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Review



A systematic review and critical analysis of research on public responses to large-scale solar in the United States

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ABSTRACT

Large-scale solar photovoltaic (LSS) systems have been the largest source of electricity generating capacity added annually the United States since 2009. As LSS development matures, strengthening the foundation of the supporting research is important for establishing a shared understanding of public responses to siting and a robust evidence base that can guide decision-making. This systematic review and critical analysis synthesizes social science research on public responses to LSS in the United States. We examine research trends, geographic coverage, key explanatory factors, and enduring issues within the literature, highlighting high-value research areas and key considerations for decision-makers, developers, and host communities. We also propose a conceptual framework for interpreting the research findings and offer recommendations to help the field converge around shared definitions, methodologies, and priorities. Across the literature reviewed, public responses to LSS are most consistently associated with place-based values and meanings, risk-benefit perceptions, and judgements about procedural and distributive fairness. Three broader implications emerge from this review related to information and trust; opportunities and constraints for LSS integration with agriculture; and place-based siting approaches that build on common principles. These insights provide practical guidance for LSS research and public engagement and offer transferrable lessons for socially acceptable siting and land use decision-making more broadly.

1. Introduction

Large-scale solar (LSS) systems have been the largest source of electricity generating capacity added annually in the United States since 2009 [1]. LSS system deployment is expected to continue, evidenced by growing transmission interconnection queues [2] and capacity projections [3]. Although all U.S. regions have substantial technical potential for solar energy [4], project siting is constrained by access to available transmission capacity, interconnection points, and competitive market structures—such as utility request-for-proposal processes—that favor projects able to minimize interconnection and permitting costs [5]. Together with the need for sufficiently large contiguous land areas, these constraints have produced an uneven geography of LSS development, concentrating projects in rural suburban, and exurban landscapes where suitable land coincides with grid access.

In places where LSS development is concentrated, concerns about its potential economic, environmental, and sociocultural impacts are driving increased public opposition [6]. U.S. developers identify public opposition as a major contributor to project delays, cancellations, and escalating development costs [5,7–11]. Understanding how the uneven

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geography of LSS shapes the distribution of its benefits and burdens and public responses is essential for anticipating deployment trends [12–18].

Social science scholarship on energy systems offers rich explanations for public responses to LSS [19], building off research on wind [20], nuclear [21], oil and gas [22,23], tidal power [24], and transmission infrastructure [25]. Researchers have integrated scholarship on social acceptance [26], risk perceptions [27], and place attachment and place making from human geography [28] to examine public responses within broader socio-energy systems [29]. This research illustrates that public responses are shaped by spatial, temporal, and contextual factors and cannot be reduced to "one-dimensional" [30] or "not in my backyard" ('NIMBY') explanations [24,26,31–35]. Despite NIMBYism getting much emphasis in public discourse and media, proximity is only one potential factor that shapes public responses to energy development—many have stressed that the NIMBY trope is inadequate because it overlooks and misunderstands the complex motivations and place-based values that shape community concerns [28,36–42]. Instead, this research consistently finds that public responses emerge from the interaction of place attachment and ecological and sociocultural values [35,43], community identity and heritage [15,44,45], anticipated landscape changes [46], and concerns about the procedural and distributive aspects of development [13,40,47].

Research on LSS in the United States is still emergent because widespread deployment is a recent phenomenon. Installed LSS capacity additions grew substantially between 2020 and 2025; 2026 is expected to see a new record again for installed solar generating capacity [3]. Initial studies often relied on hypothetical development scenarios to study public responses [48], with a few exceptions of case studies that explored the impacts, political dynamics, and public reactions to early LSS projects [49,50]. The recent expansion of LSS has enabled research on operating and proposed projects to document their impacts as well as characterize broader trends in deployment and public responses [6,9,13,47]. This rapidly evolving LSS deployment landscape is reflected in a body of literature that varies widely in scope, context, and methodology. A comprehensive synthesis and critical analysis of the literature at this formative stage of LSS deployment in the United States is necessary to identify consistent findings, unresolved questions, and priorities for future research.

Reviews of public responses to energy development have examined several technologies and synthesized findings across multiple geographies and project scales [30,34,51–55]. However, we are not aware of any review paper that systematically tracks the key issues and geographic heterogeneity of public responses to LSS in the United States. Although Wallace & Batel [19] and Gadzanku et al. [56] include U.S. case studies within a broader review of global trends in social science on LSS, they do not focus on issues or patterns distinct to the United States. Our study complements this work by providing an in-depth examination of LSS literature in the United States, explicitly highlighting how geographic, sociopolitical, and other contextual factors shape both the research and public responses. This provides a necessary foundation for future comparative research examining which patterns are distinctive to the United States and which generalize across national contexts and energy technologies.

The objective of this review is two-fold: 1) to characterize the current state of social science literature on LSS in the United States; and 2) to critically analyze this literature to identify limitations, gaps, and priorities for future research. Our goals are to provide a comprehensive summary of current insights, clarify the implications that can be drawn, and establish a research agenda for future work, thereby informing development practices and public engagement for LSS in the United States.

2. Approach and methods

2.1. Terminology and scope

The definition of LSS lacks consensus across the academic literature, industry, government, media, and public discourse. No single term is used consistently, as some refer to these facilities as utility-scale solar energy (USSE) developments while others refer to them as "solar parks." In this paper, we align with definitions used in recent literature and refer to LSS as ground-mounted solar photovoltaic projects $\geq$1 MWdc [45,57].

We examine LSS separately from other forms of solar development for three main reasons. First, LSS is the dominant source of new electricity-generating capacity in the United States and is projected to significantly expand in coming decades [3]. Under high-deployment scenarios, this expansion could require up to 12–15 million acres of land by 2050 [58,59]. Second, because of their size, land requirements, and spatial concentrations, LSS projects can produce ecosystem and community impacts that differ substantially from smaller scale, more distributed solar installations [42,60]. Third, decisions about adoption of rooftop, residential, and other distributed solar are motivated by different risk-benefit perceptions than LSS, involving individual investment decisions and different ownership arrangements that do not typically require the same public and political processes as large developments [30].

We use *public responses* as an umbrella concept encompassing perceptions (beliefs about impacts or fairness), attitudes (general evaluative judgements), and acceptance (behavioral or political outcomes). Scholars including Wolsink [39], Batel et al. [61], Devine-Wright [35], Fast [53], and Wüstenhagen et al. [26] have cautioned the tendency to use these terms interchangeably and have shown that such conflation can influence what is measured—for example, support for a proposed facility versus attitudes towards an existing one. This conceptual ambiguity can make it challenging to interpret findings consistently. Nonetheless, we use *public responses* to provide conceptual cohesion and more simply synthesize findings across studies. Our review includes literature on perceptions, attitudes, and acceptance (collectively, "public responses"), and we critically analyze opportunities to better measure and communicate these nuances.

Lastly, extensive scholarship in environmental psychology, human geography, and energy social science provide valuable theoretical and empirical insights into place attachment, procedural and distributive aspects, and public responses to energy development. Much of this work however examines Western European contexts [62], Canada [63], or other technologies such as wind energy [64]. We limit the scope of this review to LSS in the United States. This focus is necessary because patterns of development and public response are shaped by context-specific political institutions, legal frameworks for siting, land-use governance, participation models, economic conditions, and land constraints, all of which vary substantially across national contexts and technologies [8,65,66]. Findings from international cases and from other technologies, while informative, are not always transferable to LSS in the United States. We draw on international and wind energy scholarship where it offers relevant theoretical insights, but only synthesize empirical evidence from studies of LSS in the United States.

