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Conference Abstract

Can social media data be used to detect temporal changes in human-nature relations? A case study using Google Reviews in Haifa

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Abstract

Long-term ecological research increasingly seeks to understand not only how ecosystems change, but also how relationships between people and nature change with them. Conventional surveys and interviews provide depth, yet are difficult to repeat continuously across many sites. Social-media data can complement these methods by providing scalable, near-real-time insights (Depietri et al. 2025, Ghermandi et al. 2026a). However, platform-specific users, norms and content create representation and measurement biases (Ghermandi et al. 2026b). We ask whether online reviews can reliably detect changes in human-nature relations and what is lost when they are used as a proxy for stakeholder experience.

We examine 34,690 Google Reviews and Tripadvisor reviews of 39 urban nature sites in and around Haifa, Israel. Reviews were translated into English and classified according to cultural ecosystem service (CES) mentions and other relevant content through an AI-assisted protocol grounded in the Common International Classification of Ecosystem Services (CICES v5.2). The CICES classes were operationalized as a structured codebook containing category definitions, inclusion and exclusion criteria, and representative examples, which guided the AI in assigning one or more labels to each translated review. The prompts and classification rules were iteratively refined through

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manual inspection of model outputs before the review-level classifications were aggregated for analysis. This process allowed us to identify and distinguish among CES, including physical and experiential recreation, education, heritage, aesthetic, symbolic, sacred, existence and bequest values, as well as emotional tone and social relations. To explore dimensions not captured by service categories alone, BERTopic, a transformer-based topic-modeling method, was applied separately to negative reviews (N = 2,342) and reviews without explicit cultural-ecosystem-service references (N = 17,716). Topics were interpreted using keywords, representative reviews and hierarchical clustering, aggregated into higher-order themes, and analyzed longitudinally for 2015–2025; years with insufficient observations were excluded from trend estimation (years before 2015 and 2024).

The results reveal change and continuity simultaneously. Non-CES discourse remained comparatively stable: generalized place appreciation, nature and landscape appreciation, recreation and site conditions, and tourism-oriented experience showed no statistically significant temporal trends. Negative discourse, however, was restructured. The share devoted to maintenance and environmental degradation increased significantly (annual slope = 0.024, $p = 0.003$, $R^2 = 0.697$), while complaints about governance and destination management declined (slope = −0.028, $p = 0.019$, $R^2 = 0.515$). Visitor-pressure and experiential-degradation themes remained stable. Thus, positive relations with urban nature persisted, while dissatisfaction shifted increasingly toward cleanliness, maintenance, infrastructure and perceived environmental condition.

Social-media reviews can therefore function as a low-cost sentinel of changing public concerns, especially when integrated with ecological monitoring and used to identify where targeted stakeholder engagement is needed. Yet they cannot establish whether the observed shift reflects ecological deterioration, management conditions, changing reviewer populations, platform conventions or shorter and less specific reviews. What we gain in volume and longitudinal reach, we lose in control over sampling, explanatory context and the voices of people who do not post. For LTER, these data are most valuable not as a substitute for stakeholder engagement, but as an early-warning and hypothesis-generating layer that helps direct interviews, surveys and participatory inquiry. The next steps are comparative analysis across Haifa, Lisbon and Helsinki to test the robustness of the identified trends and examine how their direction and magnitude differ among cities, and textual analysis of changing review vocabularies to assess whether this data source reflects environmental phenomena such as climate-change impacts, altered fire regimes, and changes in local and non-native wildlife.

Keywords

cultural ecosystem services, social media, Google Reviews, human-nature relations, BERTopic, urban nature, longitudinal monitoring.

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Conflicts of interest

The authors have declared that no competing interests exist.

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