

## REVIEW

# Global biodiversity conservation requires traditional Chinese medicine trade to be sustainable and well regulated

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## Abstract

Traditional Chinese medicine (TCM) is highlighted by conservation practitioners as an ongoing threat to many overharvested plant and animal species, including several charismatic threatened vertebrates. However, studies that provide evidence-based and practical recommendations on how to better regulate the TCM trade for sustainability and biodiversity conservation remain limited. China is the biggest promotor of and market for TCM and understanding the TCM trade in China is important for global biodiversity conservation. In particular, conservation researchers need to better understand how the TCM trade and its regulations interact with China's development needs and should collaborate with TCM communities to propose locally adapted suggestions to decision makers. However, progress in these areas has been restricted by language, cultural, and knowledge barriers. In this paper, we provide an overview of the current status of TCM-related regulations in China, identify weaknesses in regulation frameworks, and highlight issues that currently limit our understanding of the magnitude, dynamics, and impact of the trade. We propose changes in trade regulations, actions to enhance law enforcement, and future research directions to encourage a more sustainable TCM trade that benefits both global biodiversity conservation and TCM development.

## KEYWORDS

China, demand reduction, evidence-based policy, sustainability, traditional Chinese medicine, wildlife trade

## 1 | INTRODUCTION

Traditional Chinese medicine (TCM) is a complex and dynamic term that includes a diverse range of practices from prescription to acupuncture (Cheung, Doughty, et al., 2021; Cheung, Mazerolle, et al., 2021), and encompasses both practices acknowledged in national policies (e.g., Pharmacopoeia of the People's Republic of China; hereafter the Pharmacopoeia) and unregulated non-official practices (Moorhouse et al., 2021). The Law of the People's Republic of China on Traditional Chinese Medicine defines TCM as “the general

term of medicine of all Chinese ethnic groups including the Han ethnic group and minority ethnic groups reflects the understanding of the Chinese nation on life, health and diseases, and is a medicine and pharmacology system with long historical traditions and unique theories and technical methods” (National People's Congress of China, 2017).

Since its inception thousands of years ago, TCM has been an important part of Chinese culture and has co-evolved alongside many of China's national development initiatives (Chen & Xie, 1999). Today, TCM is still an indispensable part of China's healthcare

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system and is practiced in parallel with Western medicine (Chen & Qian, 2019). For example, TCM-specialized hospitals and clinics in China treated 0.962 billion patients in 2016, with medical services provided through TCM treatments accounting for 15.8% of the total national medical services provided that year (National Health and Family Planning Commission of the PRC, 2017; Tang et al., 2008). TCM use is not limited to China, but is also practiced in a wide range of international markets where Chinese communities have settled, including Japan, southeast Asia, USA, Canada, and many European countries (Lin et al., 2018). As a healing system, TCM targets illness and provides guidance on lifestyle and exercise. Herbal medicines are commonly used, but acupuncture, massage, diet recommendations, and animal-based medicines are also used, sometimes in combination (Tang et al., 2008).

The use of products from threatened vertebrate species, such as pangolins, musk deer and bears, has attracted considerable conservation and animal welfare concerns, although this aspect of TCM reflects only a small proportion of TCM practices. Animal-based products make up only a relatively small proportion of commonly used TCM ingredients: 98 of 616 ingredients listed in the latest Pharmacopoeia are animal-based (Chinese Pharmacopoeia Commission, 2020), and 823 animal species are documented in the Medical Fauna of China as having been used or still in use (Li et al., 2013), with most being insects or other invertebrates. Herbal products make up the majority of ingredients listed in different national TCM regulations and daily practices, but much less attention has been devoted to these products, despite both Chinese policies (e.g., List of National Key Protected Wild Medicinal Species) and scientific research highlighting the importance of ensuring sustainable trade and addressing potential threats to wild populations (Zhou & Lu, 2013; Zhou & Xu, 2016). Studies have also increasingly highlighted the potential impact on biodiversity from the rapid development of TCM (Chi et al., 2017; Esmail et al., 2020; Hinsley et al., 2020; Still, 2003). Moreover, biodiversity that could be threatened by unsustainable TCM trade includes not only species native to China but also non-native species (e.g., African pangolins) and non-Chinese populations of target species (e.g., *Terminalia chebula* and other plants) with known examples to be incorporated into TCM practices within China (Challender & Hywood, 2012; Chapagain et al., 2021; Kailash et al., 2022).

