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A Field Method for Landscape Conservation Surveying: The Landscape Assessment Protocol (LAP)

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Abstract: We introduce a field survey method to assess the conservation condition of landscapes. Using a popular rapid assessment format, this study defines observable "stressed states" identified through the use of general metrics to gauge landscape degradation. Fifteen metrics within six thematic categories were selected through a literature review and extensive field trials. Field tests on the Greek island of Samothraki show a strong correlation between a single expert's scores and five assessor's scores at 35 landscape sites. Only three of the metrics did not maintain a high consistency among assessors; however, this is explained by the difficulty of interpreting certain anthropogenic stressors (such as livestock grazing) in Mediterranean semi-natural landscapes with culturally-modified vegetation patterns. The protocol and proposed index, with five conservation condition classes, identified areas of excellent and good quality, and reliably distinguished the most degraded landscape conditions on the island. Uncertainties and difficulties of the index are investigated, and further research and validation are proposed. The protocol effectively goes beyond a traditional visual aesthetic assessment; it can be used both by experts and non-scientists as a conservation-relevant multi-disciplinary procedure to support a holistic landscape diagnosis. The combination of an on-site experiential survey and its simple integrative format may be useful as a screening-level index, and for promoting local participation, landscape literacy and educational initiatives.

Keywords: rapid assessment; landscape; nature conservation; heritage; index; environmental education; ecosystem services

1. Introduction

Assessing the quality and overall health of landscapes is an important aspect of nature conservation and sustainability [1–3]. However, diagnosing the conditions of landscape quality or its degradation has proven to be a complex undertaking [4,5]. These diagnoses are hampered by the conceptual difficulties of landscape definition and the bewildering diversity of multifunctional cultural landscapes [6]. The European Landscape Convention (ELC) provides a broad definition of landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" [7]. The ELC promotes raising awareness of the value of so-called living landscapes, yet there are very few field methods for assessing the quality of landscapes through the participation of people living in or visiting particular landscapes [8–10]. Efforts to educate people about landscapes (i.e., landscape literacy) are also needed since many of their values and the services they provide are non-material cultural attributes that cannot be easily quantified or systematically assessed [5,11,12], while "reading the landscape" should lead to better stewardship [13].

The idea of landscape diagnosis strives for a holistic assessment. This approach goes back to research in Western Europe in the 1950s [14] with several technical assessment procedures being developed until recently [12,14–17]. However, on-site field assessments are usually complex procedures, and technical protocols are developed solely for experts. These protocols usually target specific landscape aspects and objectives; these commonly include scenic or aesthetic quality assessment and evaluations [6,8,12], specific landscape type evaluations [18–20], degradation assessment [21,22], restoration and planning [23–25], and vegetation inventory and monitoring at the landscape scale [26,27]. There are many applications, most are off-site techniques, widely employing Geographic Information Systems (GIS) during the last 25 years [21,28]. Some landscape assessment approaches, such as aesthetic assessments based on off-site use of photographs, have been criticized as inconsistent and unreliable [16,29]. Many of the various standard approaches are of course effectively used widely in many planning and conservation procedures (e.g., [30]). However, despite much effort in researching landscapes from a multitude of sectoral perspectives, few field-based landscape approaches are truly integrative or widely applicable in different landscape types [9,28,31–34]. Also, few landscape-scale assessments employ trained non-experts or citizen scientists, although citizen science is considered fertile ground for landscape ecology approaches [35,36].

Here we provide a new field method to support an integrative diagnosis of landscapes for nature and heritage conservation assessments, and associated educational endeavors. This protocol is similar to popular rapid “visual” assessment methods, such as the stream visual assessment protocol-SVAP [37] and the riparian forest index QBR (Index of riparian habitat quality) [38], which are now widely used for policy-relevant monitoring and non-expert assessments of stream corridors in many jurisdictions in at least three continents [39–42]. Through the novel protocol’s development and initial testing, we aim to provide a foundation for a standardized field-based assessment procedure that is simple and rapid in its format.

2. Methods

2.1. Protocol Philosophy

We introduce the landscape assessment protocol (hereafter LAP). The key objective was to produce a simple field method for assessing the conservation condition or state of landscapes to be used both by professionals and trained citizen scientists. This is a landscape quality index that broadly follows tenets of landscape ecology [3], landscape history and natural history and site-based bioassessment surveys [43,44]. Accurately measuring the state of a system is a complex process that often resorts to the use of indicators in order to evaluate performance [45], or a “status” based on a pre-conceived reference condition. As expressed by Mazri and colleagues [46], indicators are “mental constructs aiming to capture one or several aspects of reality considered of importance when it comes to a specific subject”. The use of indicators is meant to provide synthetic and action-oriented knowledge; in our case, a rapid conservation assessment. Our index calculation follows the format and field form template of the stream visual assessment protocol (SVAP), a popular interdisciplinary field-based “bioassessment” approach to assess river and stream corridors [37], which has also been adapted for use in broader assessment procedures (e.g., [33]). LAP was developed using similar development steps as SVAP (see [39]) and contains 15 metrics (or indicator attributes); however, nearly all are very different from the original SVAP. Each metric is a quality or characteristic element of the landscape that is known to predictably alter when influenced by human-induced pressures or changes. Each metric reflects the quality of a different aspect of the ecosystem or in our case the "landscape system" that responds to different anthropogenic stressors [43,47]. This new assessment protocol is to our knowledge the first bridging of this type of field bioassessment-based protocol to landscape conservation assessment.

The workflow for the protocol development has evolved through the following stages (Figure 1). Step 1: Review of assessment methods, Step 2: Format and protocol framework and template selected, Step 3: Potential metrics selected, first prototype LAP constructed, Step 4: Field trial; Step 5: Revision process, Step 6: Current publication, Step 7: Future work.

