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Article

Disentangling Values in the Interrelations between Cultural Ecosystem Services and Landscape Conservation—A Case Study of the Ifugao Rice Terraces in the Philippines

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Abstract: In the past few years, there has been a growing amount of research on economic quantifications and valuations of ecosystem services (ES) in agricultural systems. However, little attention has been given to cultural ESs (CES) in general and their link to the landscape in particular. This paper tries to tackle this gap with a case study on the Ifugao Rice Terraces of the Philippines. The study aims to understand the interrelations between the different CESs and their relationships with the landscape. Besides contributing to knowledge about the degradation of the rice terraces, this study was conducted in order to discuss at a theoretical level how CESs and their relationship with the landscape must be addressed in ES management and policy decisions. The methodological approach includes a combination of semi-structured interviews (n = 60) and a perception survey (n = 66). The results reveal that CESs, apart from being interrelated, are also responsible for and affected by the degradation of the rice terraces, which is why they are important factors to consider

in ecosystem conservation. This paper finally provides policy recommendations for the empirical case and demonstrates the importance of connecting CES analysis with landscape studies looking at agricultural systems.

Keywords: cultural ecosystem services; landscape; agriculture; Ifugao rice terraces; interrelations; tradeoffs; Philippines

1. Introduction

The growing body of research on ecosystem services (ES) in agroecosystems has concentrated mainly on the provision of food, fibre and fuel and its supporting and regulating services [1–4]. Although cultural ESs (CES) also play a crucial role in agroecosystems, they have been rather neglected or just mentioned marginally in the literature [5]. Only recently has the importance of analysing CESs in agroecosystems started getting attention [6,7]. More research is therefore needed, especially on the link between CESs and (agri)cultural landscapes [8,9].

The focus of this study is precisely to analyse the link between an agroecosystem, its CES and the cultural landscape, with a case study of the Ifugao Rice Terraces in the Philippines. The area was chosen as a case study because its unique cultural landscape provides several CESs, which is also why the rice terraces were declared a UNESCO World Heritage site in 1995. However, in 2001, the terraces were added to the List of World Heritage Sites in Danger as experts estimated that almost one third of them have been abandoned. Although they were withdrawn from the List in Danger in 2012, the degradation of the rice terraces remains a problem [10]. While the anthropological and ethnographic research on the Ifugao is relatively abundant [11–15], so far little work has focused on the cultural landscape-CES link, and there has not yet been an evaluation of the different CESs in this area.

In order to understand how this problem of degradation can be addressed effectively while contributing to the mentioned gaps in the academic literature, the aim of this paper is to identify and analyse the interrelations and tradeoffs between different CESs and their relationships with the state of the landscape. To this end, we address the following two research questions: *How are the different CESs related to each other and to the state of the landscape, according to local perceptions? What are the most salient interlinkages for landscape management and policy decisions that aim to benefit the local populations?* Our hypothesis is that there is a widespread local perception of the relationship between CESs, and between them and the state of the landscape. In particular, we expected to find CESs to be responsible for and affected by an increasing degradation of the rice terraces in Ifugao, which makes them important factors to consider in landscape management.

After providing the theoretical background of the study (Section 2), the methodology (Section 3) and the most important results (Section 4) will be explained. The ensuing discussion (Section 5) then analyses the interrelations and tradeoffs between the different CESs and between them and the landscape before finishing with our concluding remarks.

2. Theoretical Background: Relevance of Cultural Ecosystem Services and Progress of Cultural Ecosystem Service Studies

The popularity of the ES approach has resulted in an increasing number of academic publications [16] and its consolidation as a paradigm of ecosystem management [17]. Within this field of study, interest in analysing the link between agroecosystems and ES is relatively recent [1,4,18,19]. That is to say, the assessment of CESs in the agricultural context is in its infancy and has mostly focused on quantifications in monetary terms [20].

CESs are defined as "the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences" by the Millennium Ecosystem Assessment (MA) ([21]; p. 40). This definition is part of the ES approach established by the MA, which understands ESs as linkages between ecosystems and human well-being, in particular as the benefits people obtain from ecosystems. For some CESs like recreation, where a combination of other ESs such as aesthetic enjoyment or food provision becomes a final benefit in terms of recreational opportunities, this concept becomes more ambiguous. Still, we stick to this approach while recognizing and deliberating its problems in the discussion below. The lack of attention towards cultural ESs, as mentioned above, however, is not a particular issue for agricultural systems. In fact, many authors claim that the assessment of CESs in general remains under-represented and under-valued compared to other categories [7,8,20,22–27]. Such under-representation is due to several reasons. First, most CESs are less tangible than other services and encompass non-use values, which makes their estimation and quantification problematic [7,26–28]. Vague definitions stemming from this intangibility also complicate systematic analysis [22]. Furthermore, CESs imply complex and dynamic relationships between humans and ecosystems that appear to be difficult to grasp. Related to this, CES have a normative nature and thus are valued quite heterogeneously by different stakeholders [29].

Why, despite these difficulties, is it still relevant to deal with CES at all? First of all, there are perception studies that, in line with previous propositions by the MA [21], found that people's preferences for CESs are as important as preferences for regulating or providing services [30]. Moreover, addressing CESs with alternative evaluation approaches is crucial in order to gain insight into the socio-cultural sphere—which is rather neglected, as mentioned above—avoiding bias toward other ecosystem services and unwanted trade-offs in land management ([24]; p.119).

When looking at the progress made in this respect, it is easy to observe that most CES assessments concentrate on the category of recreation, whereas other categories, such as aesthetics or cultural identity, remain quite unaddressed [27,29,31]. Considering the occurrence of trade-offs, especially in CESs, it is necessary to analyse different ESs to be able to support decision-making [28]. The negligence of other categories than recreation is motivated by the fact that recreation is relatively easy to assess through quantitative methods. However, the use of quantitative approaches for CES assessments, especially when treating intangible values, is quite controversial. There is an extensive discussion about the need to employ more qualitative and non-monetary valuation studies [9,20,27,32–34]. Within these non-monetary valuations, researchers are requested to grasp different perspectives in order to represent the divergent understandings, interests and perspectives on human–environment relationships and ecosystem management [35]. Furthermore, according to Daniel *et al*. [22], more research effort is especially needed in terms of resolving tradeoffs among CESs. Belt and Blake [27] identified up to six studies in the field

which explicitly analysed tradeoffs in agroecosystems. However, five of them used spatial models and none focused on CESs.

Apart from the issue of under-representation, some authors see a more specific knowledge gap in the connection between CESs and the cultural landscape [8,9,36,37]. According to Stephenson [36] the cultural significance of landscapes comes up short in general. Furthermore, the influence of CESs on land use practices is underrepresented [37]. Yet this link between CES and landscape is important because "humans interact with landscapes in dynamic transactional processes" and "cultural landscapes are at the interface between nature and culture, tangible and intangible heritage, biological and cultural diversity" ([8]; p. 70).

This is particularly relevant for agricultural landscapes where management and ecological structures are in permanent interaction [38]. Management of agricultural landscapes by small-scale farmers is not only crucial for the maintenance of cultural values, but also for achieving biodiversity conservation, economic stability and social integrity [39]. Therefore, it is essential to integrate CESs into landscape management and planning [8,37]. Understanding the relationships between flow and values of ES is also important in order to identify where policy instruments can help to enhance the contributions of agricultural landscapes to added value for society [38].

As landscape carries cultural identity and common historical heritage, it is of great value to consider how the contribution of landscape to cultural identity and heritage can be sustained [34,36]. Accordingly, more case studies are needed that do ES assessments by integrating the tangible and intangible values of cultural heritage and identity. These values should then be connected to conservation planning policies and management of landscapes [9,20]. In order for policies and management to be successful, decision-makers must understand where and how these values interact. Inappropriate landscape development can lead to a split between communities and their past and thus is likely to have negative consequences for cultural values [36].

From the above, several knowledge gaps in the literature on ES can be summarized which are relevant for the purpose of this research. The broader gaps are the under-representation of studies about CESs in general, about other CESs than recreation in particular, and the use of alternative approaches that do not aim to do a monetary valuation. The more specific gap is the missing link between the CES and the cultural landscape in agricultural contexts.

This paper tries to fill these knowledge gaps by analysing the link between different CESs and the landscape with a non-monetary approach. As the selected case involves complex interdependencies between the CESs, the use of monetary valuation approaches was not considered to be appropriate in the scope of this study. Nevertheless, this article still makes an important contribution by identifying key structures, functions and interactions between different CESs and the state of the landscape, which are, according to Limburg [40], the first steps in the valuation process and an important basis for possible future assessments.

3. Material and Methods

3.1. Study Site

The province of Ifugao is located on the east of the Cordillera Mountains in the north of Philippines' biggest island, Luzon (Figure 1; [41]). Ifugao has eleven municipalities with a total population of 191,078 people [42]. It is one of the less developed regions in the Philippines having a Human Development Index of 0.456, it is under the bottom provinces of life expectancy (59.8 years) and it has the fourth lowest average of school years in the Philippines [43].