2.2. Systematic review process

We conducted a systematic review of social science literature on public responses to LSS in the United States. Systematic reviews provide a structured process for identifying, evaluating, and synthesizing an existing body of literature. This approach is used in environmental social science to summarize findings, identify research gaps, and guide priorities for future research [67,68].

Documents compiled for this systematic review were primarily identified through Scopus. Google Scholar was also used to supplement

this more standard source, as was citation chaining (i.e., following reference lists). The initial search was conducted during the spring of 2025. Database searches used different permutations of the following key words: "social acceptance," "public perceptions," "public attitudes," "support," "opposition," and "solar," "utility scale solar," and "large scale solar." The initial search yielded 525 documents; after removal of duplicates, the remaining documents were individually screened ($n = 492$). Abstracts were reviewed to identify documents with geographic focus in the United States, explicit emphasis on large-scale solar, inclusion of novel data or analysis, or relevant theoretical perspective (i.e., focus on public perceptions). In total, 60 documents (journal articles, reports, book chapters, and theses) and eight additional documents (reviews and commentaries) met the selection criteria, which aligns with values reported in recent systematic reviews of the same literature [19,56]. Documents included in the final review range in publication date from 2009 to 2026. Fig. 1 illustrates our review process.

Bibliometric and content analyses were conducted on the final document sample ($n = 68$). Key metadata for each study were catalogued in a bibliographic matrix (Appendix A), including but not limited to research question, methodological approach, variables and measures, sample characteristics, study location, key findings, and publication year. The bibliometric analysis also involved tracking longitudinal, geographic, and methodological trends. Qualitative content analysis entailed examining major findings and conclusions of all studies; comparing across the entire sample to identify points of convergence, divergence, and limitation; and critically analyzing the different empirical and theoretical approaches. These combined procedures allowed for a systematic and replicable synthesis of the literature.

2.3. Conceptual framework

To organize the various explanatory factors associated with public attitudes towards energy technology, Boudet [30] developed a conceptual framework that groups factors into four distinct categories: people, place, process, and technology. Similarly, Rand et al. [45] distinguished between two broad categories of explanatory factors of public responses to LSS: "subjective" variables, related to sentiments, values, and beliefs, and "objective" variables, related to technical project attributes and sociodemographic characteristics.

Building on these foundations, we adapt these frameworks in three ways. First, we use the terms *experiential factors* (place-based meanings, values, beliefs, risk-benefit perceptions, and procedural and distributive aspects) and *technical factors* (project proximity, visibility, size, land use, and groundcover) to preserve their important distinctions without implying a hierarchy between "subjective" and "objective" knowledge [69]. Then, we treat sociodemographic factors (e.g., age, sex, income, education, housing attributes) as separate from experiential and technical factors. Third, we retain the original categories of *people, place, process, and technology* to acknowledge that they contextualize all interactions. Our conceptual framework (Fig. 2) serves as a conceptual tool for researchers and practitioners by distilling the key factors shaping public responses to LSS, illustrating their interconnections, and organizing the emerging research findings in a way that makes them more interpretable.

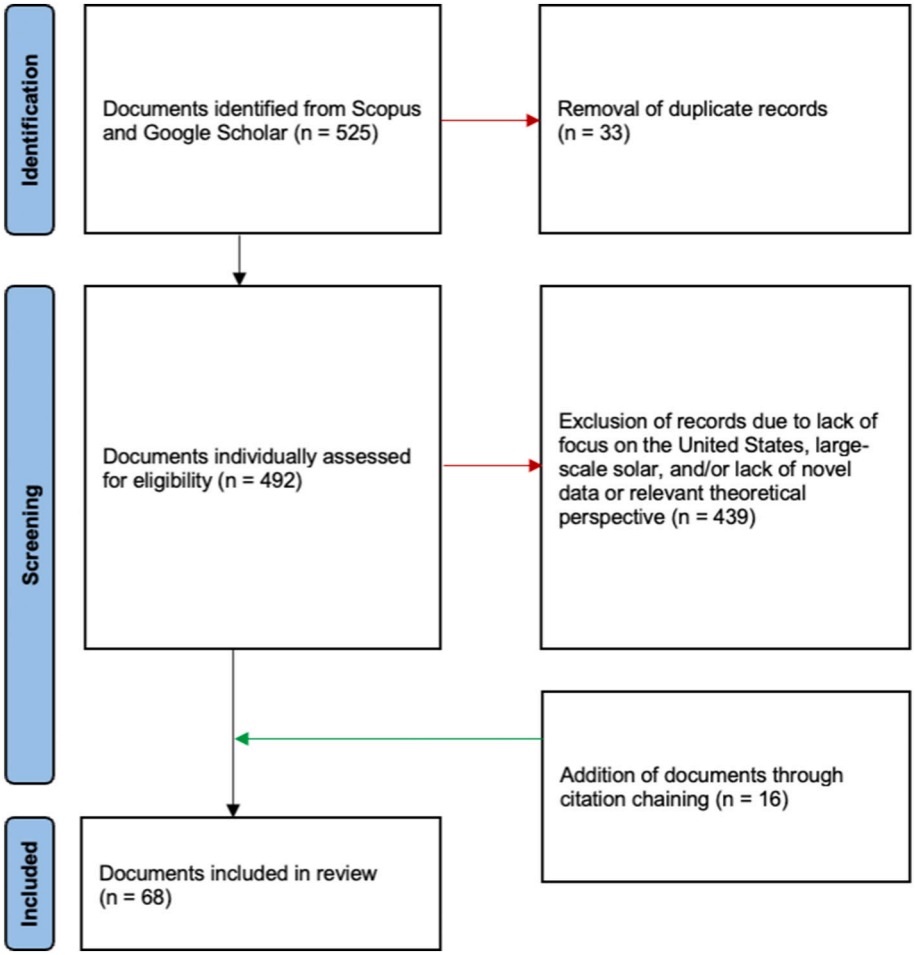

Fig. 1. Illustrative flow chart of literature review process.

