



# Unsiload agroforestry research and policy: Livelihood and multifunction as chestnut (*Castanea sativa*) management priorities for Türkiye

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## ABSTRACT

In this study, we investigate variation in the priorities for the chestnut tree held by stakeholders across Türkiye in order to highlight the importance of unsiload research and policy in the study area and beyond. We designed our study to evaluate the operating hypothesis of state agencies who manage the tree in sharp regional contrast, with the western provinces managed overwhelmingly for horticulture, and the northern provinces for silviculture. We utilized ethnobiological methodologies of plant trait preference cataloguing and freelisting to engage and analyze the priorities for chestnut trees for 96 stakeholder households across Türkiye's chestnut suitable territory. We found that no household utilized the tree for one purpose only, that every household used the tree for both its fruits and its timber, and that the vast majority utilized the tree for nuts, timber and one other category of use. We explored the resulting data using saliency analysis, multiple correspondence analysis and geospatial visualization through inverse distance weighting. We found no significant effect of western or northern location on priorities. Our findings substantiate conservation and livelihood development theories which advocate for unsiload, interdisciplinary research informed by stakeholders, and also showcase an application of agroforestry as a framework for directly amplifying the priorities of livelihood practitioners in the formulation of land use policy. Insights generated by this study support recommendations for Türkiye and beyond, including more thoroughly interdisciplinary research to perpetuate multifunctional use of trees as well as more regional and unified governmental strategies for conservation and rural livelihood viability.

## 1. Introduction

Across societies and sectors, there is growing agreement on the need to meet “wicked problems” (Brown et al., 2010) such as climate change and global poverty with integrated and collaborative knowledge production approaches. For decades, agroforestry has been successfully promoted as one such promising approach to addressing the compounding global challenges of food insecurity and environmental degradation (Garrett et al., 2022). This study projects agroforestry principles for a multifunctional land use strategy onto circumstances in Türkiye, where current state management and conservation of chestnut tree populations assumes a bifurcated geographic approach, with horticultural priorities predominating in Western Türkiye and silvicultural priorities in the northern Black Sea provinces. This application generates

important knowledge in-country by testing the assumptions underneath this approach like a hypothesis while also informing current debates about how to best mainstream agroforestry by operationalizing its broadest possible definition, and homing its optimizing its orientation within a multitude of sustainability initiatives. We show how researchers can positively impact forest livelihoods and communities by promoting unsiload research and actionable, integrated policy.

Agroforestry has a history of multiplying definitions, a dynamic rich enough to “easily occupy” (Jose et al., 2022, 4) numerous entire articles. Efforts to define agroforestry over time have meandered between viewing it as a conservation science intent on preserving countless agroforestry (tree-inclusive food production) systems around the world and other inclinations to identify it as a prescriptive science intent on increasing the occurrence of trees in existing agrarian livelihood

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approaches. Thus, Nair's well-regarded *An Introductory to Agroforestry* opens by saying that "Agroforestry has come of age during the past fifteen years" (Nair, 1993, xi), yet soon after states that "Cultivating trees and agricultural crops in intimate combination with one another is an ancient practice that farmers have used throughout the world," (Nair, 1993, 3). In a similar display of dissonance, then-Director of World Agroforestry Center (ICRAF), Leakey, appealed to readers to revisit the definition of agroforestry, stating that while the basic definition has "served well and helped agroforestry to become recognized as a branch of agricultural science in its own right," (Leakey, 1996, 5) it is actually farmers themselves "who are already ahead of the game, and are already practicing" the "kind of agroforestry" (Leakey, 1996, 7) his long experience has convinced him exemplifies the science.

At another edge of agroforestry scholarship, advocates currently work to figure out with which orientation and at which scale to promote it, particularly in relationship to other, perhaps more sweeping, sustainability framings such as "productive conservation" (Josiah et al., 2004), "multifunctional agriculture" (Jose et al., 2022) "ecosystem services" (Tsonkova et al., 2014) and "nature's contributions to people" (Elbakidze et al., 2021). One current push promotes agroforestry principles as a guide to geographically large scale land use management strategies (Jose et al., 2022). This study operates with the full span of agroforestry's definition – from objective and/or prescriptive science to traditional non-expert practice to land use management strategy – to demonstrate the efficacy of this open approach to accommodating evidence and priorities from the ground level.

An openness in definition, geographic scale and orientation for agroforestry renders the field compatible with emerging strategic visions arising elsewhere, in fields of study most oriented toward local community ecological knowledge and priorities (Wall et al., 2023). This is especially true of the emerging capabilities in Indigenous Environmental Science, also known by other terms such as Indigenous-Led

Conservation, and biocultural conservation among others. In the tradition of the ethnosciences, these and similar research approaches validate and engage, rather than preside over, the local ecological knowledge of enduring experienced practitioners of traditional practices like agroforestry. This study introduces theories and methods of the ethnosciences to this broadest operating mode of agroforestry to rigorously empirically engage enduring traditional livelihood approaches.

Our research program has demonstrated since 2015 how, when and why agrarian communities across Türkiye have maintained chestnut trees in the face of chestnut blight (*Cryphonectria parasitica*), ink disease (*Phytophthora cambivora*) gall wasp (*Dryocosmus kuriphilus*), rural abandonment, erratic climate and other challenges. Our findings have shown that the motivation for the protection of chestnut trees flows from any number of dimensions including the tree's bountiful utility along with its cultural, historic, and psychological values (Wall et al., 2018, 2019a, 2021). Furthermore, we have found that interest in the protection of trees is highest at "sites of maintenance," the places where trees are understood and cared for with the greatest intensity (Wall et al., 2019b). What we have yet to report on is the specific trait preferences that may be accounted for by state agencies in their on-going efforts to protect plant populations, promote economic related activities, produce and disseminate tailored germplasm that can withstand on-going disease and climate change pressures, and other initiatives. In this study we investigate this question while strategizing around the current siloed approach to strictly administering the chestnut species as a forestry species in the north and a horticultural crop in the west. We treat this operating strategy as a hypothesis which is testable through our data.