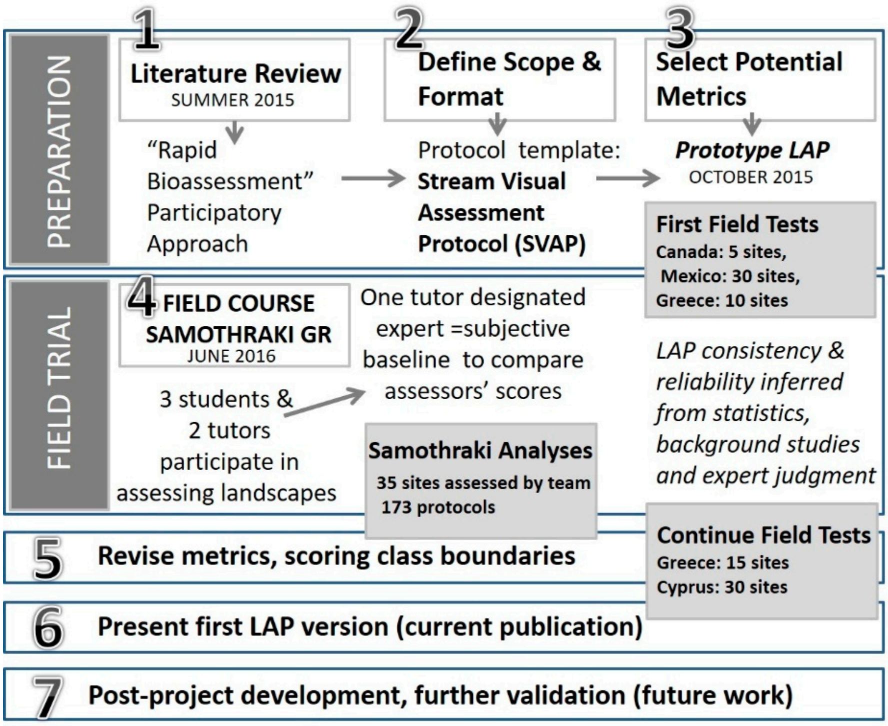

Figure 1. Workflow diagram with consecutive steps developed in this project.

2.2. *Protocol Review and Selection of Metrics*

The rationale for selecting specific metrics is summarized in Table 1 and is also apparent within the narrative of the field form (Appendix A). Metric selection is based mainly on visually apparent indicators of "state change" in natural and cultural landscapes. Since each metric is assessed on-site in the field, utilizing a trained assessor's visual [48], acoustic [49,50], and olfactory senses [51], specific easily apparent and practical elements were chosen. The assessment is meant to be able to discern widespread and general "quality conditions" in all types of landscape [52]; this includes all types of cultural landscapes, even urban areas (i.e., the most "culturally-modified" landscapes).

Table 1. Thematic categories, metrics and indicative references of the final LAP protocol.

Thematic Category	Final Metric	Summary Rationale for Inclusion	Indicative Literature
Land-use	Land Use Pattern	Integrative; degradation gradient perceivable. Naturalness and traditional cultural land-uses define reference conditions.	[18,33,48,52]
	Agriculture	Integrative; degradation gradient perceivable. Traditional land-uses and high nature value farming define reference conditions.	[1,2,52]
Human-made structures	Roads Network	Visual, semi-quantitative. References defined by no or minimal road network in natural areas; higher density road network progressively shows degradation.	[1,52]
	Buildings	Visual, semi-quantitative. Different approaches to assessment in build-up versus non-urban conditions. Aspects of authenticity and order also considered in defining reference conditions in built-up areas.	[19,52]
	Modern Anthropogenic Interference	Visual, semi-quantitative. Refers to dominating modern artificial structures and disorder (i.e., structures breaking horizon)	[33,37]
Pollution	Pollution, Garbage & Debris	Visual, semi-quantitative/qualitative; degradation gradient perceivable. Quantities, extent of spread and toxicity of anthropogenic waste materials considered.	[37,39]
	Smellscape Pleasantness	Olfactory, qualitative. Natural and "culturally authentic" smells versus artificial smells guide assessment.	[51]
Biodiversity	Flora	Integrative natural history observation; degradation gradient perceivable (concerns alien species and human-induced species impoverishment)	[26,38,52]
	Wildlife & Wildlife habitat	Integrative natural history observation; degradation gradient perceivable. Concerns presence of high quality wildlife habitat types.	[31,33,47]
Ecosystem integrity	Vegetation	Integrative natural history observation; degradation gradient perceivable. Considers both natural and traditional culturally-modified vegetation types.	[48,53,54]
	Shorelines &/or Riparian Conditions	Integrative natural history observation; degradation gradient perceivable. Considers both natural and traditional culturally-modified vegetation types; riparian quality emphasized (i.e., extent and naturalness).	[37,38]
	Hydrologic Alteration	Integrative observation; degradation gradient perceivable. Absence of water abstraction or storage structures (dams, dikes).	[20,27,29,33,37,47]
	Livestock Grazing	Integrative natural history observation; degradation gradient perceivable by trained observer. Visual-indicators of overgrazing affect plant communities and growth-form structure. Specific indicators are related to local conditions.	[53–55]
Aesthetic quality	Landscape Attractiveness	Visual, qualitative. Scenic qualities, rarity, and variety are included in reference conditions.	[6,18,29,33,48,52]
	Soundscape Quality	Acoustic, qualitative. Naturalness defines reference conditions.	[49,50]

2.3. *Protocol Assessment Procedure*

Each metric is scored by the assessor on-site using a field card (Figure 2) from a single view-point in the landscape. Assessed sites must have at least a 180-degree view of the landscape, and we allowed assessors to wander up to a 50 m radius during the assessment. The assessor bases the scoring of each metric on the scoring criteria field form (Appendix A) that provides a descriptive narrative guiding the evaluation of a descending score level from "excellent" (10) to "bad" (1) condition. In all metrics, the excellent category (10) refers to landscape features or attributes that are at or near 'reference condition' (i.e., referring to high integrity, naturalness, authenticity, scenic quality, and other high-quality landscape features and elements). If an assessor is uncertain to assess a metric it should be left without a score. A trained assessor completes the LAP in about 10 minutes and should fill in at least 90% of the metrics. The overall score, the "LAP conservation index", is gained by dividing the sum of metric scores by the number that was scored and then multiplied by ten. The score integration is intentionally kept simple, and no aggregation or weighting is involved in order to allow a variety of ways to express increment metric scores and provide transparency and ease of interpretation of the assessment. The LAP conservation index ranges between 0 and 100, and for index presentation and mapping it is split into five color-coded quality classes, and two general condition states (favorable and unfavorable) (Table 2). The five class-category framework follows widely-applied policy-relevant reporting procedures, such as those within the EU Water Framework Directive [38,56]. The proposed arithmetic class boundaries of the quality classes have been set according to the authors' experience in many trials with this protocol; an important condition boundary is the good/moderate class line (i.e., broadly defining favorable and unfavorable condition states). As in other rapid assessment methods, it is often stated that this initial index class-boundary proposal may require further verification [38], or could receive adaptation under different geographical or specialized implementation contexts [33,37].