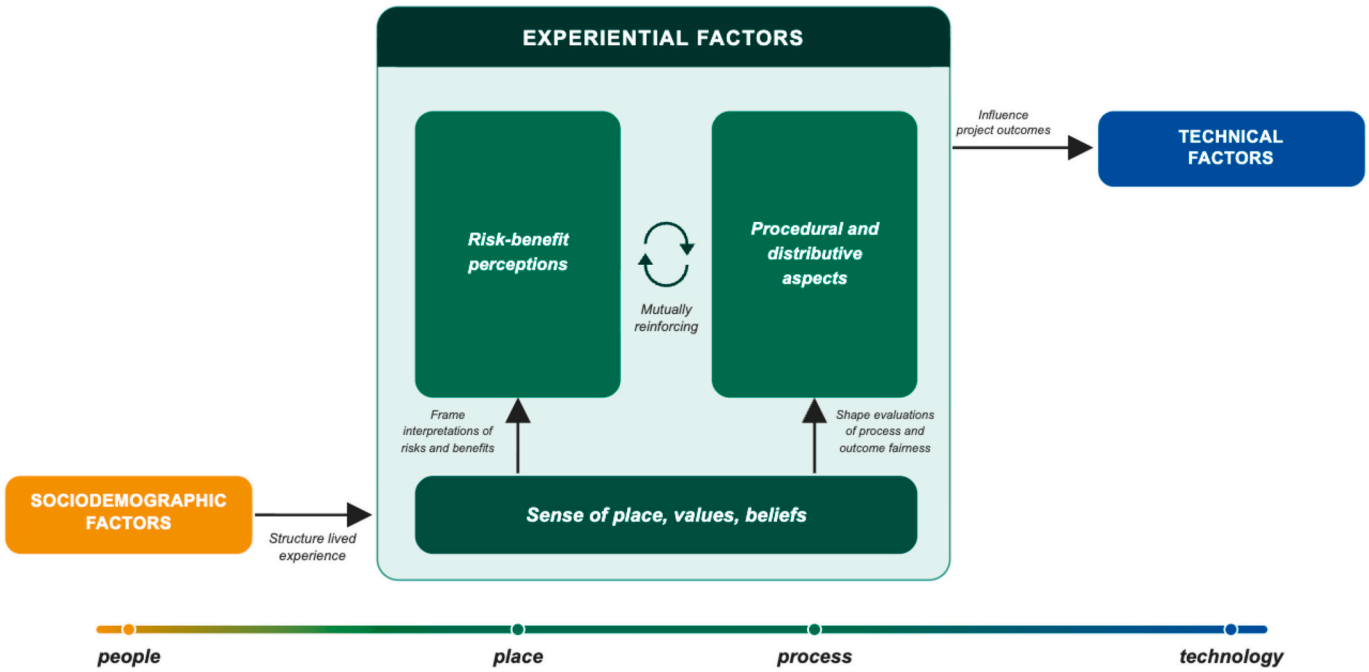

Fig. 2. Conceptual framework: Factors shaping public responses to LSS

3. Methodological trends and geographic coverage of reviewed studies

Public perceptions of energy technology and socio-energy systems have long been a topic of research inquiry [29,70,71]. Research specifically examining LSS became more prominent beginning around 2014 [72] and has increased substantially since then. Among the primary literature included in this review, 80% were published between 2020 and 2026, with 22% published in 2025 alone, reflecting a marked increase in attention to LSS in the United States.

Nearly half of the research in our sample (47%) utilizes survey methodology to measure correlation between LSS factors and public responses. One focus of these studies has been to explain how public responses to LSS differ in relation to technical factors, such as proximity to residence [37], as well as across sociodemographic variables [73,74]. Recently, qualitative research drawing from interviews, focus groups, public comments, and participant observation have taken precedence as researchers seek to elaborate how the explanatory variables identified by earlier survey studies influence public responses [75]. Mixed method approaches that combine primary data collection with content analysis of policy and environmental review documents, public media, and other grey literature are also common approaches to examining place-based historical and political dynamics related to LSS [43]. The body of literature largely represents the perspectives of residents of respective study locations [6]; solar developers [10] and local officials [13] are other commonly engaged stakeholder groups.

Fig. 3 compares the geographic coverage of LSS research included in this review with a national inventory of existing installations across the contiguous United States [76]. The left map depicting research coverage only represents studies with an explicit geographic focus and therefore does not include studies based on national samples (23% of review sample) or broadly defined study regions (e.g., "Mid-Atlantic"). Studies that represent multiple states [16] are accounted for. Datasets that led to the publication of numerous papers [48] are only counted once (i.e., multiple papers from the same dataset did not increase the number of studies counted for a state).

Geographic coverage of LSS research largely aligns with installed capacity, with the exception of the eastern seaboard being underrepresented in research relative to deployment levels. Research coverage gaps are apparent in the central United States, Alaska, and Hawaii. As the early site of LSS development, the southwestern United States has been the subject of extensive case studies [8,18,43,44,48,49,72,77–82].

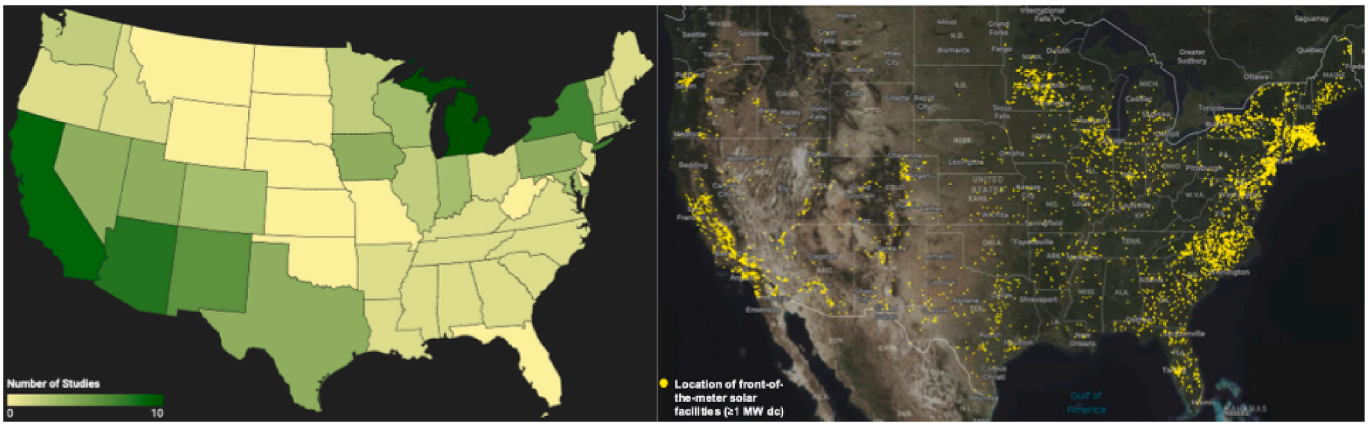

Fig. 3. Geographic coverage of research on public responses to LSS compared to installed capacity in the United States

There is also a research emphasis on the Midwest and Northeast regions, with significant focus on Michigan [6,15,75,83,84], New York [14,40,74,85,86], and Pennsylvania [87–89]. These concentrations suggest that the empirical literature reflects not only the geography of LSS deployment but also the locations of established research programs and available data.

4. Evidence synthesis

Across the literature reviewed, public responses to LSS are most consistently associated with three domains: place-based values and meanings, risk-benefit perceptions, and judgements about procedural and distributive fairness. Technical project attributes including proximity, visibility, size, land type, and groundcover, also influence public responses, but are highly contingent on geographic and social context. By comparison, sociodemographic factors provide weaker and less consistent explanations.

This section first synthesizes research on the place-based values and meanings that shape how LSS is interpreted, before examining the economic, environmental, and sociocultural risk-benefit perceptions that arise from those interpretations. Then we provide an overview of findings across other key experiential, technical, and sociodemographic factors. Broader implications and reflections are brought forward in sections 5 and 6.

4.1. Experiential factors

4.1.1. Sense of place, values, and beliefs

Place attachment and place-related meanings help explain how LSS and other large developments are interpreted through the relationships people have with particular landscapes and communities [6,14,28,72,90]. Local histories, identities, values, and experiences shape the meanings attributed to landscapes, and consequently, how LSS projects are understood [45]. These place-based meanings provide the interpretive lens through which the potential risks and benefits of LSS are subsequently evaluated.

Agricultural landscapes illustrate these dynamics particularly well. Farmland may represent cultural heritage, local identity, land stewardship, and livelihood. Consequently, stakeholder groups often attribute different and sometimes conflicting meanings to the same agricultural landscape. Farm-owner operators may view LSS as a means of revenue diversification, sustaining land stewardship, protecting their land from alternative developments, or exercising private property rights, whereas community members may view LSS as a threat to the preservation of farmland, bucolic views, and rural character [8,15,16,74,78,87–89,91–93]. Goldberg [93] characterizes these varying interests as “conflict, synergy, and compromise,” underscoring the need for place-based interpretations of responses to LSS.

