Forum

Conservation experiences, evidence and opinions

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Searching the effectiveness within conservation projects: Applying the Swiss Cheese Theory to the creation of a supplementary feeding station for the Black Kite *Milvus migrans* in central Italy

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Abstract - The paper explores the application of the Swiss Cheese Theory ('linear accident causation model') to a local conservation project as a study case: i.e. the construction of a supplementary feeding station to support a local Black Kite *Milvus migrans* breeding population in a nature reserve of central Italy. In this regard, the project brings light to the conditioning factors (and related 'slices') that may be more critical when planning a conservation project. This experience provided valuable lessons in regards to conservation: (i) the authorization process (and related bureaucracy) represented the most challenging obstacle for the promoters and slowed down the project; (ii) the authorization process was easier and faster for a research project that anyway implied providing food to Black Kites; (iii) highly motivated volunteers and expert researchers made the difference; (iv) the use of the 'effectiveness trajectories' in conservation projects may highlight critical points, suggesting changes in strategy and facilitating the adaptive improvement of the project.

Keywords: linear accident causation model, bureaucracy, effectiveness trajectory, project cycle

INTRODUCTION

In the industrial engineering field, an "accident" (i.e. an unexpected disaster) happens as a result of a chain of sequential errors, occurring under particular circumstances, that are not controlled or solved along an "accident trajectory". The Swiss Cheese Theory (hereafter SCT) or 'linear accident causation model' represents the metaphor of holes in cheese slices (i.e. control filters) illustrating human or technological errors (Reason 2000). When an "accident trajectory" passes through the holes of all slices (i.e. the path of events), the accident will occur. Therefore, during a project, a team should ensure that this trajectory does not intercept all the holes in the slices (thus, leading towards a final accident): if the trajectory ends its race and passes through the holes, the project or the organizational system will be ineffective (further details in Larouzee & Le Coze 2020).

The metaphor introduced by the SCT can be reversed to apply it to the problem-solving process typical of conservation projects replacing the concept of "accident trajectory" with that of "effectiveness trajectory". Indeed, conservation projects set certain goals achievable through intermediate steps, namely: problem analysis, solutions, decisions, planning and time management, resources allocation, outcomes monitoring and adaptation (Hockings et al. 2006). In this framework, a goal can be achieved only when a number of conditions are met and a number of steps (threats, obstacles and constraints) are overcome throughout the life of a conservation project (Battisti 2018). The success in a conservation project is achieved when a series of favourable events has occurred and all the unfavourable events (e.g. lack of resources, bureaucracy) have been tackled and resolved. Metaphorically, each step or sub-step of the project can be represented (i) by cheese slices symbolizing the multiple organizational, social, and environmental threats, obstacles and constraints that will make the achievement of the results difficult and (ii) by holes representing the opportunities, i.e., the favourable conditions and circumstances that will overcome these threats, obstacles, and constraints. Along this path, and continuing the metaphor, not all the slices will have the same thickness depending on the type and intensity of the threats/obstacles/constraints in each project phase. Of course, the ideal condition would be to have no obstacle at all, or at least thin slices with big holes, which would mean that the success of a conservation project would be easy to achieve. Unfortunately, this is not always the case and obstacles are common along the way of conservation projects.

The aim of this Forum was to discuss the history of the start of a small project of conservation aiming at the creation of a supplementary feeding station for the Black Kite *Milvus migrans*, a species included in the Annex 1 of the 2009/147/CEE 'Birds' Directive, in a nature reserve of central Italy (Decima Malafede Nature Reserve; 41°45'55"N 12°27'25"E; Fig. 1), neighbouring the Castelporziano Presidential Estate (a State Nature Reserve; Rome, central Italy).

By applying the SCT to the chain of events occurred during this project, we were able to identify the conditioning factors (and related 'slices') that effected more critically the onset of the project and how the working group used 'holes' to overcoming these 'slices' (see Battisti 2017; see also the SWOT analysis in Hill & Westbrook 1997).

