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CONCLUSIONS

Mind the gaps when using science to address conservation concerns

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Abstract Conservation science and conservation action are assumed to have identical goals. However, in reality, there is a strong divide between research and practical conservation that has been mostly discussed with respect to the 'knowing-doing gap', i.e. the results from science are not being translated into practical management. In this commentary, we argue that there is not one but there are at least three different types of gaps impeding a positive impact of science on conservation: (1) the knowing-doing gap; (2) the thematic gap that exists between the topics addressed by conservation science and the problems faced in conservation; and (3) the disciplinary gap, i.e. the lack of communication and cooperation between different fields of science, e.g. between

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fundamental biodiversity research and conservation research. These different gaps have different origins and require different means to be overcome. In a survey, scientists from the field of conservation research (all contributing to this special issue on European grasslands) assessed the importance of these three gaps. They highlight that the disciplinary gap is just as relevant as the knowing-doing gap, while the importance of the thematic gap between practical conservation needs and theoretical conservation science is, in the view of the authors, of less importance. Also, the respondents identified the complexity of academic content in scientific publications as an additional cause for knowing-doing gaps. Based on our survey and various other studies analysing these gaps, we suggest two ways to overcome the gaps: if you consider yourself to be a conservation scientist make sure to address questions of relevance for conservation issues, if you are a scientist interested in fundamental issues, be open to mutual interaction and translation of scientific results with conservation scientists. The knowing-doing gap could be addressed by more readily translating the theoretical findings into practical advice. "Conservation Journals" could, for instance, require a second "Conservation Management Abstract", which has to be published open-access, and back-to-back with the conventional abstract.

Keywords Conservation management · Knowing-doing gap · Thematic gap · Disciplinary gap · Knowlege Translation · Practice-Oriented research

Conservation science versus conservation management?

This special issue on biodiversity of European grasslands (see Habel et al. 2013) combines contributions both on fundamental biodiversity research and biodiversity conservation. These papers can be classified into four main topics: (1) effects of abiotic and biotic factors on species assemblages and richness (Horváth et al. 2013; Moeslund et al. 2013; Morris et al. 2013; Weiss et al. 2013; Zelnik and Carni 2013); (2) natural and anthropogenically induced gradients along temporal and spatial scales (Albrecht and Haider 2013; Bieringer et al. 2013; Filz et al. 2013; Pipenbaher et al. 2013); (3) the effect of man-made modifications of habitats on species composition, in particular eutrophication and abandonment versus habitat restoration (Bonanomi et al. 2013; Lauterbach et al. 2013; Rácz et al. 2013; Weiss et al. 2013; Wiezik et al. 2013); and (4) genetics and physiology within single species or species groups (Habel et al. 2013; Pluess 2013; Wellstein et al. 2013). While these papers touch on several important aspects of conservation science, they mostly focus on single model taxa and/or are mostly restricted to investigating relationships among only a few factors. Hence, they generally do not capture the complexity of ecosystems and the interaction between conservation goals and human needs.

Such a simplified approach is, however, now common practice in conservation science, as also exemplified by the majority of conservation studies that analyse effects of environmental stress on individual fitness and species' viability (Hoelzel 1999; Lens et al. 2002; Aguilar et al. 2004; Zachos et al. 2007; Habel et al. 2012). The question arises whether this reductionist approach to the science is the underlying reason for the divide between "scientific publications" and "public action" (Arlettaz et al. 2010). Indeed, the discipline of conservation biology has been accused of failing to produce results of practical use and applicable in reality (Balmford and Cowling 2006; Knight et al. 2006). Despite this, quantity of publications in the conservation biology and restoration ecology is steadily growing (Fazey et al. 2005; Arlettaz and Mathevet 2010), yet research continues to contribute only marginally to concrete management of species and ecosystems (Pullin et al. 2004; Hulme 2011). Here we argue that it is not the reductionist approach per se that limits the impact of science on conservation. Rather, we identify three different types of gaps each of which contributes to the existing divide between conservation science and action.