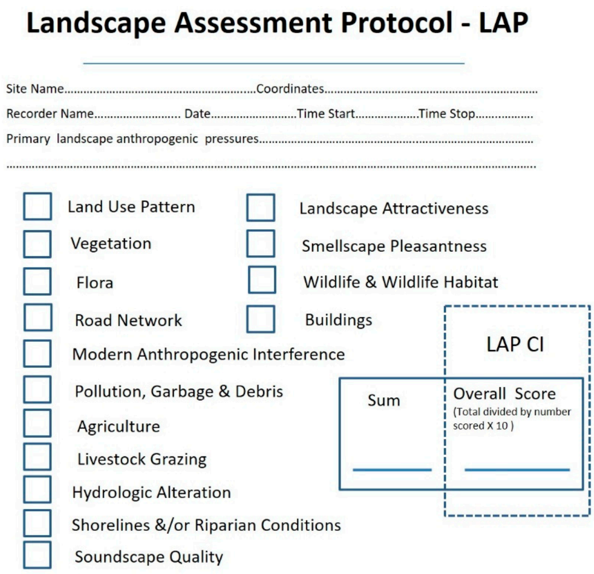

Figure 2. The LAP field form's scoring card with metrics (first page of the field protocol). See Appendix A for accompanying scoring criteria field form.

Table 2. Quality classes proposed for the current version of the LAP Conservation Index (LAP CI).

Quality Class Condition	Condition Description	LAP CI	Mapping Colour
Excellent	Favorable conservation condition. Natural/semi-natural landscape or exceptional quality cultural landscape with high degree of natural elements and features.	≥85	Dark Green
Good	Favorable conservation condition. Near natural or cultural landscape with slight degradation; high quality urban or peri-urban landscape	70–84	Green
Moderate	Unfavorable conservation condition. Moderately degraded landscape with various modern changes and pressures.	50–69	Yellow
Poor	Unfavorable conservation condition. Degraded landscape. Moderately degraded urban or peri-urban area	31–49	Orange
Bad	Unfavorable conservation condition. Severely degraded non-urban landscape or degraded cultural/urban landscape	≤30	Red

2.4. Protocol Developement and Testing

The protocol was developed after a review of many assessment methods and tools, especially those that are rapid site-based and useful in citizen science approaches. A completed prototype was tested in field trials in very different environments: Vancouver, Canada; Jalisco and Nayarit, Mexico; Attiki, Greece, and the Districts of Pafos and Lemessos, Cyprus (October 2015 to January 2019) (Figure 1). During these trials different metrics were tested and finally 15 were chosen. In the revised form presented here, there have been slight changes from the original prototype based on ease-of-use during earlier trials and the results of testing with university students during a 9-day field trial on Samothraki, Greece.

The field trial using LAP took place on the Greek island of Samothraki (Samothrace), during the Samothraki Summer University, a socio-ecological field course, 10–19 July 2016 (for summary presentations and context see [57]). Samothraki is a distinctly varied high-relief island (178 km^2 in area), with diverse agro-pastoral and semi-natural landscapes. The resident population of 2800 inhabit two major town centers and several small villages and hamlets. Samothraki has been fairly well studied for its biodiversity and natural resources [58,59], a major part of the island is included within two Natura 2000 protected areas and it has been proposed as a UNESCO biosphere reserve [60]. The island is experiencing a socio-ecological transition [61], undergoing landscape changes primarily due to poorly-planned infrastructure development, subsidized livestock overgrazing, deforestation, freshwater and habitat degradation, and localized tourism-associated building and sprawl. Also there are plans for future developments, including industrial-scale wind farms.

In the field trial presented here, five assessors visited 35 different sites together on Samothraki; they independently assessed each landscape vista using the LAP. Effort was made to place sites at least about 500 meters apart (at the shortest distance), to cover completely different vistas, and to cover all representative landscape types throughout the island. The five assessors included two course tutors (S.Z. and V.V.), one undergraduate student, and two PhD students from abroad (see acknowledgments). A third course tutor (P.D.) participated but did not complete all protocols (so these are not treated in the analyses). There was a brief training session that included the entire summer school group (about 30 students and tutors) but no intercalibration trials among the main assessors was foreseen. For the purposes of a comparative baseline, one of the course tutors was chosen as an "expert" (S.Z.) in order to establish an expert-based standard to describe the variation among the other assessor's scores. The expert was chosen by consensus due to his experience with index development and long-term knowledge of the island. In the absence of any objective means of quality base-lines this kind of subjective expert-based ranking helped to infer accuracy of the team's assessed scores, a procedure that is consistent with several other rapid assessment validations (e.g., [39]). Part of the analyses of 173 completed protocols is presented here (two protocol sheets were not completed).

3. Results

Figure 3 maps the LAP Conservation Index results from 35 assessed sites on Samothraki as assessed by the designated expert member of the team. Most of these sites offer panoramic views across the island's high relief landscapes and there is very little overlap among them although some are quite close to each other. Thirteen sites fell below the good class boundary (i.e., unfavorable conservation condition), but only three and one of these were assessed in poor and bad condition, respectively. The degraded sites were situated in the western part of the island, especially near the port town of Kamariotissa and particularly the adjacent coastal and lowland areas. In this part of the island, there are signs of localized infrastructure construction, new buildings with associated modern anthropogenic changes and locally overgrazed conditions. Otherwise, much of the rest of the island is deemed to be in a favorable conservation condition, and this includes areas even within the urban center of the old town of Samothraki (also known as the Chora, a protected traditional settlement).

