Biological Conservation

Title: Making sense of domestic wildlife and CITES legislation: The example of Nepal's orchids

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Abstract

Governing wildlife resources is a global challenge, with illegal domestic and international trade emerging as a leading threat to biodiversity. This has prompted a range of international conservation commitments and domestic legislation, including protected species lists and legislation associated with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Despite their importance, heavy focus on national-level legislation potentially belies the complex networks of sub-national legislation that often inform on-the-ground wildlife management decisions. We highlight the need for a detailed understanding of sub-national legislation in order to meaningfully understand legal and illegal wildlife trade. We demonstrate this using the example of orchids – representing more than 70% of all CITES-listed species – and focus on Nepal, a wildlife trade hotspot. We describe the available evidence on the country's overlapping legal and illegal orchid trade and provide a structured analysis of 55 pieces of domestic legislation that govern the country's orchid resources. It is likely that other countries and taxa face similar levels of complexity, and we propose an approach for more thorough and systematic evaluations of sub-national legislation – across areas of law, hierarchical levels of governance, and types of legislation.

Keywords: CITES management, environmental law, governance, poaching, sustainable harvest, wildlife trade

1. Introduction

Governing wildlife resources remains a huge challenge (Phelps et al. 2016; Sas-Rolfes et al. 2019; Fuller et al. 2020); illegal trade is a key threat to biodiversity (Biggs et al. 2017; Moshier et al. 2019), and legal sustainable use of wildlife resources is often challenging to regulate (Abensperg-Traun 2009). Efforts to reduce illegal trade and support legal trade often focus on strengthening criminal sanctions (e.g., Challender and MacMillan 2014; Biggs et al. 2017; Paudel et al. 2020), and operationalising international commitments and domestic legal frameworks, notably linked to the Convention on International Trade of Endangered Species in Wild Fauna and Flora (CITES) (e.g., Korenblik et al. 2016). These are often vital efforts, but potentially belies the complexity of national and subnational legislation (laws, regulation policies, plans) that govern wildlife harvest, management, trade, taxation, processing, and use.

We highlight the need for a detailed understanding of domestic and sub-national legislation – not only across the hierarchy of legislation but also areas of laws and types of legislation – to meaningfully understand legal and illegal wildlife trade (see Pascual et al. 2021). We do this using the example of orchids, which represent more than 70% of all CITES-listed species (Hinsley et al. 2018). Our study focuses on Nepal, where legal and illegal orchid trade overlap and are governed through a complex network of legislation.

1.1. Legal frameworks governing wildlife resources

Wildlife harvest and trade legislation in many countries are often tightly linked to domestic wildlife and protected areas legislation. They are equally influenced by the national commitments to CITES. Established in 1973, CITES is one of the oldest environmental multilateral agreements and has 184 Parties (CITES 2023). The challenges of CITES implementation are well-documented in the literature (Olsen, 2005; Phelps et al. 2010; Dongol and Heinen 2012; Oldfield 2013). Critically, CITES implementation depends on each signatory country to develop national legislation that operationalizes its commitments; CITES rules have limited legal power in a country unless that government has developed relevant domestic legislation.

Wildlife legislation covers many other areas of law (see Pascual et al. 2021), including a complex legal framework that extends to provincial and site-level rules. Moreover, at least 72 CITES signatory countries have not made the legislative progress needed to meaningfully incorporate CITES commitments into their national legislation (CITES 2021). A strong focus on international commitments and national legislation potentially belies the complexity of sub-national legislative frameworks governing wildlife resources.

We use the example of orchid trade from Nepal to explore how international and national-level CITES legislation abut with a range of other national and sub-national legislation, on which implementation heavily relies (see Laird et al. 2009). We propose that strengthening CITES implementation and wildlife governance requires work to further disentangle various national and sub-national legislation, including guidelines and strategies and sub-national plans that often help govern resources on the ground.

1.2. Orchid trade in Nepal

Orchids, perhaps more than any other plant groups, hold unique legal protections. This includes both international and domestic laws that regulate their wild harvest and trade (see Hinsley et al. 2018). Of the over 30,000 species recorded globally, six species and two genera are on CITES Appendix I. This means commercial international trade in wild plants of these taxa is prohibited (Hinsley et al. 2015), and harvest for trade may also not be permitted at the national level, which is the case in Nepal (Bhuju et al. 2009; Dongol and Heinen 2012; Uprety et al. 2021). The vast majority of orchid species are listed on CITES Appendix II, which allows legal international trade in wild plants if it is regulated and based on Non-Detriment Findings (NDFs), which verify trade will not harm species survival.

Nepal hosts >500 species of orchid and has a long-standing, commercial trade in wild orchids, notably of medicinal species for local uses and international trade (Pant and Raskoti 2013; Subedi et al. 2013; Vaidya 2019). This harvest is an important part of rural livelihoods in many parts of the country (e.g., Tillerman and Smith-Hall 2019), driven by exports mainly to China, India, Southeast Asian countries, North America, and Europe (Larsen et al. 2005; He et al. 2018;

Pyakurel et al. 2019), including for Ayurvedic Medicine (Ghimire et al. 2021) and Traditional Chinese Medicine (Lama et al. 2001).

This trade faces a complex legal status: Some forms of harvest and trade in Nepal are long-standing and pre-date current regulations (Subedi et al., 2013; Chapagain et al., 2021). They then became legal and regulated under the Forest Act and Orchid Collection and Cultivation Directive before facing shifting national CITES regulations. Although a signatory of the CITES Convention for more than 40 years, Nepal only established a CITES Act in 2017 (ratified in 2019). This had profound implications for how orchid species and resources are governed, as the new legislation interacts with various pieces of national and sub-national legislation.

We highlight what is currently known about the nature of the legal and illegal orchid trade in Nepal. This draws on an analysis of the seizure records for illegally traded wild orchids over the last 10 years and analysis of the legal trade data from the CITES Trade Database, while acknowledging the challenges and limitations to documenting wildlife trade. We then conducted a structured analysis of the national and sub-national legislation governing orchid resources in Nepal. We consider what these mean for both the governing of orchid resources in Nepal and its broader illustration of the challenges of implementing wildlife and CITES legislation across the hierarchy of legal frameworks.

2. Methods

To understand legal international trade, we reviewed comparative tabulation outputs from the CITES Trade Database (UNEP-WCMC 2021) for all Orchidaceae exported from Nepal to any importing country (including re-exports), listed under all source, purpose and term codes between 1977 and 2018. We considered all unit codes, using both weight and individual items (unit: blank) to calculate trade volumes. We used exporter reported quantities for all analyses, but also analysed importer-reported quantities to show where there were discrepancies between these figures. It is well-recognised that CITES data are often incomplete, especially for taxa such as plants that are traditionally overlooked (e.g., Phelps et al. 2010); limitations include mismatches in importer and exporter reporting, the use of trade terms differently by different parties and taxonomic reporting errors (see, Berec et al. 2018; Robinson and Sinovas 2018).

However, because they represent the official record of what governments report as legal trade, they provide a baseline against which to recognise possible illegal trade.

To examine illegal trade, we collected seizure records between 2010-2020 for insights into trade dynamics. We reviewed published reports of seizures from Nepal's major English and Nepali language newspapers: The Kathmandu Post, Kantipur daily, Gorkhapatra Daily, The Himalayan Times, and Republica Daily. We used keyword searches in their online databases (terms in English and Nepali: orchids, wildlife trade, plant seizures, "sunakhari", *Dendrobium*, "sungava"). For each case identified, we collected information (as available) on plant origin, trade volume, destination, and the agencies involved. We reviewed identifying characteristics for each case (i.e., dates, sites) and removed any duplicates. We also collected seizure data for the same period by contacting Nepal Police's Central Investigation Bureau (CIB) and Division Forest Offices of Gorkha, Dhading, Nuwakot, Rasuwa, Makwanpur, Chitwan, Kaski, and Manaslu Conservation Area, Annapurna Conservation Area, Chitwan National Park, Langtang National Park within the Chitwan Annapurna Landscape area. We also used the seizure data from Division Forest Office of Kathmandu, Sindhupalchok, Kavrepalanchok, and Dolakha. Of these, 18 cases only mentioned the amount seized with very few details; 6 others did not mention the amount seized (which we excluded from our list) while 4 cases repeated listings of the same case. Also, practitioners confirm that the majority of seizures are likely underreported or misreported as "forest/plant products" (Government official. Pers comm. 21 July 2021). Indeed, there are a number of limitations to seizure data (see Underwood et al. 2013; Paudel et al. 2022); reports are often incomplete and also over-representation of enforcement prioritised species. Seizure records should not be used to estimate trade volumes, but it provides an indication of the active harvest and trade. Nevertheless, especially in the context of trades about which very little is documented, seizure data can provide insights into emerging problems / overlooked illegal trade and enforcement efforts.

To understand legislation governing orchids in Nepal, we collected all national related to forests and wildlife, as well as related provincial legislation for Gandaki province and Bagmati province which covers our study sites, and district-level legislation for three districts (Kaski, Gorkha, and Makawanpur). The province-level documentation refers to legislation prepared after Nepal's

157 decentralisation, but are nevertheless illustrative of provincial documentation across Nepal
158 because these legislation follows a common pattern from province to province. Similarly,
159 district-level legislation, despite different content, follows a fairly standard structure of legal
160 documentation across sites. These three sites were selected as examples for this case because
161 they were centers of Nepal's commercial wild orchid harvest, reported in the literature (e.g.,
162 Subedi et al. 2013; Pant et al. 2018), and confirmed during our field scoping and consultation
163 with experts.
164
165 Documents were obtained from the official websites of the Department of Forest and Soil
166 Conservation (DoFSC), Department of Plant Resources (DPR), Ministry of Forest and
167 Environment (MoFE) and Law Commission, all searched from January to April 2021. We
168 contacted relevant experts (1 leading orchid researcher, 1 national and environmental lawyer, and
169 4 senior government officers in Nepal's CITES Management Authorities and Scientific
170 Authority for flora, Department of Plant Resources to identify further relevant pieces of
171 legislation, and re-consulted with them iteratively check our growing list of legislation. District-
172 level legislation, which is rarely available online, was collected from Division Forest Offices
173 during site visits. This yielded 113 pieces of legislation, including acts, policy documents,
174 directives, regulations, guidelines, and management plans (including their amendments at
175 different times).
176
177 We manually reviewed each document to identify the relevance to the collection, trade and/or
178 conservation of orchids, as most documents were scanned copies in Nepali and not keyword
179 searchable. The detailed review was necessary because, although the term "orchid" was not
180 mentioned in many documents, some mentioned specific orchid species (e.g., Gorkha's 5-year
181 district-level forest management plan mentions *Brachycorythis obcordata* and *Flickingeria* spp.),
182 medicinal plants, non-timber forest products, plants, and/or CITES-listed species. This narrowed
183 our list to 55 pieces of legislation.
184
185 We extracted content from each document, summarising the specific rules related to orchid
186 harvest conservation, and/or trade. We faced a number of confusing/unclear statements in
187 legislation as well as conflicts among documents, which we resolved through consultation with