More broadly, personal value orientations and belief systems related to energy and the environment shape how LSS and land use is perceived [94]. Survey research associates stronger environmental values, concern about climate change, and interest in energy security with more positive responses to LSS [40,45,73,83,95]. However, debates and tradeoffs framed as “local habitat degradation versus global climate change mitigation” [16,49] and “preservation versus LSS development” [18,44] reflect deeper value-based disagreements about how places should be used and protected and illustrate how environmental values can lead individuals to interpret the same project differently. Although the importance of place-based values in local development is well established, more research is needed to explain how these values translate into specific perceptions of LSS risks and benefits across different geographic and social contexts.

4.1.2. Risk-benefit perceptions

Risk-benefit perceptions—how individuals evaluate the anticipated risks and benefits of LSS—are well documented in the literature, including both perceived and real impacts across economic, environmental, and sociocultural domains. Evidence from this research demonstrates how LSS perceptions are strongly shaped by place-based meanings and values. Table 1 summarizes key findings from risk-benefit perceptions research.

4.1.2.1. Economic impacts. Across all commonly perceived outcomes of LSS, both personal and community-scale economic impacts (positive and negative) have a strong influence on public responses [13,40,95]. Positive responses are linked to interest in economic benefits, such as local employment [96], tax revenue and resulting support services [97,98], and industrialization [95] influence. Whereas negative responses are associated with concerns over increases in electricity rates [40], impacts to property values [6,45,99,100], and trade-offs with other local goals of commercial and residential development [8] also shape responses. Economic aspects of LSS are most often discussed in public discourse and media in a positive light [16].

However, there appears to be a disconnect between expectations, understanding, and realized benefits [101]. Broadly, there are concerns that the community benefits from LSS development do not persist in the long-term [98] and are therefore exaggerated [6]. Investigating these concerns, recent case studies have explored boomtown dynamics—which has been extensively written about in the context of large fossil-fuel-based developments [102]—finding that, to some degree, LSS results in a boom during construction followed by few, permanent, local operations and maintenance jobs [43,79]. Additional economic concerns regard the exclusivity of LSS benefits to certain community members, such as the landowner who leases or sells their land [88]. The extent to which landowner payments actually go to permanent residents of the community (rather than nonresident landowners) is increasingly in doubt [13]. Tracking and quantifying the economic impacts of LSS [89], who they benefit or harm, and how they differ based on the land used and community type remains a gap in the current literature.

Agriculture sector-specific economic risk-benefit discourses are prevalent. Survey studies have reported the highest support levels for projects that provide income diversification opportunities for farm owner-operators [40,84]. In-depth interviews elaborate on how LSS is perceived by some as a means to improve farms' economic viability and enable intergenerational succession of farmland [6,8,15,78,85,87–89]. Some research finds that leasing or selling farmland to LSS developers as a “retirement plan” is already common, especially in places where farm owner-operators are exiting the industry due to drainage impaired and salt-contaminated land [103]; changes in water rights, allocations, and costs; or a lack of familial successors to operate the land [8,78,81]. Other research suggests that concerns about farmland loss due to LSS may be overstates, as farmers with LSS leases state intentions to use solar revenues to continue farming rather than exit the industry [74]. Yet a tension exists between the benefits realized by landowning farmers and the impacts on their local agricultural economies. Concerns about LSS impacts on agricultural economies span land tenure dynamics (e.g., farmland leasing versus other various types of ownership), displacement of farm operators through increased competition for rented land, rising rental costs, and potential effects on farming supply chains, food production, agrarian livelihoods, and farmland loss [13,16,18,46,78,86,87,93,104–106]. Case studies that document personal and community-scale economic impacts across different contexts could help clarify LSS expectations.

4.1.2.2. Environmental impacts. Environmental and landscape impacts of LSS vary significantly across ecosystems, land uses, and geographic context. Potential impacts on farmland, soil, and water quality raise comparably more concern in the Northeast and Midwest [6,42] than projects proposed on farmland and ranchland in the Southwest [43,107]. Documented concerns in desert ecosystems include LSS

Table 1
Summary of relationships between risk-benefit perceptions and public responses to LSS.

Impact		Summary of Research Findings
Economic	Local development	LSS is often viewed as a local economic opportunity through direct local spending, tax revenue and jobs, community benefits agreements, and indirect and induced economic activity. Concerns persist about "boomtown dynamics," financial benefits accruing to non-local or marginal actors (e.g., absentee landowners), and tradeoffs with other local development priorities.
	Property values	Positive public responses are linked to expectations of increased property values, especially where LSS replaces undesirable land uses. Concerns about declining property values more often drive negative responses.
	Electricity rates	Anticipated reductions in personal electricity rates are linked to positive responses, while expected increases are linked to negative responses.
	Agricultural operations and economies	LSS is often framed as supporting farm viability through revenue diversification and stabilization. However, these benefits tend to accrue to landowners, raising concerns about impacts on non-landowning farm operators such as displacement or rising farmland rental costs. Debates between the benefits and threats of LSS to agricultural livelihoods and rural economies are common.
Environmental	Wildlife and biodiversity	LSS raises concerns about ecosystem and wildlife impacts, including habitat loss and fragmentation, threats to biodiversity, impacts on sensitive and protected species, and disruptions to wildlife habitat, with risks varying across geographic contexts and land-cover types (e.g., forest conversion).
	Water	In arid regions, there are concerns about water stress and potential groundwater contamination from LSS construction and operations. In the Midwest and Northeast, concerns focus on altered stormwater patterns and increased erosion.
	Health and safety	LSS raises concerns about potential air pollution (dust due to vegetation and soil disturbance during construction), microclimate changes (heat/cool island effects), fire risk, panel toxicity and chemical leachate (panel runoff contaminating local soils and water sheds), and end-of-life disposal impacts.
	Agricultural land	LSS siting on agricultural land raises concerns about soil impacts, loss of productive land, and farmland fragmentation. Some narratives frame LSS as supporting farmland preservation, land fallowing, reduced chemical input, and protection from other permanent developments.
Sociocultural	Amenity value	Concerns about changes to viewshed, visual impacts on rural landscapes, threats to green and open spaces, and generally negative aesthetic perceptions are common. Agrivoltaics and ecovoltaics are seen as ways to improve LSS aesthetics and retain rural character.
	Cultural resources	Impacts on cultural resources—such as sacred sites, burial grounds, historic structures, and landscapes important to community heritage, as well as ecological resources that confer cultural services—are associated with negative responses. LSS has also been framed as providing local benefits that can improve community quality of life.
	Recreation and tourism	Anticipated negative impacts on recreation and tourism and linked to negative public responses; concern about loss of access to public lands where LSS projects affect historic access.

threats to critical habitat of sensitive and culturally significant species [18,43,44]. Similar concerns with impacts on wildlife and biodiversity loss in the other regions are related to forestland conversion [40], avian impacts [108], reptile impacts [13], land cover changes [109], native bee habitat loss [110], and displacement and fragmentation of wildlife habitat [37,60,87].

Across these geographies, water and groundcover concerns are common but differentiated—changing water patterns and demands resulting from LSS in the Southwest and Intermountain West is concerning from a water replenishment and savings perspective for humans, flora, and fauna [13,43,78,79,81]. Whereas stormwater runoff and soil erosion are concerns in the Midwest [16]. Alternatively, there is interest in the potential for LSS to act as a "thirty-year cover crop" by enabling land fallowing and reducing chemical input [87]. Other perceived and real environmental health and safety concerns contribute to negative public responses to LSS nationally, such as air pollution from fugitive dust, heat and cool island effects, fire risk, panel toxicity and chemical leachate, end-of-life disposal impacts, and "valley fever" [111] [13,42,79,87,98,112–114]. More longitudinal research across more geographic contexts is needed to characterize these environmental impacts.

