Cultural Ecosystem Services in a Retro(per)spective

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I. INTRODUCTION

The Ecosystem Services (ES) debate plays a crucial role in conservation science and practice. The concept of ES aims the valuation of multiple services of ecosystems and landscapes, the identification of trade-offs among different land-use scenarios, and encourages decision making in land use planning (Schaich et al 2010). The Millenium Ecosystem Assessment defines Cultural Ecosystem Services (CES) as "non material benefits which people obtain from ecosystem through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences (MEA, 2003).

To communicate and discuss the relevance of CES, it is essential to find interpretation methods to visualize them. This requires also the understanding of the historical evolution of landscapes as well. Within this issue we consider CES in a retrospective way and visualize landscape changes in the urban forest of Göttingen, called Hainberg in 3 time periods: before (1878), during (1910) and after (2013) afforestation processes.

II. AIMS

➤ **To show the relevance of landscape visualization as a tool to understand Cultural Ecosystem Services,**

➤ **To visualize landscape changes within the last 200 years in the Urban Forest of Göttingen**

Table 1

Cultural ES	Cultural diversity			Educational values			Inspiration			Aesthetic values			Cultural heritage			Recreation		
Time interval	b	d	a	b	d	a	b	d	a	b	d	a	b	d	a	b	d	a
(b: before, d: during afforestation, a: actual)																		
Case studies																		
(1) Bismarckturm	-	-	-	-	+	+	-	+	+	+	+	+	-	+	+	-	+	+
(2) Borhecktempel	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
(3) Eulenturm	-	-	-	-	+	-	-	-	-	-	+	+	-	+	+	-	+	+
(4) KWP	-	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	+
(5) Lange Nacht	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	+
(6) Molkengrund	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	-	+	+
(7) Rodelbahn	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	+
(8) Rohns	+	-	-	+	+	-	+	+	-	-	+	-	-	+	+	-	+	-
(9) Schillerwiese	-	+	-	+	+	-	+	+	-	-	+	-	-	+	+	-	+	+
(10) Weiße Wand	-	-	-	-	+	+	-	-	-	-	+	+	-	+	+	-	+	+
SUM of CES/Time intervals	Before: 8						During: 42						Actual: 32					

Table 1. The presence of CES in the Hainberg before (1790-1878), during (1879-1910) and after (2013) afforestation processes. The case studies have been numbered for the interpretation in GIS (Figure 1-2-3).

III. METHODOLOGY

We have used the interdisciplinary approach to analyze and visualize Cultural Ecosystem Services. This approach requires historical knowledge, geographical planning knowledge, and advanced software skills. Thus, we have used historical maps, old photographs, copper engravings, paintings, as well as contemporary and secondary literature. The historical and actual maps referring to the three time intervals (1878, 1910, 2013) have been digitalized in ArcGIS and visualized with the interactive real-time visualization software Biosphere3D.

Our methodology is based on the following steps:

1. DEFINE CES & INDICATORS
2. SELECT CONVERTIBLE CES
3. DEFINE CASE STUDIES
4. EVALUATE CES / TIME INTERVALS
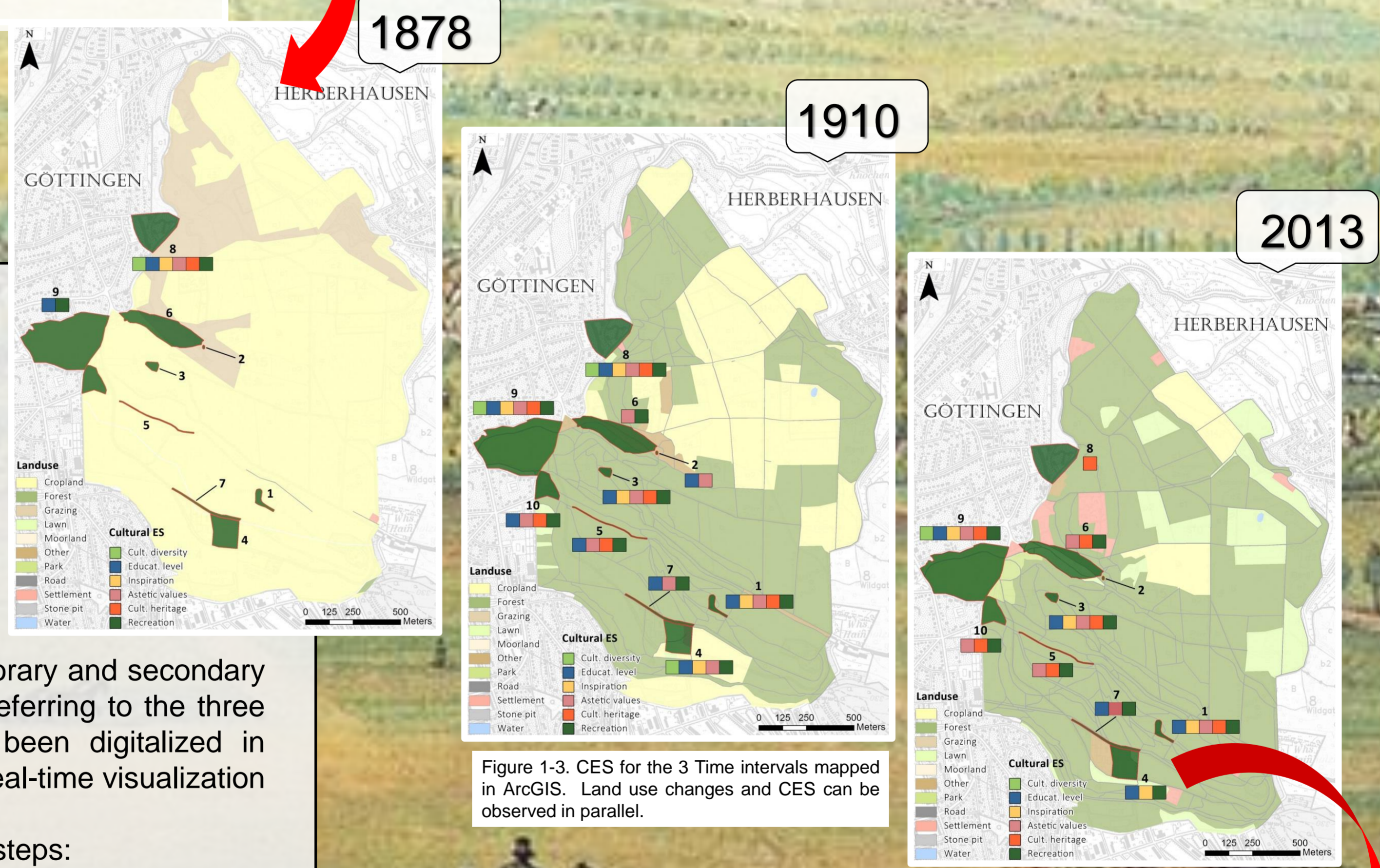5. MAPPING IN GIS
6. VISUALIZATION IN B3D

Figure 1-3. CES for the 3 Time intervals mapped in ArcGIS. Land use changes and CES can be observed in parallel.

IV. RESULTS

Figure 4-5. Case study of Bismarckturm visualized with Biosphere 3D during the forestations (1890) and today (2013)) (L.Szücs & J.Mülder).

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