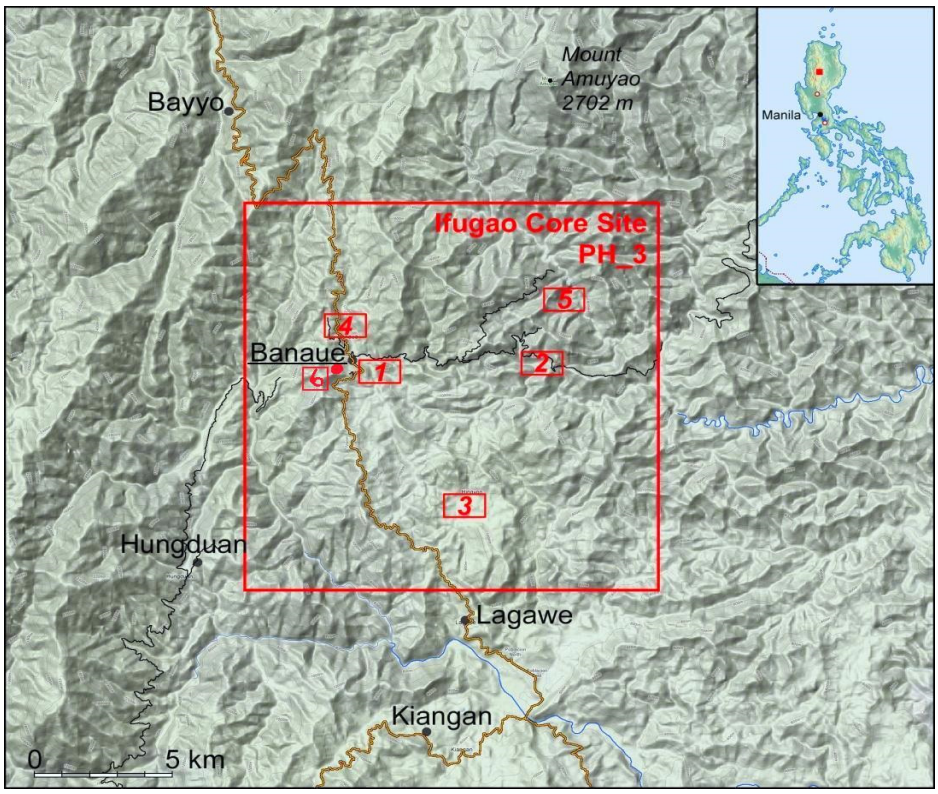

Figure 1. Sketch map of the Philippines with zoom into the researched study sites (Figure 2) in the Ifugao region (red quadrate of 15 × 15 km^2): 1 = Poitan, 2 = Bangaan, 3 = Hingyon, 4 = Banaue Viewoint, 5 = Batad, 6 = Banaue (source: ©2015 Google; Image ©2015 CNES/Astrium / Image ©2015 DigitalGlobe; modified by Reinhold Jahn).

The Ifugao rice terraces were constructed by the indigenous Ifugao population hundreds of years ago. Whereas first estimations placed the origin up to 3000 years ago, this number was reduced over time and the latest calculations using more advanced models date the origin of these terraces in the 16th century [15,44]. Despite not having any formal organization, the Ifugao passed on this singular socio-ecological system from one generation to the other through a system of family inheritance and customary laws [45]. Rice is planted once a year in terraces carved in the mountains, benefitting from ecological processes related with forest buffer rings ("*muyong*") and an extremely rich ethnoecological tradition [11,12].

Apart from being the source of subsistence, the rice terraces are also the keystone of the Ifugaos' culture and heritage. Ancient traditions entangle the annual cycle of farming and rituals, along the

stages of seeding, land preparation, sowing and planting, pest protection, seed selection and harvest. For each stage of the cycle there are specific rituals which are performed to make the crops healthy and robust to get a bountiful harvest [11]. Figure 2 shows how the landscape of these rice terraces looks like in the different researched study sites.

Figure 2. Study sites (**a**) Site 1 Poitan; (**b**) Site 2 Bangaan; (**c**) Site 3 Hingyon; (**d**) Site 4 Banaue Viewpoint; (**e**) Batad; (**f**) Site 6 Banaue (Photo credit: B. Tilliger).

Despite its uniqueness, the place did not call the attention of the Philippine people and of the international tourism until the 1970s when the Philippine dictator Marcos declared the terraces as

national landmark with high value and began the construction of the Banaue Hotel and Youth Hostel. This hotel was the source of growing tourism which converted Banaue into the tourism centre of the region and made tourism an important source of income [10]. Despite the growing tourism sector, the cultivation of the rice terraces has been the principal economic activity of the Ifugaos for centuries and it is still the primary source of local livelihood [41].

3.2. Methodology

The methodological approach of this paper combines qualitative and quantitative methods, outlined in Figure 3 and described below.

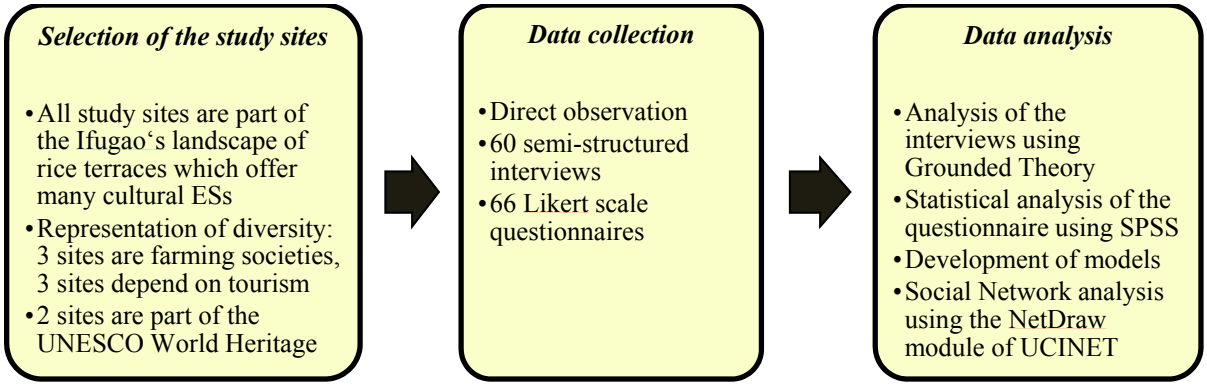

Figure 3. Main steps of the methodological process (Source: own elaboration).

3.2.1. Selection of the Study Site(s)

The study sites were selected in line with a larger research project on rice ecosystems in East Asia (LEGATO, www.legato-project.net; [65]), which is taking place in different regions in Vietnam and the Philippines. Among them, the Ifugao region was selected because its unique landscape of rice terraces incorporates and depends on many CESs. The fact that our study aims at analysing these CESs and their interrelations in an agricultural landscape underpins this selection. Five villages in the Ifugao region and the city of Banaue were selected for in depth research (see Figures 1 and 2). The selection of all these sites is deliberate as it guarantees representation of diversity within the region: three of the villages (Poitan, Hingyon and Bangaan) are farming societies with little impact from tourism, whereas two villages (Batad and Banaue Viewpoint) and the city of Banaue experience major impact from touristm. Also, the terraces located in the villages Batad and Bangaan are UNESCO heritage sites, which makes their analysis of particular interest.

3.2.2. Definitions

As mentioned above, the categories of the CES that will be analysed in this paper are difficult to define. Nevertheless, we will try to clarify them according to concepts used in the LEGATO project and in well-established literature [9,46,47,65]. We recognize that the definitions and categories of the LEGATO project are not unambiguous. Although it might have been beneficial to consider other, more explicit lists, the LEGATO definitions are operative and useful for the purpose of this study. However,

knowing its limitations and in order to not rely on these basic categories, we aligned the LEGATO list with other established categories from the MA.

Furthermore, there is a legitimate debate with some authors questioning if cultural services and values are 'services' at all (as defined by the MA) or if this terminology is too reductionist and CES values should be rather classified with other terms like 'benefits' or be complemented with other concepts [37,48–50]. However, as the term 'service' is still the most commonly used in the academic debate to which this paper wants to add value [7,22–25,29], we decided to stick to the established term. Besides, we faced problems with the purely positive connotation of the word 'benefit'. This positive value is not always achieved in our study, especially regarding recreation.

Another critical point is that in the existing literature, the relation between the notions 'knowledge systems' and 'ecosystem services' is far from being established. The idea of associated cognitive developments as a benefit from human interaction with the ecosystems [21] still comes up in analyses that consider knowledge systems as one type of CES [7,51,52]. In contrast, other works see knowledge systems more as a fundamentally social process that influences ecosystem management and hence ES provision [53,54]. In any case, knowledge systems have become a keystone of ecosystem governance [55,56], and therefore we deemed it suitable to consider them explicitly in the assessment. We did this by including it as an additional type of ES, in the line of recent publications mentioned above, although we are aware that this is clearly an ongoing debate.

To give an overview of the terms used in this study, some clarifications on the categories we analyse are explained below:

- *Recreation* relates to people's decision about where to spend their free time based on the characteristics of a landscape in a particular area.
- *Spiritual values* are sacred, religious, or other forms of spiritual inspiration attached to ecosystems.
- *Aesthetic values* represent the beauty that people see in various aspects of an ecosystem.
- *Knowledge systems* consist in the traditional and formal knowledge different cultures developed over time influenced by the ecosystems.
- *Cultural heritage values* (or simply '*heritage*') stand for the value that societies place on the maintenance of historically important landscapes. In its tangible form, cultural heritage can be physical historical objects and places that have been passed on from generation to generation. In its intangible form it includes languages and traditions.
- *Cultural identity* is related to the attachment to home, values, norms and a certain lifestyle. It develops from people's collective roots.