4.1.2.3. Sociocultural impacts. In a variety of case studies, LSS has been perceived as a threat to culturally, historically, and spiritually significant landscapes [42–44]. The perceived loss of amenity value and impacts on green and open spaces, recreation and tourism, public land access, landscape character, and cultural heritage due to LSS development are frequently raised concerns [6,14,15,42,43,115]. While some associate LSS with improved quality of life [45] or preservation of agricultural heritage and aesthetics through agrivoltaics or ecovoltaics [84,101], others perceive negative impacts on viewsheds and rural identities [15]. Other discussions about the appropriateness of LSS siting among Tribal communities demonstrate that sociocultural impact concerns extend beyond visual change to include impacts on cultural resources [43]. Together, this research suggests that sociocultural impacts cannot be understood independently of place-based values and meanings but instead represent how they become evaluations of LSS and ultimately shape public responses.

4.1.3. Procedural and distributive aspects

There is a rich literature unpacking the procedural and distributive aspects of LSS [9,14,45,47,116]. Overall, perceptions and experiences of process fairness (the ability to meaningfully participate in or affect decision making) and outcome fairness (the distribution of benefits and burdens) most strongly explain public responses to LSS. This literature provides an integrative lens for understanding how engagement, influence, and trust relate to personal values and beliefs, shape risk-benefit perceptions, and influence project outcomes.

4.1.3.1. Process fairness and engagement. The "how, when, whom (with, by, and for), where, and why" of engagement in the LSS development

process has implications for public responses [116]. Perceptions of unfairness, lack of due process, exclusion, or "instrumentally motivated" engagement (i.e., as a means to the end of approval) [10] lead to distrust and belief that developers are disingenuous [6,16,42,80,88,95]. Examples of issues that exacerbate negative public responses include a lack of meaningful environmental reviews [80], Memoranda of understanding that reduce negotiating power [88], project denials that appease opposing community members rather than landowners seeking fair process [88], and failed Tribal consultation [43].

The timing and type of engagement, as well as the goals of engagement activities, are key determinants of LSS responses [10,13,42,75,116]. While early notification to community members of a proposed development allows time for opposition groups to organize and compromise project feasibility, delaying notice until site control is established perpetuates the "decide-announce-defend" approach [117] and reduces perceived opportunities for meaningful participation [10,47,88,116,118]. Recent research has increasingly focused more on the type, meaning, and depth of engagement activities, emphasizing that poorly structured processes—or those that create unmet expectations or obscure public participation roles and rights—can erode trust and foster cynicism [43,116]. The "Public Participation Spectrum" developed by the International Association of Public Participation [119] and the "Engagement Curve" and Guidebook established by Bessette et al. [116] outline key participation stages and one potential order of operations for LSS engagement, with attention to how level of effort and intention by the developer shape public responses. Most of the literature focuses on the developer's role in public engagement—often the least trusted party—highlighting the need for future work to explore how responsibility can be better shared among developers, local officials, and other trusted actors [120] to improve the LSS engagement process.

4.1.3.2. Input and influence. Opposition to energy development is often related to perceptions of distance from, and limited influence on, decision-making [6,34,121]. A national survey of LSS neighbors, defined as those living within three miles of existing LSS projects, found 90% of respondents were unaware of their local development planning process [47]. These LSS neighbors reported feeling an inability to affect change, concerns that developers were unresponsive to their feedback, and a consistent belief that they should be entitled to provide input, especially for larger and proximate projects [47]. LSS developers' preference for a "one-way process" that solicits public input but does not grant the host community any decision-making power [10], or to offer compensation more often than to make project design changes in response to community feedback [9,10], presents a gap between public expectations and development practice [18].

However, demands for greater public input on development plans do not align with the private decision-making that is characteristic of LSS, which varies across jurisdictions and often involves many private landowners [88]. Private forums that offer exclusive participation to those involved in LSS negotiations can perpetuate perceptions of unfairness and inequalities between landowning and non-landowning community members [10], a pattern documented also with wind energy [122] and gas drilling [123]. As LSS and all other forms of electricity generation can create impacts that transcend individual properties—affecting the environment and ecosystems [124] as well as economies [79]—questions about shared landscapes, public goods, private property rights, and community decision-making may become more prevalent. Issues related to state preemption of local rule for LSS remain largely underexplored [47,125].

4.1.3.3. Information and trust. The significantly positive relationship between an individual's self-reported knowledge level and support for LSS [126] suggests a need for more attention to the role of (mis)information in shaping public responses [127]. Research on offshore wind energy development in the United States highlights that misinformation and disinformation led to high levels of uncertainty about siting risks [128]. Information access, quality, source, and trust in project actors are critical areas of concern with the procedural aspects of LSS development [13,40,42,48,126]. LSS neighbors report limited accessibility to and low provision of project information, which contributes to uncertainty about project impacts [13,88], limits community members' access to related programs [75], creates a "narrow window of participation" [79], and exacerbates lack of trust in LSS [42,98]. Community members are demanding more information pre- and post-construction [9,47], yet local officials often lack trusted sources of information on LSS impacts—including property values, ecosystems, energy reliability, and public health [7]—and must navigate relational and political constraints with developers, who hold this technical knowledge. This "power asymmetry" between developers and local officials, who face limited knowledge and capacity, has been documented in wind energy development [129] but remains underexplored in LSS, pointing to areas for future research on structural asymmetry [130] in solar development. A complex relationship is emerging between information provision and source trustworthiness [9], LSS developer credibility [10], accountability [6,13,80], and local official decision making [7]. Insights from the robust scholarship on the "social license to operate" [131] have not been fully incorporated into LSS research.

4.1.3.4. Distribution of benefits and burdens. Concerns over the "winners and losers" of LSS are prevalent [15,40,84], spanning rural-urban divides [14], levels of government [79], and stakeholder types [42]. Questions about the share of benefits and placement of burden of LSS have intensified as case studies reveal how LSS can exacerbate existing inequalities [43,80,81]. "Fraught legacies" of natural resource exploitation in rural U.S. communities have led residents to question the local benefit of supplying urban areas with power, creating strong negative sentiments about "rural burden" and "sacrifice zones" [13,14,42,87]. Perceptions of distributive unfairness, such as whether a community feels they are hosting an unfair share of undesirable infrastructure, have a negative effect on LSS responses [6,9,16,40,42,132], especially in rural areas where residents view LSS as an extractive use of land for urban "electricity export" [13,14] and a threat to non-landowning farm operators [15,81]. This perceived rural burden of energy production is also held by communities that host LSS projects agreed upon and owned by state or federal entities, where the burdens are felt locally but the benefits are not [79]. Issues with nonlocal financiers and beneficiaries and "failed benefit sharing" continues to fuel negative LSS responses [40,42,79]. Future research is needed to explore how these distributional debates are intertwined with rural identity and broader political-cultural dynamics between rural and urban places [133].

A small stream of literature has focused on the role of ownership models, Community Benefits Agreements (CBAs), and payment mechanisms in influencing LSS responses [9,40,75,85,95,97]. Although community ownership and subscription models that localize the benefits and control of projects are preferred by the public [9,13,95], legal frameworks do not often support bill credits nor is local ownership feasible from a corporate finance perspective [10], leaving a gap between what communities desire from LSS and what developers can deliver. CBAs have become a popular approach to meeting the value sharing demands of communities and investing in local services while bypassing complicated ownership models [43,97,134]. A national survey of LSS neighbors finds a correlation between payment and perceived fairness—those who received payment described the development process as fair, whereas those who didn't reported feeling ignored and uninformed [9,13]. It is anticipated that perceived fairness of value sharing and levels of transparency regarding economic aspects of LSS will continue to shape public responses [13,40,88], suggesting a need to fill current research gaps on how solar lease models are negotiated and structured.