188 an environmental lawyer and several senior government officials. The research was conducted
189 with permission from Nepal's Department of Forest and Soil Conservation and ethical approval
190 from the Greenhood Nepal's Research Ethics Committee.
191
192 We grouped legislation according to 1) their position in the legal hierarchy (i.e., national,
193 provincial, site-specific); 2) into one of five types of legislation (Table 1), and 3) into one of six
194 themes that describe the major topic covered (e.g., CITES compliance, import/export rules). This
195 provided an overall description of the legislation governing wild orchids in Nepal, though it did
196 not provide specific insights into the reasons why legislation has evolved in specific ways.
197
198 Table 1: Five types of legislation

Legal delineation	**Definition**
Acts	Legally binding, national-level legislation (approved by Federal Parliament and/or President of Nepal) and province-level legislation (approved Provincial Parliament and/or provincial governor)
Regulations, Rules and Notices published in Gazette	Legally binding legislation that helps to operationalise Acts (e.g., the scale of fines, whether quotas must be set, amount of taxes). They can be national or provincial and are usually prepared by the relevant Ministries, with parliamentary/cabinet approvals. The Gazette is the government's official journal of record that lists statutory notices.
Directives, Procedures, Guidelines	Detailed guidance that helps to further implement the specific rules of the Acts and Regulations/Rules/Notices (e.g., the procedure for applying for quotas, harvest techniques). They are generally published by the relevant Ministries and their departments to inform resource users and government officers. Directives and procedures are legally binding. Guidelines are not normally legally binding unless they are a response to and quote a specific article of the acts/regulations (i.e. they explicitly serve to operationalise legally-binding legislation).

Policy and Strategy	Documents that discuss broader, strategic directions for the government at the national and provincial levels. These are usually developed by the relevant Ministries, their departments, and planning commissions. They are generally non-binding but guide priorities, decision-making, and legislation-making.
Action, Management, Work, and Operational Plans	Documents that guide a specific plan of work to achieve a particular management or conservation goal (e.g., species conservation action plan, site management plan, community forest plan). They can be set at any level, but are usually taxa and/or site-specific.

3. Results

3.1. Legal orchid trade in Nepal

Over the period 1977-2016, the CITES Trade Database showed a total of 38 species from 15 genera were exported from Nepal. Only 4 of these genera (*Dendrobium, Coelogyne, Cymbidium, Otochilus*) were reported by Nepal, with all of the remaining genera reported only by the importing countries (*Aerides, Agrostophyllum, Arachnis, Arundina, Bulbophyllum, Calanthe, Gastrochilus, Paphiopedilum, Pleione, Vanda*). This may be an underestimate of genera in trade, as trade was often reported only at the family level.

Recent trade reporting has become more detailed because starting in 2008 the country began reporting with standard units (kilogram). Over the 2008-2016 period, Nepal reported 49,789kg of orchids (importer-reported volume was 44,194kg), with volumes fluctuating across years (Supplementary Table 1). The majority of exporter- reported trade by weight was in stems (40,800kg: 82% of total kg), followed by live plants (7,992kg: 16% of total kg), and a very small amount as dried roots (997kg: 2% of total kg). In addition to trade reported by weight, there were also 18 individual live plants exported.

Contemporary export was limited to only 4 genera, dominated by the genus *Dendrobium*. The vast majority of exported orchids since 2008 were wild-harvested (96% of total kg), with only

4% of total kg (1,699.5kg) from artificial propagation. No CITES Non-detriment findings (NDF) were conducted for wild-harvested orchids over this period, as confirmed by the CITES Focal Point at the Department of Forest and Soil Conservation (Kathmandu); in Nepal, NDFs are currently conducted only for species that have an established quota system (i.e. *Nardostachys jatamansi,* syn. *N. grandiflora,* which is the name typically used in legislation).

Nepal only reported exporting orchids to three countries between 2008-2016: Thailand (80% of total kg, 39,900kg), Switzerland (16% of total kg, 7,992kg), and China (4% of total kg, 1,897kg). However, if we consider importer-reported CITES data, China ranked as the largest importer (36,187kg).

3.2. Illegal orchid trade in Nepal

We identified 36 seizure records between 2010-2020, involving at least 28,315kg of orchids, with volumes ranging from 7 individual plants to 9,364kg (Supplementary Table 2). The seized orchids were reportedly collected from the wild, from forests of central and western Nepal. In one case involving 4,536kg of orchids, the plants were reportedly collected from different parts of Nepal, stored in a central location, and then seized during transport. Indeed, most seizures occurred during transportation, detected at police check posts, except in two cases that were raids on storehouses. They were mostly transported in public buses or trucks, where orchids were bundled in sacks, plastic, or clothes, either on their own or in mixed form with other herbs as camouflage. Several newspaper articles described unique ways used by traders to avoid detection, such as hiding orchids in the engines of buses or storing them in sealed drums. The majority (n=19) of the seizure cases occurred by the police upon a tip-off from their informant or a report from a member of the public. Discussions with experts suggest that this is likely a common pattern, with plants collected across sites and locally aggregated by local nursery owners who not only grow plants but also process and dry wild plants. Plants are then transported to district centres, then to Kathmandu, and on to final destinations.

Only two records had species-level details, both involving the protected species *Dactylorhiza hatagirea* for which all harvest is banned. The largest seizure occurred in Gorkha District, with 75kg of dried *D. hatagirea*, representing a reported 19,538 individuals with an estimated market

value of approximately US$166,280. Several enforcement agencies were involved in the seizures: Division Forest Offices, Central Investigation Bureau, staff at Nepal Police/Army check-posts, and Conservation and Protected Area management agencies. Except for one case that involved both Chinese and Nepali, other seizures involved mostly Nepali nationals from indigenous communities.

Beyond the seizures, we also made a number of observations of illegal trade associated with the misidentification of orchids as unprotected taxa. For example, *Pleione praecox* was harvested and traded at local levels in parts of Central Nepal in the name of "pani amala", the common fern species *Nephrolepis cordifolia* known as Himalayan Gooseberry that is neither protected nor CITES-listed. We also found that local management plans listed certain orchid species as permitted for legal harvest but did not acknowledge that these are in the family Orchidaceae, for which legal restrictions should apply (discussed in Section 3.3.3). Although these cases may be the result of mistaken identifications, it is possible these were intentional misidentifications used in order to evade legal restrictions and taxation. Also, many district-level authorities included orchid species like *Satyrium nepalense and Brachycorythis spp.* in their harvest plans and issued collection permits under the name of "gamdol*",* but not identifying them as orchids. Indeed, the main term orchid in Nepali, "sunakhari", seemed to be associated primarily with some epiphytic orchid species (e.g., *Dendrobium* spp*., Coelogyne* spp., *Pholidata* spp.). The use of other local names (in local dialects) for orchids likely adds to the potential for misreporting, whether mistaken or intentional (e.g., "chhedung", "pumlyaha", "kyasumar").

3.3. Legislation governing wild orchid conservation, use, and trade in Nepal

Nepal has at least 55 pieces of legislation governing orchid resources, both directly and indirectly, across the legal hierarchy, and across different categories of law (Fig.1). This includes legally-binding legislation and "guiding" documents such as strategies and action plans that are non-binding but are nevertheless important to policy and implementation. Legislation were related to seven key themes:1) Constitutional protections, 2) compliance with CITES commitments, 3) Import and export rules, 4) Management and enforcement of natural resources inside and outside of protected areas, 5) Environmental impact assessments, 6) Policing and enforcement, and 7) Designated rights and responsibilities under the Federal system.

Notably, Nepal's Constitution states the intention to conserve, promote, and make sustainable use of forests and wildlife. Following that, Nepal has a number of national legally binding legislation that govern orchid conservation, harvest, and trade. Much of this legislation applies to Non-Timber Forest Products (NTFPs) and plant resources that include, but do not specifically mention orchids.