These definitions should only serve as a clarification of the important concepts and to make their analysis a bit easier, but they clearly form artificial segmentations of the different cultural services. When looking at them, it is striking—as rightly argued by Tengberg *et al*. [9]—that 'cultural heritage values' and 'cultural identity' and several other CES categories defined by MA (such as spiritual and recreational values) are interrelated and overlapping when used in cultural landscape research. We are aware of this overlapping and the occurrence of interrelations, and it is the aim of this study to figure out to which degree they are related and what impact this relation has on a possible evaluation.

Apart from the CES categories, the term landscape in this study is predominantly assessed based on the state of the rice terraces, with regard to its degradation. Other landscape features are not included as the rice terraces generate the CES and thus are the most important factor of the landscape for this study.

3.2.3. Data Collection

Data was collected in the Ifugao province in February 2014 through direct observation, semi-structured interviews and a survey of perceptions about changes in agricultural landscape using a Likert scale questionnaire.

Semi-Structured Interviews

The aim of the interviews was to identify the reasons for the degradation of the rice terraces and the interrelations and tradeoffs that exist between the different CESs and between them and the state of the landscape It should be remarked at this point that the aim was not to identify cultural ES categories in the interviews. The different cultural ES categories were identified separately through literature review, including literature on the region, and then interviews were analysed accordingly. In total, 60 semi-structured interviews lasting about half an hour were conducted. The interviews started after at least a one-day observation period of the normal day routines at the villages in each site, paying attention to work practices, social interactions, meals and economic activities. The interviews were held in English without problems since most people in the region speak this language well.

The target interviewees were farmers and people working in tourism-related jobs. Therefore, in the villages with less impact from tourism, interviewees were selected randomly going door to door. Almost all interviewees were farmers, and only a very few had other jobs, like teachers. As the villages are quite small, all available people that agreed were interviewed. In the other tourism-related villages and Banaue, interviews were held with people from almost all accommodation facilities and souvenir shops, whereas due to the amount of restaurants these were selected randomly. In Batad, rice terraces are still maintained, which is why approx. 20% of the interviewees were also farmers, whereas in Banaue it was almost impossible to find farmers and interviews were held 100% with people working in tourism-related jobs.

All in all, the number of interviewees in tourism-related villages and cities (n = 31) and the number of interviewees in agricultural villages (n = 29) is quite balanced. There is also a representation of more or less 50% younger and 50% older people, though females were 20% overrepresented due to their higher availability. However, this does not appear to be a relevant problem as no significant differences in the analysis could be found regarding how females and males responded. In general, 5.6% of the households in Bangaan, 5.4% of the households of Hingyon, 5% of the household in Batad, 3% of the households in Poitan and 0.43% of the households in Banaue (including Viewpoint) were interviewed. The low percentage in Banaue is due to the fact that it is the third biggest city in the region, which goes beyond the scope of this research. Besides, a higher percentage would not have been desirable as already more interviews were held in Banaue than in the other villages and conducting further interviews would thus have distorted the results.

Likert Scale Questionnaire

In order to assess people's perception about the causes and future implications of the degradation of terraces for different CESs, a short Likert scale survey was conducted (see Supplementary S2). The survey was designed based on the research interest and according to the standards for this kind of research [6,57].

The first part of the survey checks and backs up the information about the causes of the degradation gained from the interviews. In this part, ten statements about environmental, social, economic and cultural reasons for the degradation were given and people had to indicate how much they agreed with each statement. There were five possible categories: strongly agree, agree, undecided, disagree or strongly disagree. In the second part of the survey, people were asked to indicate how much they agree about the future implications that further degradation of terraces might have. This was another ten statements. Some of these statements were formulated according to a different pattern in order to check if people had read the survey carefully. The different categories of cultural ES were represented in 13 of the 20 statements (see Table 1). Six statements were about recreation, two about cultural heritage values, two about knowledge systems, one about cultural identity, one about aesthetics and one about spiritual values. The other seven statements included economic and environmental reasons in order to not neglect important points. Prior to the survey, the questionnaire was piloted on-site and slightly tuned accordingly. Concretely, statements related to the environmental conditions (water issues and landslides) were added or rephrased.

The sample of the survey (n = 66) includes 57 of the 60 interviewees plus 9 other respondents who either had no time or did not want to do an interview but still agreed to fill out the survey. As in the interviews, people were either selected randomly or according to their occupation in tourist-related jobs and in general there was a similar representation (Bangaan 5%, Hingyon 5.9%, Batad 4.6%, Poitan 3% and Banaue 0.6% of the households). Instead of applying a formula, the selection of the sample was chosen with a normative criterion. This criterion consisted in interviewing all available people within a given period of time for each region. This period of time depended on the size of the region and was between 3 days for very small communities up to 3 weeks for larger communities. We recognize that this rather low representation, especially in Banaue, is a limitation of the study. However, we would like to emphasize that the aim was to find a balance between the number of interviewees and surveyees, which should preferably be the same people regarding the scope of this study. As both methodologies have other requirements, the representation resulted in a rather small sample for the survey and a rather large sample for the qualitative interviews, the latter of which enabled a more meaningful and deeper analysis.

3.2.4. Data Analysis

As this study uses a combination of interviews and a survey, there were two types of data to be analysed, qualitative and quantitative data. In most cases, interactions among ES cannot be disentangled by a quantitative valuation but are rather resolved by semi-structured interviews [31]. Having two types of data is thus especially useful in order to carry out a profound analysis and

compare data in this data-poor region. As a consequence, two different kinds of methods were used to analyse these data.

Qualitative Data Analysis

First of all, the method used for the systematization and analysis of the qualitative data gained from the interviews relies on the premises of the Grounded Theory, an approach in the social sciences which aims at elaborating theory based on the analysis of empirical data [57]. Following the steps of this method, the interviews were transcribed, systematically coded using Microsoft Word, categorized into different themes and summarized in written memos. Also, these memos served as a basis to develop models of relationship between categories. Microsoft Excel and pivot tables were used in order to analyse how people valued the statements in the survey according to the above-mentioned grouping of the interviewees (age, job, gender and village). These different categories were compared by looking at the most frequent response in every question (see Table S3). For example, the number of people who mentioned the decline of the practice of the rituals in their interview was counted, as were how many of these people were female and how many male. This was done for all aspects that were mentioned by a large number of people.

Quantitative Data Analysis

Secondly, basic statistics like frequency distribution and a correlation analysis were used for the analysis of the survey. The frequency distribution was calculated with Microsoft Excel. Looking at the most frequent response for each statement (the mode) was valued as most appropriate here, as calculating means in a Likert scale might be problematic [57]. Apart from the frequency distribution, the correlation tests Kendall-Tau-b and Spearman-Rho were conducted using IBM® SPSS® Statistics 21. The Kendall-Tau-b and Spearman-Rho tests were chosen because they are the most appropriate tests for a Likert scale survey. However, as the Spearman-Rho tends to overvalue and Kendall-Tau-b is more suitable for not normally distributed and ordinal scaled data [58], only the results of Kendall-Tau-b will be presented. The correlation was tested between all items (the 20 statements of the survey) and all respondents ($n = 66$).

In order to better illustrate the significant results of this correlation analysis, a network analysis tool, the NetDraw module of the UCINET software [59], was used to represent the relationships between items. In the derived models, only significant correlations were considered, which means those correlations between items that have a correlation coefficient higher than 0.5. The purpose the NetDraw illustration is to only represent the network and not its analysis. Therefore, it must not be confused with a comprehensive social network analysis, which this software is usually used for.

4. Results

4.1. Reasons for and Implications of the Degradation of the Rice Terraces

One preliminary result is that the vast majority of the interviewees perceived a change in the landscape and specifically a degradation of the rice terraces. The reasons for and implications of this change, and its relationship with CESs, were figured out by analysing the responses to the survey (see Table 1) and exploring the qualitative data gained from the interviews in depth.

Table 1. Frequency distribution of all statements in the survey, in percentages for the responses to each statement. Note: (1) Categories of analysis include: CES categories, environmental conditions (ENV) and socioeconomic aspects (SE). The environmental and socioeconomic aspects were included in order to avoid neglecting important elements. (2) The most frequent responses appear in bold red font. Numbers are rounded up (Source: Own elaboration).