4.2. Technical factors

4.2.1. Proximity and visibility

There is mixed evidence on the relationship between proximity and visibility and public responses to LSS. Some surveys that measure differences in attitude by using distance as a predictor detect a positive correlation between proximity and opposition [37,38,96]. Rand et al. [45] report a null effect of proximity, finding that the nearest LSS neighbors are not any less supportive of additional LSS than those further away from existing facilities when controlling for other variables. Other studies provide evidence for the concept of "distance decay" [83,135], in which support for a project decreases with increasing distance. Consistent with this pattern, residents living closer to a hypothetical LSS project report greater support [41], a trend also observed in wind energy scholarship [53], where residents perceive that potential benefits are less relevant when projects are located farther from their homes or communities. Similarly, some research finds strong preference and greater support for projects with zero visibility [37,45,136], while another study finds greater visibility and the resulting awareness and exposure is related to positive attitudes [97], which is similar for wind [137].

Proximity to LSS is often confounded by financial or community incentives, such as "good neighbor payments" [87] or CBAs [138], making it difficult to isolate its effect on public responses. Visibility also interacts with land use and site type; for example, people tend to be more accepting of projects on brownfields than greenfields [40] or projects that retain agricultural character (agrivoltaics) [84]. Overall, neither proximity nor visibility are consistent predictors of public responses to LSS, further underscoring the limitations of the 'NIMBY' explanation [38,40,41,45,96,136].

4.2.2. Size

Most studies examining LSS project scale report larger projects are associated with negative public responses [9,45,85,101,139]. Hess et al. [98] describe the "compound effect" of size and how larger projects enhance related concerns with LSS, such as impact on neighboring farms [8], or the "spatial reach" of projects, including material inputs and benefits distribution [85]. The perception that larger projects will have larger impacts drives increased public expectation around levels of engagement and ability to make decisions in siting and development [47]. Further, recent research flags a disconnect between small-scale farm landowners' interests in agrivoltaics and the large size of traditional solar projects [82]. Overall, interrelated issues around project size and perceived impacts and benefits, as well as cumulative impacts or thresholds, have been generally overlooked in the literature, but the existing evidence suggests that reactions to size are less about physical size and more about the implications on communities [47] and ecosystems [18].

4.2.3. Land type

There is evidence that existing land use and/or habitat quality of land under consideration for LSS development is a key explanatory factor of public responses [13,40,83,85,95,136]. Across geographies, there is general preference for siting LSS on brownfields or former landfills (often defined as 'marginal lands') rather than more productive or 'prime' farmland, open space, greenfields, forestland, or wildlife habitat [9,13,40]. However, strong relationships between siting preferences and prior land cover do not persist in multivariate models [45], indicating a more complex relationship between land type and public response that deserves future research attention. Further, public responses to LSS across land types likely reflect perceptions of landscape, habitat, or open space rather than parcel-level land use classifications [105], highlighting the need for future work to explore relationships between land type, place-based meanings, land classifications, and siting outcomes.

There are also conflicting perspectives on whether LSS siting is most appropriate on private versus public lands, which mostly occur across western states. In the Southwest, the "virtual privatization" of U.S. Bureau of Land Management (BLM) lands for the purpose of LSS development has raised criticism because many public lands are in conservation by default, having found no takers during westward expansion. Large swaths of public lands were believed to have been protected from development by policies such as the 1994 California Desert Protection Act, which put restrictions on public lands disposal [18,44,79]; in some cases, private lands were bought by wildlife conservation organizations and donated to the BLM to be conserved in perpetuity as public lands [107]. In the Northeast and Midwest, there is tension between private property rights and community decision-making, where farm owner-operators seek to protect their right to lease their land in the face of community opposition to changing agricultural landscapes and other land competitions [10,87,98]. Disputes around farmland as either a public or private good as it relates to LSS deserve more attention [15].

4.2.4. Groundcover

Groundcover choices, influenced by project location, size, and land type, shape perceived aesthetics and risk-benefit tradeoffs [46,82,101]. As an interrelated measure, the effect of groundcover choices on public response to LSS has not been completely isolated in research. Studies that specifically assess preferences for different groundcover or project land uses find that support is generally highest for projects incorporating agricultural uses (agrivoltaics) [8,9,40,84,101]. However, some research suggests that agrivoltaics will not be uniformly accepted or relevant across geographies [15,45,47,106]. Because groundcover directly influences environmental impacts, ecosystem services, aesthetics, and other potential co-benefits of LSS [46], further research is needed to clarify how public responses vary across specific choices, particularly different agrivoltaic applications such as crops, grazing, and pollinator habitat. Table 2 summarizes research findings on the relationship between technical factors and public responses to LSS.

4.3. Sociodemographic factors

Survey research has largely focused on measuring the relationship between sociodemographic factors and public responses to LSS. Overall, findings demonstrate that sociodemographic factors provide weak and inconsistent explanations [38,41,48,72,83,140]. Positive responses to LSS are somewhat more common among individuals identifying with a liberal political ideology [38,41,72], with higher income and education levels [38,40,48,73,139], and within younger age groups [73,141]. The correlation between "rurality" (i.e., rural residence) and public responses to LSS is mixed [48,135,140]. Approaches that capture

Table 2
Summary of relationships between technical factors and public responses to LSS.

Technical Attribute	Summary of Research Findings
Proximity and visibility	Proximity and visibility exhibit inconsistent effects on public response, offering little support for NIMBY explanations. Proximity to LSS is often associated with stronger responses because perceived risks and benefits are more tangible. Projects with zero visibility can be preferred, while in other cases, visible projects can improve attitudes through awareness and familiarity.
Size	Larger projects generally elicit greater concern due to perceptions of amplified economic, environmental, and sociocultural impacts.
Land type	There is consistent preference for siting LSS on brownfields or former landfills ('marginal lands') rather than productive or 'prime' farmland, forestland, greenfields, open space, or wildlife habitat. Conflicts regarding the use of private versus public land persist.
Groundcover	Agrivoltaic projects generally elicit more positive responses, but they may not be universally preferred or relevant across geographies.

sociodemographic factors among other experiential factors or integrate qualitative data appear better suited to fully understand the underlying values, risk-benefit perceptions, and place-based considerations that shape LSS responses [47].

5. Critical analysis

As LSS development matures in the United States, strengthening the foundation of the supporting research is important for establishing a shared understanding of public responses to siting and a robust evidence base that can guide decision-making. Our review revealed a few common methodological issues related to operationalization and representation that shape how current findings can be interpreted and applied. Here we highlight areas that deserve attention as the field advances and provide recommendations for future research.

5.1. Operationalization

A central limitation of the literature is inconsistent or ambiguous operationalization of key constructs and units of analysis. Terms such as *acceptance, support, perception, perspective, attitude, response, tolerance, resistance, conflict,* and *opposition* are used interchangeably and often without explicit definition, which challenges measurement validity, generalizability, and interpretation by researchers, study participants, and interested audiences. Issues with construct and unit of analysis clarity often co-occur, for example, when studies frame their object of inquiry as "social acceptance" or "community acceptance" while relying on survey instruments that measure individual perceptions [84]. When community-level phenomena are inferred solely from individual responses, important relational dynamics and institutional contexts that shape LSS responses may be obscured. Seay-Fleming et al. [101], for example, observed a disconnect between expectations of personal versus community-level benefits, demonstrating that individual perceptions and collective experiences may diverge in ways that are not being fully captured. This is further complicated by lack of clarity in whether studies assess perceptions about a hypothetical project or LSS in general, support for a proposed project, or attitudes towards or acceptance of an existing project—which are three analytically distinct phenomena that reflect different evaluative processes and require clear definition to meaningfully understand and compare [61]. Recent work has given close attention to these distinctions [9,13,45,75] and future work could directly assess how public responses vary across these scenarios. Strengthening the clarity and consistency of key constructs and units of analysis could make LSS research findings more interpretable and actionable.