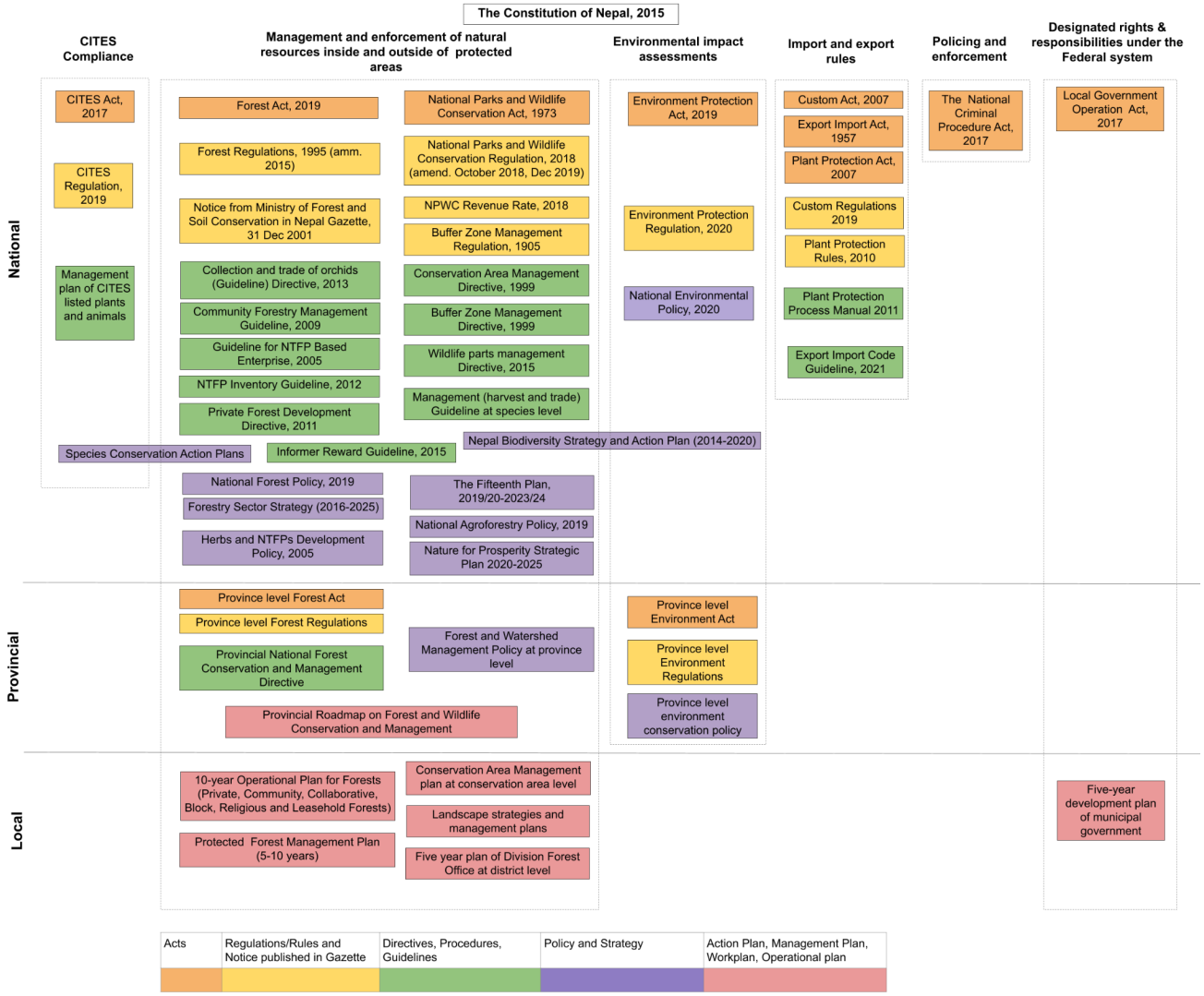

Figure 1: Laws and regulations guiding wildlife trade in Nepal (with a specific focus on orchids)

3.3.1. CITES legislation, and other import/export rules

Nepal joined CITES in 1975 and started documenting international trade records including all Appendix II listed orchids (Supplementary Table 1). Nepal also hosts two Appendix I listed orchids for which international commercial trade is banned (*Paphiopedilum* lady slipper orchids, *P. insigne*, *P. venustum*).

However, it was not until 2017 that it established domestic national legislation to align with CITES commitments. Although CITES aims to ensure that trade is legal, and sustainable, Nepal's original CITES Act 2017 banned wild harvest and trade of all CITES-listed species, including Appendix II species, temporarily shutting down the legal export of all orchids and creating confusion (Article 6 [Cha] and [Chha]). In 2019, amendments to the CITES Act and ratification of the CITES Rules clarified that Appendix II species can be legally harvested and traded, contingent on the preparation and approval of Species Management Plans by the CITES Management and Scientific Authorities (CITES Rules, Article 4 [Ka, 1]). These plans estimate population sizes, identify threats and priority areas and stipulate conditions for sustainable use such as harvestable stocks and techniques (see CITES Rules, Article 22). Such plans have been prepared for some plant species (e.g., *Nardostachys*), but not yet orchids, until which no legal trade can occur. For example, if someone wants to harvest or open a nursery that grows CITES-listed plants, there must first be a Species Management Plan in place nationally, and they additionally require CITES Authority permission (CITES Rules, Article 18). As such, Nepal's domestic CITES regulations not only regulate international trade but also guide in-country conservation and management of CITES-listed species.

Domestic CITES legislation also has provisions of punishments for violating any rules. It is designed based on the CITES Appendix; fine of NPR 100,000 to 500,000, or 1 to 5 years imprisonment or both for Appendix I plant species; NPR 50,000 to 100,000, or 6 months to 1-year imprisonment or both for Appendix II plant species; NPR 1,000 to 50,000, or 1 month to 6 months imprisonment or both for Appendix III plant species (CITES Act, Article 21).

In addition to CITES legislation, Nepal has national-level legislation that governs the import and export of plant material. Customs and export legislation set out general standards related to

product identification, tracking, and taxation. Parallel legislation on plant health and pest control provides few additional regulations, but does set a minimum level of genus-level identification for exported plants/plant products (Plant Protection Act, 2007).

Table 2. Examples of key domestic legislation governing orchids (Full summary in Supplementary Table 3)

Constitutional principles
Constitution of Nepal 2015 It envisions to conserve, promote, and make sustainable use of forests and wildlife (Part 4, Article 51, g, 5).
CITES compliance
CITES Act, 2017 and CITES Rules 2019 ▪ Regulate the conservation, harvest, and trade of the CITES-listed species. ▪ State that harvest and trade are only possible if Management Plans have been prepared by the CITES Scientific and Management Authorities with setting quotas. No such plans have yet been prepared for any Orchid species. ▪ List sanctions for violations: For Appendix I-listed species, NPR 100,000- to 500,000 (USD835-4175), or 1 to 5 years imprisonment or both. For Appendix II-listed species, NPR 50,000-100,000 (USD417-835), or 6 months-1-year imprisonment, or both.
Import and export rules
Customs Act, 2007 and Custom Regulations, 2019; Export Import Act, 1957 ▪ Do not mention orchids or plants, but cover general import-export rules, including for forest products. ▪ State conditions for legal trade, including that shipments should comply with CITES legislation, and be properly tagged to enable the proper tracking of shipments (and necessary paperwork) from exporting countries.
Plant Protection Act, 2007 and Plant Protection Rules, 2010 ▪ Focus on plant quarantine and the prevention of biological pests during the import/export of plants and plant products

- State requirements for tracing signs/codes, phytosanitary certifications of plants or plant products.
- Require a minimum of genus-level identification for plants and plant products.

Management and enforcement of natural resources inside and outside of protected areas

Forest Act 2019 and Forest Rules 1995

This Act does not include anything specific to orchids but it addresses forest products inside all forests. It specifies that the use, sale, and distribution of forest products (including timber, wood, and NTFPs) shall be made as prescribed and only after the permission of Division Forest Office Plans (Section/parikched 10, 36 (2)). This likely refers to rules set out in local management plants. Based on this legislation, the Government of Nepal has banned the harvest and trade of orchid sp. *Dactylorhiza hatagirea*.

It also sets a national taxation rate for NTFPs. For orchids, it specifically sets taxation for

- *Dactylorhiza hatagirea* taxed at NPR500 per piece [Khanda (cha) Article/anuchuchi 3, (ka, no. 25), page 6]. The rate is doubled if it is harvested for export
- Gastrodia elata taxed at NPR10 per kilogram [Khanda (ka, no. 54), page 3]
- Rates are tripled for export (Article 3, Summary, SN 3, page 10)

National Park and Wildlife Conservation Act and Its Regulation

It applies primarily inside the protected areas. It has a provision that no one can harvest and harm wildlife including plants inside the protected area without obtaining written permission from the authorized official (Article 5). Each protected site has its own regulations approved by the Department of National Parks and Wildlife Conservation (Article 3). Unlike animals, there are no separate provisions of sanctions for illegal harvest and trade of plants and orchids inside the protected areas. In such cases, the prevailing rules apply (i.e., CITES Act, Forest Act). If the offense is not described in other laws, imprisonment of up to six months and a fine of up to NPR 20,000 (USD163) applies (NPWC Act, Article 26.6).

Regulations of each protected area

Each of the protected areas has its own regulations and management plans which control the conservation and use of wildlife including orchids. For example,

- Himali NP Regulation, 2009 (first amendment 2014) provisions the harvest and trade of NTFP are allowed for a maximum of 30 days/ /harvest season/year. However, this excludes

banned/restricted species and species that do not have a national CITES Management Plan. They also collect royalty and other permission from the Division Forest Office (Article 24, Ka)

- Panchase Protected Forest (2012) was established specifically to protect orchid species. Does not allow for the harvest of orchids at this site

Conservation Area Management Directive, 1996

It mentions NTFPs but does not specifically mention orchids. It sets out rules for the formation, rights, and duties of the user group and says that they should work in collaboration with the Conservation Area and their operation plan, and collection permit should be authorized by the Conservation Area authority

Buffer Zone Management Directive, 2015

It does not specifically mention orchids, but mentions user groups (e.g., Community Forest User Group) that have rights to use and conserve resources in these sites, including NTFPs. It states that harvest must follow the user groups' guidelines

Collection and trade of orchids (Guideline) Directive 2013 (2069)

Promotes the commercial cultivation of orchids in Nepal (see Supplementary Table 3). It includes provisions for wild orchid harvest, including the orchid inventory and site selection, provisions for block divisions, collection/harvest, and commercial development.

Guideline for the collection and trade of NTFPs (2073 BS) 2016 AD

The guideline sets methods for developing NTFP inventories for Five Year Plans of the Division Forest Office, but does not mention orchids specifically (see Supplementary Table 3)

Five Year Plans of Division Forest Office, Gorkha (district level management plan) and Ten-Year Operational Plans for Forests (site-level, by Community forest User Groups)

Management of the forests outside protected areas are governed by Five Year Plans of Division Forest Office at district level for the government managed forests, and community forests are governed by its Ten-year Operational Plan. It also includes orchid species conservation and harvesting plans. Species that are not listed in the plans cannot be harvested and traded.

For example,

- Five Year Plans of Division Forest Office, Gorkha (2021) mentions specific orchid species as plants that can be legally harvested, but does not recognise that these are in the family

Orchidaceae (e.g., "gamdol" harvest [*Brachycorythis* spp., probably *B. obcordata*] is permitted). For each species, they also identify the total stock and harvestable amount, and where the resources are located within the District. They also allocate a certain amount of taxation as per Forest Act, a protocol for harvest and harvesting seasons

- 10 Year Operational Plan of Bhume Mantuli Devisthan Community Forest in Dharche Ward 4, Gorkha District (2075/76-2084/85) states orchid stock and harvestable quotas, which we interpret as: the available orchid ("sungava", all orchid species) stock is 400kg (equivalent to 140kg dry weight), of which 40% is allowed for harvest and trade, twice a year.

Environmental impact assessments

Environment Protection Act 2019 (2076) and Regulations 2020

Establishes requirements for conducting environmental impact assessments for the harvest and process of forest products including orchid species

Policing and enforcement

The National Criminal Procedure Act, 2017

Identifies wildlife trade crimes as having high importance. It states that once cases are filed in court, they cannot be withdrawn. It is not clear if this applies to plants, but plants and orchids are not specifically mentioned.