Statement (Q1–Q10: Causes of Degradation, Q11–Q20: Implications of Future Degradation)	**Strongly Agree**	**Agree**	**Undecided**	**Disagree**	**Strongly Disagree**	**Category of Analysis [1]**
Q1. Farmers have been abandoning the fields to work in tourism	8%[2]	**39% [2]**	12%	35%	6%	Recreation (CES)
Q2. Agricultural work is no longer profitable	8%	**50%**	11%	23%	9%	Economy (SE)
Q3. More migration to other cities	14%	**62%**	8%	15%	2%	Migration (SE)
Q4. The young gen. has higher education and doesn't want to work in agriculture	20%	**52%**	8%	20%	2%	Knowledge systems (CES)
Q5. The young gen. doesn't have the same skills to cultivate the terraces than the older gen.	14%	**63%**	2%	20%	2%	Cultural heritage (CES)
Q6. The young gen. doesn't want to work in agriculture anymore because other work has a higher status and is better seen	18%	**52%**	12%	17%	2%	Cultural identity (CES)
Q7. There is not enough water due to irrigation or due to other problems	8%	**58%**	11%	20%	5%	ENV
Q8. The climate has been changing and does not provide optimal conditions to sustain the terraces anymore	8%	**52%**	17%	21%	3%	ENV
Q9. Because the soil has been losing its fertility	5%	24%	11%	**55%**	6%	ENV
Q10. Because of landslides destroying the terraces	12%	**73%**	6%	8%	0%	ENV
Q11. The number of visitors will decline	29%	**55%**	14%	3%	0%	Recreation (CES)
Q12. The income from visitors will decline	17%	**73%**	6%	5%	0%	Recreation (CES)
Q13. Visitors will be more satisfied with their visit	3%	8%	12%	**71%**	6%	Recreation (CES)
Q14. The overall quality of the recreational experience will decline	5%	**70%**	19%	5%	2%	Recreation (CES)
Q15. The crop production of the communities will be threatened	6%	**82%**	8%	5%	0%	Economy (SE)
Q16. The landscape scenery of the region will be less beautiful	11%	**77%**	5%	6%	2%	Aesthetics (CES)
Q17. Spiritual values will get more & more lost	9%	**39%**	22%	27%	3%	Spiritual values (CES)
Q18. The practice of rituals will not decrease, but maintained	3%	30%	15%	**48%**	3%	Cultural heritage (CES)
Q19. The number of people with traditional agricultural knowledge will decrease	5%	**62%**	15%	17%	2%	Knowledge systems (CES)
Q20. The current trends in the tourism activities will remain the same. It does not depend on the state of terraces	0%	11%	27%	**56%**	6%	Recreation (CES)

The degradation of the terraces is attributed mostly to different reasons for the abandonment of agricultural practices by the younger generation (Q4, Q5, Q6), through migration in general (Q3) or due to the missing profitability of agriculture (Q2). The reasons for this migration and especially for abandonment by the younger generation will be explained and associated with the CES in the next section. Additionally, environmental reasons like problems with water (Q7), a changing climate (Q8) and landslides (Q10) were mentioned, though landslides can also be interpreted as a consequence of the abandonment of agricultural practices. These environmental reasons were included to not miss relevant points, but are not analyzed in detail as the focus of the research are cultural ES. Leaving aside the mentioned lack of water, changing climate and landslides, the reasons given were extreme climate events like typhoons, earthquakes and droughts, erosion and plagues like the giant earthworm and the golden apple snail. Concerning the impacts of future degradation of the terraces, all CESs might be affected. According to the survey, most people think that recreation (Q11, Q12, Q13, Q14, Q20), aesthetics (Q16), spiritual values (Q17), knowledge systems (Q19) and heritage values (Q18) will be affected.

Furthermore, how people valued the statements in the survey and what people focused on in the interviews were also compared according to different categories, which were age, job, gender and in which village people lived (see Table S3). Most differences in the responses could be found according to where people lived, though these only appeared in four statements of the survey. Only in three statements did people respond differently according to their gender and job, and the age category made absolutely no difference, as old and young people responded the same.

In particular, questions with no agreement were analysed according to the different categories. Interestingly, the majority of people living in the tourist city Banaue disagreed with statement Q1 ("Farmers have been abandoning the fields to work in tourism"), explaining the high amount of people disagreeing. It was also the majority of people from Banaue and people working in tourism-related jobs in general who agreed on statement Q18 ("The practice of rituals will not decrease, but maintained"). This might be due to the fact that they do not want to blame themselves or their lifestyle for the abandonment of the fields and the loss of the rituals. Another hypothesis is that they know the importance of tourism for the region and do not want to worsen the image with the loss of Ifugaos' identity. For statement Q17 ("spiritual values will get more and more lost") patterns are less clear, though more old people disagreed with the statement than young people as they might be more connected to spiritual values. In general, differences in the other statements that are important for the analysis of the interrelations and tradeoffs will be explained in more detail in the next section.

4.2. Interrelations and Tradeoffs between the State of the Landscape and Different CES

4.2.1. Cultural Identity and Heritage Values

In the interviews, one of the most commonly mentioned reasons for the degradation of the terraces was that the young generation does not work in the rice fields anymore. The majority of respondents (≥70%) agreed on statements related to this point. Combined with data from the interviews, the survey offers supplementary explanations. First, there are socioeconomic reasons, which in turn are strongly connected to the decline of cultural identity and heritage values. The enhancement of the young

generations' formal education facilitates their migration to the cities or even abroad, attracted by higher incomes. One interviewee describes this as follows: "now their children and children's' children [of the old folks] wanted a better life, they wanted a white-coloured job, they apply abroad (...) to make them more progressive, because you know they don't want to be like this forever". Parents in general prefer sending their children to school instead of sending them to the fields. The only young people who work in the fields are the ones without education or those who do not find another job.

This is closely related to a decline of heritage values as these values placed on the maintenance of historically important landscapes are getting lost when people abandon their terraces in order to study or migrate. The on-going change of these values can therefore be the result of people going away, but also a cause for people to leave their terraces behind. Possible indicators for the decline of heritage values are the decreasing number of native houses and use of traditional clothes, which are only worn for special occasions like festivals, if at all. Moreover, and in direct relation with the agricultural management, the periods of the traditional rice cycle are not always followed, more people sell their terraces (which was unthinkable in the past) and many people do not practice the ancient rituals anymore. One young male interviewee even spoke about an "extincting" culture.

The decline of heritage values is strongly interrelated with another reason why young people do not work in the fields anymore, which is the erosion of cultural identity due to a changing lifestyle and a shift in interests and values. Whereas the rice was said to be a significant part of the Ifugaos' identity, nowadays it has become less important for the young generation and some are even ashamed of working in the fields. While the older generation defends the importance of its traditional rice, the children of one interviewee told her she should sell her traditional rice and buy commercial rice instead. In particular, older people claimed that the young generation is lazier now and does not like to work under the sun and in general in the fields as it "makes their fingers dirty".

Some of the previously mentioned reasons also appeared in the survey and all items about the young generation had significant correlations among each other and with other items (see Table S4). This shows that the different reasons for young people not to work in the fields, like education, status and skills are interrelated and that cultural identity and heritage values are related with the socioeconomic reasons. Interesting enough, there were no significant differences in how young and old people contested in the survey and in the interviews. Divergent opinions were rather found according to the village where people lived.

To sum up, there are tradeoffs between decreasing cultural identity and heritage values leading to an increasing degradation of the terraces.

4.2.2. Aesthetics, Spiritual Values and Knowledge Systems

Another stated reason for the degradation of the terraces is the decline of traditional knowledge of the young generation as they, apart from a lack of interest, also simply do not know how to take care of the terraces anymore. This lack in young people's skills was also confirmed in the survey (75% agreement to Q5). As many already grow up in the city, they are not used to work in the fields. Only in the villages not influenced by tourism there are still young people with traditional knowledge of working in the fields, although this is a small minority. In general, throughout all villages, mainly the old generation is left to cultivate the terraces. Moreover, concerning the future implications of

degradation, the results of the survey show that with increasing degradation the number of people with traditional agricultural knowledge will decrease.

Furthermore, aesthetics and spiritual values are also perceived to be affected by increasing degradation. In general, a change of the landscape was observed by most interviewees. This was especially related to the degradation of the rice terraces, but also to the disappearing native houses replaced by modern houses. The landscape in the past was therefore seen as much more beautiful than the current landscape. The future prospects obtained from the survey prove that there is a link between the degradation of the terraces and a decreasing aesthetic value of the landscape (88% agreement with Q16). Furthermore, the spiritual values and the practice of the rituals will probably also be affected by a future degradation. Though people confirmed this in the interviews, the majorities in the survey are rather weak (48% agreement to Q18). Still, it can be concluded that there are existent tradeoffs between an increasing degradation of the terraces leading to a decline of landscape aesthetics, spiritual values and knowledge systems.

4.2.3. Recreation

The last analysed cause for the degradation of the rice terraces is tourism, although this point is more controversial, as it had a weak majority in the survey (47% agreement to Q1) and as the influence of tourism in general is very complex. First of all, tourism is made responsible for the degradation of the terraces as people nowadays prefer to go to the cities and work in better paid tourist jobs, which is why some terraces are not being cared of. Tourism is in many cases the most important economic activity; as one female interviewee said: "Tourism is where we get most income from". This is also due to the fact that nowadays, the harvested rice can feed the household of most families just for three to six months, threatening the subsistence of many families if they do not engage in other work like tourism [41].

The negative impact of tourism on the degradation of the terraces also has to do with the fact that not all people benefit from the generated tourism incomes. These incomes are kept in Banaue and Batad, whereas farmers and people living in other villages are usually excluded from the revenues. One hypothesis is that if the neglected villages and farmers in general would benefit more from the tourism revenues, there might be less migration and abandonment of the terraces and thus less decline of cultural identity, heritage and spiritual values.

Moreover, tourism can contribute indirectly to the degradation of terraces because woodcarving is sourced from old trees and their clearing has severe impacts on the water cycle, on water conservation and soil conditions. This leads to problems with the irrigation system and a lack of water, which many people claimed to be a reason for the degrading terraces.