5.2. Representation

Another limitation of the literature is uneven stakeholder representation and limited differentiation among them. Studies of "communities" may overrepresent highly engaged individuals, such as vocal opponents and landowners who benefit economically from LSS leasing [6,47,88]. Further, interpretation of current research is challenged by the fact that much of the existing literature is not grounded in the experience of individuals with direct experience with LSS but instead reflects individuals' expectations or speculations. Additionally, relatively sparse representation of solar developers, policy makers, local officials, and permitting officials also leaves gaps in understanding the experiences of those with influence and authority in LSS siting processes. Such representation of certain groups with high interest and influence and/or low experience can potentially skew findings and limit understanding.

Beyond *whose* perspectives are being represented, there is limited differentiation between stakeholder types, particularly between landowning and non-landowning individuals. This limitation is especially salient in agricultural contexts, where responses to LSS can vary substantially depending on farmland tenure arrangements [78,104]. Treating a Tribe, "community" or "the public" as a single unit can obscure meaningful variation in how people with different interests and roles perceive LSS, such as residents versus government agencies or interest groups. For conceptual cohesion, this paper used the umbrella term "public responses" to refer to social responses broadly and in doing so, we acknowledge that important nuances—particularly distinctions among different stakeholder groups—are not fully captured. Future research would benefit from more differentiated stakeholder representation to address the risk of overemphasizing the concerns of poorly defined groups and overlooking how different actors influence and respond to LSS.

Temporal representation is also limited. Studies often capture public responses at a single point in time [142], offering a snapshot that may shift considerably as projects move from proposal to construction and operation. Evidence from wind energy scholarship suggests that support can increase over time as residents gain experience with a project [143,144], but comparable dynamics remain largely unknown for LSS, in part because it's a relatively recent land use. As deployment matures, communities and landowners may become economically dependent on tax revenues or lease payments or accustomed to altered landscapes [45,145], potentially reshaping attitudes towards existing and future LSS. Without longitudinal data, it remains difficult to determine whether attitudinal shifts drive fairness evaluations or whether perceptions of fairness shape attitudes over time [9]. Additionally, limited examples of and research on later phases of LSS development, including repowering and decommissioning, constrains our ability to anticipate and address growing public concerns about these stages [87] and to distinguish between initial risk-benefit perceptions and responses to realized, long-term project impacts. A recent rise in ex-post installation studies signals growing recognition that public responses to LSS vary over time and reflects the fact that LSS deployment has reached a scale that now allows such longitudinal and post-installation analysis [9,13,43,45,47,75,79,80]. This ability to study ongoing and existing LSS projects and consider cumulative impacts presents an opportunity to explore if early expressions of concern reflect dissatisfaction with engagement, decision-making, information access, distributive aspects related to value sharing, or cumulative changes over-time—insights that could support more targeted interventions and engagement strategies.

While many of these recommendations (Table 3) are intended primarily for individual researchers or research teams, a broader coordinating body could propose shared terminology, standardized instruments, and best practices for research on public responses to LSS. In doing so, the conceptual clarity, methodological consistency, and comparability of findings across geographies and other energy technologies could be improved. Our conceptual framework (Fig. 2) offers one step in this direction by providing a common structure for organizing key factors and clarifying their relationships. Such collective efforts to build a social science canon on LSS could help converge and direct actionable research for guiding siting practices as deployment matures.

6. Discussion

This review demonstrates that research on public responses to LSS in the United States is emergent yet increasingly expansive. The literature integrates multiple stakeholder perspectives and geographically situated findings that reflect the fundamentally socioenvironmental and place-based nature of energy siting and land use decision-making. This literature also consistently highlights the central role of risk-benefit perceptions, procedural fairness, and distributive aspects in shaping public responses to LSS, which aligns with social science research on other energy technologies. As the field advances, there are significant opportunities to build on this foundation by expanding research coverage and stakeholder representation, refining methodological approaches, developing shared conceptual frameworks, drawing more explicitly

Table 3
Overview of methodological limitations and recommendations for future research.

Limitation		Recommendation
Operationalization	Ambiguous and inconsistent constructs	Align terminology and measurement with established distinctions between "perceptions" as related to a hypothetical project or LSS in general, "support" for a proposed project, or "attitudes" towards or "acceptance" of an existing project [20,61]. Explicitly define in research instruments and publications whether the study examines hypothetical, proposed, or existing LSS projects.
	Unclear units of analysis	Clarify the unit of analysis, ensure alignment between what is measured (e.g., individual perceptions) and what is claimed (e.g., community acceptance), and consider individual-level factors in relation to community-level contexts. Differentiate between perceptions about personal impacts of LSS (e.g., job opportunities for me) and community-level impacts (e.g., job opportunities for my community).
Representation	Uneven stakeholder representation and limited differentiation	Purposively sample and compare responses across stakeholder groups with different roles, interests, and influence. Specifically account for variations in responses to LSS as they relate to land ownership, as well as rural versus suburban residence.
	Lack of longitudinal data and attention to specific project phases	Collect longitudinal and/or panel data to track changes over time, for proposed and existing projects. Distinguish initial risk-benefit perceptions from responses to realized, long-term project impacts, examining whether early concerns reflect dissatisfaction with engagement, decision-making, information access, value sharing, or other procedural and distributive aspects.

from adjacent scholarship, and strengthening public engagement and value sharing. Together, these insights invite reflection on how LSS development might better align with place-based sociocultural, economic, and environmental values and how social science can deepen understanding of the evolving interplay between public responses and energy siting.

Many of the procedural and distributive issues reported in the LSS literature reflect broader systemic challenges in infrastructure development and land-use change that extend beyond the energy sector. Core debates—such as local versus state control over siting, public versus private influence over land-use decisions, and local burdens versus global sustainability—transcend LSS, touching on governance, public goods, the conceptualization of private land as a commodity, political ecology, and distributional fairness. Long-standing social science research on public engagement [146–148], adaptative governance [149], environmental federalism [150], procedural fairness [151,152], rural theory [153], and "private participation" [123,154] for energy and other types of development provide a strong foundation for understanding these dynamics and may offer transferrable lessons. Advancing research on public responses to LSS will likely require engagement with scholarship that goes beyond traditional energy social sciences.

Three broader implications emerge from this review. First, the scarcity of trusted resources on LSS impacts shapes risk-benefit perceptions and reinforces public mistrust. Second, the potential compatibility of LSS with agriculture offers opportunities for value sharing, participatory planning, and preservation of agricultural livelihoods and heritage, yet a truly integrated approach remains nascent at large scales. Third, common siting principles persist across contexts, but implementation requires place-based approaches given the highly diverse nature of project review processes, decision-making authority, and socioenvironmental conditions.

6.1. Knowledge gaps constrain trust and the social license to operate LSS

As LSS deployment in the United States has recently accelerated, research on long-term economic, environmental, and social impacts is not yet fully mature. Limitations in empirical evidence and trusted case studies shape how risks and benefits are perceived and debated, particularly when their distribution across stakeholders remains unclear. This absence of longitudinal and context-specific evidence restricts informed public participation, allows potential misconceptions to persist, exposes local officials to unverified claims, challenges trade-off assessment, and impedes the industry's ability to implement mitigation strategies—issues that can undermine trust and constrain the "social license to operate" [131].