Conservation of TCM-related animal and plant species has a relatively long history in China, with the State Council of China issuing the "Regulation on Protection of Wild Medicinal Resources" in 1987 for "protecting and rationally utilizing wild medicinal resources" (State Council of China, 1987). However, demand for TCM has increased in recent decades as a result of ongoing population growth within China and the development of both national and international TCM markets, and this development is supported by the Chinese government through legal documents. National-scale supportive documents included "Outline of the Strategic Plan on the Development of Traditional Chinese Medicine (2016–2030)," "Opinions of the CPC Central Committee and the State Council on Promoting the Preservation, Innovation, and Development of Traditional Chinese

Medicine," and "14th Five-Year' Traditional Chinese Medicine development plan" (State Council of China, 2009, 2016, 2019, 2022). International scale supportive documents concentrated around the Belt and Road Initiative, for example, "Traditional Chinese Medicine 'Belt and Road' development plan (2016–2020)" and "Promote the high-quality integration of Traditional Chinese Medicine into the 'Belt and Road' development plan (2021–2025)" (State Administration of TCM, 2021; State Administration of TCM & NDRC, 2016). All documents have mentioned or highlighted sustainable TCM trade as one aspect. Moreover, the Law of the People's Republic of China on TCM, which came into effect in 2017, marked stronger national legislative support to promote and develop TCM services. Article 1 of Chapter 1 specifies the purpose of this law as "inheriting and carrying forward traditional Chinese medicine, guaranteeing and promoting the development of the traditional Chinese medicine undertaking, and protecting the health of the people." TCM has also been used as part of the treatment for COVID-19 within China during the current pandemic, further promoting its reputation and development (Chen & Chen, 2020; Wan et al., 2020).

The trend of growing market demand for TCM will very likely continue over the near future due to this policy support. It is therefore critical to understand the impact and sustainability of TCM on threatened or potentially threatened species. Since China is a major demand market and driving force for TCM development (State Council of China, 2016), it is particularly important to gain a better understanding of TCM trade in China for more effective management. However, few studies have focused on this aspect to provide useful insights. To address this key information gap, we provide an overview of current TCM-related regulations for threatened species in China, with reference to TCM practices that are officially recognized under current national or regional Chinese regulations, and discuss three main problems we have identified as barriers that limit the development of more sustainable TCM trade related to threatened biodiversity: (i) non-transparent regulations and loopholes, (ii) weak law enforcement, and (iii) lack of research and collaboration with the TCM sector. Laws and regulations discussed in this study are summarized in Supplementary material for reference.

## 2 | REGULATION OVERVIEW OF WILDLIFE TRADE FOR TCM

Current regulations for threatened species used in the TCM trade within China vary according to the different contexts facing each harvested species. Most Chinese animal species listed as threatened by IUCN, or that are locally rare, are nationally protected in China, with wild harvest for commercial use strictly prohibited by the Wild Animal Conservation Law (National People's Congress of China, 2020). However, products from only two types of conservation-priority species, rhinos and tigers, are completely banned from TCM trade (State Council of China, 1993). Some wildlife species and their products that originated from legal farming/importation or historical stockpiles, which include some threatened

species, are allowed in China's legal TCM trade (Figure 1). All legally traded wildlife medicines originating from protected animal species are required to carry trade permits on the smallest trading package (i.e., the ready-to-sell final products). Legal permits can also be issued for commercial harvesting and trading of wild-sourced Class II protected plants, with these permits not specifying criteria or thresholds to ensure sustainable harvesting (State Council of China, 2017).