THE CASE STUDY: CONTEXT ANALYSIS (LOCAL PROBLEM, THREAT ANALYSIS AND THE SELECTED TEMPORARY SOLUTION)

The Roman countryside (Campagna Romana, central Italy) is home to breeding colonies of Black Kite (De Giacomo et al. 2004; Panuccio & Canale 2004). The individuals belonging to these colonies mostly fed in a local rubbish dump (Castaldi & Guerrieri 2006). The species is declining at the regional level (from 100-200 pairs in the 1990s to 80-109 pairs in the early 2000s; De Giacomo and Tinelli, 2006). In the Roman area until a few years ago there were over 50 pairs, with a population of 28 pairs in Castelporziano Presidential Estate which is showing a sharp decline in recent years (De Giacomo et al., 2004; Tab. 1).

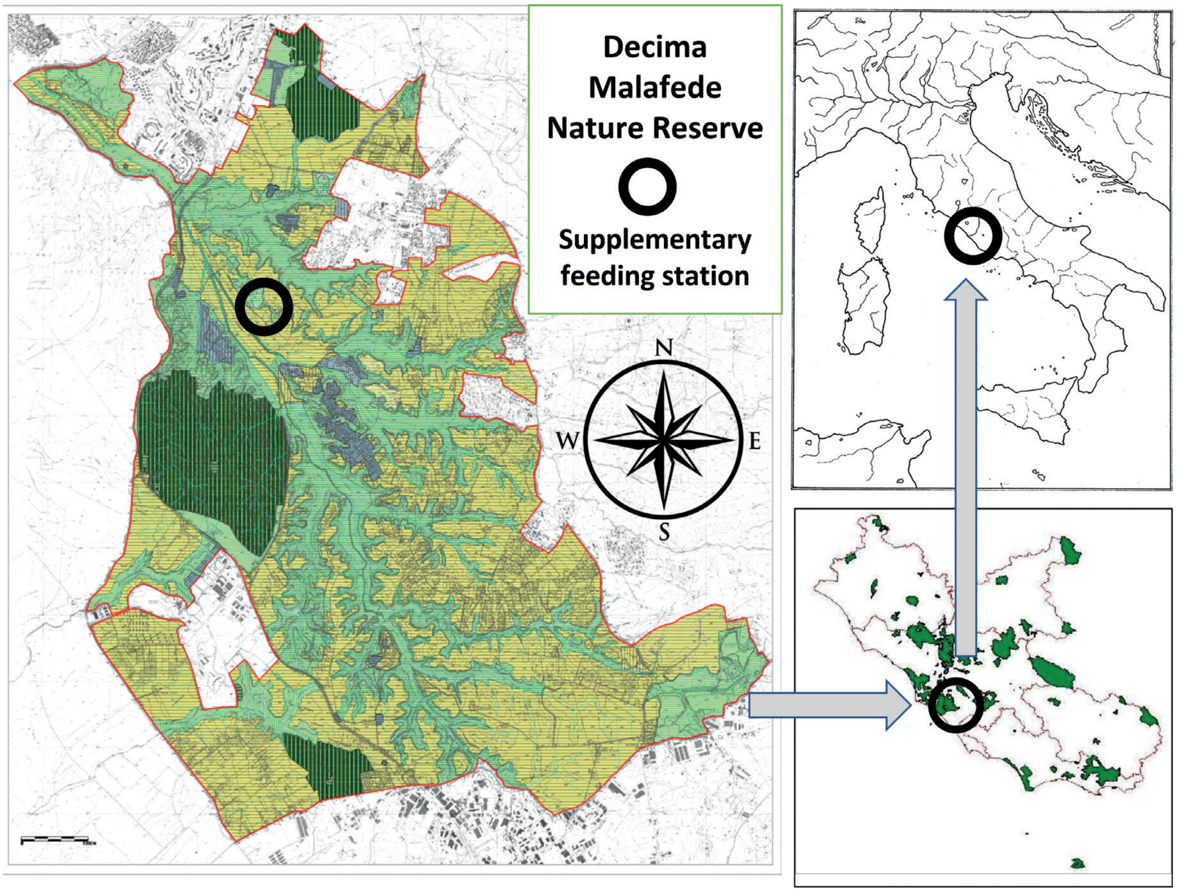

Figure 1. Land use map of the study area (source: Regione Lazio, 2002). Bottom right: the location inside the nature reserve system of Latium, central Italy.