The three gaps

A survey of publications in Conservation Biology between issues 1 and 12 (1986–1998) showed that of the 223 respondents, 78 % ($n = 173$) had included management recommendations, but of these, only 54 % ($n = 164$) believed their recommendations were being used (Flaspohler et al. 2000). This is the well-known knowing-doing gap, i.e. the lack of translation from theoretical knowledge into practical action. A survey of research papers dealing with conservation assessments published between 1998 and 2002 still indicated that less than one-third ($n = 29$, total $n = 88$) of conservation assessments led to any implementation (Knight et al. 2008). Two-thirds of these studies, however, did not deliver direct conservation recommendations or did not translate the findings into suitable recommendations. Because conservation advice that arose from a scientific study is not implemented in practice, the knowing-doing gap is primarily a communication gap. It is related to scientists preferring to publish in peer-reviewed international journals and refraining from publishing in the more easily accessible and interpretable non-peer-reviewed journals as these contribute little of bibliometric value (i.e. citations, impact factors) to their scientific career—but would contribute to conversion from theory into practice (Prendergast et al. 1999). Conservation biologists are mostly employed by universities and therefore experience the general pressures of academics (teaching, tenure, publishing, grant acquisition). Conservation practitioners, on the other hand, are a much broader group that includes non-profit organizations, land managers, politicians, private landowners, etc.

In contrast to the knowing-doing gap, the thematic gap highlights the discrepancy between the topics which are of interest for the respective groups, scientists or practitioners, which have been argued repeatedly to be different (e.g. Pullin et al. 2009). The thematic gap is highlighted by a recent survey asking practitioners to rate the importance of scientific findings for conservation activities. They identified that questions related to economic, societal, and stakeholder conflicts are more important than conceptual questions often addressed in research papers (Braunisch et al. 2012). This thematic gap between conservation needs and conservation research is fundamentally different from the knowing-doing gap, as research on a question not relevant for conservation cannot generate knowledge that is applicable to conservation. Hence it cannot contribute to overcoming the "not-knowing but doing" problem in conservation. For example, Linklater (2003) reported an increasing number of scientific publications about the highly endangered and declining rhinoceros species. But these studies predominantly comprised ex situ laboratory-based conservation approaches, while conservation action plans created by practitioners focused to safeguard the species in situ. This example (as many others) highlights that conservation and land management organizations often develop their own conservation assessment techniques independently of published research (Prendergast et al. 1999; Hopkinson et al. 2000).

The third gap is located between different disciplines of science, thus it is a disciplinary gap. One particularly booming field of biodiversity research deals with the analysis of potential consequences of biodiversity loss for ecosystem processes such as seed dispersal or element cycling (e.g. Hooper et al. 2005). While in this functional biodiversity research species loss serves as the starting point, the questions addressed are usually generic, e.g. related to investigate whether complex ecosystems generally function differently from more simple ones. To answer such questions, researchers often apply strictly controlled experiments, either in the field or in contained laboratory microcosms, e.g. by artificially creating (plant) communities with different levels of diversity and/or structural complexity (e.g. Schmid and Hector 2004). Biodiversity experiments provide innovative research platforms that may generate hundreds of papers, such as in the case of the Jena Experiment (Roscher et al. 2004). A second recent approach in biodiversity research is that of comparative studies in real landscapes, with plots that are managed differently. Land use is a main driver of biodiversity loss and comparing the effects of land use on biodiversity and ecosystem processes, such as in the Biodiversity Exploratories (Fischer et al. 2010), again provides a platform for interdisciplinary research that potentially yields outcomes relevant for conservation. However, there appears to be a disciplinary gap between fundamental biodiversity science and conservation science that does not just include differences in the topics being addressed, but apparently there are also different subsets of scientists addressing the different topics. While scientists conducting functional biodiversity research often argue that their work is relevant to conservation (Hector et al. 2001), this is regularly questioned (Srivastava and Vellend 2005). As a consequence, the importance of functional biodiversity research for conservation is often reduced to providing a general argument for why conservation is necessary for humankind, such as in the Millennium Ecosystem Assessment that classified the ecosystem services that are potentially adversely affected by a loss in biodiversity (Millennium Ecosystem Assessment 2005a, b). Another example is given by population genetics where fundamental research often focuses on the genetics of natural indigenous grazers, while applied conservation research focuses, for example, on the mechanistic effect of grazing by domestic animals on plant recovery in nature reserves. A link between these types of research is often lacking. All fields have their right to be pursued, and transforming fundamental biodiversity research into applied conservation biology would be sending the wrong signal. Scientists doing fundamental biodiversity research, however, should not pretend that their research has direct relevance for conservation practice. On the other hand, conservation scientists do not need to emulate fundamental biodiversity research when their findings are relevant to conservation practice. While there are notable exceptions in which scientists appear to make contribution to both fields, as is the case of the scientists involved in the advisory board of the Swiss biodiversity forum (www.biodiversity.ch), overall the disciplinary gap appears to be large.