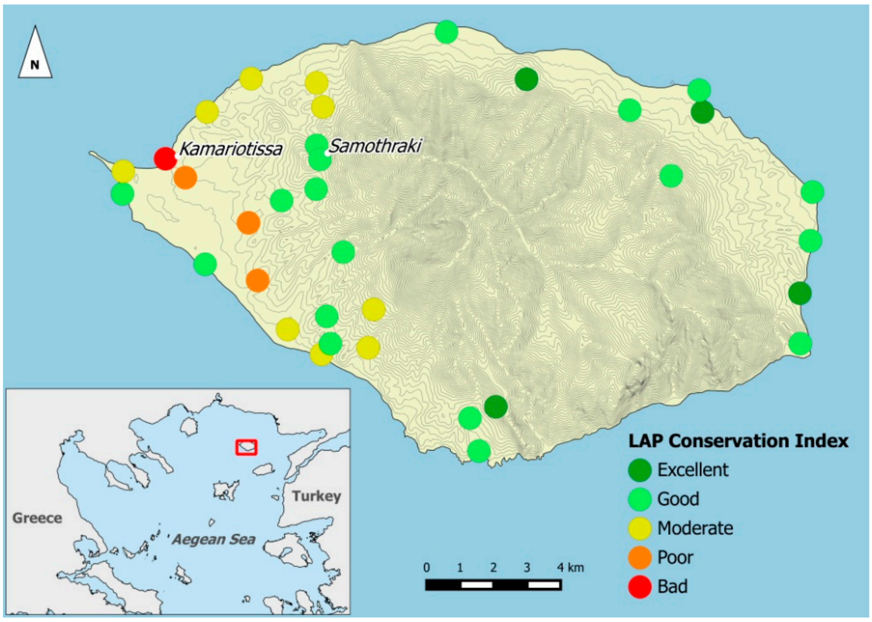

Figure 3. Results of index calculation of all landscape sites on Samothraki, as assessed by a single expert.

Table 3 shows the number of sites per LAP quality class based on expert scores and number of sites where the majority of other assessors (3/4) significantly differ in their scoring compared with the expert's score. The p-values between expert and the other assessors' scores show significant similarities (p-value > 0.2) in 69% of all assessments. At locations where expert LAP quality class was excellent or good the majority of other assessors' scores were significantly similar to the expert's score. The significant differences between expert and other assessors' scores were recorded at locations where the expert gave lower scores than the others (poor or bad).

Table 3. Number of sites per LAP quality index and number of sites where expert scores disagree with the majority of the other assessors.

LAP Quality Class	Number of Sites (Expert Scores)	Number of Sites Where Majority of Assessors (3/4) Scored Significantly Different (p-Value < 0.2) than the Export Score
Excellent	4	1
Good	18	1
Moderate	9	1
Poor	3	2
Bad	1	1

Overall, the correlation among the five-person team results (mean and median) and the single expert scores for each site was positive (Figure 4).

Table 4 ranks each metric with respect to the standard deviation for the assessments of the five-member team. Also, the assessor's unscored metrics were used as an indicator of the uncertainty of interpreting these elements/attributes. The fairly large number of unscored metrics may relate to the poor level of experience in assessing Mediterranean landscapes by most members of the five-person group. However, it should also be noted that certain metrics are not frequently assessed because they are not easily visible within the specific landscape vistas (i.e., shorelines/or riparian conditions, hydrological alteration). This initial documentation does show that some metrics are easily and frequently assessed, others not.

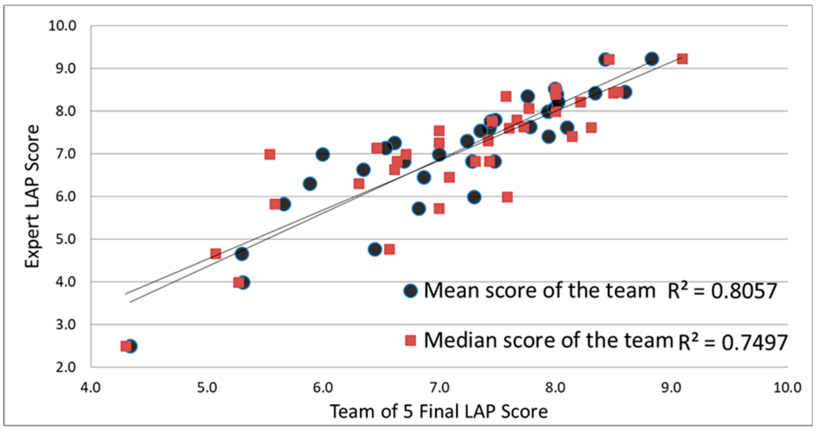

Figure 4. Correlation among the five-person team results and the single expert scores for each site (N = 35).

Table 4. Validation of consistency among metric scoring in 5-person team scores (utilizing standard deviation as a measure spread). Since assessors left some metrics unscored when they were uncertain about the values, the percent not scored (out of 173 protocol sheets) is given for each metric.

Metrics	Number of Sites with std > 2	Percent Unscored
Road Network	0	1.8
Flora	1	1.2
Agriculture	1	22.4
Soundscape Quality	1	1.2
Garbage & Debris	2	1.2
Buildings & Urban sprawl	2	8.8
Land Use Pattern	3	1.2
Modern Anthropogenic Interference	3	1.2
Hydrological Alternation	3	45.3
Shorelines &/or Riparian Condition	3	31.8
Landscape Attractiveness	3	1.8
Abandonment *	3	46.5
Vegetation	4	1.2
Wildlife & Wildlife Habitat	4	65.3
Livestock Grazing	8	9.4

Perhaps due to the preliminary nature of the trial format, with only brief training and no intercalibration trials among team members, three metrics in the protocol showed high inconsistency in scoring, these are: grazing, wildlife and wildlife habitat, and vegetation. The other 12 metrics had fairly closely scored values, possibly suggesting higher reliability in their measurement. However, these results do not preclude a noticeable variation among scores even for some of the 12 metrics. As an example, Figure 5 shows how the 35 landscape sites were assessed for the land use pattern metric (which had a standard deviation of 3 among the assessors; Table 4). This rather integrative metric shows a fairly broad variation among assessors but there are instances of close scoring in the expert-assessed highly degraded areas (sites 1 through 10, Figure 5). Furthermore, one metric which was not assessed on nearly half the protocols (abandonment) (Table 4) was subsumed in a later version into the agriculture metric (Appendix A).