## 2. Study context

In contemporary Türkiye, Chestnut (*Castanea sativa*) is found across the Eastern and Western Black Sea, Marmara, and Aegean regions,

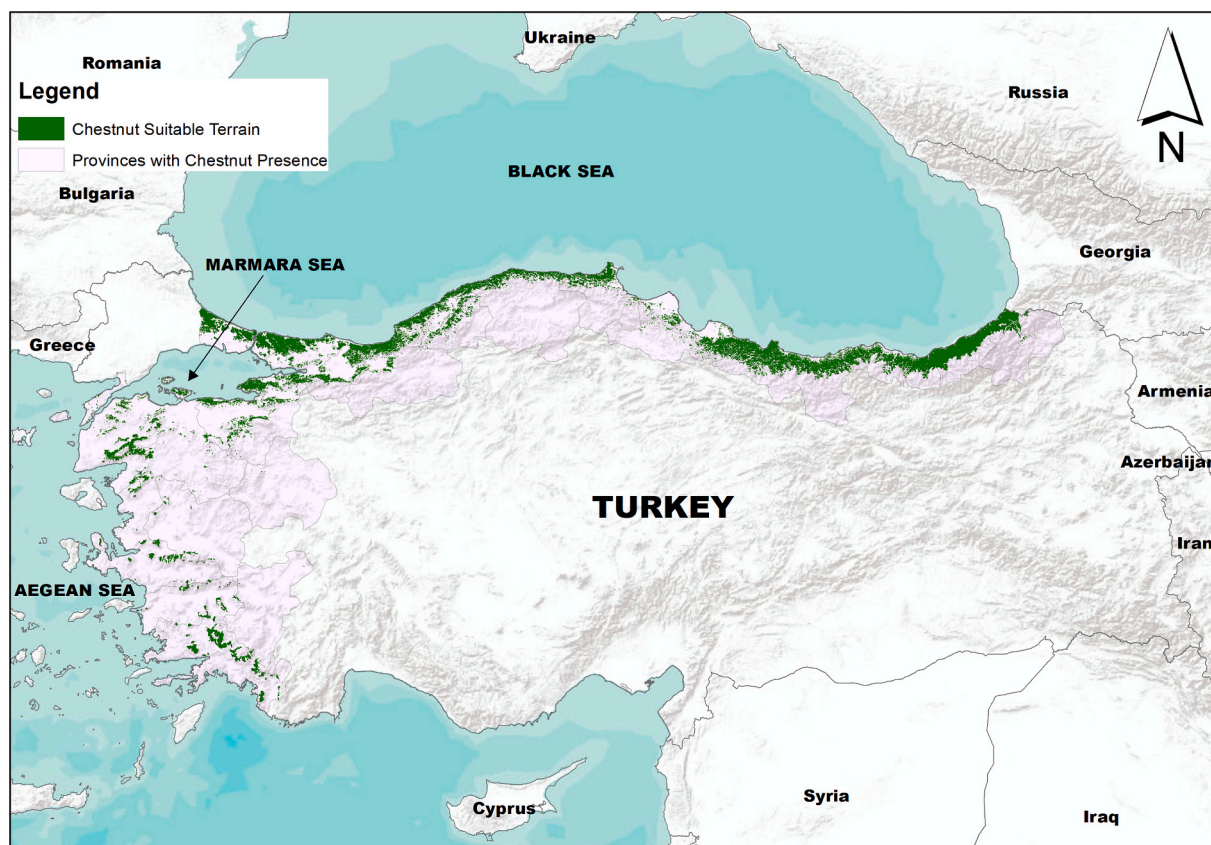


Fig. 1. Türkiye and chestnut habitat, recorded presence and suitability (Figure generated in ARC-MAP 10.8.1 using Maxent analysis by Wall).

thriving in diverse elevations, precipitation levels, and temperature conditions (Fig. 1). In the Eastern Black Sea, *C. sativa* grows in areas with high year-round rainfall, steep terrain, and dense forests above 400 m above sea level (MASL). In the Western Black Sea, the climate features wet summers and dry winters, with chestnuts growing in more managed forests between 20 and 600 MASL. In the arid Mediterranean climate of western Marmara, *C. sativa* is mainly found at elevations above 600 MASL, while in the mild, high-precipitation environment of eastern Marmara, it historically grows along the southern coast of the Marmara Sea at elevations as low as 20 MASL. The Aegean region, with its warm, dry Mediterranean climate, hosts the largest chestnut production in Türkiye, mostly above 800 MASL.

These geographic differences are mirrored by significant variations in socioeconomic patterns. In the northern Black Sea Regions, chestnuts are mainly collected after naturally falling to the forest floor. Conversely, in the Western Aegean and Marmara regions, chestnut cultivation is a primary economic activity, practiced in orchards with most trees grafted with preferred cultivars. In these areas, nuts are collected in their husks after being knocked from the trees with sticks just before natural ripening. Due to this clear distinction between the conditions of Northern/Black Sea provinces and those farther the west, it is sufficiently accurate to discuss and evaluate conditions using these two categories. This article uses Black Sea and Northern interchangeably.

What is common to all chestnut trees and spaces prevalent with them is their multifunctionality. This is a celebrated fact of *kestanelik*, the well worn term meaning, among many other things, chestnut space (Wall, 2022). Most pertinent to agroforestry, animals graze in them outside of the nut collecting season. Berry bearing species are encouraged within. Medicinal plants and game are procured there. All parts of the tree itself are used, including its inflorescence, or flowers, as tea, hair washing and dying additive, forage for bees and fake cigarettes, its husks as mulch, its roots as rootstock and charcoal. All manner of utility is drawn from the rot-resistant branches and timber including posts, rails, doors, cabinetry and more (Wall et al., 2019a; Wall et al., 2021). The starchy nuts are consumed in a wide variety of ways, from simply roasted to candies, snacks and baby food mash.

Institutionally, the context is similarly complex. Efforts to monitor, preserve and disseminate chestnut materials are undertaken by both the General Directorate of Forestry (OGM) and General Directorate of Agricultural Research and Policies (TAGEM). These institutes concentrate their chestnut-related activities and outreach primarily in Northern and Western Türkiye, respectively. In the Black Sea region, especially under the Kastamonu regional OGM directorate, numerous chestnut seedlings are nursery-cultivated for plantings across the Black Sea region. The Ministry of Food, Agriculture and Livestock, specifically the Aegean Agricultural Research Institute (AARI), manages chestnut materials in seed and tissue banks as well as research orchards, largely in western Türkiye. This same institute has carried out important, unpublished, studies to document genetic diversity for the species' populations across Türkiye (Sami Doğanlar, personal communication). The institutional treatment of *C. sativa* in Türkiye is strongly binary between agriculture and forestry. The one known official repository for *C. sativa* germplasm in Türkiye is located at AARI in the southwest. Collections grown out in this Mediterranean-type ecosystem are deeply shaped by horticultural production priorities. Additionally, it is unlikely that Black Sea germplasm would successfully thrive in grow-outs in this Mediterranean climate. Thus, Black Sea materials are managed predominantly by the Ministry of Forestry according to their distinct institutional priorities, namely, for stocking logging forests.