How authors of the special issue perceive the gaps

In order to assess and highlight the importance of the three different types of gaps we recognize, and to better assess the way forward, we asked all authors who contributed to

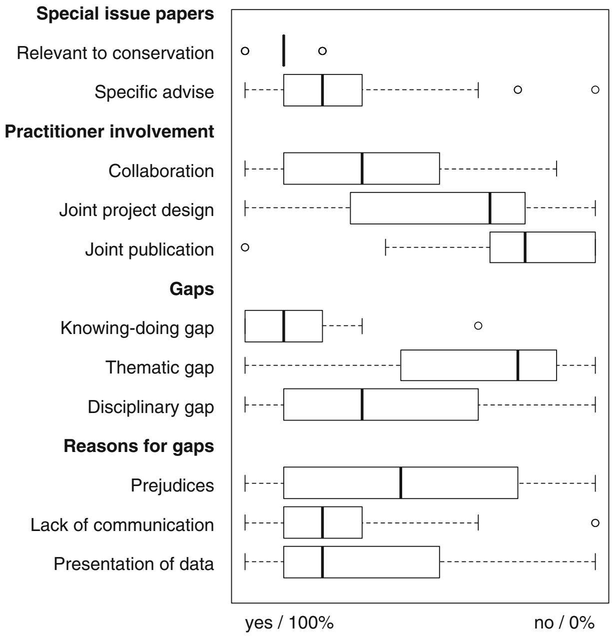

Fig. 1 Summary of the answers received from the respondents ($n = 24$). Questions to assess the conservation relevance of the own contribution; 1. Is your contribution of relevance for practical in situ conservation management (yes/no)?; 2. Do you give specific management advice in your contribution (yes/no)? Questions concerning the cooperation with conservation practitioners; 1. Do you collaborate with stakeholders from the field of conservation management (always/never)?; 2. Which proportion of your projects was designed in collaboration with stakeholders from the field of conservation management (please estimate, 0–100 %); 3. Which proportion of your scientific articles was published together with practitioners (please estimate, 0–100 %)? Please evaluate the importance of the following three potential gaps; 1. Scientific knowledge becomes not translated into management activities (knowing-doing gap) (high/no); 2. Scientific studies analyse topics which are of limited relevance for conservation action (high/no); 3. Communication between fundamental biodiversity research and applied conservation research is too limited (thematic gap) (high/no). Questions concerning your assessment of the "knowing-doing" gap: What are the underlying causes for the "knowing-doing gap"; 1. Prejudices between scientists and practitioners (yes/no); 2. Different communication (theoretical science versus practical management) (yes/no); 3. The way of data-presentation (English-written journals, complex statistics) (yes/no). Given is median, 25 and 75 % quartile (box) and minimum/maximum values (whisker) excluding outliers (open circles)

this special issue on European grasslands to complete a questionnaire. We asked them for their opinion on the relevance of their contribution to biodiversity protection, and their perception on the causes underlying the divide between research and conservation action. The returning answers were analysed anonymously. In Fig. 1 we present a summary of the answers as box-plots showing the median, 25 and 75 percentiles as a box, with whiskers that extend to either the maximum or the 1.5 times interquartile range of the data (whichever is smaller). Points beyond the whiskers are drawn individually. The graph was plotted using the programme R (version 2.15.1; R Development Core Team 2010).