Designated rights and responsibilities under the federal system

Local Government Operation Act, 2017

This Act does not specifically mention orchids, but it mentions details on the natural resource use/revenue generation, including NTFPs at the local level

Five-year management plans of municipal government

Municipal governments at the local level prepare a five-year development plan and yearly work plan. This plan directs the local development and management of the resources.

For example:

- Dharche Rural Municipality Five-year Plan (2019 - 2024): This FYP indicates that they will promote NTFPs including orchids cultivation and trade (specifically "gamdol", *Brachycorythis* spp.) to support local livelihoods (Article 6.1.5)

- Policy and Program of Annapurna Rural Municipality 2020 prioritizes the cultivation and promotion of medicinal plants for research, conservation, and eco-tourism development (strategy 1.10)

3.3.2 Governing orchids inside protected areas

Orchid governance includes legislation spanning inside and outside protected areas. Inside protected sites, The National Park and Wildlife Conservation Act (NPWC) 1973 prohibits any wildlife harvest inside National Parks and Reserves. This is further reiterated in a number of site-specific management plans, some of which specifically highlights the conservation and research of NTFPs, particularly orchids. For example, Panchase Protected Forest was designated in order to protect its orchid diversity. No legal harvest is allowed, although the Central Government conducted an evaluation of the value/supply chain of orchids of Panchase (MoFSC, 2014). The Chitwan Annapurna Landscape Strategy and Action Plan 2016-2025 recognises that orchid species are highly threatened with small or declining populations due to poaching, unsustainable harvesting, or other ecological threats such as extensive habitat loss or degradation and climate change (pg. 32), yet calls for science-based management of orchid resources (pg. 47). These studies likely reflect the on-the-ground realities of orchid harvest, even in and around protected areas.

Violations of the Act inside protected areas are enforced by park rangers and the Nepal Army and are heavily sanctioned (see Paudel et al. 2020). However, no sanctions are listed for plants, unlike for fauna for which species-specific penalties are listed. Instead, the Act references that other prevailing Acts should apply. For orchids, this would be the CITES Act and Forest Act or, if the offense is not described, then the sanction shall be imprisonment for up to six months and a fine of up to NPR 20,000 (NPWC Act, Article 26.6).

The NPWC Act also regulates Conservation Areas and Buffer Zones, where it allows and regulates NTFP harvest relevant to site-level plans. National regulations subsidiary to the Act governing buffer zones and conservation areas are also very general, stating that harvest should follow local plans set by site managers and/or local Buffer Zone or Community Forest User Groups (BZFUG, CFUG). For example, Api Nampa Conservation Area Management Plan

estimates a stock of 2,632kg of *Dactylorhiza hatagirea* across the entire protected area and sets the harvestables amount at 1,974kg annual harvestable quantity (draft, 2022-2026, section 9.2). It also references a stock of 54 kg of “orchids" (various species), yet sets the harvestable amount at 410kg annual harvestable stock of Orchids (in SN 42)-presumably a mistake. However, the plan also clearly states that no harvest permit will be provided for species that are banned for collection and trade by other legislation.

3.3.3 Governing orchids *outside* protected areas

Two key pieces of national legislation govern orchid harvest outside of protected areas, including on national forests, private lands, and community forest areas, are the CITES Act 2017 (discussed above) and The Forest Act 2019, with further subsidiary Regulations, Directives/Procedures/Guidelines, Provincial Acts, and many site-specific plans.

The Forest Act does not mention orchids specifically, but sets out broad provisions for the legal harvest of timber and NTFPs. It states that these should follow CITES legislation (thus including orchids), and site management plans, notably the Five-Year Plans prepared by Division Forest Offices, and 10-year operation plans prepared by different forest users groups, as approved by the corresponding Provincial or Division Forest Office. The regulation is more specific about setting specific taxation rates for orchids in general, and for two orchid species of high historical economic importance (*Gastrodia elata* and *Dactylorhiza hatagirea*) these rates are tripled for plants intended for export (Table 2). Subsidiary documents, including the National Forestry Policy 2019 and Forest Sector Strategy 2016-2025 actively promote sustainable harvest and trade, but provide no guidance on orchids.

The Management Plan 2021 of Division Forest Office of Gorkha is an example of one of these site management plans that mentions specific orchid species as plants that can be legally harvested, and also sets the taxation as per the Forest Act. However, it does not recognise that these are in the family Orchidaceae (e.g., “gamdol” harvest is permitted, i.e. *Brachycorythis* spp., *Satyrium* spp., possibly other terrestrial orchids). For each listed species, they also identify the total stock and harvestable amount, and where the resources are located within the District (site names, not mapped). These are reportedly developed using the national NTFP Inventory

Guideline 2012, which includes methods for establishing inventories based on predictions informed by past/current trends and the establishment of sample plots. However, informal discussions with practitioners at several sites make clear these methods are referenced, but are not actively used in practice.

The 10-year operational plan of Bhume Mantuli Devisthan Community Forest in Dharche 4, Gorkha (2075/76-2084/85) also includes orchid harvest (sunghava) (in SN. 4). It estimates an orchid density at 800kg/ha, and a total available stock in the community forest of 400kg fresh weight (140kg dry weight). They set the harvest quota at 40% of available stock for harvest two times annually (i.e. 320kg/year).

A notable exception is *Dactylorhiza hatagirea,* the only orchid species specifically mentioned in legislation outside of the CITES Act 2019; the Forest Regulation 2015 and the Notice from the Ministry of Forest and Soil Conservation 2001 banned trade, production, and trade of this economically valuable medicinal orchid. For other orchid species, the Collection and Trade of Orchid (Guideline) Directive 2013 is the only document that promotes the cultivation; it granted two companies permission to commercially produce orchids for export (trade listed in CITES data, Supplementary Table 1). The Directive also promotes the harvest and trade of wild orchids, guides managers to develop inventories of wild orchid stocks, instructs that sites should be divided into "blocks" for harvest on a 5-year rotation, and orders for royalty payments to the Division Forest Office. However, these local plans must now comply with the additional requirements of the recent CITES Act 2017.

Any violations operate in parallel with the Criminal Procedure Act 2017, which governs the investigation and prosecution of all criminal acts, including illegal wildlife harvest and trade. Wildlife crimes are designated as "high priority" crimes that cannot be compromised, mediated and withdrawn once submitted to the court, although it is unclear whether plants are included under the definition of wildlife.

3.3.4. Environmental Assessments

The Environmental Protection Act stipulates that Environmental Assessments must be conducted

on projects likely to impact physical, biological, socioeconomic, and cultural environments, to determine the scales of impact and possible mitigation (Bhatta and Kahanal, 2009). Assessments are thus required for extractive activities, including timber and NTFP harvest, and the development of plantations and medicinal plant nurseries and processing units. Assessments are also referenced in parallel legislation, including the Collection and Trade of Orchids (Guideline) Directive.

Nepal has a tiered approach to assessments, determined by the scale and sensitivity of the project; Environment Impact Assessment (EIA), Initial Environmental Examination (IEE), and Brief Environmental Study (BES). It has no specific provisions for orchid species though in the case of NTFPs, this is determined by the volume of harvest in particular sites (EPR, Article 3). EIAs are required for large-scale harvest of forest-based products (e.g., > 50 metric ton of roots; > 150 metric ton of bark or leaf or stem or flower, > 200 metric ton of fruit or seeds), all the harvest less than this requires an IEE (EPR Schedule 1, 2 and 3). Where EIAs are approved by the Federal Government, IEEs are approved by the provincial government or concerned government departments, and BESs are approved by the local government.

3.3.5. Designated rights and sub-national management

A number of pieces of national legislation (Table 2) reference the establishment of local-level management plans, to direct wild harvest of timber and non-timber forest products–both within and outside of protected areas, and at the landscape, province, district, or municipal or site/forest-level (Table 2, Supplementary Table 3). This local autonomy over resources was strengthened in 2015, with Nepal's transition to a Federal system that increased decentralisation (Local Government Operation Act, 2017). This open the potential for wide diversity in sub-national management plans, a number of which mention NTFPs and orchids, and reflect different levels of detail and management approaches, although the types and structure of legislation are similar across sites.

At the provincial level, legislation is often also general. It employs similar (or copied) language to national-level legislation, and delegates responsibility for management to local management plans and concerned authorities, implicitly the Division Forest Offices that operate at the

District-level. For example, Bagmati Provincial Forest Policy, 2019 states that forest products can be traded as instructed by the concerned authority (Article 18, 1-4); herb research centers can be established (Article 21), and commercial cultivation of herbs is allowed. However, taxonomic groups are not indicated. Moreover, a number of the reviewed sub-national plans used local names that correspond to the orchid family ("sungava" or "sunakhari"), and one term to refer to multiple genera of terrestrial tuberous orchids ("gamdol", including *Brachycorythis* spp. and *Satyrium* spp.).

Below the district-level legislation includes Five-year Municipal plans and strategies that often mention NTFP harvest. For example, the Dharche Rural Municipality Five-year Plan identifies specific orchid species for harvest, notably "gamdol" (*Brachycorythis* spp. *Satyrium* spp., or all tuberous orchids) to support livelihood development.

4. Discussion

4.1 Illegal trade of CITES-listed species

Even for one of the most – on paper – protected groups of CITES-listed species, the results highlight illegal commercial-scale, but largely undetected, regional trade, as noted in an emerging literature on the subject in Nepal (e.g., Pyakurel et al. 2019; Chapagain et al. 2021). This is evidenced by the seizures which, although relatively few in number, clearly reflect a large-volume trade (see Supplementary Table 2). Moreover, some of the smuggling strategies described in the seizures suggest that traders are going to considerable effort to trade wild orchids and avoid enforcement detection – strategies also described in other studies of wild plant trade in Nepal (e.g., Pyakurel et al. 2019). The large volume of wild orchid imports reported by China – but which were not reported by Nepal as legal exports – also suggests an illegal, commercial orchid trade between those countries (see Supplementary Table 1). Indeed, Nepal's porous borders with India and China have been widely documented as facilitating unregulated cross border trade for many other taxa (Pyakurel et al. 2019; Kunwar et al., 2020; Chapagain et al. 2021), and this is likely the same for orchids. Collectively, this evidence highlights that existing wildlife governance, even for CITES-listed species, faces many challenges on-the-ground. Although possibly compliant with some sub-national guidelines in Nepal, this trade violates national-level legislation and the country's international CITES commitments.