### 3. Methods

#### 3.1. Fieldwork

The field work program which included the investigation activities

reported on in this study took place between 2016 and 2019 across Türkiye's chestnut suitable territories. Sites for research were selected with the advisement of Türkiye's General Directorate of Forestry (OGM) and their branch offices in the provinces. Further siting of research activities was designed to evenly distribute our sample across the swathe of chestnut suitable terrain shown in Fig. 1. As our guiding purpose was to learn from those most actively engaged with chestnuts and chestnut trees, our household selection followed a purposive sampling approach. Also referred to as selective sampling, this is a non-probability sampling technique where the researcher selects participants based on specific characteristics or criteria (Miles and Huberman, 1984). This approach can provide valuable insights and in-depth understanding of particular phenomena such as our interest in priorities for chestnut populations across Türkiye. Our approach to selected households was further advised and consented to by village *muhtars*, locally elected representatives charged with facilitating engagements with visiting outsiders. Prior informed consent for all exercises was sought and received from participants of all exercises in line with the International Society of Ethnobiology code of ethics (International Society of Ethnobiology, 2006).

Once consent was offered, households participated in semi-structured questionnaires and identified sites they determined to be significant for their chestnut livelihood activities. These sites were then utilized for field protocol. Questionnaires were designed to elicit nested sets of information stemming from uses for chestnut tree derived materials. Participants were invited to share each and every use for these materials. For each and every identified use, the part of the plant needed for the use was noted. For each part of the plant identified for each use, participants were asked to describe the quality or trait of that material that made it good for the use.

Field protocol entailed demarking a 10 × 10-m geo-coordinated plot at the site designated by participants. In this plot, the location of each chestnut tree was noted. Each chestnut tree was evaluated for chestnut blight, along with several other attributes. Among these recorded factors, only the precise geolocation for each tree - which was later assigned a derived value for the priorities for it - is pertinent to this analysis.

#### 3.2. Analysis

The dataset for the present study was constructed from the recorded observation data indicated above. The major preparatory stage was formulating data to generate saliency measurements of plant parts used. Saliency analysis is an established ethnobotanical method designed to measure frequency and placement of mention as an indicator of significance (Nolan, 2014). Commonly, saliency analysis takes prominently used words, terms or concepts within utterances or text such as statements, comments, and/or rhetoric to indicate significance or importance. Repetition and order of occurrence is factored into this analysis (Buetow, 2010). Asking directly after economic or other importance can cause discomfort or insecurity in contexts like Türkiye, where certain ambiguity about access rights to the products in question exists. Saliency can prove to be a useful window into priorities in these circumstances.

In our approach, the reported plant parts utilized along with traits and uses for each plant part were understood as text for saliency analysis. We later treat these plant part associations as the following use-categories: nuts indicate horticultural, timber indicate silvicultural use categories. In data visualization exercises plant parts other than nuts and wood, we categorized as 'other' use-category in order to sharpen the focus of analysis. We make this categorization because the overwhelming context for chestnut importance in Türkiye is related to the nut or the timber. While we are on the record demonstrating the error of this limited association (Okan et al., 2021), our main aim in the present study is to allow for the representation of multifunctionality writ large, meaning any evidence of strong utility for the chestnut tree other than singular importance for its nut or timber was sufficient for our purposes.

Because numerous traits could be suggested for each part for each

use, our treatment of the data did not differentiate between reported uses and reported traits, but instead converted them to mentions of nut, timber or other. With a final table that included subjects and each of their mentions of nut, timber or other, we calculated a salience value for each report, using the salience function in the AnthroTools package in R statistical analysis software (Purzycki and Jamieson-lane, 2017).

In addition to summary statistics, we utilized Multiple Correspondence Analysis to illustrate relationships between salience values for use categories and regions. MCA visualizes relationships between many categorical variables, showing correspondence through proximity in a two-axis plane of constructed dimensions (Roux and Rouanet, 2010). To prepare data for MCA we converted salience values to categorical factors or high or low, with high being the upper 50 % of the range and low being the lower.

Finally, we performed the spatial analytic technique of inverse distance weighting (IDW) in ARC-MAP 10.8.1 to generate a spatial representation of the distribution of salience for horticultural and silvicultural priorities. IDW is a multivariate interpolation method which predicts and illustrates values across space based on weighted averages derived from a set of known points with associated values (Panigrahi, 2014). Using trees and their associated salience values for horticultural, silvicultural or other multiple-use categories ( $\geq 3$ ), we deployed IDW to illustrate the prevalence of these values across Türkiye's chestnut growing provinces.

#### 4. Results

96 households participated in our study, evenly distributed across the chestnut growing territories of Türkiye. 56 were located in the Black Sea provinces while 40 were located in Western Türkiye. These households were collectively associated with 1500 geolocated and inspected trees. Results fail to support the hypothesis that populations of Western Türkiye primarily hold horticultural priorities for the chestnut tree and Black Sea provinces primarily hold silvicultural priorities for the tree. As Table 1 shows in the very top row, not one participating household indicated singular interest in any one use-category. Neither wood, nor nuts, nor other use categories drew an exclusive interest from any one household. Rather, 100 % of subjects reported combined silvicultural and horticultural usage of the tree. Therefore, 100 % of households held multifunctional value for the tree. Furthermore, more participants held 3 use categories (23/37.5 %) than 2 (28/29.2 %). More reported 4 (30/31.3 %) than 3. A small sample reported 5 of 6 observed use categories. In summary, more than 70 % of our study population used their trees for nuts, timber and one other use-category.