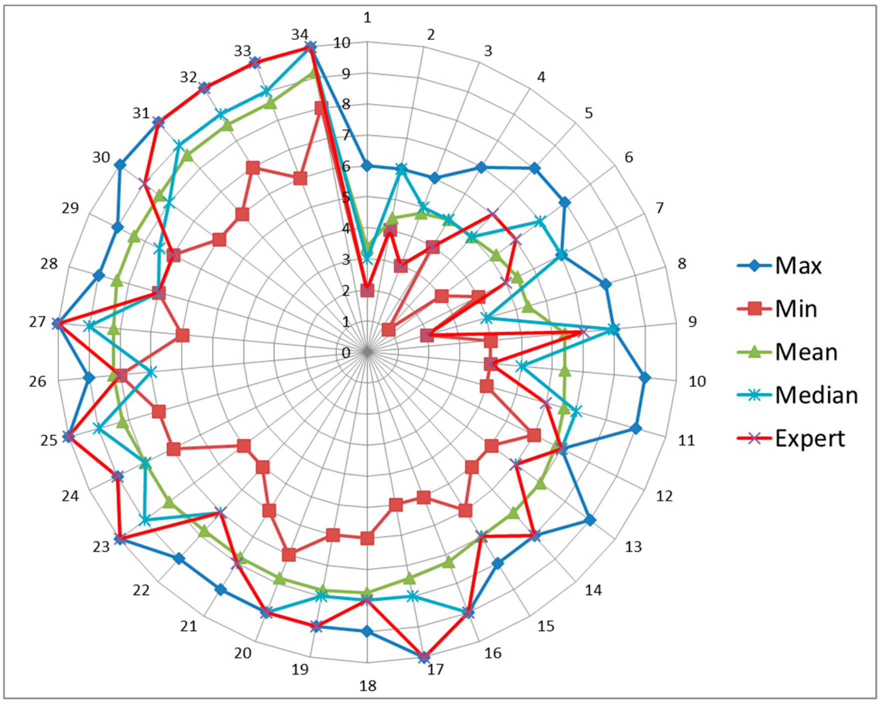

Figure 5. Results of five-person team scores (max, min, mean. median) and the single expert for each site (N = 35) for the "land use pattern" metric.

Finally, in exhibiting results from such multi-assessor trials it is our opinion that cumulative scores from several assessors should not be used to express a site's assessment. The mean score is not a good summation value since spread is quite wide. Although median values correlate with the expert assessment better than the mean values there is really no reason to show cumulative scores (as Figure 4 shows that median values do not improve correlation when used for all sites). Alternatively, individual assessment scores depicted independently or collaborative group decisions on scoring (i.e., scoring on card through a group consensus) can be better than summing cumulative score results from various assessors of the same site.

4. Discussion

4.1. A Simple Field Protocol Applied to Complex Cultural Landscapes

Mediterranean cultural landscapes, as on Samothraki, are especially challenging to assess for their conservation condition. This is primarily due to their complex semi-natural vegetation patterns and the pervasive influence of humans on the landscape for millennia [11,27,62]. Specific challenges and obstacles to objectively interpreting anthropogenic degradation in the Mediterranean are now well known [53,54] and these difficulties extend to so-called anthropogenic landscapes in general [63]. On Samothraki, in a few metrics, such as livestock grazing, there were widely differing scores even though it is well known that the island does suffer from locally severe overgrazing [53]. This difficulty mirrors discrepancies present in opinions on the effects of grazing on Mediterranean ecosystems. Other challenging interpretation problems include natural versus anthropogenic erosion patterns [54] and vegetational degeneration patterns related to traditional agricultural abandonment and changing wildfire regimes. Also, wildlife habitats and the vertebrate fauna is usually impoverished on most Mediterranean islands [64]. These complex Mediterranean anthropogenic "pressure conditions" have seen controversy and paradigm shifts in recent decades [11,53,54,64]. Qualitative statements of landscape condition are difficult to streamline in such complex cultural landscapes.

However, there is high certainty and documentation that in the Mediterranean coastal areas, the issue of landscape degradation is very high on the list of the most serious modern anthropogenic changes to nature and cultural heritage [5,30,53,54]. Landscape assessment in the wider region remains underutilized in planning and conservation practice [34,65] and in contrast to other European regions, the Mediterranean countries have also lagged behind in effective landscape conservation and restoration [5,11]. For these reasons, conservation-relevant assessment methods, such as LAP, could provide a useful vehicle for concerted landscape conservation action in this region and in other regions, where traditional cultural landscapes are rapidly changing and facing multiple threats.

4.2. Samothraki LAP Interpretation

Despite the difficulties expressed above, islands such as Samothraki represent Mediterranean microcosms that provide well-studied research areas [5,58,64]. Although the Samothraki assessment team had minimal in-depth field training, it is notable that the five-person team came very close in most of their final assessment scores. The strong positive correlation found between the final LAP scores of five assessors and the single expert's appraised scores was not expected, especially due to the island's varied conditions. It is important to note that the significant differences between the assessors' and expert scores were recorded at locations where the expert gave lower scores than the others (poor or bad). These sites had comparably lower scores from all assessors for road network, modern anthropogenic interferences and buildings. However, the expert gave lower scores for the other metrics as well in comparison to the scores by the other assessors. In these cases, perhaps the assessors underestimated the effects of anthropogenic inferences on the other metrics. Finally, all participants reported that the scoring criteria guidance sheet afforded clear-cut boundaries for scoring and a general ease-of-use of the protocol.