The data does not provide a clear explanation for how or why Nepal has this large unregulated trade, but the literature highlights that government corruption, bureaucratic controls, and collusion are often involved in illegal trade for multiple taxa in and through Nepal including both timber (Adhikari 2015; Basnyat et al. 2022) and medicinal plants (Larsen et al. 2005). This is likely to apply to orchids as well. However, corruption and collusion probably do not fairly or fully explain illegal wild orchid and plant trade in Nepal. In the following sections, we discuss the challenges of understanding, prioritising, and operationalising complex legal wildlife trade frameworks – especially when looking beyond just CITES legislation to also consider subnational governance; for diverse taxonomic groups that present identification challenges, and especially for plant groups that have been traditionally overlooked relative to fauna.

4.2 Complex framework, beyond just CITES

The focus of wildlife trade governance is usually narrowly on CITES implementing legislation and a small number of other national-level laws, but our analysis revealed 55 pieces of legislation immediately relevant to orchid harvest and trade. These cross different areas of law and many agencies across the hierarchy, governing orchid harvest and trade in a seemingly disjunct incrementalist fashion that characterizes much policymaking (Lindbolm 1959; see Atkinson 2011). This forms a surprisingly complex framework (Table 2). Indeed, throughout discussions with experts, traders, and officials in Nepal, no one could articulate Nepal's current rules for the orchid trade (Greenhood Nepal 2021).

Governance of orchids was made significantly more complex by the addition of the 2017 CITES Act, which, in an attempt to internalise CITES commitments into national legislation, initially banned all trade in Appendix II species, including all orchids. The law's revision now again allows for trade of Appendix II species, contingent on the development of a national-level management plan for each species (none yet exists for orchids). However, such national-level changes have not cascaded down to sub-national legislation or policy documents, some of which encourage conservation but continue to actively promote harvest and trade in the name of allocated harvest quotas. The resulting legal framework has apparently confused enforcement bodies, site managers, and both legal and illegal traders. It is likely that, in many cases, the

changes are not widely communicated to all of the relevant stakeholders, and the researchers' own struggle to clarify relevant rules highlights the confusion and challenges facing practitioners.

These national-level policy developments are potentially promising because they could improve compliance with international commitments and improve social and environmental outcomes through the purported promises of "scientific forestry". This is particularly important for taxa like orchids, many species of which can be highly sensitive to overharvest, have limited available data, and for which management of wild populations likely requires considerable research and technical support (e.g., orchids, Ticktin et al. 2023). However, increasing technical demands should not be used as an excuse for centralisation merely increases bureaucratic control over local resources, introducing expensive and bureaucratic barriers to participation in forest management while yielding few benefits (Baral et al. 2018; Basnyat et al. 2020).

Indeed, there is no reasonable expectation that the current framework could be successfully navigated by practitioners, or achieved affordably or on reasonable timescales (see Basnyat et al. 2022). This is a particular concern given that many NTFP harvesters in Nepal are poor (Ghimire et al., 2021) and most of the identified orchid seizures involved Indigenous marginalised communities (Supplementary Table 2), while sub-national plans that reference orchid harvest usually does this with a focus on improving rural incomes (Supplementary Table 3). The current legal complexity seems likely if unintentionally to encourage illegal trade and corruption because the regulations are too difficult to understand, technical demands are not realistic and processes are bureaucratically complex. Moreover, it likely overlooks the potential for traditional knowledge and management regimes, which are known to exist for some orchids and could inform contemporary management (cf. Rutt et al. 2015; Ticktin et al. 2023). There is a need for science-based, but also locally-accessible, pragmatic, and fair processes for improving the management of wild orchid resources (see Ticktin et al. 2023), as well as for reviews of legislation that grant harvesters greater involvement and stakes in sustainable management of wild plant resources (Larsen et al. 2005).

4.3 Responsibility shifted to local site managers

Much of the reviewed legislation was dominated by statements that deferred technical decisions to the sub-national level actors – usually forest department bureaucrats and Community Forestry Chairs. For example, the Forest Act 2019 and Buffer Zone Management Directive 2015 both state that NTFP harvest should be done in compliance with local harvest rules. National acts, regulations, and policies mention principles of sustainable harvest but provide no guidance. As a result, site-level managers are responsible for identifying orchid stocks and quotas, but without clear methods, quota-setting for plant harvest in Nepal is often not based on robust science (Timoshyna and Drinkwater 2021). This places not only burdens but also disproportionate power into the hands of forest sector bureaucrats who, in other contexts in Nepal, have been known to abuse their position aided by technocratic discourse (Basnyat et al. 2020). In fact, there is very little published information on sustainable orchid harvest globally, although based on the limited information available from proposed quotas and observations of seizures and in the field, sub-national harvest quotas in Nepal are greater than what is likely sustainable (see Ticktin et al. 2020; Ticktin et al. 2023). Some local managers are also including orchids in their management plans listing them as other, non-orchid taxa (e.g., Bhume Community Forest10-year Operational Plan, Table 2), placing it beyond national requirements.

Yet, the legislation also includes a constant, if generic, instruction that sub-national rules must be compliant with other existing national legislation. As mentioned, the new CITES law mandated national-level Species Conservation Action Plans, though none has been established for any orchid species. This means that site managers are not currently legally able to meet their local responsibilities, although they continue to actively develop such plans.

4.4 Coarse taxonomic identification and reporting

Management challenges are exacerbated because of the coarse nature of taxonomic identifications and data reporting. Orchidaceae is a taxonomically challenging group whose identification is based primarily on floral characteristics, yet plants are often traded without flowers and as dried pseudobulbs/stem making identification challenging or impossible (see Phelps and Webb 2015). It is unsurprising that many species are misidentified, although we also observed intentional misidentifications (e.g., of *Pleione praecox*) and legislation that grouped all orchids or all terrestrial orchids together (e.g., “gamdol”, “sungava”). This precluded the ability

to comply with national legislation, such as the CITES Law that requires species-level identification, and the plant trade legislation that requires a minimum of genus-level identification (Plant Protection Act 2007, Plant Protection Rules 2010). It also limits species-level CITES Non-Detriment Findings and the reporting required for CITES Annual Reports (Robinson and Sinovas 2018).

Taxonomic challenges aside, there is very limited monitoring and reporting of the orchid trade. Sub-national quotas, although referenced in legislation, do not have mechanisms for inspection or reporting, nor is there related guidance (Table 2). At the national level, the CITES data highlights reporting mistakes that do not meet reporting requirements or expectations (Supplementary Table 1). This includes not only a lack of species-level reporting but significant mismatches in reporting between Nepal and importing countries. This is likely due to related challenges, but potentially provides a convenient technical excuse for non-enforcement and abuse of the rules (cf. Basnayat et al. 2020).

4.5 Improving orchid governance

Although orchids are the largest group of CITES-listed species, and have unique legal protections in many countries (see Hinsley et al. 2018), the governance of the orchid trade is a global issue that has received comparatively little attention. This overview highlights some of the key challenges to improving their governance, in Nepal and other countries where they are commercially traded, from Mexico to China. Notably, there is a need to align for more accurate species-level reporting, which requires new, more accessible resources for practitioners to identify them. For the legal harvest, it also requires the ability to conduct Non-Detriment Findings, set quotas, and undertake IUCN Red List assessments, which is exceedingly difficult with available science for many traded species (Hinsley et al. 2018). Moreover, these types of knowledge are needed not only among national-level authorities but also need communicating to the range of sub-national stakeholders (provincial, district, community) where most harvest decisions are made.

5. Conclusion

CITES plays a central role not only in regulating international wildlife trade but also in shaping domestic management of protected species, influencing quota setting, and defining priorities and methods. Across taxa, this has prompted a considerable focus on national-level CITES reporting (e.g., Phelps et al. 2010; Robinson and Sinovas 2018) and national CITES implementing legislation (e.g., Nepal, Dongol and Heinen 2012; Morocco, Bergin and Nijman 2014; Colombia and Brazil, Goyes and Sollund 2016). However, there remains little attention to how these national frameworks interact with the sub-national legislation that contends with the complex, socio-economic realities of harvesting communities (Sas-Rolfes et al. 2019). This legislation governs a range of provincial, district, and site-level procedures and management decisions that also shape local bureaucracies, the allocation of power and rights that affect local access to resources (see Basnyat et al. 2020) and that ultimately shape wildlife outcomes (see Laird 2009; Pascual et al. 2021; although see Mexico, Arroyo-Quiroz et al. 2005; China, Li 2007).

We highlight the complexity of this domestic legislation, which was far greater and more complex than the researchers had expected. There is a clear need to harmonize not only national legislation with CITES commitments, but to link national laws with sub-national legislation and implementation – cognisant of cascading impacts on roles, rights, budgets, policies, and power dynamics. It is likely that other countries and taxa face similar levels of complexity, and we propose an approach for more thorough and systematic evaluations of sub-national legislation– across areas of law, hierarchical levels of governance, and types of legislation.

If academics and policymakers cannot understand legislation to disentangle what trade is considered legal or illegal, we cannot reasonably expect end-users to comply with wildlife legislation.

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8. References

Abensperg-Traun, M., 2009. CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. Biol. Conserv. 142, 948–963.

Adhikari, K., 2015. Perception or reality? A case study of corrupt practices in the forestry sector in Nepal. *European Bulletin of Himalayan Research* 46, 9-34.

Arroyo-Quiroz, I., Perez-Gil, R., Leader-Williams, N., 2005. Developing countries and the implementation of CITES: The Mexican experience. *Journal of. International. Wildlife. Law Policy*, 8, 13–49.

Atkinson, M.M., 2011. Lindblom's lament: incrementalism and the persistent pull of the status quo. *Policy and Society,* 30,9-18.Baral, S., Meilby, H., Chettri, B.B.K., Basnyat, B., Rayamajhi, S., Awale, S., 2018. Politics of getting the numbers right: Community forest inventory of Nepal. *Forest Policy and Economics*, 91, 19-26.Basnyat, B., Treue, T., Pokharel, R.K., Baral, S., Rumba, Y.B., 2020. Re-centralisation through fake Scientificness: The case of community forestry in Nepal. *Forest Policy and Economics,* 115, 102147.Basnyat, B., Treue, T., Pokharel, R.K., Shreshta, G.K., Kyastha, P.K. 2022. Conservation by Corruption: The Hidden Yet Regulated Economy of Nepal's Community Forest Timber Trade. Available at SSRN 4177641.