Fig. 2 allows for the visualization of Table 1 data in addition to showing the overall distribution of reported uses and traits by plant part. It shows that reports of chestnut timber use represents the largest use-category by this count, despite the nut enjoying a more pronounced position in terms of public interests. Flowers, largely cited as a resource for coveted chestnut honey, similarly prevail in cultural importance (Okan et al., 2021) for the broader public. Yet, at the "sites of maintenance" (Wall et al., 2019b), there is indisputable utility for the great timber properties. Black Sea respondents reported 371 timber uses compared to 194 nut uses, while Western respondents reported 241 timber uses and 127 nut uses. For flowers, leaves, roots and husks, Black Sea respondents cited 34, 37, 0 and 0 uses, respectively, compared to 16,

**Table 1**  
Breakdown of plant parts mentioned by households.

No. of plant parts utilized	No. subjects	% Subjects	% Timber & Nut
1	0	0 %	NA
2	28	29.16 %	100 %
3	36	37.50 %	100 %
4	30	31.25 %	100 %
5	2	2.08 %	100 %

9, and 5 and 2 uses by Western respondents.

Breakdown of mean salience data by parts and by region (Fig. 3) supports the general findings of raw plant part reported uses above, yet offers further nuance. First, the difference between salience and raw counts of reports becomes clear in the case of timber, cited as an example above. The order in which uses were reported factors into salience values; counts of mentions does not translate into greater salience necessarily. As research into the enormous importance of chestnut honey shows, concentrated favor for one aspect of plant use manifests in conversational focus and order. Consequently, nuts outweigh timber in both Western and Black Sea regions of Türkiye. Flowers (for honey) does so also, though just in Western Türkiye. Breakdown of salience of utilized plant parts also produces two further insights. First, the extensive multifunctionality of the tree is verified in both regions. The salience of all reported categories are shown in the figure as appropriately significant and somewhat evenly proportional, negating an assumption of widespread overwhelming favor for any one plant part or related use, either regional or otherwise. Second, the order and actual parts represented by region do indicate regional difference worth exploring further, as our multiple correspondence analysis explores well.

MCA results provide further insight into the nature of variation between regions and otherwise (Figs. 4 and 5). At this stage and in subsequent analysis, based on the prominence of nuts and timber we group flower, leaves, roots, and husks into an "other," category and branches and timber into a timber category in order to more effectively and concisely visualize multi-functionality. Nearly 75 % of variation was captured by two dimensions, each with rather clear interpretation. On the horizontal axis, two clear poles present between high-low timber salience and high-low nut salience. Particularly striking is the tight association between high timber salience and low nut salience, as well as the inverse, high nut salience and low timber salience. At the level of the individual respondent household, a tendency to prioritize one or the other is visibly shown.

The variation (49 %) associated with prioritization of nut vs. timber is visibly unrelated to region, which is captured very well by the vertical axis of Figs. 4 and 5. This vertical axis also indicates that a high salience for "other" is correlated with region as opposed to nuts or timber. While this further fails to support the null hypothesis of a horticultural west and silvicultural north, it does indeed present an interesting topic for discussion around the prominence of this level of multi-functionality. The tight boundedness of occurrences in these categories is indicated by 95 % confidence ellipse (Fig. 5).

Spatial illustration (Fig. 6) further fails to support the null hypothesis for numerous reasons. Firstly, intensive zones of horticultural salience, namely for the eastern Black Sea Region and the province of Çanakkale, north of the Marmara Sea are not zones of intensive horticultural production in Türkiye. The Marmara Sea is a nearly inland sea in the northwest of the country. Meanwhile, Bursa, to the south of the Marmara Sea, is indeed an historic zone of horticultural production. More contemporarily, the provinces to the south and west dominate nut production, yet these present as zones of intensive silvicultural salience. Multi-use salience, again indicated by 3 or more use categories, was evenly distributed from west to east and fairly strong in the southwest as well. None of these outcomes suggest a clear regional divide between horticultural, silvicultural or other interests.

#### 5. Discussion

##### 5.1. Wider implications

Our overarching finding is that on-the-ground agroforestry practitioners across Türkiye do not corroborate the wisdom of a scientifically and institutionally siloed approach to chestnut maintenance and conservation. This finding produces insights and offers direction at several levels of analysis and application. Our discussion will take the course of panning wide to look at impactful approaches to policy and research

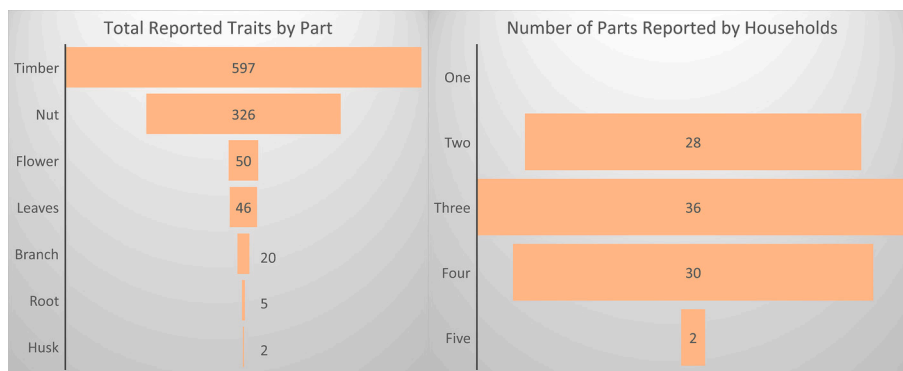


Fig. 2. Breakdown of raw mentions of plant part traits and number of plant parts used by households.

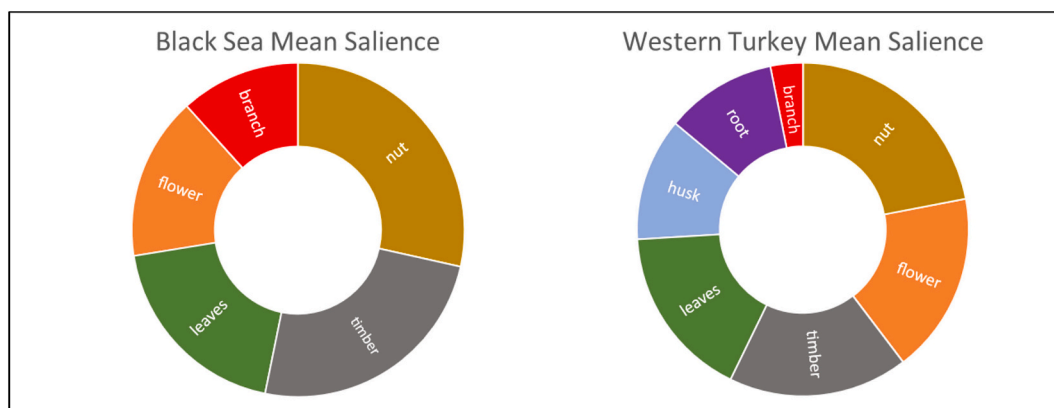


Fig. 3. Use-category salience by plant part and region.