Only about half of the contacted scientists returned a completed questionnaire. In addition to the usual work overload that characterizes many scientists, this might also be a signal that bridging the discrepancy between science and action is not seen as a pressing need. The first two questions on the relevance for conservation management of the respective contribution published in this special issue indicate the gap between theory and practice: while most of the contributors classify their article as being of high relevance for conservation (i.e. they consider that there is no thematic gap), the provision of management advice varies greatly among articles (Fig. 1). When asking about potential collaboration with conservation practitioners, the median answer was "7" on a scale from 10 ("collaborating always") to 0 ("collaborating never") with a broad scatter in responses. We therefore see the clear divide between the general aim of involving stakeholders, but limited implementation as the respondents indicated that only 30 % of their projects were designed and only 20 % of their publications were written together with stakeholders from the practical conservation management community (Fig. 1). The lack of communication between fundamental biodiversity research and applied conservation research (disciplinary gap) was classified as having a similar relevance as the knowing-doing gap, while the thematic gap was, in the opinion of the scientists asked, of little importance. This may be an indication that scientists consider the topic they work on is of relevance for conservation, or at least should be of relevance, despite the general opinion of practitioners that there is such a gap. Finally, we asked for potential underlying reasons causing this strong divide between science and action. While prejudices between scientists and practitioners are assessed to have only limited impact, the discrepancy between theoretical, highly complex and simplified research set-ups and the way how scientific results are presented in publications, are evaluated as being a major problem (Fig. 1).

Each interviewed person also had the opportunity to give personal advice on how the gaps outlined above can be closed. Many of them commented on the lack in communication between scientists and practitioners, and about inadequate data-presentation in the papers. A high proportion of scientists pointed out that the knowing-doing gap could easily be bridged by modifying the way in which the results of a study are presented. Some of those interviewed suggested organizing workshops and seminars on a local scale to consolidate scientists and practitioners. Finally, some of the respondents pointed out that universities, research institutions, and funding agencies that support or host biodiversity projects, should not only use bibliometric indicators when assessing the quality of the research output.

Why and how to bridge the gaps

When it comes to evaluating the success of field actions, ecosystem protection and biodiversity conservation lags behind many other policy fields (e.g. poverty reduction, minimal rehabilitation, disease control) (cf. Millennium Ecosystem Assessment, MEA 2005a, b). However, if we want to ensure that the limited (financial) resources devoted to conservation make a practical difference, we should test conservation policies with equal thoroughness and state-of-the-art methods as we do in conservation science. Hereby, approaches from various fields of science could help to improve the efficiency in conservation actions. Therefore, bridging the gaps between both fields would be synergistic. Based on the results from the questionnaires we make the following suggestions to bridge the three gaps identified above.

Stimulate mutual interaction and translation (overcoming the knowing-doing gap)

There is a wealth of literature on expert elicitation, decision theory, and risk analysis—all of which can be important aspects of conservation—but technical terminology can be especially impenetrable to practitioners. In turn, field practitioners should document their field experiences and experiments in a manner that can meaningfully inform conservation scientists. To address this point, we asked all contributors to this special issue on European grasslands to (1) translate their key-findings on short-term activities for conservation practitioners, (2) to separate long-term effects from short-term activities, and (3) to evaluate how the impact of the respective action (conservation efficiency) could be translated into the conservation practitioner's language (see Table 1 in Appendix). Several authors commented in their questionnaire that a "Conservation Management Abstract", a summary in which theoretical findings are being translated in specific conservation management advice, would be an important step in overcoming the "knowing-doing" gap. We therefore suggest that journals publishing studies relevant for the field of conservation should consider requiring a practical abstract that has to be open-access and published at the beginning of each article (e.g. just after the conventional abstract).

Make sure to address questions of relevance to conservation (overcoming the thematic gap)

Whereas conservation scientists are aiming at academic novelty and broad applicability of their research results, the conservation practitioners may be more interested in well-tested decision support tools and a local focus (although this is not always the case, see Shaw et al. 2010). Nevertheless, if conservation scientists have the aim and claim that they do research relevant for conservation, they need to bridge the thematic gap. To ensure the right questions are addressed and proper methodology is used, practitioners have to be involved (not only formally) early in the process in conservation research. Undertaking research that is not only innovative but useful is a goal of the Society for Conservation Biology (see Meffe et al. 2006).

