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Conservation experiences, evidence, and opinions

Conservation front lines need experienced troops: the role of a scientific trust in a changing world

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Abstract – The active participation of scientific trusts, including CISO (Centro Italiano Studi Ornitologici), in applied conservation actions plays a crucial role in addressing the challenges faced by natural and semi-natural landscapes, which are increasingly impacted by improper land-use and land-cover. This is particularly true for those landscapes where Large Infrastructures and Big Events (LIBEs) are planned. In these circumstances, researchers, professionals, and environmentalists typically express their concerns on the impacts of LIBEs through mediatic campaigns, often highlighting the ecological importance of vulnerable areas. These actions form the first, useful level of engagement in conservation. However, we advocate for a more proactive role of scientific trusts, which should entail forming task forces of conservation experts and providing scientific support in management decisions when LIBEs are being considered. In our opinion, scientists should locally produce original field studies by using effective sampling designs such as Before-After-Control-Impact surveys. We highlight that such a targeted level of action may support the public agencies when authorizing (or not) LIBEs, by providing evidence-based information about the ecological value of the target area and the potential impacts of LIBEs on ecosystem functions and local biodiversity. The aim is to avoid emotion-based social media loops, conflicts, and polarizations in the discussions about the ecological impacts of LIBEs.

Keywords: Large Infrastructures, Big Events, Task Force, Environmental Impact Assessment, Biodiversity Conservation.

LARGE INFRASTRUCTURES AND BIG EVENTS AS UNSUSTAINABLE LANDSCAPE POLICIES

Natural and semi-natural habitats are increasingly affected by anthropogenic activities, which often result in unsustainable land-use policies (Bajocco et al. 2012). In recent years, new EU incentives have created opportunities to open construction sites for new infrastructures in many areas that are ecologically important (Benvenuti & Marangoni 1999, Sergi et al. 2020). Although large works and infrastructures must be subjected to Environmental Impact Assessment procedures, a large part of them, not falling within the categories indicated by the Directive, do not require this type of *a-priori* evaluation (European Union, 2011). Similarly, Big Events (e.g., outdoor concerts) have increased, often with natural ecosystems as a setting (Luoma 2018) and this pattern has been enhanced by the post-Covid2019 'hunger for nature' (Battisti 2021a). In Italy, recent examples of important habitats potentially in danger for proposed Large Infrastructures and Big Events (hereafter, LIBEs) are the heathlands in Lombardy threatened by Malpensa airport expansion [1], coastal dune systems threatened by outdoor mass musical events (Andriolo et al. 2022, Battisti 2024), alpine meadows, lakes and glaciers because of Olympic Games and ski infrastructures (Rolando et al. 2007; Brambilla et al. 2016; [2]), marine environments and mountain ridges impacted by electric power lines (Rubolini et al. 2005). Impacts of these actions and events may affect ecosystems and species (e.g., Cole & Landres 1996). Moreover, when different LIBEs co-occur, it is possible that a 'cumulative' or synergistic impact may emerge, disrupting structure and functions of ecosystems at multiple levels (Côté et al. 2016). Because of the growing number and size of LIBEs, their environmental effects have become more tangible, and the importance of sustainability awareness has thus increased (Cavagnaro et al. 2012).

THE RESPONSE OF CITIZENS AND ENVIRONMENTALIST GROUPS

When LIBEs are planned, local conservation and environmentalist groups have the right to express their concerns and often end up opposing LIBEs through public demonstrations and communication via mass and social media. These actions constitute an important part of the decision process about LIBEs, yet local groups often lack systematic and reliable data collected in the areas where LIBEs have been planned, which would be critical to support with scientific evidence the concerns about the ecological damages the LIBEs can cause. This gap constitutes a significant area for improvement in the ability of local groups to support their actions against potentially impacting projects. Indeed, the lack of solid evidence can undermine the possibility for such conservation and environmentalist groups to effectively contribute to the listing of the pros and cons of a proposed new LIBE project. This can trigger conflicts, polarizations,

and vicious cycles in social media, with the emergence of prejudices towards the 'environmentalists' and other cognitive, emotion-based biases (Catalano et al. 2018). In these contexts, dynamics related to the human dimension can emerge, often shifting the attention from the real problem (i.e., the impact of LIBEs on ecosystems) towards aggressive and ideological conflicts between social actors (e.g., Dansero et al. 2012, Voegeli & Finger 2021, Byun & Leopkey 2022).

THE ROLE OF CISO AS SCIENTIFIC TRUST

Scientific trusts, such as CISO (Centro Italiano Studi Ornitologici [3]) can play an important role in moving forward from opinion-based conflicts among social actors by providing objective and robust scientific evidence derived from original field studies conducted on the areas where LIBEs have been proposed, or after LIBEs have been already carried out. In many cases, CISO has expressed its concerns during scientific conferences, and through social media and websites, highlighting the ecological value of important natural or semi-natural sites (e.g., [4] and [5]). These types of communications - which can be considered as a first, basic level of action when LIBEs have been proposed - can be used by public agencies (e.g., regional administrations) to issue (or not) the authorization, supported by science-based reports.