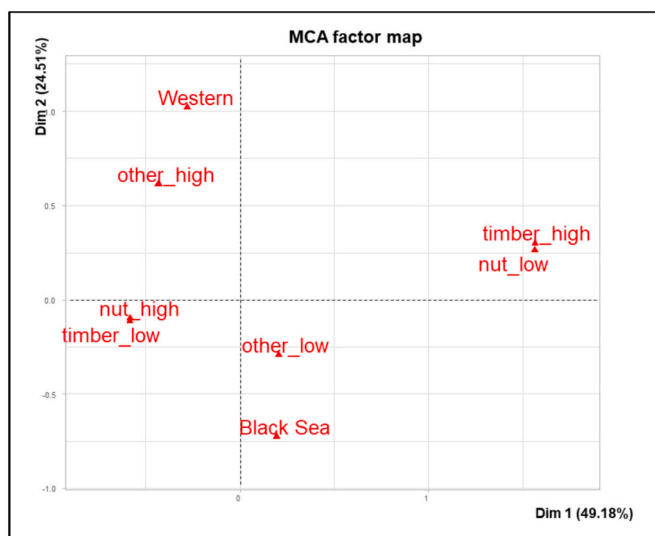


Fig. 4. Multiple Correspondence Analysis output with percentage variation explained.

generally before zooming in to applications in Türkiye. First, the testimony of livelihood practitioners clearly argues against a status quo in which siloed science clearly manifests as siloed policy. This finding is directly in line with one of the clearest arguments against the silos of knowledge: that reality in which we must live and act and succeed does not exist in silos. This self-evident fact is at the foundation of arguments for transdisciplinarity, interdisciplinarity and various advocations away

from strict disciplinary approaches (Gadamer, 1960). Many scholars insist that if their work is to be impactful, it must be forged “in spaces and environments of practice such as the classroom, the hospital, or the living room amongst everyday interactions in which something is at stake for individuals.” (McCaffrey and Moules, 2016: p. 2). We note here that the agroforest can and does serve as an especially effective example of an environment of practice. Moreover, agroforestry, operated with its most open definition, can provide essential common terrain and methods with which Ministries or Departments of Agriculture and Forestry - which are slovenly divided in numerous countries around the world other than Türkiye - can harmonize their efforts to the betterment of constituents.

On the other hand, the utility of the divide-and-conquer disciplinary approach to science and research is so self-evident as to be automatic. The observable world is nearly infinite and unimaginably complex. Individuals must follow numerous paths to behold it. For this reason, even the charter on interdisciplinarity states that transdisciplinarity *must complement* disciplinary approaches (Nicolescu et al., 2002). This impasse suggests the need to strategically unite both approaches. What our study demonstrates is a specific need along with a general path toward a strategic “unsiloing”, done in accordance with directives and priorities announced by stakeholders, livelihood practitioners and other contributors to research efforts. In effect, this dovetails with other efforts to promote science as a service for clients (Chambers and Jiggins, 1987). Agricultural extension, including tremendous agroforestry resources (see Mudge and Gabriel, 2014), is a celebrated example of such a working field (Peters, 2006). This study demonstrates one way to harness the agroforested landscape as an environment of practice where numerous disciplines can collaborate for the generation of purposeful new knowledge capable of informing more harmonized governance.

The main axes for defining agroforestry appear to be: 1) a mere word

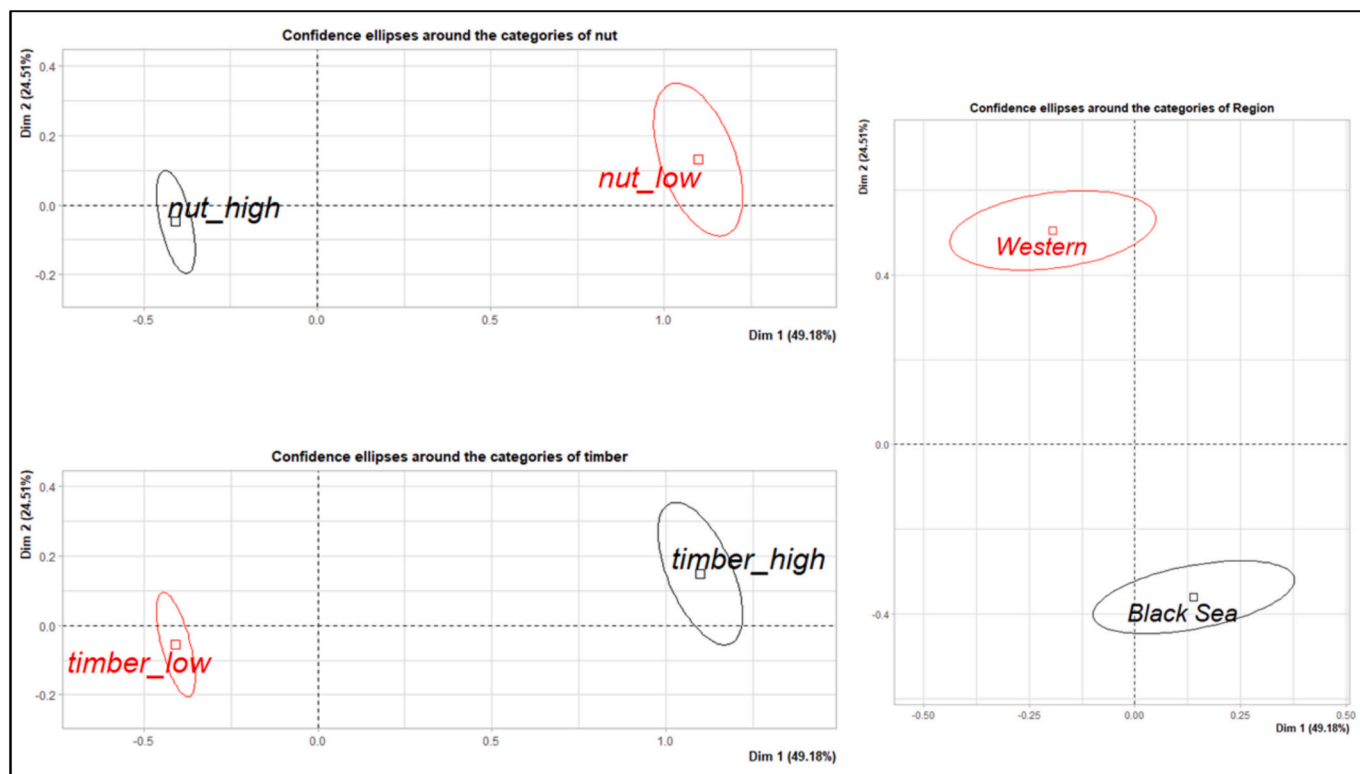


Fig. 5. Multiple Correspondence Analysis output with 95 % confidence ellipses around key factors.

for geographically and historically countless examples of tree-inclusive food production systems, 2) the natural science of these systems; or 3) advocacy for intensifying and disseminating tree-inclusive food production systems. Our findings show the advantage of operating with a definition that accommodates all three axes at once. This facilitates more generative engagement with actual practitioners, while validating their knowledge and skill, and uncovering of *their* priorities for sustaining and enhancing *their* practice.