Overall, the LAP results on Samothraki show that the island's landscapes are still in a rather good or "favourable" conservation condition (Figure 3, Table 2), and this is corroborated by other recent surveys as well [58,59]. Furthermore, an independent landscape assessment project assessed and mapped landscapes quality on Samothraki in 2015 [66] and it similarly identified limited degraded areas mostly in the western part of the island and along its coasts, very similar to our LAP scoring result. The LAP scores' accuracy and reliability were also inferred by comparing them with both with the above assessment project and the subjective opinion of the three tutors in the study team.

4.3. Difficulties, Uncertainties, Validation and Training

Despite its positive prospects, the LAP does have weaknesses. When employing a large number of indicator elements (15 metrics) some metrics will "eclipse" others since each is considered to have equal value in determining the final index [31]. In this way, one metric, such as "anthropogenic interference" (e.g., by a wind farm), may alert for a severe degradation, but this one degradation signal may be lost because several other metrics may have high values thus improving (i.e., eclipsing) the overall final LAP conservation index. Trade-offs between providing an easy-to-use and transparent procedure for the greater precision provided by a more complex technical tool do exist.

There are advantages to keeping the score integration as simple as possible. In the simple format provided here, metric and index results can be depicted in different ways to highlight specific or general landscape stresses. The metric values can be separated in respective "thematic categories" (the six thematic categories provided here) (e.g., [18]). The final LAP conservation index can also be displayed with pie-slice graphs to underscore how each metric behaves [31]. This flexibility in presentation may help go beyond the cumulative quality-class color index mapping. And finally, it goes without saying, the class boundaries of the quality classes presented here may not be optimal in all environments (i.e., urban, peri-urban conditions). As mentioned in the methods section, problems with uncertainties and environment-specific difficulties are notable caveats in several rapid assessment protocols [10,38].

In a regulatory context, LAP would need to be thoroughly validated to be legally defensible as a policy-relevant index [29]. Meeting that expectation would require extensive research and testing as has taken place in other policy-relevant indices of regulatory monitoring frameworks [37,56]. Further quantitative validation of LAP's accuracy is highly recommended, and this will be best accomplished through comparison with rigorous assessment methods in different environments. However, since the protocol is aimed to be used in various supportive initiatives towards a holistic landscape diagnosis, its simple and transparent procedure does offer interesting advantages even at this young stage of development [8].

It should go without saying that protocol-specific training is required for executing LAP with increased accuracy and consistency. In our trial on Samothraki, it was notable that assessors did not score several metrics primarily due to uncertainty and unfamiliarity with the specific features/elements to be assessed. Training is critical to the success of this and any other citizen science and non-specialist assessment scheme [38,40,67]. Many new training methods have recently been developed to respond to this general requirement [68,69]. For the LAP, training must have an intercalibration trial (at least one field day) so the assessors view their results in the context of others and progress to learn to assess in a uniform manner, as is best possible. A basic knowledge of local natural history is an important baseline for reliable assessment, as it is in interpreting and making judgments in all kinds of rapid visually-based assessment methods [40,43,47].

4.4. Pros of a Rapid and Multidisciplinary Assessment Method

Unlike other assessment methods, the simplicity of the LAP allows for index calculation on-site in a few minutes. This rapid snap-shot method may be an advantage over various discipline-specific technical assessments, especially for wide-ranging screening surveys and in utilizing the public through citizen science [70]. On-site field assessments have been widely shown to be more reliable than the use of photographs, which dominate in landscape aesthetic and scenic quality studies [6,29]. Thus, LAP promotes a standardized experiential investigation rarely provided in many assessments [6,66]. LAP also provides for a flexible way to present and interpret results; ranging from the basic favourable/unfavorable to the five-class quality conditions that are akin to the EU water policy assessments [38,53]. The LAP may overlap with some other landscape indices, but it shares very few metrics with ecosystem-specific or other technical aesthetic assessment protocols [16,20,64,66,67]. It can therefore be used in parallel with other on-site or distance-based methods. LAP may also complement other surveys, assessments and evaluations through the participation of locals or visitors. Finally, as experience in the Samothraki trial has shown, LAP is an excellent field course procedure for education on a variety of landscape issues, including an immersive, multi-sensory appreciation of landscape, perhaps akin to "aesthetics engagement" [71,72].

LAP provides metrics and an integrative index that we suggest can be scored quite reliably. The overall rationale for utilizing such metrics is based on Rapport's premise that "natural systems, despite their diversity, respond to stress in similar ways" [73]. This approach is also supported by the bioassessment concept of reference conditions and biological integrity [31,40,47,58]. A knowledge of natural history and local heritage allows a trained assessor to detect the major signs of ecosystem distress [71] and to appreciate thresholds of anthropogenic change in inherently diverse cultural landscapes. Many types of human disturbance can be generic and simple in their identification [22], even by non-specialists who may learn to hone their natural history skills in a multidisciplinary understanding of landscape [36,53]. Conceptual common ground does exist between aesthetic and ecological landscape characters [58]; there is no real reason to warden-off landscape assessment to either bio-centric or socio-cultural realms [8], both can be investigated in an integrated way [28]. LAP attempts to follow the rapid assessment index tradition in being holistically comprehensive and applicable in a wide range of conditions [30,35] and this is what recent landscape conservation policies dictate as well [7,28].

4.5. Why Use this Assessment Method?

Landscape assessment in a nature and heritage conservation context has been described as "a daunting task" [62]. The coexistence of many different landscape definitions and different discipline-specific research traditions does not facilitate the development of widely-applicable standardized assessment methods. Approaches to landscape assessment have seen a strong development of new methods in recent years [16,72]; however, the choice of method and criteria depend on the objectives of application. In our case we are driven by the widespread crisis of landscape degradation. The LAP primarily strives to be a conservation tool which provides a qualitative statement (and an index) of conservation condition using a methodology informed by bioassessment procedure development.