## 2.1 | Group 1: Wildlife with legal importation and established commercial farming

International imports for commercial use are allowed for some species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), including geckos, sea horses and many plant species, through taxon-specific regulations (CITES, 2016a). Trade of legally imported wildlife products is regulated similar to trade of local wildlife products, and requires trade permits. Commercial farms have also been established for many species used in TCM, with several plant species and vertebrates including Asiatic black bear (*Ursus thibetanus*), sika deer (*Cervus nippon*), musk deer (*Moschus* spp.) and various snake species farmed at commercial scales (Huang & Li, 2007; Meng et al., 2011; Wu et al., 2013). Trade in these species relies on farmed products such as bear bile, deer musk and shed snake skins. Farming of protected wildlife species in China is regulated by numerous laws and regulations, from the national Wild Animal Conservation Law to provincial-level regulations that specify conditions for farming and sources of animals (National People's Congress of China, 2020). Threatened or rare

plant species are also protected by the Regulations of the People's Republic of China on Wild Plants Protection, and wild collection is regulated; however, farming and trade-related regulations are unclear in terms of standards to prevent negative impacts and protect threatened wild populations (State Council of China, 2017; State Food and Drug Administration et al., 2022). In addition to regulations on farming that apply to all protected species, selling of bear bile and deer musk is subject to further specific regulations due to the rarity of these animals; only 33 hospitals in China can sell bear bile and deer musk medicines directly to patients (SFA of China, 2008a), and use of these products in prescription drugs also requires province-level permits from the Medical Products Administration (formerly the Food and Drug Administration) that regulate the types of medicines and quantities to be used. The use of farmed deer musk is further restricted to four drugs produced by five companies, which can only be sold in some certified hospitals (China Food and Drug Administration, 2005).

## 2.2 | Group 2: Wildlife with historical stockpiles

Stockpiles have been established for a second group of TCM products including pangolin scale, saiga antelope (*Saiga tatarica*) horn, and skins of rare snake species protected under the national Wild Animal Conservation Law and relevant CITES appendices (SFA of China, 2007a). These durable products were said to have accumulated in stockpiles before the Wild Animal Conservation Law came into place in 1989. Pangolin scale was removed from the Pharmacopeia medicine list in 2020, but still exists as an ingredient