Here, we propose an additional level of action (conceptual framework in Fig. 1). We advocate for scientists to adopt a more operational and proactive approach by forming task forces of conservation experts, carrying out robust field studies and data collection on sensitive environmental components in the areas where LIBEs have been proposed. This further level of action can be crucial, especially since LIBE proposals are often communicated well in advance, thus presenting a scientific opportunity to plan field surveys using site-based designs, methods, and protocols. Conservation-experts task forces can thus obtain site-specific results that are tailored to each conservation issue according to the local environmental constraints and available resources.

THE BACI APPROACH

As a general framework of proactive actions, we propose to adopt BACI (Before-After-Control-Impact) data collection protocols (Green 1979; for birds: e.g., Vanermen et al. 2015, Bernardino et al. 2018). This sampling design is widely used to investigate environmental impacts on biodiversity (using univariate metrics at the population or community level). The principle is that an anthropogenic disturbance in the "impact" (I) location will cause a different pattern of change from before (B) to after (A) the disturbance compared with natural dynamics in the control (C) location (Underwood 1992). Including "control" sites, i.e., ecologically comparable areas free from the impact under study, is pivotal to enhance the robustness of the conclusions as it allows inferring the causal relationship between the observed ecological changes and the impacts arising from LIBEs (Underwood 1992). Hence, thanks to the robust sampling protocol, the data collected within a BACI framework provide robust results also in the "before" phase (i.e. before the impact has occurred, see e.g., Williams et al. 2011, Battisti 2024), and can therefore be useful for public agencies, which should eventually evaluate and — when necessary — authorize (or not) the LIBE (e.g., using Environmental Impact Assessments and similar evidence-based procedures).

The BACI approach facilitates the acquisition of robust data, thanks to the incorporation of essential sampling requirements such as replication, data independence, protocol standardization, and spatial-temporal representativeness (Sutherland 2006). Hence, data collected within a BACI framework offer an incredible opportunity to provide reliable results (e.g., Williams et al. 2011, Battisti 2024) that are, ultimately, useful for public agencies, which should eventually evaluate and — when necessary — authorize (or not) the LIBEs (e.g., using Environmental Impact Assessments and similar evidence-based procedures).

The data collected with BACI protocols can also play a crucial role in the early identification and implementation of appropriate mitigation strategies and compensation measures during the decision-making process, thus before a LIBE has even occurred (when any action may no longer be effective (Venton et al. 2019)). Indeed, public agencies often initiate authorization procedures such as, for example, the Environmental Impact Assessments and the Incidence Assessments (VINCA) in Natura2000 sites, based on data sourced from local "grey" literature, anecdotal information, or, seldomly, by consulting available Citizen Science platforms such as Ornitho.it, iNaturalist.org, and eBird.org, but data collection after the event is often disregarded. In addition, although these platforms are valuable for analysing spatial patterns and temporal trends on a large scale (Guariento et al. 2019), they may lack the precision needed at the local scale (Isaac et al. 2014). Conversely, the implementation of BACI field sampling carried out by experts could evaluate the possible impacts of the LIBEs (Serrano et al. 2020). Ultimately, we advocate public agencies to request mandatory BACI protocols for LIBEs, especially when they are going to potentially impact habitats of particular concern.

Last but not least, the same line of reasoning proposed for LIBEs could be applied to restoration or management interventions and practices aimed to act with a positive impact on species and ecosystems. Also in these contexts, the BACI approach would provide the strongest proof of their (un)effectiveness for a target group, promoting informed and transparent decisions (Bro et al. 2004, Armstrong 2017, Battisti & Marini 2018, Stephens et al. 2021, Brambilla & Gatti 2022).

CONCLUSIONS

In a dynamically changing world, experts from scientific trusts should seek the opportunity to gather evidence of anthropogenic impacts (e.g., LIBE-induced). This must be accompanied by suitable and targeted methods aiming at contributing to the progress of nature conservation as an applied science discipline (Primack & Boitani 2013). Finally, such a framework represents an opportunity for academic students to get their hands dirty in conservation and applied ecology (i.e. Master's or PhD theses; Battisti 2021b).

It is time for scientists to improve their operationally pro-active engagement and for institutions to embrace science during decision processes (Wright et al. 2020), making a difference in the 'real world' (Reed et al. 2018). Such paradigm change can therefore overcome social media loops, cognitive biases, emotional conflicts, and polarizations, providing strong evidence in the conservation front lines. With this position note, CISO embraces this approach, urging all biologists (and not only ornithologists) to identify and, most importantly, act on the conservation front lines.

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Figure 1. Conceptual framework showcasing a causal chain starting from the proposal of a LIBE project in a site of ecological interest (the conservation front line). After the mobilization phase, two levels of action are reported. While the first level (communications through mass/social media) can be exposed to emotional-based conflicts (among pros and cons of the LIBEs), a second proactive level should include a task force of experts initiating BACI sampling designs, so as to obtain evidence to be made available to public agencies. The black arrows indicate the chain of events. Based on this evidence, public agencies will be able to authorize the LIBEs, suggesting appropriate compensation/mitigation measures or, in the case of significant evidence of impact, denying the authorization.