There could be many conservation-relevant uses for LAP, including citizen science assessment projects and monitoring of landscape areas within a state-wide inventory process (e.g., [74]). Just like the SVAP, the LAP could become instrumental as a first-tier screening survey method [37]. Participatory frameworks for landscape conservation assessment and awareness are an important unmet need, as promoted by the ELC [7,68,75] and other relevant conservation policies [12,28,52,76]. The ELC also promotes "awareness-building" of landscapes, and it is believed that experiential field-based approaches optimally provide effective tools for this [66]. To our knowledge, LAP is one of the few field-based assessment methods to assist education, public awareness and public sensitization in this way. Furthermore, LAP could support policy-relevant advocacy for practical conservation, promoting the active involvement and voicing of participant perspectives, as underlined by conservation policy frameworks [8,16] and landscape literacy initiatives [13]. LAP can be important for rapidly evaluating conservation conditions in sensitive situations such as protected areas [77] and perhaps integrating this data within assessment of cultural ecosystem services [15,78–80] and other approaches where participatory science is called for (e.g., [81]).

5. Conclusions

This work contributes to sustainability science by providing a simple and rapid tool for supporting a holistic landscape diagnosis. This novel protocol is a new applied research idea that requires further testing; and it may help trigger wider participation in landscape conservation and restoration, particularly by local communities, conservation and management stakeholders, academic and educational initiatives and citizen scientists. At this early-stage of its development, the new assessment tool shows positive prospects primarily because it provides a user-friendly format which utilizes an approach that is popular in the bioassessment community's tool-box. The new field method is interdisciplinary: in a broad sense some of the LAP's thematic metric categories can be viewed as bio-centric (ecosystem integrity, biodiversity), socio-cultural (land-use, aesthetic quality), or both (human-made structures, pollution). Above all, the LAP may fill an important void in promoting and guiding easy-to-use screening-level site-based landscape surveys. In the face of mounting changes and threats to landscapes, concerted efforts aimed at "reading the landscape" must see a new revival.

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Appendix A

Table A1. Landscape Assessment Protocol—LAP—Scoring Criteria Guidance Sheet.

1. Land Use Pattern									
Original landforms, vegetation and cultural landscapes. Traditional elements and features intact.		Original landforms dominate. Slight modern changes and breaks in patterns of traditional land uses.		Moderately degraded. Some signs of changes in traditional land use and bio-physical patterns		Few natural and traditional cultural patterns. Disorder and disharmony, notable signs of degradation. Recent changes evident.		No or minimal natural and traditional cultural features. Modern elements dominate. Multiple recent changes and disorder dominate.	
10	9	8	7	6	5	4	3	2	1 or 0
2. Vegetation									
Natural vegetation or centuries-old traditional culturally-modified vegetation.		>70% natural vegetation or cultural landscape vegetation. Slight modification from reference conditions.		<50% natural vegetation or cultural landscape features.		<30% natural vegetation or cultural landscape vegetation Much degradation and modern pressures affect vegetation.		No natural vegetation; no real centuries old culturally-modified vegetation types.	
10	9	8	7	6	5	4	3	2	1 or 0
3. Flora									
Native flora, natural or near-natural assemblages; or benefited by semi-natural centuries old traditional land-uses. Habitat types/plant communities related to the reference habitat types.		Natural flora present. Slight degradation due to anthropogenic influence; otherwise natural floral assemblages cover >70%.		Impacted by human pressures. Tolerant species present; low species diversity due to human pressures.		Disturbed plant communities. Non-native species may dominate. Degraded by anthropogenic pressures, recent modern changes affecting flora.			
10	9	8	7	6	5	4	3	2	1 or 0
4. Road Network									
No modern paved roads; only traditional trails, tracks, cobbled and other very old routes evident.		Only small dirt roads present. Very low-density road network, >70% of view has no roads present.		Few roads; no large highways or many paved roads but paved road network covers several parts of landscape.		Road network nearly dominant. Evidence of bad engineering practices. Habitat fragmentation evident.		Road network dominant in landscape. Even when few roads, road network creates widespread degradation (visible erosion, lands-slides, fragmentation etc)	
10	9	8	7	6	5	4	3	2	1 or 0

Table A1. *Cont.*

5. Modern Anthropogenic Interference									
Human-built structures are traditional (all). No urban, industrial or other sprawl. No structures or buildings breaking the horizon (no wind farms, electricity networks etc). Rural or natural scene dominates.		Slight influence of human-made structures (very few utility poles, isolated or single structure). No structures or buildings breaking the horizon (e.g., pylons, electric wires, wind farms etc). Rural or natural scene dominates.		Modern anthropogenic structures immediately apparent. A few structures slightly breaking the horizon at least in one position on the horizon. Rural/natural environment still dominates. In urban areas this state is near-reference (much green-space, traditional architecture).		High anthropogenic structures evident in some areas (electric wires, tall structures). Modern buildings and high structures break the horizon at several (2–5) places on the horizon. Urban or peri-urban environment with good planning but some slight disorder and loss of integrity present. (Some structures may be far away; e.g., wind farms at a distance).		Totally degraded by modern anthropogenic structures. Recent modern landscape-level changes. Many structures such as new buildings and other structures breaking the horizon at several places (5+) on the horizon. Wind farms may dominate on nearby ridgelines and break horizon at several places.	
10	9	8	7	6	5	4	3	2	1 or 0
6. Pollution, Garbage & Debris									
No garbage, and no heavy construction site debris or other anthropogenic debris in sight.		Very small quantities of garbage scattered. Slightly altered conditions due to old dumping (very localized).		Noticeable scattered trash. Some scattered construction-site debris may be evident. Slightly altered conditions due to general disorder (old dumping but very localized).		Several areas of garbage dumped in sight and/or large quantities of debris. Toxics may be present. Extensive infilling may be apparent (e.g., in-filled wetlands). Water pollution evident.		Severe dumping. Garbage and trash dump in sight. Much of trash and debris dumped in large quantities (10+ truckloads). Also may include large mounds of debris or other forms of pollution. Toxic chemical dumping may be present.	
10	9	8	7	6	5	4	3	2	1 or 0
7. Agriculture									
If agriculture present only traditional forms exist in mixed small- scale; i.e., small parcels No modern monocultures. High nature value farming practices evident.		Biodiversity rich agricultural lands with high nature value farming practices but slight degradation. Some monocultures present (but usually, less than <30% of landscape under monocultures). Other forms traditional agriculture and small-scale holdings dominate.		Moderate agriculture impact. Monocultures present. Low nature value farming practices evident. Varied agricultural practices with much "nature" still present on farms despite increased intensification patterns.		At least up to 50% of landscape in modern monocultures. Many associated modern infrastructure elements. Intensive farming (e.g., greenhouses) and industrial farms low naturalness.		Excessive intensive agriculture or poorly placed crops; dominant chemically-supported industrial agriculture. Monocultures dominate and modern farming structures (greenhouses etc). No or weak signs of "nature" present on farms.	
10	9	8	7	6	5	4	3	2	1 or 0