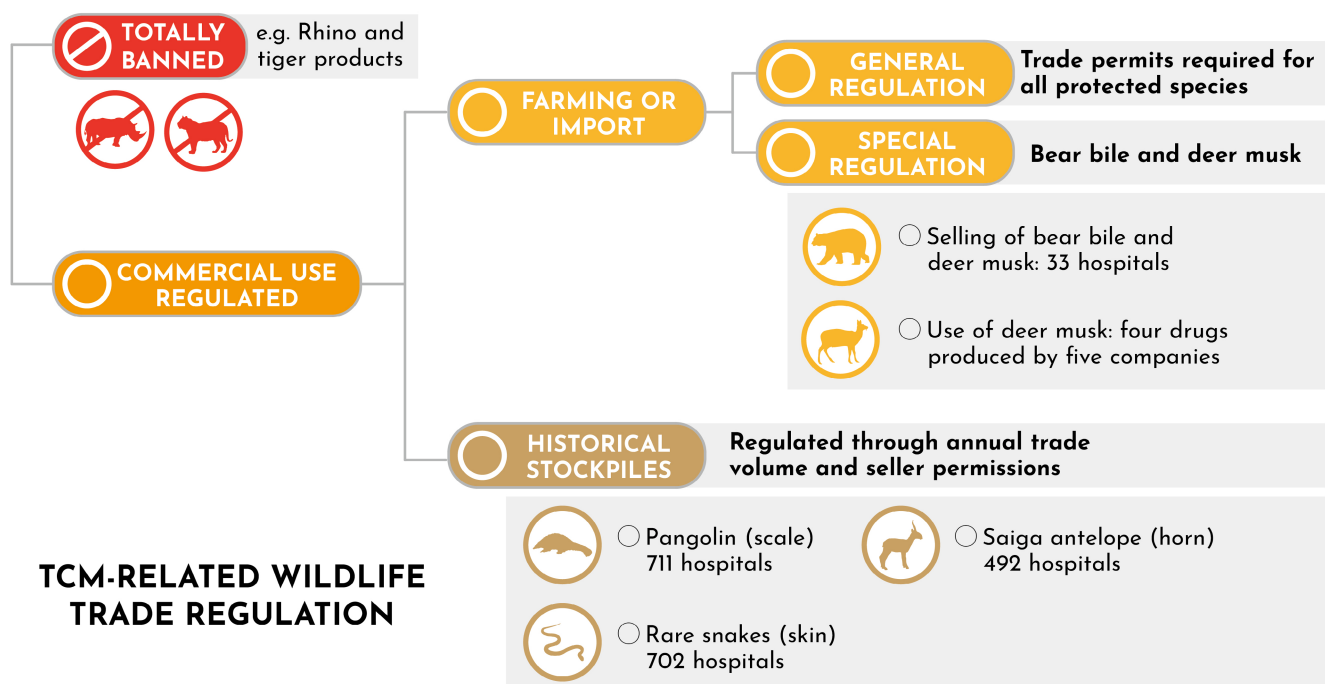


FIGURE 1 Overview of current traditional Chinese medicine (TCM) trade policies on protected wildlife, grouped according to whether they address legal trade (collecting, farming, importing, or reliant upon historical stockpiles) or illegal trade. Designed by Runxi Wang.

in patent drugs in the Pharmacopeia and in the official processing standards released by many local government bodies in China (e.g., Anhui Province, 2019). The impact of this change to on-the-ground practice is unclear.

Volumes of traded pangolin scales, saiga horns and snake skins continue to be regulated by annual quotas that are decided by provincial forestry administration bodies, based upon applications made by stockpile holders on the amounts they intend to use in the coming year. The mean annual quota for pangolin scales was  $26.58 \pm 1.58$  tons from 2008 to 2015, and quotas for snake products were 35.43 tons in 2008 and 36.90 tons in 2009; quota amounts for other years or for saiga horn are not publicly available (SFA of China, 2007b, 2008b, 2009, 2010, 2011, 2012, 2013, 2014). End sellers are regulated, with only 711, 492, and 702 hospitals in China allowed to sell medicines containing pangolin scale, saiga horn, and snake products to patients, respectively (SFA of China, 2008a).

The ongoing COVID-19 pandemic has raised the importance of regulating wildlife trade to a national priority for many countries. At the onset of the pandemic, China quickly established new regulations restricting the national trade of wild animals for consumption or fur (Ministry of Agriculture and Rural Affairs of China, 2020). However, these new regulations did not include species farmed for TCM, so that policies related to TCM farming remain unchanged. As the risk of zoonotic disease transmission will likely be similar across different types of farms, the farming and handling of wild animals for purposes other than consumption or fur, including TCM, therefore also requires further regulation.

### 3 | PROBLEMS

#### 3.1 | Ambiguity in current regulations

Although TCM trade in China is regulated by various levels of laws and regulations, the current regulation system is impeded by non-transparent information and unclear details, weak law enforcement, and a lack of baseline research (Figure 2). For example, most of the relevant information on the stockpile trade (including the distribution of quotas beyond the provincial level, the total amount of remaining stockpiles, and recent annual quotas) is not publicly available. This regulatory approach therefore means that key public stakeholder groups (e.g., scientific and conservation organizations, the general public) are excluded from the policy processes behind many key legislative decisions, including defining the volumes assigned under annual quotas, assessing the suitability of certified hospitals, and issuing permits to manufacturing companies and stockpile holders.

This lack of transparency within the policy process also provides loopholes for corruption and other unlawful behaviors. A recent legal case in 2020 focused on the former head of Beijing Wildlife Protection Station, the gatekeeper responsible for validating stockpile statutes and issuing TCM trade permits for many threatened species including pangolins, saiga, and bears. During a 19-year term of office, this official amassed more than 8 million RMB (~1 million

USD) in bribes and a further 49 million RMB (~6.9 million USD) from uncertain but probably illegal sources (Gao, 2020). Amassing these sums was made possible by the lack of clarity in the regulations for applying for permits and status certificates to use stockpiles. Regulations did not specify conditions or timelines for issuing these permits, meaning that this individual gained full control over whether to allow, reject, or defer applications.