Bergin, D., Nijman, V., 2014. Open, unregulated trade in wildlife in Morocco's markets. *Traffic Bulletin* 26, 65-70.

Berec, M., Vršecká, L., Šetlíková, I., 2018. What is the reality of wildlife trade volume? CITES Trade Database limitations. *Biological Conservation*, 224, 111–116.

Bhandari, P., Shrestha, K., Subedi, C.K., 2020. Orchids of Panchase Forest , Central Nepal : A Checklist. *Journal of Plant Resources* 18, 143–156.

Bhatt, R.P., Khanal, S.N., 2009. Environmental impact assessment system in Nepal–An overview of policy, legal instruments and process. *Kathmandu University Journal of Science, Engineering and Technology*, *5, 160-170.*

Bhuju, U.R., Aryal, R.S., Aryal, P., 2009. Report on the Facts and Issues on Poaching of Mega Species and Illegal Trade in Their Parts in Nepal Transparency International Nepal.

Biggs, D., Cooney, R., Roe, D., Dublin, H.T., Allan, J.R., Challender, D.W.S., Skinner, D., 2017. Developing a theory of change for a community-based response to illegal wildlife trade. *Conservation Biology*, 31, 5–12.

Challender, D.W.S., MacMillan, D.C., 2014. Poaching is more than an enforcement problem. *Conservation Letters,* 7, 484–494.

Chapagain, D.J., Meilby, H., Baniya, C.B., Budha Magar, S., Ghimire, S.K., 2021. Illegal harvesting and livestock grazing threaten the endangered orchid *Dactylorhiza hatagirea* (D. Don) Soó in Nepalese Himalaya. *Ecology and Evolution,* 11, 6672-6687.

(CITES) Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2023.List of Parties to the Convention. URL: https://cites.org/eng/disc/parties/index.php . Accessed 03 February 2023.

(CITES) Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2021. Status of Legislative Progress for Implementing CITES. URL: https://cites.org/sites/default/files/LAC/Legislative_status_table_October_2020.pdf. Assessed 20 Oct 2021.

Davenport, T.R.B., Ndangalasi, H.J., 2003. An escalating trade in orchid tubers across Tanzania's Southern Highlands: Assessment, dynamics and conservation implications. *Oryx* 37, 55–61.

Dongol, Y., Heinen, J.T., 2012. Pitfalls of CITES implementation in Nepal: A policy gap analysis. *Environmental Management*, 50, 181–190. Fuller, A., Decker, D.,

Schiavone, M., Forstchen, A., 2020. Ratcheting up rigor in wildlife management decision making. *Wildlife Society Bulletin*, 44, 29-41.

Ghimire, P., Pudasaini, N., Lamichhane, U., 2021. Status, prospects and challenges for non-timber forest products conservation in Nepal: A Critical Review. *Grassroots Journal of Natural Resources*, 4, 1–16. Goyes, D., Sollund, R., 2016. Contesting and contextualising CITES: Wildlife trafficking in Colombia and Brazil. *International Journal for Crime, Justice and Social Democracy* 5, 87-102.

Greenhood Nepal. 2021. Workshop proceeding: Illegal trade and sustainable use of medicinal orchids of Nepal. URL: https://greenhood.org/reports/workshop-proceeding-illegal-trade-and-sustainable-use-of-medicinal-orchids-of-nepal/

He, J., Yang, B., Dong, M., Wang, Y., 2018. Crossing the roof of the world: Trade in medicinal plants from Nepal to China. *Journal of Ethnopharmacology*, 224, 100–110.

Hinsley, A., Verissimo, D., Roberts, D.L., 2015. Heterogeneity in consumer preferences for orchids in international trade and the potential for the use of market research methods to study demand for wildlife. *Biological Conservation*, 190, 80–86.

Hinsley, A., De Boer, H.J., Fay, M.F., Gale, S.W., Gardiner, L.M., Gunasekara, R.S., Kumar, P., Masters, S., Metusala, D., Roberts, D.L., Veldman, S., Wong, S., Phelps, J., 2018. A review of the trade in orchids and its implications for conservation. Botanical *Journal of the Linnean Society*, 186, 435–455. Kunwar, R.M., Adhikari, Y.P., Sharma, H.P., Rimal, B., Devkota, H.P., Charmakar, S., Acharya, R.P., Baral, K., Ansari, A.S., Bhattarai, R. Thapa-Magar, S., 2020. Distribution, use, trade and conservation of *Paris polyphylla* Sm. in Nepal. *Global Ecology and Conservation*, 23, e0108

Laird, S.A., Wynberg, R., McLain, R.J., 2009. Wild Product Governance: laws and policies for sustainable and equitable non-timber forest product use. United Nations University, Centre for International Forestry Research, People and Plants International, Environmental Evaluation Unit.

Lama, Y., Ghimire, S.K., Aumeeruddy-Thomas, Y., 2001. Medicinal Plants of Dolpo: Amchis' Knowledge and Conservation. WWF Nepal Program, Kathmandu.

Larsen, H.O., Smith, P.D., Olsen, C.S., 2005. Nepal's conservation policy options for commercial medicinal plant harvesting: stakeholder views. *Oryx*, 39, 435-441.

Li, P.J., 2007. Enforcing wildlife protection in China: the legislative and political solutions. *China Information* 21, 71-107.

Lindblom, C.E. 1959. The science of 'muddling through'. *Public Administration Review* 19:79–88Mirenda, T., Wallick, K., Gabel, R.R., 2007. The role of CITES rescue centers in orchid conservation: Concerns and questions raised by the collaboration on an endangered slipper orchid (*Paphiopedilum vietnamense* O. Gruss & Perner). *Lankesteriana* 7, 150–151. https://doi.org/10.15517/lank.v7i1-2.19400

MoFSC, 2014. Value chain designing of orchids of Panchase Protected Forest Area. Published by Government of Nepal, Ministry of Forests and Soil Conservation, Department of Forests.

Moshier, A., Steadman, J., Roberts, D.L., 2019. Network analysis of a stakeholder community combatting illegal wildlife trade. *Conservation Biology*, 33, 1307-1317.

Oldfield, S.F., 2013. The evolving role of CITES in regulating the international timber trade. *Review of European, Comparative & International Environmental Law,* 22, 291–300. Olsen, C.S., 2005. Trade and conservation of Himalayan medicinal plants: *Nardostachys grandiflora* DC. and *Neopicrorhiza scrophulariiflora* (Pennell) Hong. *Biological Conservation,* 125, 505–514. Pant, B., Raskoti, B.B., 2013. Medicinal orchids of Nepal. Himalayan Map House, Kathmandu.

Pant, B., Paudel, M.R., Chand, M.B., Pradhan, S., Malla, B.B., Raskoti, B.B., 2018. Orchid diversity in two community forests of Makawanpur District, central Nepal. *Journal of Threatened Taxa*, 10, 12523–12530.

Pascual, M., Wingard, J., Bhatri, N., Rydannykh, A., Phelps, J., 2021. Building a global taxonomy of wildlife offenses. *Conservation Biology,* 35, 1903-1912.

Paudel K, Hinsley A, Veríssimo D, Milner-Gulland E. 2022. Evaluating the reliability of media reports for gathering information about illegal wildlife trade seizures. *PeerJ* 10, e13156.

Paudel, K., Potter, G.R., Phelps, J., 2020. Conservation enforcement: Insights from people incarcerated for wildlife crimes in Nepal. *Conservation Science and Practi*ce, 2, e137. Phelps, J., Biggs, D., Webb, E.L., 2016. Tools and terms for understanding illegal wildlife trade. *Frontiers in. Ecology and the Environment*. 14, 479–489.

Phelps, J., Webb, E.L., Bickford, D., Nijman, V., Sodhi, N.S., 2010. Boosting CITES. *Science*, 330, 1752–1753. Phelps, J., Webb, E.L., 2015. "Invisible" wildlife trades: Southeast Asia's undocumented illegal trade in wild ornamental plants. *Biological Conservation,* 186,296–305.

Pyakurel, D., Smith-Hall, C., Bhattarai-Sharma, I., Ghimire, S.K., 2019. Trade and Conservation of Nepalese Medicinal Plants, Fungi, and Lichen. *Economic Botany*, 73, 505–521.

Robinson, J.E., Sinovas, P., 2018. Challenges of analyzing the global trade in CITES-listed wildlife. *Conservation Biology*, 32, 1203–1206.

Rutt, R.L., Chhetri, B.B.K., Pokharel, R., Rayamajhi, S., Tiwari, K., Treue, T., 2015. The scientific framing of forestry decentralization in Nepal. *Forest Policy and Economics*, 60, 50-61.

Sas-Rolfes, M., Challender, D.W.S., Hinsley, A., Veríssimo, D., Milner-Gulland, E.J., 2019. Illegal wildlife trade: scale, processes, and governance. *Annual Review of Environment and Resources*, 44, 201–228.

Siriwat, P., Nijman, V., 2018. Online media seizure reports: A tool to monitor CITES implementation in regulating the international rosewood trade. *Forest Policy and Economics*, 97, 67–72.

Subedi, A., Kunwar, B., Choi, Y., Dai, Y., van Andel, T., Chaudhary, R.P., de Boer, H.J., Gravendeel, B., 2013. Collection and trade of wild-harvested orchids in Nepal. Journal of Ethnobiology and Ethnomedicine, 9, 1-10.

Ticktin, T., Charitonidou, M., Douglas, J., Halley, J.M., Hernandez-Apolinar, M., Liu, H., Mondragon, D., Perez-Garcia, E.A., Tremblay, R.L., Phelps, J., 2023. Wild orchids: A framework for identifying and improving sustainable harvest. *Biological Conservation,* 277:109816 .

Ticktin, T., Mondragón, D., Lopez Toledo, L., Dutra Elliott, D., Aguirre León, E., Hernández Apolinar, M., 2020. Synthesis of wild orchid trade and demography provides new insight on conservation strategies. *Conservation Letters*, 13,e12697.

Timmermann, L., Smith-Hall, C., 2019. Commercial medicinal plant collection is transforming high-altitude livelihoods in the Himalayas. *Mountain Research and Development*, 39, 13-21.