Agroforestry has the major benefit of bringing an environment of practice to the table: the agroforest (which is easy to define):

*We define agroforests as forest structures planted and managed by farmers for the production of various forest and agricultural products on the same piece of land. Established through a complex succession of development and production stages involving the planting of crops as well as of various commercial and useful tree species, agroforests mimic natural forest structures, with a complex multistrata structure and a closed or almost closed canopy that is usually dominated by a few tree species. (Foresta and Michon, 1996)*

Like other environments of practice, the agroforest is a foil to the laboratory, as it is operated, created, and constantly adapted around the world by non-specialists and non-scientists. Like the fields of education and agricultural extension, this environment of practice allows science to be developed and expressed in a woven approach with live and evolving practices (Corcoran and Cook, 2023).

The articulation of the agroforest as an environment of practice for science and policy calls up a third area of contribution: modeling the introduction of ethnoscience methods and theory to agroforestry. Consequently, the recommendations for Türkiye outlined below can be understood to represent more than sound strategy for a specific locale - but as an exemplary output from research which engages agroforested landscapes and their custodians as leaders in local land use policy, and consequently promises impact for communities and the lands they care for that has been authentically and specifically requested.

## 5.2. Local significance

Our findings lead to a number of specific recommendations for all abovementioned efforts to conserve chestnut resources. First, while multifunctional priorities for the tree are the rule rather than the exception across Türkiye, people of the Black Sea region and people of western Türkiye do value and manage the chestnut species very differently. A national program to implement conservation would be wise to consider these differences and develop divergent approaches. Specifically, livelihood-centered approaches should recognize that a premier value of chestnut trees in the Black Sea is low-maintenance and vigorous self-propagation in a variety of conditions. This proved to be true in recent efforts by the FAO to implement biological control of chestnut blight. This was likely due to the ease of garnering local participation and cooperation to care for and monitor a handful of trees. As a village *muhtar* in the Black Sea Region declared when asked how many trees he collected from, "I don't know, a hundred or a thousand maybe." (*Bilemiyorum, belki yüz, belki bin*).

In the Black Sea region, a policy approach which allows villagers to establish and maintain *kestanelik* (chestnut groves) may prove more alluring. *Kestanelik* are everywhere in the Black Sea region, but it is formally prohibited to graze animals in them, prescribe fire or otherwise remove unwanted vegetation. This has rendered many *kestanelik* to be described as inhospitable, unattractive places for locals. Where once families hauled out picnics and maintained two-week vigils in the forest, sleeping out of doors, now thick and obnoxious rhododendron, thorny shrubs and ticks prevail. Chestnut trees in these places do not prevail. Places where local livelihood vigor insists on maintenance of these spaces should become model sites in the Black Sea region. We believe it will prove very successful conservation policy to encourage livelihood activities in communities like those found in Zonguldak, Ayancik and Erfelek, where *kestanelik* are actively maintained, with local attitudes that border on ownership.

In Western Türkiye, there is considerable success to build on. For instance, new leasing practices in the Aegean region between growers