In addition to those negative impacts, the impact of tourism was also valued as positive because tourists, apart from benefitting people's business and income, also help to restore the terraces. This, however, was remarked mainly by people working in tourism-related jobs or living in tourist locations and not by farmers in the other villages. Terraces were said to be only repaired in those villages that are important for tourism, while people in the other villages claimed to not see any money. The reason for this favouritism is the negative effect the degradation of terraces would have on the recreational sector as the landscape will be less beautiful and would attract fewer tourists. This relation can be comprehended by looking at the various correlations (see Table S4) that exist between the decreasing number of tourists, the satisfaction of the visitors, the declining beauty of the landscape and the tourist activities remaining the same.

To sum up, increasing recreation firstly leads to more degradation, but secondly to more restoration of the terraces. Lastly, there are tradeoffs between increasing degradation leading to decreasing recreational sector.

4.3 Interrelations and Tradeoffs between Different CES

4.3.1. Interrelations Gained from the Correlation Test

Apart from the interrelations between the state of the landscape and the CES, the survey and the interviews were also used to analyse the interrelations between the different CESs. As a result of the survey, a correlation test was conducted (see Table S4) in order to assess the relations between the different items of the survey. In general, there were various significant correlations and in four cases the correlation coefficient was >0.5. These were between statements Q4 and Q5, Q4 and Q6, Q7 and Q8 and between Q11 and Q12. Besides, the most significant negative correlations existed between statements Q11 and Q13, Q12 and Q13, Q13 and Q16 and between Q16 and Q20. The existence of several significant correlations shows that the survey and its items are somehow consistent and that the items are interrelated. This indicates that the different reasons and implications of the degradation were not made up randomly.

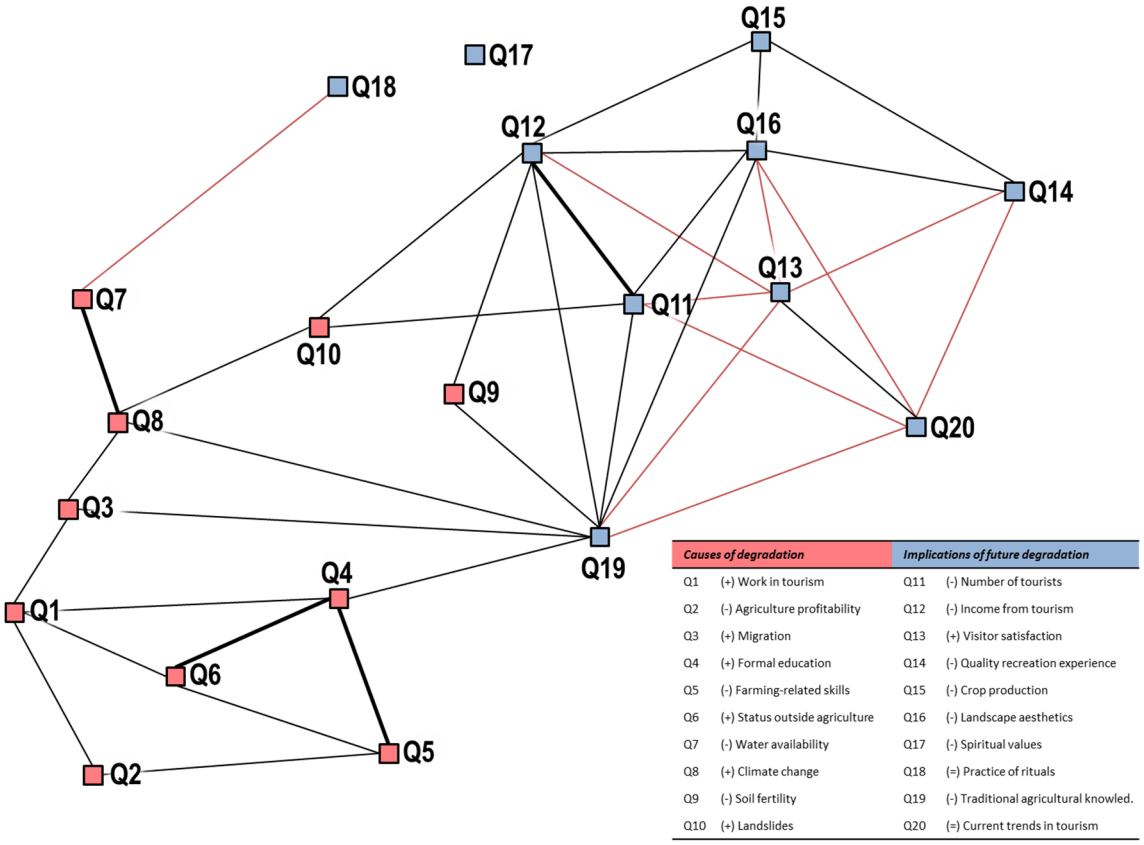

Figure 4. Network of highly significant correlations between the answers to the survey. Statement listed in Table 1. Only highly significant correlations are represented; bold lines represent coefficients >0.5; red lines represent negative coefficients. Red nodes represent causes of landscape degradation and blue nodes represent implications of landscape degradation. Source: Own elaboration.

For enhanced interpretation, results of the correlation analysis are also represented in Figures 4 and 5. Figure 4 represents the correlations between all single survey items and Figure 5 the correlations between the survey items grouped according to the different CES categories (specified in Table 1). As can be seen, most cultural ESs are related either directly or indirectly. Additionally, the graph offers an understanding of the links to explore between CESs and the economic activities in the region. For instance, statement Q19, linked to traditional knowledge systems, appears as a key connector of causes for landscape degradation and implications of such degradation.

However, it must be underlined that the purpose of the illustrated network is only a graphical representation of how the different items of the survey are statistically interrelated. It should not be used as a basis for a comprehensive analysis of the interrelations of the CESs. These interrelations and tradeoffs were predominantly assessed in the interviews, which is why the next section will present and analyse the results of the interviews in detail while also referring to this quantitative data.

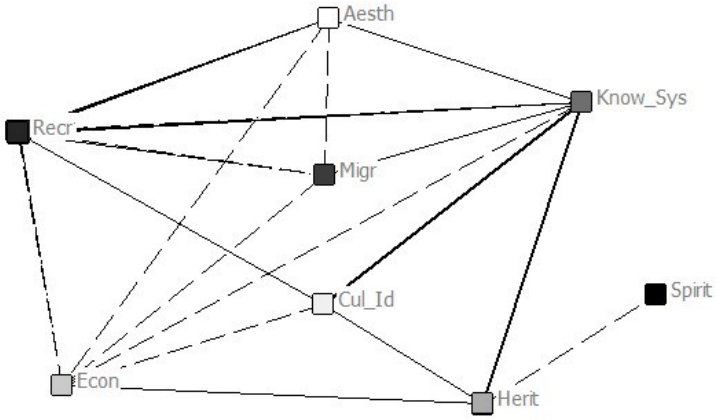

Figure 5. Relations between different CESs according to correlations in the survey. Continuous lines represent a high significance (the correlation is significant at the level of 0.01) and dashed lines a low significance (the correlation is significant at the level of 0.05). Source: Own elaboration.

4.3.2. Interrelations and Tradeoffs Identified and Analysed from the Interviews

As shown above, recreation has a strong impact on the state of the landscape and is expected to be strongly affected by a change of this state. Apart from this influence, recreation also has a strong impact on the other CES. While tourism was said to have a few positive impacts on culture (e.g., people learning from tourists), the majority only mentioned the positive economic effects. There were also some negative economic impacts mentioned, like people's economic dependency on tourism and the rise of living expenses which many farmers cannot afford. When talking about negative impacts, however, most people focused on cultural aspects. The first negative impact is the decline of cultural identity. This relates to the fact that tourists change people's values, attitude and lifestyle into a more "westernized" one. Inappropriate behaviour of tourists who drink, shout, smoke, kiss in public or do not wear proper clothes especially influences the values and attitudes of the people in a negative way. This affects particularly the younger generation, who are rather prone to copy such behaviour. An increasing overall commercialization was criticized as well. This interrelation of recreation and cultural identity could also

be seen in the results of the correlation analysis. Moreover, recreation negatively influences the heritage values, as these values, which people associate with the maintenance of historically important landscapes, are getting lost when people abandon their terraces in order to work in tourism. Finally, recreation was said to influence the practice of rituals and thus the spiritual values negatively.

Apart from tourism, though, the practice of rituals is decreasing because of many other reasons related to a decline of cultural identity and heritage values. One reason is that people converted to Christianity and prefer Christian values over the ancient spiritual Ifugao values, as the opinion of one interviewee shows: "[The rice guard] is only wood, it is not a true god". Some people even sold their rice guards. Other reasons named for the disappearing practice of rituals are their high costs and that people are "civilized" now. The reason most people were concerned about was that after the death of the old folks and last priests, there will be a lack of the knowledge necessary to practice the rituals. In the interviewed villages, there are already either no ritual performers or very few left. The problem is that the young generation does not know or does not want to learn the rituals because, contrary to the old generation, rice has become less important to them. One older woman said they may think "if you do that you belong to the old people". In general only a very few families still practice the rituals and most of them already do it differently, without a priest, in a Christian way, or only on special occasions. The "*Bayanihan*", a traditional helping system between neighbours, where farmers help carry out one another's farm operations, is slowly eroding. However, some of the cultural activities have been revived in festivals. These interrelations between spiritual values, cultural identity and heritage values were also identified in the correlation analysis.

Finally, with the qualitative and quantitative results obtained from interviews and the survey, we have identified and analysed several interrelations and tradeoffs between the different CESs and between them and the state of the landscape. How to interpret these interrelations and tradeoffs and how to evaluate its implications and consequences for future policy or academic work will be discussed in the next chapter.