The origin of this decline can be traced back to a series of local anthropogenic threats, for which, however, a precise and analytical investigation is lacking. Therefore, to define actions and priorities aimed to stop the observed decline, we carried out an expert-based threat analysis (Salafsky et al., 2008; Fig. 1) by: (i) listing the main local threats that, according the experts' opinion, were acting on the Black Kite population of the area (Fig. 2), (ii) defining a group of local experts with different levels of expertise and age (seniors, n = 6, i.e. the Authors of this manuscript, except CB as coach, and juniors, n = 9, i.e. students of a Master course in Natural Sciences – University of Rome 'Sapienza', that carried out a stage in the preceding breeding season in the nature reserve) that individually assigned a score (range: 1: low to 4: high) regarding a set of threat attributes (extent, intensity); this step allowed obtaining a magnitude score (a proxy of its total impact and obtained as an arithmetic sum of the first two attributes; Salafsky et al. 2008); (iii) calculating the averaged values (and standard deviation) of the magnitude score of each threat and performing a statistical comparisons with the PAST software (version 1.89; Hammer et al. 2001) (alpha level = 0.01; Fig. 2, further details in Battisti et al., 2016); (iv) obtaining a ranking evidencing the prioritary threats, as perceived both by seniors and juniors (see framework and results in Fig. 2).

Results showed that the mean magnitude scores were significantly different among threats, both considering the senior and junior assessments (respectively, $H = 28.5$ and $H = 30.2$, both of them $P < 0.001$; Kuskall-Wallis for equal medians test). All the experts (both seniors and juniors) considered the

Table 1. Trend of breeding pairs of Black Kite in the Castelporziano (CP) and Decima-Malafede (DM) nature reserves (the two areas used for nesting near the supplementary feeding station), in the last years ('/': absence of data). Excluding 2021 (original data), the data were reported by Panuccio (2014, 2015, 2016, 2018) for DM and De Giacomo et al. (2021) for CP.

Year	CP	DM
2013	22	/
2014	13	8
2015	12	11
2016	6	11
2017	4	15
2018	4	/
2019	3	/
2020	3	/
2021	2	11-14

reduction in trophic availability among the first three prioritary threats. Moreover, this threat was the only for which it was possible to define a mitigation action within the limited time and resources available. It was thus chosen as the focus of this project. Locally, one of the factors at the origin of the reduced trophic availability coincided with the closure of the municipal solid waste landfill ('Malagrotta') where these birds used to feed (De Giacomo et al. 2004; Panuccio 2005; De Giacomo & Guerrieri 2008; De Giacomo et al. 2015; Sorace et al. 2017; Panuccio 2018) and there was evidence that this threat could induce a decrease in the number of fledglings (Sorace et al. 2018). As conservation measure, and considering the available resource, the expert group identified a possible temporary solution in the construction of a supplementary feeding station (see Puddu et al. 2016) that would support the local Black Kite breeding population (Trotta 2011).

In 2014 (one year after of closure of the Malagrotta landfill that provided most of the trophic resources for this population; Panuccio 2005), a first feeding station started in the Special Conservation Area "Sughereta di Castel di Decima" thanks to the participation of volunteers. However, achieving this objective required to pass over a large number of steps including both obstacles and opportunities that emerged throughout the project realization. Below we reported the 'effectiveness trajectory' that led to start this project focusing on the different steps, obstacles and their overcoming following the SCT approach applied to conservation actions (Battisti 2017). Regarding the steps along the event chain, we refer to the project planning only (see Hockings et al. 2006; Battisti 2018).

THE 'EFFECTIVENESS TRAJECTORY' THROUGHOUT THE PROJECT: OBSTACLES (CHEESE SLICES) AND THEIR OVERCOMING (CHEESE HOLES)

The first step in the project was the formation of a local project team (including researchers, volunteers, students, and park rangers) with a focus on the objective of conserving Black Kites. The main problems in this step ("cheese slice") where the small number of operators and the limited budget, equipment and materials available. This slice was overcome thanks to their high motivation and skill. Therefore, the effectiveness trajectory started, identifying the prioritary threats (details in previous section).