Table A1. *Cont.*

8. Livestock Grazing									
Livestock grazing conditions natural or sustaining traditional landscapes (no recent abandonment evidenced). If no grazing apparent; wildlife grazing evident.		Slight evidence of negative grazing impacts. Some overgrazing or abandonment may be evidenced. Otherwise impacts of grazing not detrimental to biodiversity.		Moderate evidence of negative grazing impacts that may show recent vegetation degeneration or degrading certain habitats. Strong grazing impact or conversely recent "total abandonment".		Overgrazed conditions. Noticeable vegetation degeneration process (changes in ecological succession pattern). Erosion from trampling. Stunted shrub and tree growth. Grass and herb scarcity. Livestock droppings and trails in abundance. Grazing after fire/logging and associated with vegetation clearing. (Assessment of overgrazed status varies with respect to vegetation type and cultural traditional land-uses).			
10	9	8	7	6	5	4	3	2	1 or 0
9. Hydrologic Alteration									
All river and streams in apparently natural condition. No dams, no serious water withdrawals, no dikes or other structures affecting flow regime or limiting the stream access to the floodplain. Wetland conditions in natural or near-natural state.		Withdrawals, although present, do not affect natural flow regime and/or available habitat for biota. Wetlands in good condition despite some alteration or human-induced changes.		Significant negative anthropogenic effects to flow regime exist. Moderate changes throughout river basin evident.		Degraded hydrology.Water withdrawals significantly affect flow regime and/or available habitat for biota.		Totally degraded hydrology. Withdrawals, channelization or piping have caused complete alteration of flow regime and severe loss of habitat, severely affecting aquatic biota. Dams may be present; severely degraded wetlands.	
10	9	8	7	6	5	4	3	2	1 or 0
10. Shorelines &/or Riparian Conditions									
All shorelines natural. No roads, buildings, harbors or noticeable artificial structures. Coastal process and riparian areas in natural structure and functioning.		All shorelines in near-natural condition. Slight changes and localized degradation (e.g., by a few roads, isolated buildings or other minor modern structures).		Moderate change apparent (nearly 30% of shoreline/riparian zones altered).		Most of the shorelines/and or riparian zones (>50%) altered or built-up by modern uses and infrastructures. Less than 30% natural vegetation present.		Shorelines/and or riparian zones built up; altered by modern uses and infrastructures. No natural floodplains or riparian habitats. Only tolerant and alien species dominate.	
10	9	8	7	6	5	4	3	2	1 or 0
11. Soundscape Quality									
100% natural and traditional authentic sounds dominate. No artificial modern (e.g., mechanical sounds).		Nearly all near-natural and traditional sounds dominate. Slight mechanical sounds in distance (but no frequent road noise).		Small road and/or scattered modern agricultural noise break up natural or traditional cultural sounds (e.g., road noise in the distance).		>70% modern anthropogenic sound dominate. Heavy road noise or other sources (e.g., overflying planes frequent).		100% mechanical sounds dominate. No or very few natural sounds.	
10	9	8	7	6	5	4	3	2	1 or 0

Table A1. *Cont.*

12. Landscape Attractiveness									
Exceptionally attractive; richly varied; rare landscape. Exemplar natural or cultural features or elements. Outstanding scenic quality.		High attractiveness; only slight conditions or elements impinging on natural/cultural elements. Remarkable scenic beauty.		Average attractiveness. Moderate natural elements, but some modern changes. Some degradation.		Poor attractiveness. Degraded by human changes. Unattractive features or elements.		Degraded; drab; unattractive. Altered by human interventions and not scenic in any way.	
10	9	8	7	6	5	4	3	2	1 or 0
13. Smellscape Pleasantness									
No unpleasant smells; natural and culturally authentic smells dominate.				Moderate artificial slightly unpleasant smell from human sources.		Unpleasant smells related to anthropogenic degradation.		Very unpleasant smell from anthropogenic sources.	
10	9	8	7	6	5	4	3	2	1 or 0
14. Wildlife and Wildlife Habitat									
Wildlife habitat-rich landscape. Usually scarce "special habitats" present (e.g., wetlands). Species intolerant of urban or disturbed areas present. Evidence of relatively high wildlife population density (specialist species of birds/insects may be evident).		Good conditions for wildlife; species intolerant of urban areas and/or rare or specialist species present. No or few domestic/feral/invasive species apparent. Some scarce "special habitats" present (e.g., wetlands, woods, cliffs, scarce resources, etc).		Moderate wildlife populations evident but populations low and some "tolerant species" present or prevalent (far from what would be expected in natural conditions). No/or degraded "special habitats".		Poor, human-altered wildlife habitat. No special conditions or refugia (no "special habitats" present). Some wildlife may be present or their habitat potential present; but mostly "tolerant species" (e.g., urban species).		Nearly no wildlife habitat present. No wildlife present (or only overflying and far from location of site assessment). Completely degraded habitats for wildlife.	
10	9	8	7	6	5	4	3	2	1 or 0
15. Buildings									
If outside defined settlement, modern buildings are only in defined legal area. If inside settlement, if not illegal or unsightly (i.e., in harmony, balance, order) and traditional features well preserved. High authenticity and order in urban, peri-urban environments.				Moderate landscape degradation due to buildings, but very little sprawl effect.		If outside defined settlement, several modern buildings and sprawl (breaks in natural or traditional construction patterns). No traditional architecture. If inside settlement illegal or unsightly elements dominate (i.e., disharmony, disorder, incompatible forms etc.)			
10	9	8	7	6	5	4	3	2	1 or 0

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