5. Discussion

In order to make sense of the most important results, Figures 6 and 7 give an overview of several interrelations between the different analysed CESs (Figure 6) and between them and the state of the landscape (Figure 7). According to Bennet [60], the interaction among different services can be unidirectional, which means that the level of provision of one service affects the level of provision of the other service, or bidirectional, which means that service provision levels affect each other. After examining the results presented above through this lens (represented in Figures 6 and 7 by means of the different arrows), most services analysed in this study seem to have a bidirectional interaction.

Focusing on the interrelations between CES and the state of the landscape (Figure 6), two possible processes are evident. On the one hand, there is the effect that the change of the landscape (the degradation of the terraces) has on the CES. The tradeoffs here are that increasing degradation leads to a decline of landscape aesthetics, spiritual values, knowledge systems and recreation. As spiritual values and knowledge systems are strongly connected to cultural identity and heritage values, increasing degradation might also lead to a decline of those values.

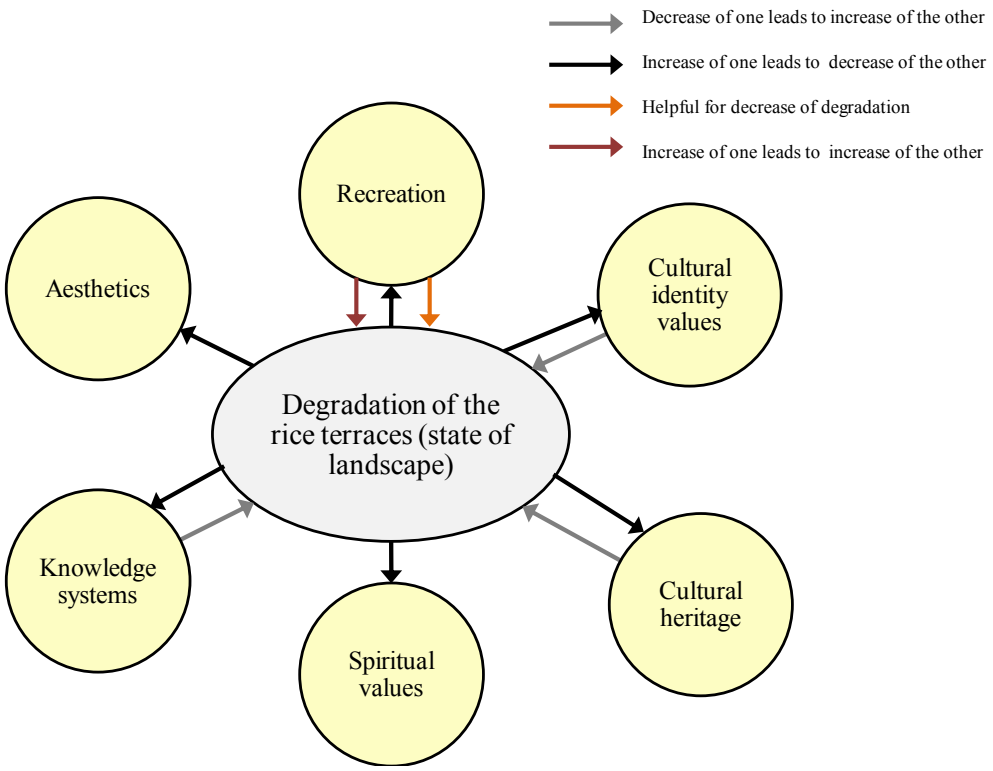

Figure 6. Interrelations between different CESs and the state of the landscape. Source: Own elaboration.

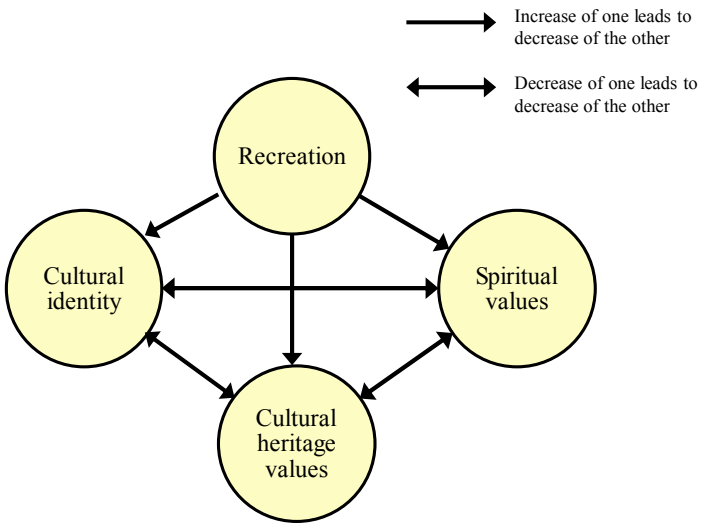

Figure 7. Interrelations between different CES. Source: Own elaboration.

On the other hand, there is the impact a change of the CES has on the state of the landscape. The tradeoffs here are that a decline of knowledge systems, cultural identity and heritage values leads to increasing degradation of the terraces. Also, increasing recreation leads to more degradation, although sometimes recreation can also be helpful for the restoration of the terraces, which would be a positive tradeoff.

This negative tradeoff with recreation might seem to call into question the linearity of the widely accepted cascade model [61,62] which understands ESs as intermediaries between an ecosystem and human well-being. In particular, the fact that an ES can actually have a negative impact on human

well-being is difficult to grasp. However, this results from the complex interrelations that emerge when looking at CESs. On the one hand, recreation indeed benefits the human well-being of those people who engage in the recreation (the tourists), but on the other hand, this perspective neglects the fact that the well-being of one group might indirectly cause the decline of well-being for another group. The portrayed negative impact recreation can have is also the reason why we preferred to use the term 'services' throughout our study and not other typologies as discussed in the definitions.

Furthermore, this negative impact of recreation is discovered when looking at the different interrelations of cultural values and not when only including the economic aspects where recreation would in fact have a positive impact. This point illustrates the problem with quantitative valuations and studies that only consider individual CES or economic aspects because the relevant cultural interactions are suppressed and neglected. Coming back to the cascade model, as CESs in general are non-market values which appear at the end of the cascade, they are easily ignored by this model, which is another reason why it is problematic in the analysis of CESs [27]. Therefore, it is crucial to use non-monetary evaluation approaches and to look at the interrelations in the study of CES.s Future studies should consider this and reflect on the extent to which they want to classify and analyse recreation as a (cultural) ES.

Connecting these findings with the theoretical debate, this paper shows that the study of CESs in agroecosystems, and especially the inclusion of CESs beyond recreation, should not be neglected. As emphasized by Tengberg *et al*. [9], such elements can trigger significant changes in landscape and agricultural practices, and the abandonment and degradation of the rice terraces is an important case in point. The analysis of CESs in agroecosystems has helped to pinpoint actual factors that turn out to be influential in the maintenance of an outstanding landscape, an exercise that has been rarely applied in landscape research [63].

Regarding the interrelations between the different CESs (represented in Figure 7), there are tradeoffs between increasing recreation leading to a decreasing cultural identity, heritage and spiritual values. Another interrelation is that a decline of heritage values and cultural identity leads to a decline of spiritual values, and the reverse, as the three are strongly interrelated. This implies some overlapping, of which we are aware. It is due to the fact that considering the nature of CESs, there are strong interdependencies which until now have been little investigated, as CESs mostly have been evaluated separately. By analysing and showing the importance of these interrelations, however, we also hope to be able to draw some conclusions about how important they are separately. It must be stressed here again that the purpose of the assessment is not to quantify the CESs but to demonstrate their importance by analysing their interdependencies and to understand the level of their local perception. This is also why the problem of double-counting should not be relevant in this study. Future investigations, however, which aim at quantifying CESs should keep this double-counting in mind. It could also be an interesting starting point for future studies to analyse how much overlapping we face in CES studies.

With respect to the above-mentioned interactions, we can confirm the hypothesis stated at the beginning, that there exist complex interrelations and tradeoffs between different CESs and between those CESs and the state of the landscape. Why is it relevant to look at these interrelations? Analysing these interrelations is important as there is evidence that the interrelations between ESs need to be better understood in order to improve ecosystem management and in order to achieve effective landscape management. As Plieninger *et al*. [63] argue, when studies use methodologies which assess

synergies and trade-offs among multiple CES, they become particularly valuable for landscape management and planning. After confirming in this case that CES are interrelated, addressing only one or two services at a time would provide too narrow a picture for a comprehensive analysis, because we do not know when trade-offs appear, which mechanisms cause them, nor how to minimize them, an issue already highlighted by Bennet *et al*. [60]. Therefore, understanding these interrelations is necessary in order to address the degradation of the rice terraces and is an essential step before assessing the value of these ESs in further studies.

The need to improve methods for the study of CESs in the context of ES bundles [25] is responded in this research through the combined use of qualitative and quantitative research methods. In relation to previous studies of rating-scale research on CESs [6], this paper presents an innovative approach that not only elicits perception of importance of a given process—in this case on the causes and consequences of landscape degradation—but also connects its constituents through a network structure. In this respect, the study also contributes to efforts linking ecosystem service assessment and network analysis [64], for the under-represented area of CESs, particularly in Asian contexts.