Second, among the prioritary threats ranked with the threat analysis process (see previous section), the team identified which of these could be mitigated considering the scanty available resources (in terms of time, budget, operators, means and technology). An evaluation process selected (i) the 'reduction of trophic availability', as a priority threat and (ii) the creation of a supplementary feeding station as its feasible temporary solution (see the previous section).

Third, a suitable site where to place the supplementary feeding station was selected. To make placement easier, the site was matched with a public property (Municipality of Rome) within the conservation area, to overcome possible constraints with private landowners.

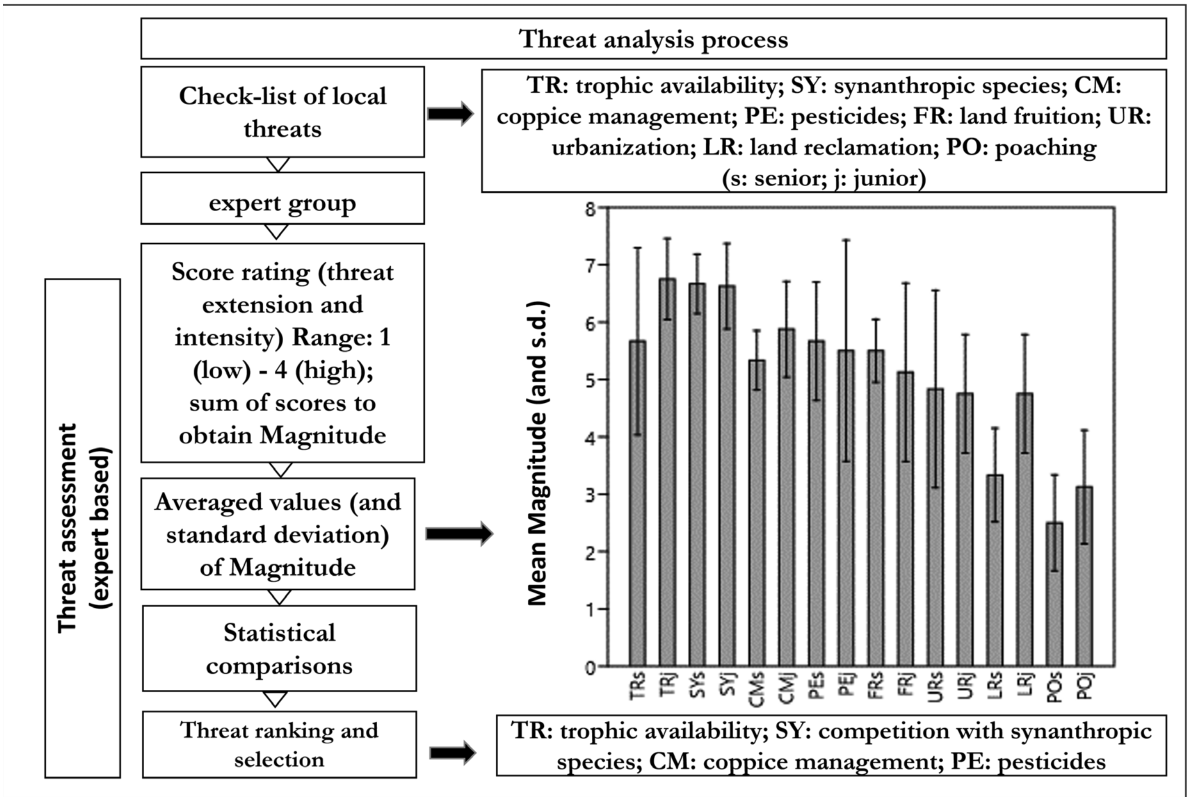

Figure 2. Threat analysis process for the focal species (Black Kite): list of local threats, score assignment in extension, intensity and magnitude, output of averaged mean Magnitudes (and standard deviation) for each threat, threat ranking. Details in the text. Abbreviations: local threats. In bold, the local threat selected.