Stimulate discussion within science (overcoming the disciplinary gap)

As fundamental research is curiosity-driven, it is clear that not all biodiversity researchers will or should be working on conservation-related questions. Nevertheless, cooperation between fundamental biodiversity researchers and conservation scientists is likely to be fruitful, with mutual benefits. We suggest that rather than writing papers about what the 'other side' should learn from the own approach, joint workshops on particular topics are a more promising means to overcoming disciplinary boundaries and to stimulate joint research activities. This would involve organizing workshops where not only people that have worked on directly conservation-related topics are involved, but also ones interested in pure science. For example, as many biodiversity experiments have been conducted in grasslands, joint workshops on grassland ecology and conservation would be of mutual benefit.

In line with our three guidelines, Sunderland et al. (2009) identified five key issues which could stimulate information exchange between participants from both fields: (1) access to scientific literature; (2) levels of scientific literacy; (3) lack of interdisciplinarity; (4) questions of relevance; and (5) lack of sharing of conservation-related experiences. Chapron and Arlettaz (2008), in turn, suggest implementing an impact factor based on an estimation of how much worse the conservation status of an endangered species or ecosystem might be in the absence of the particular research.

Practical implementation should be regarded as an integral part of scientific conservation activity as it constitutes the ultimate assessment of the effectiveness of the recommended conservation guidelines; it should therefore be rewarded as such (cf. Arlettaz et al. 2010). A possible approach towards a better synergy between research and action is the elaboration of citizen-science projects (Salafsky et al. 2001, 2002). Such citizen-science approaches not only increase awareness of biodiversity research, but also bring together conservation science and management as various stakeholders (scientists, conservation management organisations, and citizens) work together. Volunteers (mostly citizens) benefit from educational input while the scientific project profits from large data sets being assembled (see Silvertown 2009). This approach is exemplified by the European butterfly monitoring scheme (van Swaay et al. 2008), established over large parts of Europe. Citizens were engaged for butterfly counting, and by doing so they were able to document the recent status of (endangered) species and allowed to infer population trends. Another example of a good integration of research and practice is the non-governmental organisation Conservation International, and the governmental European Forest Institute. There are also peer-reviewed journals, such as the Journal of Conservation Evidence (run on a site called ConservationEvidence.com), that successfully translates scientific results into practitioner advice. This journal also publishes reports from practitioners on the outcomes of their interventions—successful or otherwise; data from these reports can then be fed into systematic reviews. However, this journal is not included in the Web of Knowledge (i.e. it has no formal impact factor) making it less attractive for scientists as a suitable publication outlet.

We hope that this contribution will encourage scientists to develop a practice-oriented research agenda and a basis for developing conjoint activities with the intention to use synergies from both, conservation science and conservation management. Scientists from fundamental biodiversity should not camouflage their research as conservation evidence, but conservation biologists should translate their findings to make the knowledge generated accessible to practitioners.

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Appendix

See Table 1.

Table 1 Translation of the scientific findings into practical conservation management advises of all 16 contributions published in this special issue (in alphabetic order)