Still, what do all these tradeoffs and interrelations tell us? Even without a quantitative valuation, this study can make some qualitative statements about the value of the CES from the local perspective. The analysis demonstrated that there is a decline of CESs related to aesthetics of the landscape, cultural identity, heritage values, spiritual values and knowledge systems, especially for the younger generation. Moreover, the value of all analysed CESs will probably be negatively affected by an increasing degradation of the rice terraces in the future. Apart from being affected, the decline of several CESs and other socioeconomic factors might also be responsible for an increase in the degradation of the rice terraces and thus a less valued landscape, which makes the CESs even more valuable.

Apart from the empirical relevance stated above, these relationships in our case study also demonstrate the importance of analysing the link between the state of the landscape, agricultural practices and CESs, and that this link should not be neglected in future management and policy decisions concerning solutions for the problem of degradation. Previous studies identified cultural aspects as the most challenging ones to address with policy [7,9]. In this case, if no policy actions are taken, the value of all analysed CESs will probably continue decreasing in the future and the decline of these CESs might lead to more degradation. The preservation of the Ifugao rice terraces is therefore difficult to achieve without dealing with the cultural aspects.

Clearly, policy decisions in the area should consider some economic aspects. The cultivation of terraces must be made more profitable for farmers. There could be programs that provide financial incentives to the people for cultivating the terraces. There should be policies ensuring that the benefits received from tourism are distributed more equitably. The current approach, where only very few benefit from the tourist revenues and government funds, will not prevent the degradation of the terraces. It is likely that none of these recommendations are new for regional managers. The crucial insight from our research is that these measures should not be managed separately and they all should be underpinned by a clearer understanding of their interconnection and their relation with cultural identity and traditional knowledge systems. A policy recommendation here is to develop projects in order to revive and strengthen the Ifugao culture based on inclusive debates about Ifugao's future with the participation of older and younger generations.

6. Conclusion

This paper has presented interrelations among CESs and between CESs and the state of the landscape, in the case of the Ifugao rice terraces in the Philippines. Empirically, the study has identified them through an innovative approach combining qualitative research, rating-scale research and network approaches. Conceptually, the paper underlines the value of looking at the link between CESs and landscapes in further studies, and the implications for policies on landscape restoration.

While the work has helped to disentangle values in the interrelations between cultural ecosystem services and landscape conservation, one limitation in the analysis is the difficulty of assessing their magnitude. Although different trade-offs were identified, it was not possible within the scope of the study and its chosen methodology to further measure the dimensions of these trade-offs, which of them are the most important ones, or to which extent. This remains a challenge to be undertaken by further studies.

From the policy perspective, this study recommends a cultural revalorization of agricultural practices in the region. This means strengthening agricultural practices not only for the purpose of food provision or as an indirect generator of income (e.g., through recreational activities), but also as the materialization of a heritage that is intertwined with diverse cultural factors. The concrete means for this revalorization is also a matter for further research, but in any case, it should rely on a detailed understanding of the cultural aspects in the agriculture of the area.

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Author Contributions

Bianca Tilliger elaborated the literature and theoretical review, designed and performed the fieldwork, analysed the data and wrote the paper. Beatriz Rodríguez-Labajos helped design the fieldwork, analyse the data and write small parts of the paper, contributed materials and analysis tools, and carried out a comprehensive revision of the article. Jesus Victor Bustamante contributed to and facilitated the field work activities. Josef Settele contributed materials and experience concerning the study site and helped put the research in the context of the LEGATO project.

The founding sponsors had a role in the election of the study sites, as these sites are part of the LEGATO project.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Dominati, E.; Mackay, A. *An Ecosystem Services Approach to the Cost of Soil Erosion and Value of Soil Conservation*; AgResearch Ltd., Grasslands Research Centre: Palmerston North, New Zealand, 2013.
2. Sandhu, H.S.; Wratten, S.D.; Cullen, R.; Case, B. The future of farming: The value of ecosystem services in conventional and organic arable land. An experimental approach. *Ecol. Econ.* **2008**, *64*, 835–848.
3. Zhang, W.; Ricketts, T.H.; Kremen, C.; Carney, K.; Swinton, S. M. Ecosystem services and dis-services to agriculture. *Ecol. Econ.* **2007**, *64*, 253–260.
4. Ibarra, A.A.; Zambrano, L.; Valiente, E.L.; Ramos-Bueno, A. Enhancing the potential value of environmental services in urban wetlands: An agro-ecosystem approach. *Cities* **2013**, *31*, 438–443.
5. Swinton, S.M.; Lupi, F.; Robertson, G.P.; Hamilton, S.K. Ecosystem services and agriculture: Cultivating agricultural ecosystems for diverse benefits. *Ecol. Econ.* **2007**, *64*, 245–252.
6. Calvet-Mir, L.; Gómez-Baggethun, E.; Reyes-García, V. Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, Northeastern Spain. *Ecol. Econ.* **2012**, doi:10.1016/j.ecolecon.2011.12.011.
7. Barrena, J.; Nahuelhual, L.; Báez, A.; Schiappacasse, I.; Cerda, C. Valuing cultural ecosystem services: Agricultural heritage in Chiloé Island, Southern Chile. *Ecosyst. Serv.* **2014**, *7*, 66–75.
8. Schaich, H.; Biding, C.; Plieninger, T. Linking ecosystem services with cultural landscape research. *GAIA* **2010**, *19*, 269–277.
9. Tengberg, A.; Fredholm, S.; Eliasson, I.; Knez, I.; Saltzman, K.; Wetterberg, O. Cultural ecosystem services provided by landscapes: Assessment of heritage values and identity. *Ecosyst. Serv.* **2012**, *2*, 14–26.
10. UNESCO. *Impact: The Effects of Tourism on Culture and the Environment in Asia and the Pacific: Sustainable Tourism and the Preservation of the World Heritage Site of the Ifugao Rice Terraces, Philippines*; UNESCO: Bangkok, Thailand, 2008.
11. Conklin, H.C. Ifugao Ethnobotany 1905–1965: The 1911 Beyer-Merrill Report in perspective. *Econ. Bot.* **1967**, *21*, 243–272.
12. Conklin, I.C.; Ng, J.; Ye, N. *Harold C. Conklin Philippine Collection*; AFC 2001/007; Archive of Folk Culture, American Folklife Center, Library of Congress: Washington, DC, USA, 2010.
13. Brosius, J.P. Significance and social being in Ifugao agricultural production. *Ethnology* **1988**, *27*, 97–110.
14. Acabado, S. The Ifugao agricultural landscapes: Agro-cultural complexes and the intensification debate. *J. Southeast Asian Stud.* **2012**, *43*, 500–522.
15. Araral, E. What makes socio-ecological systems robust? An institutional analysis of the 2,000 year-old Ifugao society. *Hum. Ecol.* **2013**, *41*, 859–870.
16. Costanza, R.; Kubiszewski, I. The authorship structure of "ecosystem services" as a transdisciplinary field of scholarship. *Ecosyst. Serv.* **2012**, *1*, 16–25.
17. Seppelt, R.; Dormann, C.F.; Eppink, F.V; Lautenbach, S.; Schmidt, S. A quantitative review of ecosystem service studies: approaches, shortcomings and the road ahead. *J. Appl. Ecol.* **2011**, *48*, 630–636.

18. Sandhu, H.S.; Wratten, S.D.; Cullen, R. Organic agriculture and ecosystem services. *Environ. Sci. Policy* **2010**, *13*, 1–7.
19. Johnson, K. A.; Polasky, S.; Nelson, E.; Pennington, D. Uncertainty in ecosystem services valuation and implications for assessing land use tradeoffs: An agricultural case study in the Minnesota River Basin. *Ecol. Econ.* **2012**, *79*, 71–79.
20. Chan, K.M.A.; Satterfield, T.; Goldstein, J. Rethinking ecosystem services to better address and navigate cultural values. *Ecol. Econ.* **2012**, *74*, 8–18.
21. *Millenium Ecosystem Assessment*; Island Press: Washington, DC, USA, 2005.
22. Daniel, T.C.; Muhar, A.; Arnberger, A.; Aznar, O.; Boyd, J.W.; Chan, K.M.A.; Costanza, R.; Elmqvist, T.; Flint, C.G.; Gobster, P.H.; *et al*. Contributions of cultural services to the ecosystem services agenda. *Proc. Natl. Acad. Sci. USA* **2012**, *109*, 8812–8819.
23. Hernández-Morcillo, M.; Plieninger, T.; Bieling, C. An empirical review of cultural ecosystem service indicators. *Ecol. Indic.* **2013**, *29*, 434–444.
24. Plieninger, T.; Dijks, S.; Oteros-Rozas, E.; Bieling, C. Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy* **2013**, *33*, 118–129.
25. Milcu, A.I.; Hanspach, J.; Abson, D.; Fischer, J. Cultural ecosystem services: A literature review and prospects for future research. *Ecol. Soc.* **2013**, doi: 10.5751/es-05790-180344.
26. Nahuelhual, L.; Carmona, A.; Laterra, P.; Barrena, J.; Aguayo, M. A mapping approach to assess intangible cultural ecosystem services: The case of agriculture heritage in Southern Chile. *Ecol. Indic.* **2014**, *40*, 90–101.
27. Van den Belt, M.; Blake, D. Ecosystem services in New Zealand agro-ecosystems: A literature review. *Ecosyst. Serv.* **2014**, *9*, 115–132.
28. Peña, L.; Casado-Arzuaga, I.; Onaindia, M. Mapping recreation supply and demand using an ecological and a social evaluation approach. *Ecosyst. Serv.* **2015**, *13*, 108–118.
29. Van Berkel, D.B.; Verburg, P.H. Spatial quantification and valuation of cultural ecosystem services in an agricultural landscape. *Ecol. Indic.* **2014**, *37*, 163–174.
30. Martín-López, B.; Iniesta-Arandia, I.; García-Llorente, M.; Palomo, I.; Casado-Arzuaga, I.; Del Amo, D.G.; Gómez-Baggethun, E.; Oteros-Rozas, E.; Palacios-Agundez, I.; Willaarts, B.; *et al*. Uncovering ecosystem service bundles through social preferences. *PLoS One* **2012**, doi: 10.1371/journal.pone.0038970.
31. Chan, K.M.A.; Guerry, A.D.; Balvanera, P.; Klain, S.; Satterfield, T.; Basurto, X.; Bostrom, A.; Chuenpagdee, R.; Gould, R.; Halpern, B.S.; *et al*. Where are cultural and social in ecosystem services? A framework for constructive engagement. *Bioscience* **2012**, *62*, 744–756.
32. Busch, M.; La Notte, A; Laporte, V.; Erhard, M. Potentials of quantitative and qualitative approaches to assessing ecosystem services. *Ecol. Indic.* **2012**, *21*, 89–103.
33. Chee, Y.E. An ecological perspective on the valuation of ecosystem services. *Biol. Conserv.* **2004**, *120*, 549–565.
34. Wegner, G.; Pascual, U. Cost-benefit analysis in the context of ecosystem services for human well-being: A multidisciplinary critique. *Glob. Environ. Chang.* **2011**, *21*, 492–504.
35. Raymond, C.M.; Kenter, J.; Turner, N.; Alexander, K. Comparing instrumental and deliberative paradigms underpinning the assessment of social values for cultural ecosystem services. *Ecol. Econ.* **2014**, *107*, 145–156.