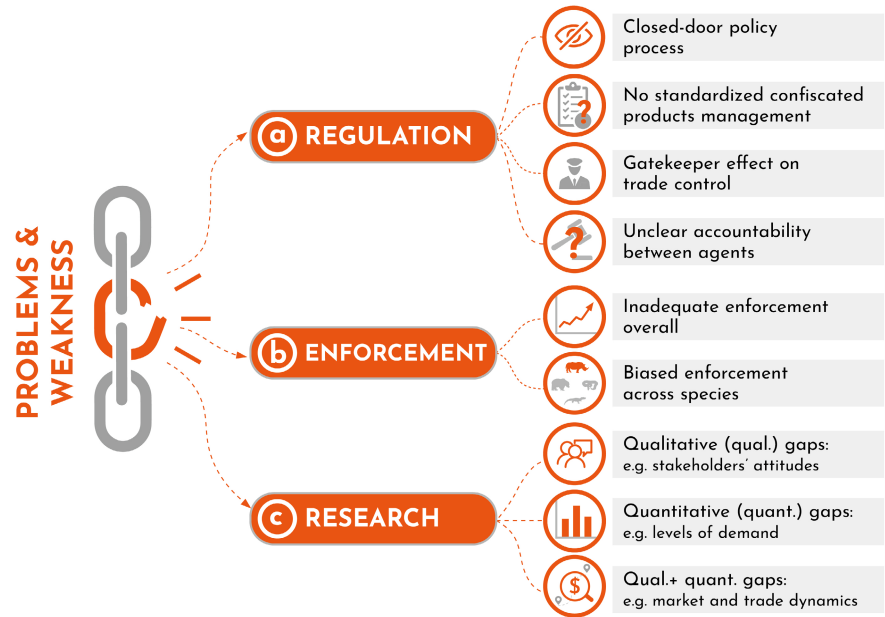
Similar problems also exist for certification of wildlife farming, where there is uncertainty over most of the requirements for obtaining farming certificates, and even over the existing number of licensed farms and animals involved in farming (Hu, 2016). Detailed standards are not publicly available on permitted types of harvest applications or preventive measures to regulate unsustainable harvesting of wild-sourced Class II protected plants. Lack of open access to information also prohibits the public from reporting observed illegal behaviors or supporting correct law enforcement processes.

#### 3.2 | What to do with confiscated products?

China's current trade policy for the management of confiscated products is also unclear, offering further loopholes for corruption and unqualified products to enter the market. Internationally, CITES recommends that confiscated wild-sourced products of species listed in Appendix I should only be reused for scientific, educational, enforcement or identification reasons, whereas confiscated Appendix II and Appendix III products can re-enter trade if no illegal trade will be involved (CITES, 2016b). However, China has no national regulations to standardize management or disposal of confiscated wildlife products, which leads to different management actions and allows certain gatekeepers to have full control of confiscated products, thus enabling unlawful behaviors such as corruption. This is a particular concern for species which have legal markets within China (e.g., pangolin scales and saiga horn), as there are no national laws or regulations that prohibit confiscated products from re-entering the market, or that specify how such products can be legally traded. A record sale of pangolin scales to certified companies by the Bozhou Forestry Administration at auction in 2013 demonstrates that it is feasible for seized products to re-enter markets (Tian Cheng Auction Company, 2013).

In addition to these legal loopholes, a further opportunity for corruption arises from quality control of traded products, in terms of mismatch between species identification and TCM products. Notably, when pangolin scales were formerly listed in the Pharmacopeia, this specifically referred to scales of the Chinese pangolin (*Manis pentadactyla*) (Chinese Pharmacopoeia Commission, 2015). However, identification of different pangolin species from scales is challenging, and species identification is rarely conducted for confiscated scales, providing an opportunity for internationally trafficked non-native pangolin species to enter the TCM market through legal auction after being seized (Cheng et al., 2017). For example, the Bozhou Forestry Administration auction record provided no species information, and just used the general terms "pangolin scales" and "roasted fragmented pangolin scales"

**FIGURE 2** Problems with current traditional Chinese medicine trade summarized across three problematic areas: Ambiguity or loopholes in regulation, weak enforcement, and lack of research. *Designed by Runxi Wang.*



(Tian Cheng Auction Company, 2013). This problem applies not only to pangolin scales but also to other TCM products that might be derived from multiple similar species, or for which species-level identification requires expert knowledge. Furthermore, the quality of confiscated products also requires greater regulation attention in terms of health concerns if they are used as TCM and consumed by the public.