Timoshyna, A., Drinkwater, E., 2021. Understanding corruption risks in the global trade in wild plants. Targeting Natural Resources Corruption, 1–15.

Underwood, F.M., Burn, R.W., Milliken, T., 2013. Dissecting the illegal ivory trade: an analysis of ivory seizures data. *PLoS One*, 8, e76539.

UNEP-WCMC, 2021. CITES trade statistics derived from the CITES Trade Database, UNEP World Conservation Monitoring Centre, Cambridge, UK.

Korenblik, A., Leggett, T., Shadbolt, T., 2016. World wildlife crime report: Trafficking in protected species. United Nations Office on Drugs and Crime.

Uprety, Y., Chettri, N., Dhakal, M., Asselin, H., Chand, R., Chaudhary, R.P., 2021. Illegal wildlife trade is threatening conservation in the transboundary landscape of Western Himalaya. *Journal of Nature Conservation*, 59, 125952.

Vaidya, B.N., 2019. Nepal: A global hotspot for medicinal orchids. In *Medicinal plants* (pp. 35-80). Springer, Cham.

Supplementary information

Supplementary Table 1. Overview of orchid exports from Nepal (2008-2018) (Source: CITES Trade Database, as reported in trade.cites.org)

Species	**Origin**	**Form**	**Purpose**	**Leading importer**	**Amount traded**	**Year(s)**
Coelogyne nitida	Propagated	Live	Trade	Japan	5 individuals	2013
Cymbidium iridioides	Propagated	Live	Trade	Japan	3 individuals	2013
Cymbidium sp.	Propagated	Live	Circus or exhibition	Japan	6 individuals	2013
Dendrobium amoenum	Wild	Stems	Trade	Thailand	9,309kg	2013
Dendrobium aphyllum	Wild	Stems and live	Trade	Thailand, Switzerland, China	stems 10,894kg, live 7,992kg	2008, 2010, 2013
Dendrobium dixonianum	Propagated	roots	Trade	China	347kg	2013
Dendrobium dixonianum	Wild	stems	Trade	Thailand	2,378kg	2014
Dendrobium eriiflorum	Propagated	stems	Trade	Thailand	3 individuals	2015
Dendrobium fimbriatum	Wild	Stems	Trade	Thailand	9,309kg	2013
Dendrobium spp.	Wild	Stems	Trade	Thailand	8,007kg	2016

Dendrobium transparens	Propagated	roots and stems	Trade	China	roots 650kg, stems 900kg	2013, 2015, 2016
Otochilus fuscus	Propagated	live	Trade	Japan	4 individuals	2013

Supplementary Table 2. Summary of orchid seizure records found in the official record of government authorities and reported by key national newspapers from January 2010 to December 2021 (Note: the table excludes 4 records from Division Forest Office (DFO) that had no further details but they mentioned orchids).

Year	**Seizure location**	**Species**	**Volume (kg)**	**Seizure Condition**	**Source of orchids**	**Transportation**		**Concerned agency to seize**
						Mode	**Destination**	
2021	Lamjung	*D. hatagirea*	15.5	People carrying in bags	Lamjung	NA	Besisahar, Lamjung	Nepal Police
2020	Dolakha	NA	22.5	NA	NA	NA	NA	DFO
2017	Arughat, Gorkha	NA	75	Transported, bus roof	Gorkha	Public	Soti	DFO, Gorkha
2016	Khalanga, Jajarkot,(Mid- West Nepal)	NA	64	NA	NA	Public	NA	Division Forest Office and Police officers
2015	Basundhara, Kathmandu	NA	4.4	NA	NA	NA	NA	NA
2014	Dolalghat, Kavrepalanchok	NA	9,364	NA	NA	NA	Kathmandu	NA
2014	Gorkha, Ghatte khola	*D. hatagirea*	8	Transported	MCA	NA	Gorkha headquarter	NA

2013	Simle (Mid-western Nepal)	NA	100	NA	NA	NA	NA	Police Officers
2012	Jomsom (Mid-west Nepal)	NA	4,536	Transported	All over Nepal	Public	Tibet- Upper Mustang, Lomanthang.	Conservation Agency, Police Officers
2012	Dhulikhel-2 (Central Nepal)	NA	51	Transported, sealed drums		Public	Khasa	Police officers
2012	Kathmandu	NA	28	Held by arrestee	Hired Villagers	Public	China	Police Officers
2012	Panchkhal Police Checkpost (Central Nepal)	NA	25	Transported, bus engine	NA	Public	Chinese Market-Khasa	Police Officers
2012	On the way: Dhading to Bidur	NA	390	Transported	NA	Public	China	Security personnel
2012	Thokarpa	NA	9	Transported	NA	Private	Khasa, China	Police Officers
2012	Sindupalchok , Bahrabise (Central Nepal)	NA	2	Transported	NA	Public	China	Police Officers
2012	Bahrabise, Sindhupalchok (Central Nepal)	NA	250	Transported	NA	Public	China	Security/Police Officers
2012	Bahrabise, Sindupalchok	NA	199	Stored in house	NA	NA	NA	Security/Police Officers
2012	Baharabise, Sindhupalchok	NA	9	Stored in house	NA	NA	NA	Security/Police Officers
2012	Lamosaghu, Sindhupalchok	NA	6	Abandoned	NA	NA	NA	Security/Police Officers
2012	Bahrabise Checkpost,	NA	7.2	Transported	NA	Public	NA	Security/Police

	Sindhupalchok							Officers
2012	District Police Office (Bahrabise), Sindhupalchok	NA	23	Abandoned	NA	NA	NA	Security/Police Officers
2012	Police Bahrabise, Sindhupalchok	NA	30	Transported	NA	Public	NA	Security/Police Officers
2012	Kavrepalanchok	NA	7 ind		NA		NA	Security/Police Officers
2012	Gorkha	NA	4.5	NA	NA	NA	NA	Security/Police Officers
2011	Attarkhel, Jorpati (Central Nepal)	NA	4,871	Stored in house	Secret Vendors	N/A	China	Police Officers and Division Forest Office
2011	While transporting to Kathmandu	NA	50	Transported	Lumle forest	Public	Kathmandu	Annapurna Conservation Area Project, Police Officers
2011	Kapilakot village-9 (Central Nepal)	NA	3,943	Stored: House	NA	Public	NA	DivisionForest office and District Police Office
2010	Ghanteshwar, Doti (Far west Nepal)	NA	50	Stored: House	NA	NA	NA	Division Forest Office
2010	Lamosaghu, Sindhupalchok	NA	45	Transported	NA	NA	NA	Lamosaghu Checkpost
2010	Lamosaghu, Sindhupalchok	NA	745	Abandoned	NA	NA	NA	Lamosaghu Checkpost
2010	Bahrabise, Sindhupalchok	NA	188	Transported	NA	Public	NA	Security/Police Officers
2010	Lamosaghu, Sindhupalchok	NA	3,200	Transported	NA	Public	NA	Security/Police Officers

Supplementary Table 3. Legislation protecting orchids and promoting legal use. * indicates legislation that specifically mentions orchids.

Policy	**Key points regulating orchid conservation, harvest, and trade**
Constitution of Nepal 2015 (2072)	The constitution of Nepal included the policies relating to protection, promotion, and use of natural resources and it envisions to conserve, promote, and make sustainable use of forests and wildlife (Part 4, Article 51, g, 5).
CITES compliance Nepal is signatory (1975) to Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Nepal's orchid species *Paphiopedilum insigne* and *Paphiopedilum venustum* are listed in App I. All other orchid species are enlisted in App II of the CITES. Trade in all the Appendix II-listed species should be supported by Non-Detriment Findings.	
CITES Act, 2017 (1st amendment on 2019)	As per the CITES Act, 2017 species listed in CITES App I and II or a specimen thereof cannot be purchased, sold, possessed, used, planted, reared, captive-bred, transported, imported, or exported without permission from the CITES Management Authority based on the recommendation from the CITES scientific authority (Article 3, 6). As such, it prohibits the international import and exports of species listed in CITES Appendix I and Appendix II for commercial trade purposes (Article 6 (Cha) & (Chha). This was clarified/relaxed in its 2019 amendment that states no permission is required to possess, plant, rear, and use plant species listed in CITES Appendix II and III if they originate from private property (Article 3, 6). Also, no import permit is required from the CITES Management Authority of the importing country for the exports of CITES Appendix II listed species from Nepal including for commercial purposes (Article 5). This is to align national

	legislation with the CITES Convention, such that import permits are only required for the trade of Appendix I listed species. *But the trade has to be done based on the management plan of the CITES Authority which is yet to be prepared– hence, the trade of orchids is still theoretically illegal.* Violations are sanctioned with a fine of NPR 100,000 to 500,000, or 1 to 5 years imprisonment or both for App I plant species; NPR 50,000 to 100,000, or 6 months to 1-year imprisonment or both for App II plant species; NPR 1,000 to 50,000, or 1 month to 6 months imprisonment or both for App III plant species (Article 21).
CITES Regulation, 2019	For the export of CITES Appendix I and Appendix II listed plant species, these should be harvested in volumes not exceeding the maximum quota mentioned in the Management Plan (Article 4 (Ka, 1) Management Plans are established by the CITES Management Authority in consultation with CITES Scientific Authority for CITES-listed species in trade (Article 22). This applies to all 3 CITES Appendices, and there is no detail about the scale or details required for the plans
Management plan of CITES listed plants and animals	Management plan of each CITES listed plants and animals should be prepared to facilitate the legal trade (see, CITES Act 2017). So far, no such management plan has been prepared for any orchid species- hence, the trade of orchids is still theoretically illegal.
Species Conservation Action Plan	There are species conservation action plan for different wildlife species. However, no such species conservation action plan is prepared for orchids.