36. Stephenson, J. The Cultural Values Model: An integrated approach to values in landscapes. *Landsc. Urban Plan.* **2008**, *84*, 127–139.
37. Plieninger, T.; Bieling, C.; Fagerholm, N.; Byg, A.; Hartel, T.; Hurley, P.; López-Santiago, C.A.; Nagabhatla, N.; Oteros-Rozas, E.; Raymond, C.M.; *et al*. The role of cultural ecosystem services in landscape management and planning. *Curr. Opin. Environ. Sustain.* **2015**, *14*, 28–33.
38. Van Zanten, B.T.; Verburg, P.H.; Espinosa, M.; Gomez-y-Paloma, S.; Galimberti, G.; Kantelhardt, J.; Kapfer, M.; Lefebvre, M.; Manrique, R.; Piorr, A.; *et al*. European agricultural landscapes, common agricultural policy and ecosystem services: A review. *Agron. Sustain. Dev.* **2013**, *34*, 309–325.
39. Johns, T.; Powell, B.; Maundu, P.; Eyzaguirre, P.B. Agricultural biodiversity as a link between traditional food systems and contemporary development, social integrity and ecological health. *J. Sci. Food Agric.* **2013**, *93*, 3433–3442.
40. Limburg, K.E.; O'Neill, R.V.; Costanza, R.; Farber, S. Complex systems and valuation. *Ecol. Econ.* **2002**, *41*, 409–420.
41. Republic of the Philippines. National Statistical Coordination Board (NSCB) Human Development Index: 2009. Available online: http://www.nscb.gov.ph/hdi/2009/2009%20Human%20Development%20Index.pdf (accessed on 1 July 2014).
42. Republic of the Philippines. National Statistics Office (NSO) Total Population by Province, City, Municipality and Barangay, as of May 1, 2010. Available online: http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/Cordillera Administrative Region.pdf (accessed on 1 July 2014).
43. Settele, J.; Spangenberg, J.H.; Kühn, I.; Klotz, S.; Wiemers, M.; LEGATO Project Consortium. *LEGATO Rice Ecosystem Services. Progress Report 2012*; Helmholtz Centre for Environmental Research—UFZ & Pensoft: Leipzig and Halle & Sofia, Germany, 2012.
44. Acabado, S. A Bayesian approach to dating agricultural terraces : A case from the Philippines. *Antiquity* **2009**, *83*, 801–814.
45. Department of Environment and Natural Resources (DENR). *The Ifugao Rice Terraces Philippine Project Framework*; FAO: Bangkok, Thailand, 2008.
46. Millennium Ecosystem Assessment (MA). *Ecosystems and Human Well-being: Synthesis (Millennium Ecosystem Assessment)*; Millenium Assessments; World Resources Institute: Washington, DC, USA, 2005; Volume 5.
47. Tekken, V. Cultural Identiy & Aesthetics: The socio-cultural dimension. In Proceedings of LEGATO—Status Conference and Workshop, Banaue/Ifugao, Philippines, 4 July 2012; p. 17.
48. Dick, J.M.; Smith, R.I.; Scott, E.M. Ecosystem services and associated concepts. *Environmetrics* **2011**, *22*, 598–607.
49. Fisher, B.; Turner, R.K. Ecosystem services: Classification for valuation. *Biol. Conserv.* **2008**, *141*, 1167–1169.
50. Nahlik, A.M.; Kentula, M.E.; Fennessy, M.S.; Landers, D.H. Where is the consensus? A proposed foundation for moving ecosystem service concepts into practice. *Ecol. Econ.* **2012**, *77*, 27–35.
51. Rova, S.; Pranovi, F.; Mueller, F. Provision of ecosystem services in the lagoon of Venice (Italy): An initial spatial assessment. *Ecohydrol. Hydrobiol.* **2015**, *15*, 13–25.

52. Hsieh, H.-L.; Lin, H.-J.; Shih, S.-S.; Chen, C.-P. Ecosystem functions connecting contributions from ecosystem services to human wellbeing in a mangrove system in Northern Taiwan. *Int. J. Environ. Res. Public Health* **2009**, *12*, 6542–6560.
53. Folke, C. Resilience: The emergence of a perspective for social-ecological systems analyses. *Glob. Environ. Chang.* **2006**, *16*, 253–267.
54. Reyes-Garcia, V.; Aceituno-Mata, L.; Calvet-Mir, L.; Garnatje, T.; Gomez-Baggethun, E.; Lastra, J.J.; Ontillera, R.; Parada, M.; Rigat, M.; Valles, J.; *et al*. Resilience of traditional knowledge systems: The case of agricultural knowledge in home gardens of the Iberian Peninsula. *Glob. Environ. Chang. Policy Dimens.* **2014**, *24*, 223–231.
55. Tengo, M.; Brondizio, E.S.; Elmqvist, T.; Malmer, P.; Spierenburg, M. Connecting diverse lnowledge systems for enhanced ecosystem governance: The multiple evidence base approach. *Ambio* **2014**, *43*, 579–591.
56. Danielsen, F.; Jensen, P.M.; Burgess, N.D.; Coronado, I.; Holt, S.; Poulsen, M.K.; Rueda, R.M.; Skielboe, T.; Enghoff, M.; Hemmingsen, L.H.; *et al*. Testing gocus groups as a tool for connecting indigenous and local knowledge on abundance of natural resources with science-based land management systems. *Conserv. Lett.* **2014**, *7*, 380–389.
57. Bernard, H.R. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*; AltaMira Press: Oxford, UK, 2006; Volume 4.
58. Kendall, M.G.; Gobbons, J.D. *Rank Correlation Methods*; Oxford University Press: Oxford, UK, 1990; Volume 3.
59. Borgatti, S.P.; Everett, M.G.; Freeman, L.C. *Ucinet for Windows: Software for Social Network Analysis*; SNA Analysis Software; Analytic Technologies: Harvard, MA, USA, 2002.
60. Bennett, E.M.; Peterson, G.D.; Gordon, L.J. Understanding relationships among multiple ecosystem services. *Ecol. Lett.* **2009**, *12*, 1394–1404.
61. Sukhdev, P.; Bishop, J.; ten Brink; P.; Gundimeda, H.; Karousakis, K.; Kumar, P.; Neßhöver, C.; Neuville, A.; Skinner, D.; Vakrou, A.; *et al*. *The Economics of Ecosystems and Biodiversity (TEEB)*; European Communities: Wesseling, Germany, 2008.
62. Haines-Young, R.; Potschin, M. The links between biodiversity , ecosystem services and human well-being. In *Ecosystem Ecology: A New Synthesis*; Raffaelli, D.G., Frid, C.L.J., Eds.; Cambridge University Press: Cambridge, UK, 2010; pp. 110–139.
63. Plieninger, T.; van der Horst, D.; Schleyer, C.; Bieling, C. Sustaining ecosystem services in cultural landscapes. *Ecol. Soc.* **2014**, *19*, 59.
64. Cooper, L.M. Network analysis in CEA, ecosystem services assessment and green space planning. *Impact Assess. Proj. Apprais.* **2010**, *28*, 269–278.
65. Settele, J.; Kühn, I.; Klotz, S.; Arida, G.; Bergmeier, E.; Burkhard, B.; Anh, Q.; Beaurepaire, A.; Beck, S.; Brandl, R.; *et al.* Cultural landscapes and ecosystems services in south-east Asia—The LEGATO-project. *Basic Appl. Ecol.* **2015**, in press.