Recent studies have begun to document project-level impacts, including effects on sensitive ecosystems [18,79], land or home values [99,100,155,156], local economies [80], and cultural heritage sites [43]. While these studies provide an important foundation, the evidence base remains fragmented and does not address the full range of potential impacts that may either be perceived as important or experienced during and after development. Critically, research has yet to systematically examine how risks and benefits are distributed over time—for example, how LSS profits flow with attention to landownership. These distributional questions are central to public responses, as perceptions of fairness and procedural integrity often reinforce or amplify risk-benefit assessments.

Building public trust in LSS will likely require a more comprehensive and longitudinal evidence base that tracks economic, environmental, and sociocultural impacts across contexts. Such efforts could inform targeted CBAs and other interventions [138], provide credible case studies for public engagement [157], and support more transparent trade-off negotiations. Bridging public concerns with development practice may also require collaboration with solar developers and local officials to clarify what changes to financial models, agreements, land management activities, and project designs are politically and economically feasible. Such insights could temper potentially unrealistic community expectations and enable frank discussions about what the industry can deliver within existing institutional constraints. By addressing knowledge gaps on LSS impacts and distributional uncertainties directly, researchers and practitioners can help foster more informed participation, strengthen trust, and support more durable social licenses to operate across diverse contexts.

6.2. Agrivoltaics has reshaped but not yet resolved LSS compatibility with agriculture

The large volume of interrelated issues around agriculture—including cultural heritage [15], land tenure [104], and farm viability [87]—underscores the need to better align LSS with the often diverse, competing, and place-based interests of agricultural communities. Agrivoltaics is often framed as a strategy to improve

public responses to LSS and permitting efficiency, provide revenue for farm owners and operators, and deliver broader community benefits of local food production, job creation, and education opportunities [8,9,84,101,106,158,159]. LSS developers operating in markets with agrivoltaics incentives report fundamental shifts in their practices, including greater due diligence in stakeholder engagement, design innovation, site preparation, and value sharing [160]. These actors have modified traditional LSS vegetation management agreements to offer revenue streams for both farm owners and operators, providing early evidence that agrivoltaics can help address concerns about LSS impacts on non-landowning farm operators and farmland access. The industry's ability to adapt project design and groundcover, EPC practices, engagement strategies, and value sharing to local agricultural contexts, whether through agrivoltaics or other approaches, may better align LSS with agriculture.

Agrivoltaics in the United States nevertheless remains largely nascent, constrained by adoption barriers [106,159], unclear negotiation terms and economic benefits [86,87], community skepticism about farmland conversion without meaningful benefits [81], and challenges in scaling crop-based projects beyond the typical 10 MW size or smaller [161]. Further, agrivoltaics is not uniformly embraced within the LSS industry in the United States. Some developers cite technical complexity, financial risk, and operation and maintenance (O&M) challenges as barriers that limit adoption across geographies [158,159], suggesting a gap between public expectations for agrivoltaics and the industry's ability to deliver. International insights on business models, legal agreements, policies, site preparation changes, and long-term O&M needs across application types (grazing, crops, pollinator habitat) [162–164] will likely become more relevant if the LSS industry in the United States seeks to legitimize agrivoltaics. At the same time, industry-community interactions and public responses to agrivoltaics are likely to evolve as practices, programs, and business models mature. This underscores the need for ongoing, region-specific research that tracks how early public responses to agrivoltaics can change and considers how stakeholders both respond to and shape the adaptive strategies industry may pursue over time. Realizing this potential at scale remains an open challenge that may ultimately determine whether LSS is viewed as compatible with working landscapes rather than competing with them.

6.3. Common siting principles persist across contexts, but implementation requires place-based approaches

LSS deployment unfolds across a diverse socioenvironmental and governance landscape in the United States. Public responses, project review processes, and decision-making authority all vary across contexts, reflecting differences in land-use histories, local politics, economic structures, and community identity [14,15,43,79,142]. In this heterogenous setting, socially acceptable outcomes cannot rely on standardized deployment models; they require place-paced approaches that are responsive to local conditions and decision-making structures. The relative adaptability of LSS—through changes in business models, design, and groundcover—could allow the retention of landscape character and create other economic and environmental co-benefits that are locally relevant.

Yet variability across place does not imply the absence of shared principles for LSS siting. Across cases, the literature highlights core principles that shape public responses: transparent and inclusive processes, meaningful local decision-making authority, and fair distribution of risks and benefits. These principles can be realized differently depending on governance structures and community context, but they remain central to socially acceptable outcomes for LSS. Our conceptual framework helps clarify these core principles, which can help guide future research and public engagement.

As LSS research advances, balancing national-level insights with local specificity will be critical. Aggregated findings can illuminate broad patterns and siting principles, but without attention to context they risk obscuring the institutional and socioenvironmental factors that shape project outcomes. As federal and state permitting reforms seek to accelerate infrastructure deployment in the United States [165], this review underscores that public participation and environmental review will be central mechanisms for achieving socially acceptable outcomes not only for LSS but other forms of infrastructure as well, such as data centers or electric transmission.

7. Conclusion

As LSS development matures in the United States, strengthening the foundation of the supporting research is important for establishing a shared understanding of public responses to siting and a robust evidence base that can guide decision-making. This systematic review and critical analysis synthesizes social science research on public responses to LSS in the United States. We examine research trends, geographic coverage, key explanatory factors, and enduring issues within the literature, highlighting high-value research areas and key considerations for decision-makers, developers, and host communities. We also propose a conceptual framework for interpreting this growing literature and offer recommendations to help the field converge around shared definitions, methodologies, and priorities.

This review demonstrates that research on public responses to LSS in the United States is emergent yet increasingly expansive. The literature integrates multiple stakeholder perspectives and geographically situated findings that reflect the fundamentally socioenvironmental and place-based nature of energy siting and land use decision-making. Across the literature reviewed, public responses to LSS are most consistently associated with three domains: place-based values and meanings, risk-benefit perceptions, and judgements about procedural and distributive fairness. Three broader implications emerge from this review related to information and trust; opportunities and constraints for LSS integration with agriculture; and place-based siting approaches that build on common principles. Collectively, these insights provide practical guidance for LSS research and public engagement and offer transferrable lessons for socially acceptable siting and land use decision-making more broadly.

In a national setting characterized by rising energy demand and expanding infrastructure investment, public responses to LSS in the United States must be situated within intensifying competition for land, global environmental change, and evolving conceptions of energy outlooks. Acknowledging these dynamics strengthens the case for examining how LSS fits within a broader portfolio of pathways, rather than assuming continual energy demand growth or the inevitability of any single deployment model. If procedural and distributive aspects and place-based meaning consistently shape public responses to siting, we should ask whether different scales or forms of solar and other energy technologies may, in some contexts, better align with these values than LSS alone. By raising these questions, this review creates space for new research, siting approaches, public engagement strategies for energy in the United States.

CRediT authorship contribution statement

Alexis S. Pascaris: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Doug Bessette:** Writing – review & editing. **Kathryn Bills Walsh:** Writing – review & editing. **Andrea K. Gerlak:** Writing – review & editing. **David Kay:** Writing – review & editing. **Jordan Macknick:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **James McCall:** Writing – review & editing. **Sharlissa Moore:** Writing – review & editing. **Dustin Mulvaney:** Writing – review & editing. **Robi Nilson:** Writing – review & editing. **Joseph Rand:** Writing – review & editing. **Chelsea Schelly:** Writing – review & editing. **Kaitlyn Spangler:** Writing – review & editing.

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Appendix A. Supplementary data

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Data availability

Data has been included as supplementary material.

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