Reference of contribution	Model unit(s)	Effects/level	Key finding	Short term activities for conservation practitioners	Long-term effect of respective activities	Evaluation of the efficiency
Albrecht and Haider (2013) Species diversity and life history traits in calcareous grasslands vary along an urbanization gradient	Plant species	Community structure, species traits	Species traits determine response of plants to urbanization in former calcareous grassland	Plant communities of calcareous grassland are significantly affected by urbanization. Therefore, conservation of remaining habitats is highly recommended; urban habitats also provide habitats for cliff dwellers with high nature conservation value	Conservation and development of urban biodiversity	Possible but no specific plans
Bieringer et al. (2013) Edge effect of a pine plantation reduces dry grassland invertebrate species richness	3 habitat guilds comprised of 254 species out of 11 taxa	Species richness	Species richness patterns indicate edge zones much wider than hitherto expected and require delineation of ecological guilds to facilitate interpretation	Giving international priority and support to the preservation of the last large steppe remnants in, e.g., Ukraine and Russia	Developing strategies to counter current policies of steppe afforestation in the name of carbon storage	Monitoring for preservation of large steppe remnants and persistence of dry grassland specialists
Bonanomi et al. (2013) Plant diversity in Mediterranean grasslands: the controlling effect of land abandonment, nitrogen enrichment and fairy ring fungi	Field plots in Mediterranean grasslands	Vascular plant species composition, richness and diversity	Land abandonment and N enrichment drive to a local litter accumulation with consequent reduction of species diversity	Periodical cutting is effective for proper management of species rich Mediterranean grasslands because it both mitigates the dominance of dominant grasses and promotes the establishment of rare species	Cutting and, to a lesser extend litter removal, are effective for restoration of abandoned areas and for conservation of still species-rich habitats	Periodical monitoring of grasslands species composition and diversity

Table 1 continued

Reference of contribution	Model unit(s)	Effects/level	Key finding	Short term activities for conservation practitioners	Long-term effect of respective activities	Evaluation of the efficiency
Filz et al. (2013) Missing the target? A critical view on butterfly conservation efforts on calcareous grasslands in south-western Germany	Butterfly species	Community composition	Species declines and trait depletion in response to habitat degradation and fragmentation	Establishment of corridors/stepping stones and buffer zones to prevent negative impacts from isolation or edge effects, conservation of high quality functional habitat characteristics for specialist species	Maintenance of habitat quality and connectivity to avoid unrecoverable losses of butterfly diversity in favour of common generalists	Periodic reinvestigations of the respective butterfly and plant communities
Habel et al. (2013) The genetic signature of ecologically different grassland Lepidopterans	20 butterfly species	Molecular genetic structure	Genetic responses on habitat structures i.e. the ecological amplitude of species	Establishing habitat networks for species with high genetic diversity, preservation of a high habitat quality for specialist taxa	Avoid losses of genetic diversity, inbreeding depressions and thus maintain long-term viability	Re-analyses of the same species and populations some generations later
Horváth et al. (2013) Large and least isolated fragments preserve habitat specialist spiders best in dry sandy grasslands in Hungary	Ground-dwelling spider species	Assemblage, species composition	Generalist and specialist species respond differently to the habitat size and isolation	The large and less isolated grassland fragments should be preserved and the further fragmentation of all fragments has to be stopped	Some small fragments should be retained as source habitats and the size of small fragments should be increased with the restoration of croplands, thus increase the proportion of specialist species in assemblages	The ground-dwelling spider assemblages should be investigated some years after grassland restoration
Lauterbach et al. (2013) Factors driving plant rarity in dry grasslands on different spatial scales—a functional trait approach	28 dry grassland plant species	Functional traits/species frequency and endangerment	Traits associated with frequency and endangerment differ on spatial scales	Retain and support sheep grazing of dry grassland	Avoid abandonment and fragmentation and enhance seed dispersal	Comparison of species and traits between managed and unmanaged grasslands

Table 1 continued

Reference of contribution	Model unit(s)	Effects/level	Key finding	Short term activities for conservation practitioners	Long-term effect of respective activities	Evaluation of the efficiency
Moeslund et al. (2013) Topographically controlled soil moisture drives plant diversity patterns within grasslands	Plant species richness and composition	Local and regional scale	Topographically controlled soil moisture plays an important role in shaping grassland plant diversity patterns both locally and regionally	Consider soil moisture and its chemistry in conservation planning, e.g. nitrogen compounds transported by water from upland arable fields	Avoid planning of conservation activities in areas that does not feature optimal hydrology for grasslands	Continuous monitoring of grassland restoration success
Morris et al. (2013) Land use and host neighbor identity effects on arbuscular mycorrhizal fungal community composition in focal plant rhizosphere	Arbuscular mycorrhizal fungi (AMF)	Root colonization and community composition	Increased mowing frequency alters AMF community composition. Increasing frequency of mowing, grazing, and fertilization reduces AMF colonization of roots	Consider how the frequency of mowing, grazing and fertilization will affect AMF, and limit these land uses when possible	Increase AMF colonization of roots and stabilize AMF community composition	Periodic monitoring of AMF root colonization and community composition
Pipenbaher et al. (2013) Dry calcareous grasslands from two neighboring biogeographic regions: relationship between plant traits and rarity	Dry grasslands	Floristic and functional structure	Ecologically similar meadows are not equally threatened	Quick action is required when species composition start to change after abandonment Meadows, still in good conditions from physiognomic point of view, have already changed their plant composition. Action required is regular mowing once a year in both compared areas	Avoid changed plant structure and changed plant functional traits	Regular monitoring every 3–5 years