Fourth, it was necessary to find trophic resources, i.e. butchery waste. The animal by-products were chosen as opposed to the carcasses normally used for necrophages. This is because of two main reasons: the Kites cannot tear the skin when it is fresh and above all, the procedure to obtain sanitary authorization from local Health Authority (named ASL) is simpler if material for human consumption is used. A screening of the possible suppliers was started by focusing on commercial establishments (butchers and restaurants) in the neighbourhoods of the Reserve. This slice was overcome thanks to some local butchers and restaurants that made animal waste available at no cost.

Fifth, the team planned a protocol to monitor the achievement of the project outcome, i.e. the assessment of the effectiveness of the supplementary feeding stations for the local breeding population of Black Kite, also considering secondary effects (e.g. the role of other necrophagous and/or synanthropic species as gulls and crows). This slice was quickly overcome thanks to the internal competence of the group. More specifically, the monitoring of the Black Kite population was continued with the collaboration of university students that allowed obtaining data about the dynamics of the population and thus, assessing the effectiveness of the feeding station. During the Covid-19 pandemic crisis, the decrease in the number of volunteers due to forced lockdown was offset by an increased effort of the resident volunteers.

All these five slices (corresponding to the steps of the organization of the project team, context analysis, solution planning, decision-making, site selection, supply of food resources, outcomes monitoring; see Hockings et al. 2006) were thus easily overcome.

Nevertheless, a critical step emerged during the project, corresponding to the need for a number of formal authorizations linked to the location of the supplementary feeding station that should be issued by the 'Roma Natura' Agency and the local Health Authority ASL (Tab. 2). Indeed, acquiring these authorizations implied rather complex bureaucratic procedures and required a long time and a substantial effort by the project team, and led to a slowdown of the whole process. In our experience, this phase constituted the thickest slice along the effectiveness trajectory of this project.

A temporary solution to overcome this 'slice' and start the project as soon as possible was to transform the conservation project into an academic research initiative. At that time, one of the ornithologists of the working group (M. Panuccio) was PhD student at the University of Pavia. It was thus possible for the research group to apply for an authorization for ringing Black Kites in the framework of a monitoring project that included also the authorization for the temporary set up of the supplementary feeding station necessary for attracting and capturing the Black Kites. Indeed, the authorization process required less time and involved fewer agencies (Tab. 2), albeit it could only provide a temporary authorization. This was anyway a 'success' that allowed starting the conservation activity (i.e. to feed birds and thus hopefully revert the negative population trend) concomitantly with the closure of the landfill. Unfortunately, with the sudden passing away of the PhD student, this research project came to an end and with it also the temporary authorization for feeding and capturing the Black Kites. The conservation initiative therefore had to be interrupted for two years (2019 - 2020).

The final authorizations by the public authorities ('Roma Natura' as the Reserve managing entity and ASL) arrived in spring 2021. Given the length of each phase of the project and the need to act as quickly as possible in support of the local population of Black Kite after the two year of stop, when that necessary authorization were obtained, the decision was made to proceed in parallel with all the phases necessary to re-open the feeding station i.e. to simultaneously find operators, re-build the feeding station, identify further suppliers of food resources (butchers and restaurants). The supplementary feeding station finally started in the same breeding season despite all the problems related to the COVID-19 crisis.

LESSONS FOR CONSERVATION

The Swiss Cheese Theory approach (Fig. 3) applied to this conservation story indicates how: (i) the authorization process can represent the biggest obstacle in a project, even greater than the management constraints (organization, logistic and site location, fund raising, food provisioning, etc.), that can significantly slow down the process, particularly when it involves governmental agencies whose primary focus is not nature conservation. Indeed, the primary goal of Italian ASL is the financial and management organization of health services (legislative decree 502/1992). Such delays may have dramatic consequences in critical conservation contexts where actions are urgent. Although we do not question at all the necessity and importance of regulating supplementary feeding stations for raptors, we complain the slowness of the authorization process that in this project appeared as a critical constraint; (ii) A flexible approach can be necessary in conservation actions. For instance, in this case a strategy was found to start supplementing food to our population by starting a research project; (iii) A diversified number of highly motived volunteers and expert researchers can make the group resilient, enabling the discovery of original solutions, opportunities and quick changes in strategy. In this regard, the team showed a collaborative participation towards a common goal (see Lindenmayer & Hunter, 2010); (iv) The reconstruction of the effectiveness trajectories in a conservation projects, using the SCT approach, can highlight critical points so as to facilitate the adaptive management process (Salafsky et al. 2001).