### 3.3 | Inadequate enforcement of TCM trade regulations

Previous studies have shown that illegal TCM trade and products are widespread across China (Li et al., 2007; Xu et al., 2016; Yin et al., 2015). Despite ongoing research attention, efforts to regulate illegal TCM trade of many threatened species in China have not yet been effective. For example, the percentage of shops selling illegal pangolin scale products has not declined significantly during the past 10 years (Challender et al., 2014; Wang et al., 2021; Xu, 2009; Xu et al., 2016). Studies on trade of pangolin scales and saiga horns also show that participants in TCM trade chains, especially end sellers and consumers, have little clear understanding of the illegal aspects of their behaviors or the products they sell or use. Indeed, illegal TCM products are often openly displayed by vendors (Li et al., 2007; Wang et al., 2020). This lack of awareness or concern over illegality, particularly among sellers, suggests that current law enforcement is inadequate and needs to be strengthened for many TCM-traded species.

### 3.4 | More attention on non-charismatic animals and plants

Awareness of existing legislation varies between traded species. Whereas relatively few TCM sellers are aware that products from

species such as pangolins are illegal to sell (Wang et al., 2020), rhino horn has been banned from trade since 1993 (State Council of China, 1993), and recent studies have shown that practitioners, sellers and consumers are well aware of this ban and that rhino products can no longer be traded legally as TCM (Cheung et al., 2018; Cheung, Doughty, et al., 2021; Cheung, Mazerolle, et al., 2021). The demand for rhino horn in China has to some extent shifted from medicinal use to investment and collectible value, differing from the main drivers of trade for pangolin scale and saiga horn products (Gao et al., 2016). Plants have received much less enforcement attention at both the source and end-market levels, despite their much greater use in TCM compared to animal products.

This unequal awareness might reflect different amounts of law enforcement (Paudel et al., 2020), which could have arisen for three possible reasons. Firstly, legal markets still exist for pangolins and some other species, potentially complicating law enforcement and lowering enforcement efficiency. Secondly, charismatic species that attract more conservation attention or higher protection status could be allocated more enforcement resources (e.g., manpower, training) and conservation resources (e.g., education programs, campaigns; Bellon, 2019). Thirdly, species with longer histories of protective legislation might receive more efficient enforcement due to familiarity of law enforcers with relevant regulations; whereas rhino horn was banned in 1993, trade in many other species threatened by TCM has only become recently regulated. However, although these reasons might explain why enforcement effort differs between species, illegal trade should be tackled regardless of such differences or the potential co-occurrence of legal trade for some species.

A further complicating factor is that multiple administrative bodies and departments are often involved in different aspects of law enforcement relating to TCM trade, because TCM wildlife products are also traded and regulated in the wider medicine and TCM product sectors. Trade regulation thus involves the TCM Administration,



the Medical Products Administration, the Forestry and Grassland Administration, and the Administration for Market Regulation. There can be benefits in having multiple departments involved with law enforcement, such as ensuring representative voices from diverse stakeholders and minority groups and thus increasing legitimacy (Sirico Jr, 1980). However, multi-agency management can also cause problems such as unclear division of responsibility and difficulties for cross-agency collaboration (Freeman & Rossi, 2011). These problems can reduce overall enforcement efficiency and lead to weak law enforcement.

### 3.5 | Lack of research to ensure sustainable trade

Although international researchers have long recognized the profound impact of TCM trade on wildlife conservation (Mainka & Mills, 1995), very little research has still been conducted into China's TCM trade, and key basic information remains lacking. There is no complete list of species threatened by TCM demand; there are no quantitative estimates of demand or actual trade volumes available for most traded species; stakeholders' attitudes, drivers of demand, and knowledge about the trade are largely unknown; and the complex and dynamic market and trade systems are understudied (Hinsley et al., 2020). Without a comprehensive understanding of all of these subject areas, there remains no basis for evidence-based policy or development of conservation mitigations. This situation contrasts markedly with baselines of conservation knowledge about many other anthropogenic threats, such as habitat loss or hunting, where such factors are a routine research topic considered integral for informing management planning (Benítez-López et al., 2017). Although the TCM trade is regarded as globally important and in need of urgent management, research is potentially hindered by factors including language barriers, lack of transparent information, and limited available or relevant data. Ethnocentrism might pose a further barrier, whereby TCM might simply be regarded as a superstitious belief that can be tackled by "education" without the need for in-depth research. This view is reflected in many conservation campaigns, which label TCM ingredients such as rhino horn as having no medicinal value (Dang Vu & Nielsen, 2020).

