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Framework and guidelines for implementing the proposed IUCN Environmental Impact Classification for Alien Taxa (EICAT)

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ABSTRACT

Recently, Blackburn *et al.* (2014) developed a simple, objective and transparent method for classifying alien taxa in terms of the magnitude of their detrimental environmental impacts in recipient areas. Here, we present a comprehensive framework and guidelines for implementing this method, which we term the Environmental Impact Classification for Alien Taxa, or EICAT. We detail criteria for applying the EICAT scheme in a consistent and comparable fashion, prescribe the supporting information that should be supplied along with classifications, and describe the process for implementing the method. This comment aims to draw the attention of interested parties to the framework and guidelines, and to present them in their entirety in a location where they are freely accessible to any potential users.

Keywords
alien, environment, impact, IUCN.

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Many invasive alien taxa have substantial effects on the ecosystems into which they have been introduced, including significant changes in native species extinction probabilities, genetic composition, behaviour patterns, richness and abundance, as well as altering phylogenetic and taxonomic diversity, trophic networks, ecosystem productivity, nutrient cycling, geomorphology, hydrology, habitat structure and various components of disturbance regimes (Brooks *et al.*, 2004; Hendrix *et al.*, 2008; Suarez & Tsutsui, 2008; Kenis *et al.*, 2009; Winter *et al.*, 2009; Vilà *et al.*, 2011; Pyšek *et al.*, 2012; Ricciardi *et al.*, 2013; Fei *et al.*, 2014). As a result, most scientists and conservation organizations consider invasive alien species to be undesirable (Lambertini *et al.*, 2011), and considerable resources have been devoted towards preventing or mitigating their impacts. Nevertheless, impacts vary greatly among alien taxa and among ecosystems, habitats or native species in the recipient geographic range; many notable impacts only become obvious or significantly influential long after the onset of invasion (Williamson & Fitter, 1996; Graves & Shapiro, 2003; Sogge *et al.*, 2008; Stromberg *et al.*, 2009; Chiba, 2010; Schlaepfer *et al.*, 2011; Pyšek *et al.*, 2012; Strayer, 2012). Thus, it has long been recognized that there is a critical need for the capacity to evaluate, compare and predict the magnitudes of the impacts of different alien taxa, in order to determine and prioritize appropriate actions.

In response to this need, Blackburn *et al.* (2014) recently developed a simple, objective and transparent method for classifying alien taxa in terms of the magnitude of their detrimental environmental impacts in recipient areas. We refer to this scheme as the Environmental Impact Classification for Alien Taxa, or EICAT. Alien taxa are classified into one of five 'impact' categories depending on the level of biological organization (individual, population or community) impacted, with the mechanisms by which the impacts occur aligned with those identified in the International Union for Conservation of Nature (IUCN) Global Invasive Species Database (http://www.issg.org/database/welcome). If applied consistently, EICAT will help to (1) identify those taxa that have different levels of environmental impact, distinguishing taxa causing impacts of low concern from invasive alien taxa with significant deleterious effects (those with negative impacts, *sensu* the definition from the Convention on Biological Diversity); (2) facilitate comparisons of the level of impact by alien taxa among regions and taxonomic groups; (3) facilitate predictions of potential future impacts of alien taxa in the target region and elsewhere; (4) aid in prioritization of management actions; and (5) aid in evaluation of management methods. It is envisaged that EICAT will be used by scientists, land managers and conservation practitioners as a tool to gain a better understanding of the magnitude of impacts caused by different alien taxa and to inform the prioritization, implementation and evaluation of management policies and actions within existing international agreements and statutes. In this regard, one aim is to have the scheme adopted as the official mechanism by which IUCN classifies the deleterious environmental impacts of those alien taxa that have become globally or regionally invasive.

A key requirement for any standardized scheme adopted under the auspices of IUCN (or any other major administrative organization overseeing international conventions and policy implementation) is the existence of a clear framework

and guidelines for implementing the scheme. To this end, we have drafted just such a framework and guidelines for implementing the EICAT scheme: the primary aim of this contribution is to draw the attention of interested parties to the framework and guidelines, and to present them in their entirety in a location where they are freely accessible to any potential users. Hence, we have appended them to this comment as supplementary online information (see Appendix S1 in Supporting Information).

To ensure that the maximum utility can be gained from any classifications carried out using EICAT, it is important that studies apply the scheme in a consistent and comparable fashion, and that consistent and comprehensive supporting information is supplied along with classifications. Therefore, the framework (1) defines some of the key concepts required to use EICAT; (2) describes the categories and criteria for classifying alien taxa, the guidelines for transferring taxa between categories and the taxonomic and geographic scope of the scheme; (3) provides a method for dealing with uncertainty over the correct classification, and in particular uncertainty that arises from the need to interpret evidence generated at spatial scales that are often very different to the spatial scales over which native communities can be characterized; (4) prescribes essential and recommended documentation that should or could be provided in support of classifications; and (5) describes the process for implementing these guidelines.

We have intended the EICAT framework (see Appendix S1) to be comprehensive, and so it reproduces the key elements of the classification scheme presented in Blackburn *et al.* (2014). However, it describes two changes to the scheme as originally published that are important to note. First, the EICAT framework describes parallel classification systems to capture both the maximum impact ever recorded for an alien taxon at a point in time, and the current impact level caused by that taxon at the same location or elsewhere in the geographical area of interest (e.g. globally, regionally, nationally). This addition ensures that EICAT captures the maximum recorded impact of an alien taxon introduced somewhere in the geographical area of interest, which may be especially important where the current impact is not as high as in the past, perhaps due to mitigation measures or spontaneous changes (Dostál *et al.*, 2013). Instigating parallel classifications for current and the maximum impacts ever recorded also helps in indicating any changes in current environmental impact through successive assessments (i.e. as a result of the invasion proceeding, or mitigation measures taking effect).

Second, the framework alters the two-letter abbreviation codes for the five categories of impact, to try to reduce the possibility for ambiguity in the original designations (and so that the codes increase in alphabetical order). These now become Minimal Concern (MC), Minor (MN), Moderate (MO), Major (MR) and Massive (MV).

The process for implementing the EICAT identifies an EICAT Unit, consisting of members of the IUCN Invasive Species Specialist Group, whose function it is to oversee the entire process, and to check each assessment to ensure consistency. The Unit is also intended to coordinate the reporting of status and trends in impacts as documented by the EICAT process and oversee any proposals for changes or revisions to the framework and guidelines. Impact classification assessments should be independently reviewed by experts, to check whether the assessment has been carried out appropriately as described in the framework and guidelines, before being submitted to the EICAT Unit for final ratification. The aim is to have accepted assessments published on the Global Invasive Species Database, where they will be freely available to the community of relevant stakeholders. Anyone who has carried out environmental impact classifications under the EICAT scheme should contact one of the current members of the EICAT Unit (see Appendix S1, section 7), to discuss the formal adoption of their assessment(s) under this scheme.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix S1. The complete version of the framework and guidelines for implementing the Environmental Impact Classification for Alien Taxa (EICAT).

BIOSKETCH

Tim M. Blackburn is an ecologist with interests in human-mediated biological invasions, extinction and other topics relating to the large-scale distribution and abundance of species. He mainly works on birds.

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