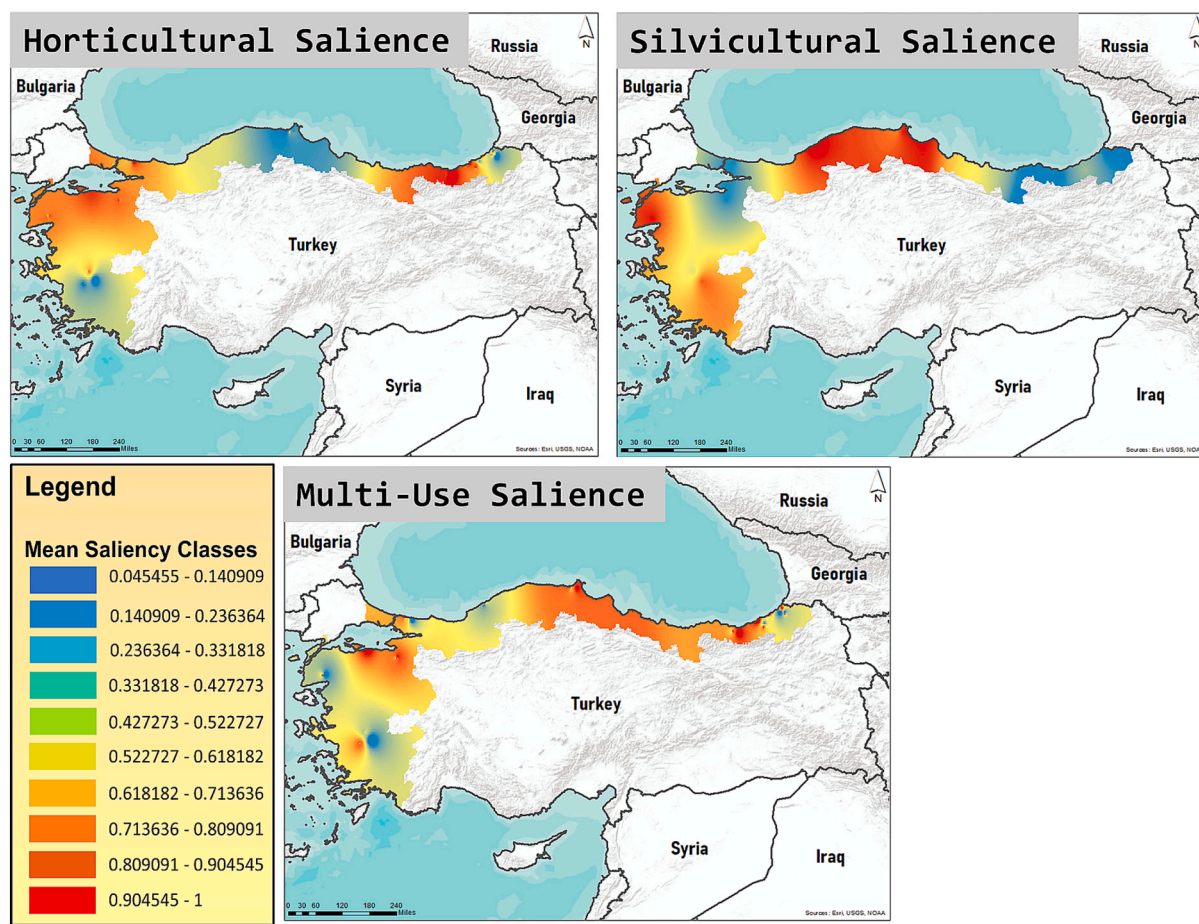


Fig. 6. Inverse Distance Weighting of horticultural, silvicultural and multi-use ( $\geq 3$  use-categories) salience associated with individual trees across Türkiye, generated in ARC-MAP 10.8.1.

and regional OGM ensure the establishment of significant new area for chestnut trees in the region. These are known as 49-year leases (*kırk dokuz yıllığına kiralık*) that farmers in all the surveyed villages in the Aegean region have been entering into over the past few years. Based on Forest Law 6831, local village residents function as unofficial managers and cultivators on land designated by the state. In Bursa, regional OGM offices actively distribute a wide variety of cultivars, including blight resistant European Asian hybrid varieties. These popular programs can achieve much more enduring impact by demonstrating concern for the multi-purpose value of chestnut trees and chestnut-dominated areas.

This feeds into an important local path for agroforestry to operate as a long-term land use strategy. In the case of Chestnut in Türkiye, this orientation we promote can reinforce local germplasm evaluations in concert with focused local nursery and breeding programs. Chestnut blight in concert with other pathogens is driving interest and necessity of the introduction of new, foreign germplasm. Chestnut blight tolerance is most reliably sourced in eastern Asian materials. European-Asian hybrids with blight tolerance are already numerous and several such cultivars are widely available in Türkiye, formally and informally. These have not been properly evaluated for fit according to local preferences. The most prevalent such variety, Marigoule, is not highly regarded. Many sweet manufacturers do not approve of the fruit qualities (Wall et al., 2019a). Villagers bemoan the short stature and minimal timber volume. Women dislike the properties of its husks, which do not decompose quickly enough for garden application (Wall et al., 2018). Thus, more work should be done to ensure the occurrence of traits of significant local value in the materials disseminated by state programs, be they TAGEM, GDF, or even, joint efforts.

## 6. Conclusions

Evaluating policy fit from the ground up reminds us that the interests of institutions do not automatically align with citizens. The utility of siloed knowledge and science to scientists has lent itself equally well to appendages of governments. This study highlights the equally substantial utility of an alternative approach. In this case, it is rooted in the priorities for chestnut trees across Türkiye held by the inhabitants at the sites of chestnut tree maintenance. Therein lies the friction. As we previously reported, 93 out of 96 participating households reported using state land for their chestnut livelihoods (Wall et al., 2019b), and the state generally operates under the assumption that human interference is generally environmentally negative.

Assuming the special and irreplaceable role of people in land use strategy makes it especially relevant to the growing ecological threat of rural abandonment in much of the world (Plieninger et al., 2014; Queiroz et al., 2014; Otero et al., 2015; Quintas-soriano et al., 2022). In rural Türkiye, it is common knowledge that rural abandonment is a chronic sign of the times. This is particularly true of the Black Sea region, which is famous in Türkiye for its massive out-migration to Europe and the cities of Türkiye. It has been posited that the ravages of chestnut blight explains this extensive out-migration (FAO, 2009).

Our previous studies indicate that, along with epidemiological and environmental factors, local culture and local involvement is a strong positive determinant in tree health (Wall et al., 2019b). In the case of the highly prized chestnut populations, attitudes which understand anthropogenic influence as wholly damaging must be reconsidered. Evidence presented here further supports this position by highlighting

the innumerable human priorities for perpetuating the tree, and by informing an unsiloed scientific and policy approach to reinforcing the essential people behind the health of chestnut populations, their habitat and comparable agro-forested ecosystems.

### CRedit authorship contribution statement

**Jeffrey Wall:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Taner Okan:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Coşkun Köse:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Nesibe Köse:** Writing – review & editing, Formal analysis, Data curation, Conceptualization. **Elif Basak Aksoy:** Writing – review & editing, Formal analysis, Data curation, Conceptualization.

### Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Jeffrey R Wall reports financial support was provided by TUBITAK. Jeffrey R Wall reports financial support was provided by Borlaug Food Security Fellowship. Jeffrey R Wall reports financial support was provided by Fulbright Commission of Turkey. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