Moreover, whereas most legal TCM wildlife trade involves certified sellers such as hospitals, there has been little attempt to estimate TCM demand from these sellers, meaning that the legal supply cannot be estimated to meet the currently sanctioned market. If demand surpasses the capacity of the legal supply, this could create space for illegal products to enter the market, and create problems for social justice on how limited resources should be distributed (Cummings, 1993). In addition, there have been proposals to use substitutes as a solution for conserving species threatened by TCM, but little research has been conducted to provide evidence about the sustainability of promoting such alternatives. Indeed, one of the few available studies to investigate this topic documented the opposite effect: When saiga horn was promoted as a substitute after rhino horn was banned from trade, saiga populations underwent

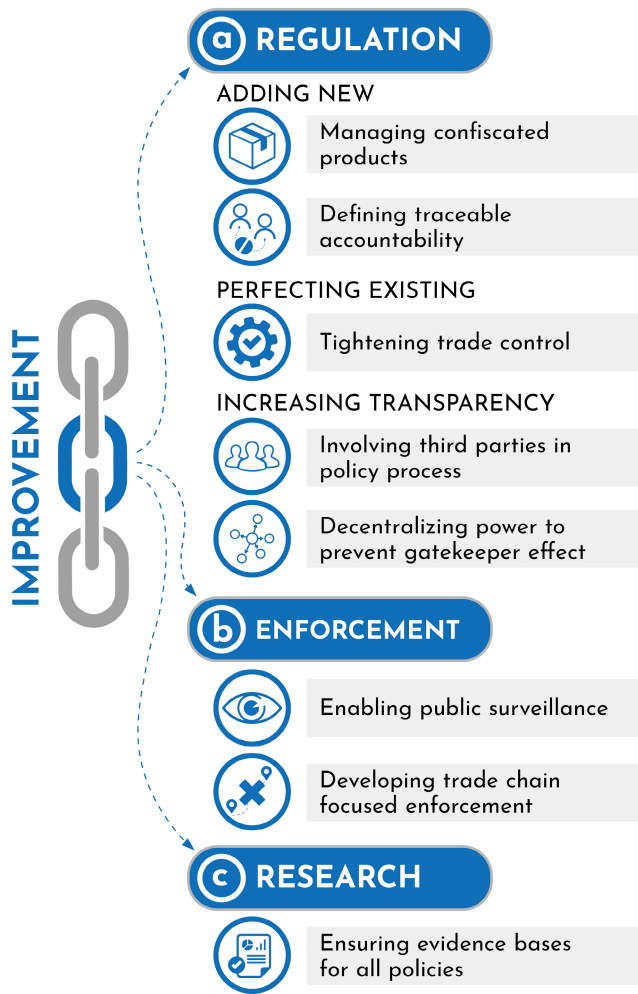
rapid declines (Kitade & Toko, 2016). As the TCM market is currently undergoing rapid expansion onto the international stage, the demand for TCM products is likely to increase in the near future (Hinsley et al., 2020; Lin et al., 2018; State Administration of TCM & NDRC, 2016). However, a lack of background research to understand the status of species traded for TCM has made it difficult to develop regulations to address the sustainability of traded TCM products.

Further basic information is therefore essential to support effective policy and management planning for the TCM trade. Research requirements include, but are not limited to: (i) assessing sustainability of wild-sourced TCM ingredients; (ii) understanding stakeholders' attitudes and knowledge of traded species; (iii) understanding quantitative aspects of the trade, such as levels of demand, sales data and product prices; and (iv) in-depth understanding of market and trade dynamics, particularly for predicting potential impacts of new policy or management decisions such as promoting new substitutes or allowing seized products to re-enter trade. In particular, plant species used in TCM should be given equal attention to the relatively limited set of animal species that are involved. All of the above research directions require in-depth and long-term collaboration with TCM stakeholders, including farmers, practitioners, consumers and TCM-related administrations, and multiple lines of research evidence need to be integrated to guide decision-making.

