and Akama (2012) describe as the "relational and responsive dimension of facilitation in participatory design", where the facilitator's role is less to deliver content than to attend to the practice of co-creation as it unfolds (Bromage et al., 2025). In our case, the cards take on part of the explanatory theoretical work, freeing the facilitator to support the cross-card synthesis that cross-referencing makes visible. A further consequence concerns how resilience itself is constructed *across* the cards rather than *within* any one of them. The cross-referencing practice makes visible that no single principle, on its own, carries the weight of a community's resilience work. As action notes accumulate on the wall, they show how participants are mapping their ideas by interconnecting different perspectives encoded on different cards, with some combinations recurring, others appearing only once, and still others surprising the room as participants notice a connection they had not previously articulated.

This innovation is, in effect, the third translation the cards perform. The first moves seven analytical principles into seven cards. The second moves each principle, on a single card, from academic register into grounding visuals and questions that enable actionable strategies. The third moves the relationships among the principles, which the source literature names but cannot itself enact, into a visible practice that community participants perform on the wall of the workshop room.

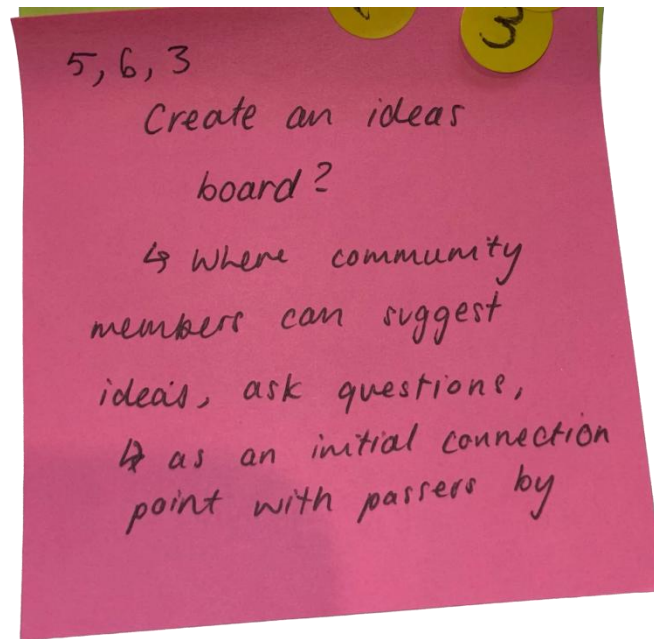


Figure 7: An action generated in Garden C Workshop

5. Discussion

This paper has presented the *Resilience Compass*, a card-based toolset for integrating SES resilience principles into community-scale TD backcasting. It offers a novel operational pathway for designers and community practitioners, translating an abstract theoretical framework into an actionable, participatory tool. The contribution of this paper is mainly methodological. It rests not only on the artefact described in Section 3 but on the trajectory by which the artefact came to take its current form, and on what that trajectory reveals about designing tools for community-scale Transition Design. Three implications follow. The first concerns the process from which a tool of this kind can be developed. The toolset did not emerge from a single act of design followed by sequential testing. It accumulated across three phases: pre-workshop co-design with garden organizers, in-workshop emergence as participants improvised with the cards in front of them, and post-workshop reflection in which the designer revisited what had occurred. The cards were not a fixed artefact whose performance could be evaluated as a finished tool; rather, their design rationale was itself being reconstructed in use.

Cross-referencing via card numbers, the refinement described in Section 3.3, is the clearest instance of this: it began as a participant practice in Shanghai Garden B and only retrospectively became a designed feature in Auckland Garden C. The way participants reassembled and recombined the cards across the two workshops was, in effect, two distinct performances of the same toolset, each revealing a different facet of its *unfinishedness* (Baron, 2018). This openness is not a residue of underspecification but an intentional property of the tool that allows participants to *finish it themselves*.

The second implication concerns the role of the designer when the tool moves into community settings. Designing the cards revealed that the figure of the designer in community-scale TD cannot be reduced either to the expert who explains a framework or to the neutral coordinator who steps aside. Neither role fully captures the work the designer performed across the two workshops. Rather the designer is participating continuously in re-interpreting what the cards were being used for, attending to which design choices were holding up in use and which were being challenged, then using their creative faculties to refine the cards between deployments. The tool's effectiveness was, in this sense, a product of the relation among three actors: the tool, the facilitator, and the participants. None of the three can be considered in isolation. Bromage et al. (2025), in their analysis of community-driven innovation, argue that design work in such settings often stalls because it remains in an ideation phase and normally not reaches implementation; they propose the figure of the “design intermediary” as a role situated between expert framing and community ownership, oriented toward sustaining the conditions under which design choices can take hold in practice. Similarly, Baron (2025) and Campbell (2017) emphasize that in adopting participatory approaches, environmental projects can move beyond externally imposed solutions and foster co-creation, where local voices and ecological systems are central. This shift not only leads to more sustainable outcomes but also contributes to building resilient partnerships and buy-in from participants who will carry out this work beyond the workshops. The work documented here is consistent with such approaches. Participatory design at community scale appears less as a procedure that can be followed step by step than as a sustained practice of mediation that the designer must hold, between authoring and yielding, between scaffolding and stepping back, between the principles encoded in the tool and the lived realities into which the tool must enter.

The third implication looks outward, beyond TD, to the social-ecological systems literature in which the seven principles originate. González-Quintero and Avila-Foucat (2019), in their systematic review of the field, identify the operationalization of SES resilience as a persistent gap and call for tools that bring the principles into contact with the contexts in which they are to be applied. The *Resilience Compass* is aiming to fill this gap. Its contribution, however, is not limited to communication. The cards function as a transdisciplinary epistemic translation artefact: a tool through which concepts assembled in one disciplinary register, in this case sustainability science, become available to actors working in another, in this case community gardening, without flattening the concepts or imposing them as top-down directives. This positioning has implications for the disciplinary reach of TD itself. If TD can contribute, through artefacts of this kind, to the operationalization challenges named by SES resilience scholarship, then its scope extends beyond design and sustainability transition studies into adjacent fields in sustainability science. The multidisciplinary commitment that has characterized TD from its inception (Irwin, 2015; Irwin, 2020) is made operational through the cards as a tool through which the knowledge of one field is rendered workable in another. These three implications, taken together, suggest that the contribution of this work is applicable beyond a particular tool and demonstrates of how an approach to toolset

creation of this kind, provides wider methodological value.

6. Limitations and Future Work

This study has limitations that bound the strength of its claims. The tool has so far been deployed in only two community gardens, both in urban settings, with engaged organizers willing to participate in pre-workshop co-design. Whether it behaves similarly in rural settings, in communities without established organizers, or where the underlying socio-ecological challenges differ markedly, remains untested. The evidence gathered here also concerns what participants produced inside the workshops and the weeks immediately following; the longer-term influence of the workshop outputs on actual garden practice falls outside what this study can speak to currently.

Three lines of future work follow from these limitations. One possibility is to deploy the toolset across a wider range of community-scale socio-ecological contexts, attending to which elements of the current design prove portable and which require localization. Longitudinal study of participants and gardens would clarify whether the actions generated during backcasting are taken up, abandoned, or transformed over time. A third direction concerns the toolset's dependence on the designer's continued presence: whether the cards can support productive workshops when used by community facilitators trained in their use, without the designer on site. This is an open and methodologically important question.

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