### References

- Brown, V., Harris, J., Russell, J., 2010. Tackling Wicked Problems through the Transdisciplinary Imagination. Earthscan, Washington D.C.
- Buetow, S., 2010. Thematic analysis and its reconceptualization as ‘saliency analysis’. *J. Health Serv. Res. Policy* 2, 123–125. <https://doi.org/10.1258/jhsrp.2009.009081>.
- Chambers, R., Jiggins, J., 1987. Agricultural research for resource poor farmers: part I transfer-of-technology and farming systems research. *Agric. Adm. Ext.* 27, 35–52.
- Corcoran, L., Cook, K., 2023. The philosophy of Hans-Georg Gadamer: an exemplar of the complicated relationship between philosophy and nursing practice. *Nurs. Inq.* 30 (1 (January)). <https://doi.org/10.1111/min.12509>.
- Elbakidze, M., Surová, D., Muñoz-Rojas, J., Persson, J.O., Dawson, L., Plieninger, T., Pinto-Correia, T., 2021. Perceived benefits from agroforestry landscapes across north-eastern Europe: what matters and for whom? *Landsc. Urban Plan.* 209 (May). <https://doi.org/10.1016/j.landurbplan.2021.104044>.
- FAO, 2009. Report on Chestnut Blight and its Management in Türkiye. Ankara.
- Foresta, H.D., Michon, G., 1996. Tree improvement research for agroforestry: a note of caution. *Agroforest. Forum* 7 (4), 8–10. <https://www.researchgate.net/publication/282168463>.
- Gadamer, H.D., 1960. Truth and Method. Continuum.
- Garrett, G., Jose, S., Gold, M., 2022. North American Agroforestry, 3rd edition. Wiley, Hoboken, NJ.
- International Society of Ethnobiology, 2006. International Society of Ethnobiology Code of Ethics (with 2008 Additions). <http://ethnobiology.net/code-of-ethics/>.
- Jose, S., Garrett, G., Gold, M., Lassoie, J., Buck, L., Current, D., 2022. Agroforestry as an integrated, multifunctional land use management strategy. In: North American Agroforestry, 3rd edition. Wiley, Hoboken, NJ, pp. 3–27.
- Josiah, S.J., St-Pierre, R., Brott, H., Brandle, J., 2004. Productive conservation: diversifying farm enterprises by producing specialty woody products in agroforestry systems. *J. Sustain. Agric.* 23 (3), 93–108. [https://doi.org/10.1300/J064v23n03\\_08](https://doi.org/10.1300/J064v23n03_08).
- Leakey, R., 1996. Definition of agroforestry revisited. *Agrofor. Today* 8 (1), 5–7.
- McCaffrey, G., Moules, N.J., 2016. Encountering the great problems in the street: enacting hermeneutic philosophy as research in practice disciplines. *J. Appl. Hermeneut.* 1–7.
- Miles, M., Huberman, A., 1984. Qualitative Data Analysis: A Sourcebook of New Methods. Sage Publications, Beverly Hills, CA.
- Mudge, K., Gabriel, S., 2014. Farming the Woods: An Integrated Permaculture Approach to Growing Food and Medicinals in Temperate Forests. Chelsea Green Publishing, White River Junction, VT.
- Nair, P.K., 1993. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht.
- Nicolescu, B., Morin, E., De Freitas, L., 2002. The charter of transdisciplinarity. In: Manifesto of Transdisciplinarity. State University of New York Press, Albany, NY, pp. 147–152.
- Nolan, J.M., 2014. Pursuing the fruits of knowledge: cognitive ethnobotany in Missouri’s Little Dixie. *J. Ethnobiol.* 21 (2).
- Okan, T., Köse, C., Köse, N., Aksoy, E.B., Wall, J.R., 2021. How managing for chestnut honey in Türkiye salvages trees and lifeways under increasing exotic pest and disease pressure. *Hum. Ecol.* <https://doi.org/10.1007/s10745-021-00220-5>.
- Otero, I., Marull, J., Tello, E., Diana, G.L., Pons, M., Coll, F., Boada, M., 2015. Land abandonment, landscape, and biodiversity: questioning the restorative character of the forest transition in the Mediterranean. *Ecol. Soc.* 20 (2). <https://doi.org/10.5751/ES-07378-200207>.
- Panigrahi, N., 2014. Computing in Geographic Information Systems. CRC Press.
- Peters, S.J., 2006. ‘Every Farmer Should Be Awakened’: Liberty Hyde Bailey’s Vision of Agricultural Extension Work, 80. <https://www.jstor.org/stable/3744806>.
- Plieninger, T., Hui, C., Gaertner, M., Huntsinger, L., 2014. The impact of land abandonment on species richness and abundance in the Mediterranean Basin: a meta-analysis. *PLoS One* 9 (5). <https://doi.org/10.1371/journal.pone.0098355>.
- Purzycki, B.G., Jamieson-lane, A., 2017. AnthroTools: an R package for cross-cultural ethnographic data analysis. *Cross-Cult. Res.* 51 (1), 51–74. <https://doi.org/10.1177/1069397116680352>.
- Queiroz, C., Beilin, R., Folke, C., Lindborg, R., 2014. Farmland abandonment: threat or opportunity for biodiversity conservation? A global review. *Front. Ecol. Environ.* 12 (5), 288–296. <https://doi.org/10.1890/120348>.
- Quintas-soriano, C., Buerkert, A., Plieninger, T., 2022. Land use policy effects of land abandonment on nature contributions to people and good quality of life components in the Mediterranean region: a review. *Land Use Policy* 116, 106053. <https://doi.org/10.1016/j.landusepol.2022.106053>.
- Roux, B.L., Rouanet, H., 2010. Multiple Correspondence Analysis. Sage Publications.
- Tsonkova, P., Quinkenstein, A., Böhm, C., Freese, D., Schaller, E., 2014. Ecosystem services assessment tool for agroforestry (ESAT-A): an approach to assess selected ecosystem services provided by alley cropping systems. *Ecol. Indic.* 45, 285–299. <https://doi.org/10.1016/j.ecolind.2014.04.024>.
- Wall, J., 2022. Chestnut time and chestnut place: conserving chestnut-ness (Kestanelik) in Türkiye. In: Wall, J. (Ed.), The Cultural Value of Trees: Folk Value and Biocultural Conservation. Routledge, London, pp. 105–118.
- Wall, J.R., Aksoy, E., Köse, N., Okan, T., Köse, C., 2018. What women know that men do not about chestnut trees in Türkiye: a method of hearing muted knowledge. *J. Ethnobiol.* 38 (1), 139–155.
- Wall, J., Köse, C., Köse, N., Okan, T., Aksoy, E., Jarvis, D., Allred, S., 2019a. The role of traditional livelihood practices and local ethnobotanical knowledge in mitigating chestnut disease and pest severity in Türkiye. *Forests* 10 (571). <https://doi.org/10.3390/f10070571>.
- Wall, J.R., Okan, T., Köse, C., Köse, N., Aksoy, E.B., 2019b. Folk biological value and chestnut conservation in Türkiye. *Econ. Bot.* 73 (4), 461–476. <https://doi.org/10.1007/s12231-019-09476-x>.
- Wall, J.R., Köse, N., Aksoy, E.B., Köse, C., Okan, T., Allred, S., 2021. ‘We live and die in chestnut’: remaining and adapting in the face of pest and disease outbreak in Türkiye. *Landsc. Res.* 1–12. <https://doi.org/10.1080/01426397.2021.1929888>.
- Wall, J., Lukawiecki, J., Young, R., Powell, L., McAlvay, A., Moola, F., 2023. Operationalizing the biocultural perspective part II: a review of biocultural action principles since the declaration of Belém. *Environ. Sci. Policy* 150 (December), 103573.