## 4 | RECOMMENDATIONS FOR REGULATING TCM-DRIVEN WILDLIFE TRADE

The development of a more sustainable TCM trade requires improvements in regulation, enforcement, and research (Figure 3). Firstly, it is essential to fill gaps in the current regulatory framework, and establish clear regulations for how to handle confiscated products. Decisions and policies over whether to dispose of seized products or to allow certain species to re-enter the trade should be evidence based. It is particularly important to understand the potential impact of trade and international trafficking on wild populations. In terms of revising existing policies, more clearly divided accountability of law enforcement staff across multiple agencies is required (Li, 2007). This is important for both efficient enforcement and mutual supervision to avoid the "gatekeeper effect".

More detailed and tightened trade regulations also need to be established and enforced. We propose that a high level of scrutiny and a more clearly defined legal market should be applied to the trade of all threatened species used for TCM. This should be comparable to the current strict source-to-end regulation for musk deer products (SFA of China, 2007a). Restricting the use of TCM products developed from threatened species through specifying applicable symptoms, designating manufacturing companies and seller groups, and limiting annual sale quantity might help to reduce demand to levels that can hopefully be fulfilled by legal and sustainable supplies. Clear specification of permitted drugs or specific target symptoms could



**FIGURE 3** Suggested potential improvements to existing traditional Chinese medicine (TCM) trade. Cross-sector collaboration is needed from policymakers, enforcement agencies, TCM communities and researchers to ensure the trade is sustainable. *Designed by Runxi Wang.*

also help with law enforcement, as it would reduce the complexity of trade and increase the difficulty of fraud through the use of certifications or trade permits if fewer products are involved. Restricting the use of specific products to designated symptoms might also help to minimize overprescribing due to financial incentives, which can be a particular concern for expensive ingredients derived from threatened species (Li et al., 2012). This policy change would require the participation of TCM stakeholders in deciding how best to allocate limited resources and minimize social injustice.

Transparency and publicity of TCM-related regulations and data need to increase (Balla & Xie, 2020). Increased transparency would allow third parties such as conservation organizations and researchers to better understand the trade and provide evidence-based suggestions to improve existing policies or enforcement. This approach can help to decentralize power and prevent gatekeeper effects, and strengthen law enforcement by allowing the public to contribute through reporting observed illegal trade or consciously avoiding illegal behaviors (Kretser et al., 2017). Recent research on trade in

pangolin products has demonstrated that TCM trade participants may have little understanding of relevant policies, which can lead to unintentional illegal behavior (Wang et al., 2020). Key stakeholders participating in TCM trade of threatened animal products should therefore receive more targeted education about existing regulations and sustainable trade, which could be integrated into the existing training systems for TCM doctors and practitioners (Standing Committee of the National People's Congress of China, 2021).

We also recommend that more professional training should be provided to law enforcers on the ground to assist with this process (Ariffin, 2015). Training provided to different groups should differ according to the species involved, the types of products and certification types, permitted quantities, and related system-specific factors. To account for uneven enforcement efforts between different species, such training should not be solely species-focused, but should instead also adopt a trade chain focus (Schneider, 2008). For example, law enforcers could be divided into teams responsible for monitoring and regulating different parts of trading chains, including TCM farms, hospitals and wholesale markets. This approach would provide clear accountability of each agency without duplicating effort and would enable mutual vigilance and collaboration between different agencies when tracking up and down interconnected trading chains.

## 5 | CONCLUSIONS

Building a greener and more sustainable TCM trade is important for both Chinese national development and global biodiversity conservation. Further research and transparent implementation of regulations relevant to both agendas are required to achieve this goal. Therefore, we recommend that both local and international researchers must collaborate with key stakeholders in TCM communities, whose voices need to be heard the most. TCM stakeholders should also be incorporated into the policy processes behind regulating legal trade and combating illegal trade. As the TCM industry expands its coverage and size, such approaches are necessary to mitigate its negative impact on threatened biodiversity.

### ACKNOWLEDGMENTS

We give special thanks to Dr Dan Challender for helping with the development of this project. We thank Runxi Wang for graphic design and Prof Wenda Cheng for proofreading.

### CONFLICT OF INTEREST

There is no conflict of interest to report from the authors.

### DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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#### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Wang, Y., Turvey, S. T., & Leader-Williams, N. (2022). Global biodiversity conservation requires traditional Chinese medicine trade to be sustainable and well regulated. *Global Change Biology*, 28, 6847–6856. <https://doi.org/10.1111/gcb.16425>