Table 2. Framework of the authorization steps for the construction of the supplementary feeding station for the Black Kite in the Decima-Malafede nature reserve (Rome, central Italy).

Document type	Applicant	Year	Agency (issuing authorizations)
First - capture and ringing (2014-2016) and 2ª Authorization - capture and ringing (2017-2019) - ISPRA prot. 24654/T-A31 May, 19, 2017 and Regione Lazio R.U. 0523135 – October, 17, 2017	University of Pavia, Italy	2014	ISPRA (Italian Institute for Environmental Protection and Research), Rome, Italy and Regione Lazio
		2017	ISPRA (Italian Institute for Environmental Protection and Research), Rome, Italy and Regione Lazio
Approval of transformation of capture activity into a supplementary feeding station (prot. 3537 – December, 21, 2020)	Medraptors (Mediterranean Raptor Migration Network)/ ALTURA (Raptor conservation private associations)	2021	RomaNatura (Agency managing Decima-Malafede nature reserve)
Technical act		2021	ISPRA (Italian Institute for Environmental Protection and Research), Rome, Italy
Authorization for supplementary feeding station (Art. 18/2 Reg. CE 1089/2009) - Aut. n. 1/2021 prot. 00899492021 – May, 3, 2021		2021	ASL Roma 2 (Local Health Agency), Rome
Registration in the National supplementary feeding station list (art. 47 Reg. CE 1069/2009 and Reg. UE 142/2011) – n. ABP5945URBP3		2021	Italian Ministry of Health (through ASL), Rome, Italy

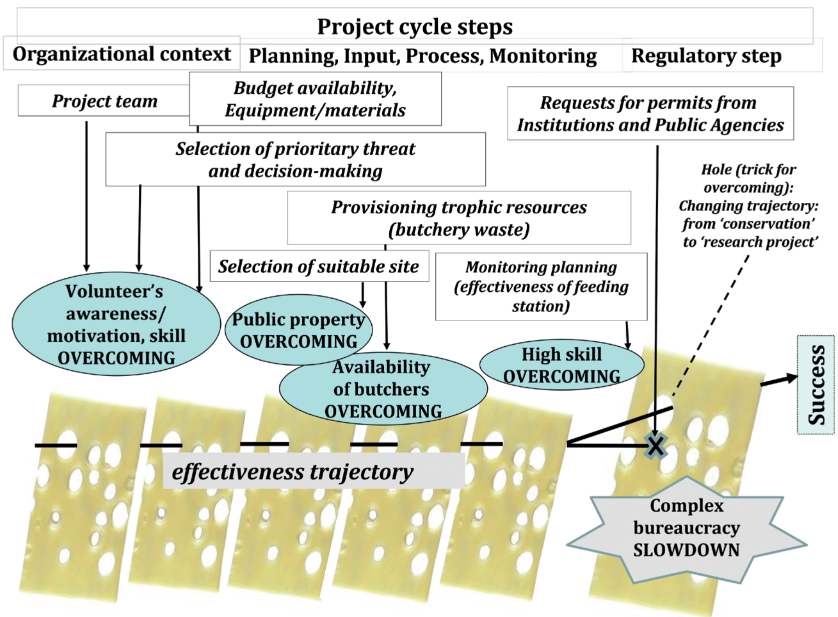

Figure 3. The effectiveness trajectory in the conservation-related Swiss Cheese Theory applied to a case study (project for a supplementary feeding station for Black Kite in the Decima Malafede nature reserve, central Italy). The main steps of the project cycle (sensu Hockings et al. 2006) have been reported. Circles represent the features ('holes') making possible the overcoming of the obstacles. The cross shows the critical obstacle (last 'slice'). The dashed line shows the change in strategy making the overcoming of the last 'slice' and the project success possible.

This simple theoretical framework could be applied to any conservation project. In the future, it would be interesting to summarize the results of this exercise over different projects to highlight the most relevant constraints and how they can be overcome.

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