Table 1 continued

Reference of contribution	Model unit(s)	Effects/level	Key finding	Short term activities for conservation practitioners	Long-term effect of respective activities	Evaluation of the efficiency
Pluess (2013) Meta-analysis reveals microevolution in grassland plant species under contrasting management	19 grassland plant species	Intra-specific vegetative, reproductive and neutral molecular variation	Plants often differ between management regimes	Maintain a variety of grassland managements	Maintain variation within species to preserve their evolutionary potential	Assess population viability, intra-specific variation, species persistence and species diversity
Rácz et al. (2013) Early changes of Orthopteran assemblages after grassland restoration: A comparison of space for time substitution versus repeated measures monitoring	crickets, bush-crickets and grasshoppers of the order Orthoptera	Species/community	Orthopterans respond positively to grassland restoration by increases in species richness, abundance and composition from year 2 after restoration	Restoring grassland habitats by sowing seeds of even a few grass species on former croplands will lead to favourable changes with time, while restoration techniques and landscape configuration play little role	Prevent weedy plant species by regular removal of dead plant material by grazing or mowing to maintain diverse communities	Resample orthopteran communities on longer time scales (5–10 years) to evaluate whether they reach target state
Weiss et al. (2013) The effects of grassland management and aspect on Orthoptera diversity and abundance: Site conditions are as important as management	Orthoptera (13 species)	Management effects on population	Aspect (south-facing > north facing) and management (grazing > mowing) influence Orthoptera abundance	Implement extensive grazing, focus on south-facing sites	Increase in abundance and species richness of Orthoptera	Continuous monitoring using transect counts

Table 1 continued

Reference of contribution	Model unit(s)	Effects/level	Key finding	Short term activities for conservation practitioners	Long-term effect of respective activities	Evaluation of the efficiency
Wellstein et al. (2013) Intraspecific phenotypic variability of plant functional traits in contrasting mountain grasslands habitats	4 perennial plant species of montane grasslands	Intraspecific variation of functional traits	Intraspecific phenotypic adaptation to fine-and landscape-scale environmental variations	Protecting grassland's landscape variability and environmental heterogeneity within habitats	Helps maintaining intraspecific variability of populations that finally can buffer against uncertainty of future climate and land use scenarios	Re-analysis of the same species after occurrence of relevant climate and land-use changes
Wiezik et al. (2013) Shrub encroachment alters composition and diversity of ant communities in abandoned grasslands of western Carpathians	33 ant species	Community structure	Differentiation of ant communities as a response to grassland abandonment	Establishing habitat networks for conservation of ants (and associated animal communities) comprised of broad array of managed grasslands and different stages of shrub encroachment	Avoid losses of grasslands biodiversity due to both abandonment and management intensification	Re-analyses in different areas, habitats and management scenarios
Zelnik and Carni (2013) Plant species diversity and composition of wet grasslands in relation to environmental factors	3 alliances of wet grassland communities 88 plots of different wet grassland plant communities	Species diversity of vascular plants. Wet grassland plant communities	Highly significant negative correlation between available P content and plant species diversity and richness. Highly significant correlation between the group of soil factors and species richness	Mapping of the preserved species-rich wet grasslands. Acquaintance of landowners/farmers to avoid: phosphorous addition, intensification/ abandonment of management, water table changes	Preservation of a high habitat quality for rare and vulnerable taxa. Avoid losses of species diversity	Re-sampling of the same plots and evaluation of potential changes. Checking the changes in area covered by studied plant communities

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