Management and enforcement of natural resources	
Forest Act 2019 (2076)	This Act does not include anything specific to orchids but it addresses forest products inside all forests. It specifies that the use, sale, and distribution of forest products (including timber, wood, and NTFPs) shall be made as prescribed and only after the permission of Division Forest Office Plans (Section/parikched 10, 36 (2)). This likely refers to rules set out in local management plants. Punishment: If the species banned for trade is found, the NTFP is seized, violations are sanctioned with either a fine up to double of the loss as per the rate per individual or 3 years imprisonment or both (Article 50, 7) If the NTFP harvest permit is found to be misused to harm other plants, this violation is sanctioned with different punishments like for original amount worth >=5 lakhs, fine is doubled and 2 years imprisonment or both
Forest Regulations 1995 with an amendment in 2015 (2072)	Bans harvest, trade and use of *Dactylorhiza hatagirea* Interested parties shall have to apply to the Authorized Officer, explicitly mentioning the type of herbs (includes orchid spp.), the area of collection, the quantity, and the purpose of collection. The Authorized Officer shall tally the herbs collected according to collection permit, check quantities, collect fees and issue a release order. The royalty fee for Orchid spp. except for *Dactylorhiza hatagirea* is NPR 200 per kg (Article 11 and Annex 3)

Notice from the Ministry of Forest and Soil Conservation, Nepal Gazette, 31 Dec 2001 (2058/09/16)	This notice, prohibited the harvest, transportation, trade, and exports of certain species including *Dactylorhiza hatagirea* in and from Nepal
National Park and Wildlife Conservation Act 1973 (2029)	No one can harvest and harm wildlife including plants inside the National Park or Wildlife Reserve without obtaining written permission from the authorized official (Article 5). Each site has its own regulations approved by the Department of National Parks and Wildlife Conservation (Article 3). 4th amendment on 9 June 1993 – The designated authority after taking a fixed charge/revenue can allow harvest of NTFP (16, ka)
National Park and Wildlife Conservation Regulation 1974	It does not mention anything specific to orchids, however, it regulates the harvest of wildlife inside the protected area under the National Park and Wildlife Conservation Act Violations are Sanctions according to the CITES Act, 2017. Unlike animals, there are no separate provisions of sanctions for illegal harvest and trade of the plants and orchid species inside the protected areas. In such cases, other prevailing rules i.e. CITES Act, Forest Act are attracted. If the offense is not described in other laws, imprisonment up to six months and a fine up to NPR 20000 applies (NPWC Act, Article 26.6).
National Park and Wildlife Conservation Revenue Rate (Nepal	Sets national taxation rate for NTFPs. For orchids, it specifically sets taxation for:

Gazette paper, part 3, khanda 68, published date October 2018	• *Dactylorhiza hatagirea* taxed at NPR 500 per piece [Khanda (cha) Article/anuchuchi 3, (ka, no. 25), page 6]. The rate is doubled if it is harvested for export. • *Gastrodia elata* taxed at NPR10 per kilogram [Khanda (ka, no. 54), page 3] This rate is tripled for export [Article 3, Summary, SN 3, page 10]
Buffer Zone Management Regulation, 1905	It mentions NTFPs but does not specifically mention orchids – it provides provisions to develop the management plans of the buffer zone of national parks, which controls the conservation and use of wildlife including orchids
Conservation Area Management Directive, 1999	It mentions NTFPs but does not specifically mention orchids. It sets out rules for the formation, rights, duties of user group and says that they should work in collaboration with the CA and their operation plan, collection permit should be authorized by the CA authority
Buffer Zone Management Directive, 1999	It does not specifically mention orchids, but mentions user groups (e.g., Community Forest User Group) that have rights to use and conserve resources in these sites, including NTFPs. It states that harvest must follow the user groups' guidelines
Wildlife Parts Management Directive, 2015	It does not mention anything specific to orchids, however it talks about the management of seized wildlife parts, primarily wild animals.
Management (harvest and trade) Guideline at species level	There are harvest and trade guideline for different species. However, no such species-specific guideline is prepared for orchids.
Collection and trade of orchids	Promotes the commercial cultivation of orchids in Nepal (see Table 3).

(Guideline) Directive 2013 (2069)	Includes provisions for wild orchid harvest, including the orchid inventory and site selection, provisions for block divisions, collection/harvest, and commercial development. Based on the orchid inventory and available stock for sustainable harvesting, forests can be divided into different blocks and collections of orchids on a 5 years rotational period. If orchids are collected from community forests or private forests, they should be provided royalty (see Table 4) The guideline identifies 13 orchid species as
Community Forestry Management Guideline, 2009	Community forestry management guidelines include the harvestable quotas for different non-timber forest products. Some of the community forest operational plans we reviewed have included harvestable quotas for orchids.
Guideline for NTFP Based Enterprise, 2005	The guideline does not say anything about orchids specifically but it is for all NTFPs
Guideline for the collection and trade of NTFPs (2073 BS) 2016 AD	The guideline does not say anything about orchids specifically but it is for all NTFPs mentioned in the District Forest Management Plan (see Table 4; species that are not listed in the Plan cannot be traded). The person, firm, or company interested in the collection and trade of a listed species should make an application to the Division Forest Office (DFO) indicating the purpose, method, and amount to be collected. Then the DFO grants permission, based on the availability of the resource in the wild, for a maximum of 2 months. In doing so, the DFO collects an advance tax prior to collection and allows the transport of the collected NTFPs only after a permit is issued

Private Forest Development Directive 2011 (2068)	Registered private firms can harvest, use and trade wild plants on private land by pre-informing the respective Division, or Sub-division Forest Office (Article 6) Transportation of the plants requires a leave permit from the Division Forest Office The Directive does not include anything specific about orchids but lists *Dactylorhiza hatagirea* as a banned species
Informer Reward Guideline, 2015	The guideline does not say anything about orchids specifically but it talks about different types of rewards that are provided for informers of illegal wildlife trade incidents
National Forest Policy, 2019	It provisions the sustainable management of forests to enhance the regeneration rate/forest products availability and conservation as well as to improve the livelihood of user groups There are also province-level forest policies to regulate forest and wildlife outside the protected area. For example, Provincial National Forest Policy, 2019 of Hetauda province states that forest products can be traded as instructed by the concerned authority (Article 18, 1-4); herb research center can be established (Article 21); commercial cultivation of herbs can be done - has not indicated species though (Article 22, 1-2)
Forest Sector Strategy 2016-2025	Identified “sustainable production and supply of forest products” and “improvement of biodiversity conservation” as two of its five major outcomes. It does not specifically mention orchids.
Herbs and NTFP Development Policy, 2004 (2061)	NTFPs cultivated on private land should be registered by providing details to the Division Forest Office

Nepal Biodiversity Strategy and Action Plan 2014-2020	It mentions about the overharvest of high value and rare species of plants like orchids (page 26) and reiterates their need for conservation
The Fifteenth Plan, 2019/20-2023/24	It does not specifically mention orchids. It however mentions the need for sustainable use of forest and equitable distribution of benefits generated through such use
National Agroforestry Policy, 2019 (2076)	It does not specifically mention orchids. It mentions about the need for new policies for non-wood forest products, research on agroforestry (page 3-5)
Nature for Prosperity Strategic Plan 2020-2025	It does not specifically mention orchids
Province level Forest Act AND Province level Forest Regulations	Each province has its own forest act and regulations, which regulate the forest and wildlife outside the protected area. For example, Provincial National Forest Policy, 2019 of Bagmati province states that forest products can be traded as instructed by the concerned authority (Article 18, 1-4); herb research center can be established (Article 21); commercial cultivation of herbs can be done - has not indicated species though (Article 22, 1-2)
Provincial national forest conservation and management directive	Each province has its own forest conservation and management directive
Forest and Watershed	This does not specifically mention orchids but guides the overall conservation and management of wildlife in the province.

Management Policy at province level	
Provincial roadmap on forest and wildlife conservation and management	This does not specifically mention orchids but guides the overall conservation and management of wildlife in the province.
Conservation area management plan at conservation area level	Management plans are prepared by each of the conservation areas. Most of them include harvestable quotas and available stock of all NTFPs available in their area. For e.g., Management plan of Api Nampa Conservation Area, Management plan of Manaslu Conservation Area.
Landscape strategies and action (management) plans	Chitwan Annapurna Landscape (CHAL) Strategy and Action Plan 2016-2025 identifies unsustainable and illegal harvest and trade of orchids including extensive habitat loss, climate change as biggest threats (pg. 32) and it calls for science-based management of orchid resources (pg. 47)
Five year plan of Division Forest Office at district level (e.g., Gorkha (district level management plan)	Explain in general. For example, Gorkha Division Forest Office Management Plan 2021 mentions specific orchid species as plants that can be legally harvested, but does not recognise that these are in the family Orchidaceae (e.g., "gamdol" harvest [*Brachycorythis* spp., probably *B. obcordata*] is permitted). For each species, they also identify the total stock and harvestable amount, and where the resources are located within the District. They also allocate a certain amount of Taxation as per Forest Act, protocol for harvest and harvesting seasons.
Ten-year operational plan for forests (site-	For example, the ten-year operational plan of Bhume Mantuli Devisthan Community Forest in Dharche 4, Gorkha (2075/76-2084/85) includes orchids (*sunghava*) harvest (in SN. 4) as

level, by Community Forest User Groups)	available 800kg/ha (in 0.5ha), total stock 400kg raw (140kg dry weight) 40% of which is allowed for harvest and trade i.e. 56kg (twice a year/duai barshik)
Protected forest management plan (5-10 years)	It guides the management of the protected forests but does not directly mention orchids
Environmental impact assessments	
Environment Protection Act 2019 (2076) (EPA, Part 5, Article 29; EPA: Schedule II, Ka, 8 and Schedule III, Ka, 7)	Establishes requirement for conducting environmental impact assessments and states that this should be done in provisions relating to the protection of national heritage and environment including sites with important plant species (Part 5, Article 29)
Environment Protection Regulations 2020 (2077)	Management plans such as a five-year district forest management plan, buffer zone or conservation area management plan, forest conservation area management plan which involves the collection of forest products require environmental impact assessments (Schedule II, Ka, 8 and Schedule III, Ka, 7)
National Environmental Policy, 2020	It does not mention anything about orchids but it mandates the local level utilization as well as conservation of the natural resources. It also promotes participatory and sustainable utilization of natural resources via equal distribution of incentives among value-chains.
Province level Environmental Act	This is the province level environmental act. It does not specifically mention orchids

Province level Environment Regulations	This is the province level environment regulation. It does not specifically mention orchids
Province level environment conservation policy	This is the province level environment conservation policy. It does not specifically mention orchids
Import and export rules	
Custom Act, 2007	It does not mention orchids or plants, but covers general import-export rules, including for forest products. This includes a requirement that these should follow CITES legislation, be properly tagged to enable tracking, letters from exporting countries.
Custom Regulations, 2019	It does not mention orchids or plants, but covers general import-export rules, including for forest products. This includes a requirement that these should follow CITES legislation, be properly tagged to enable tracking, letters from exporting countries.
Export Import Act, 1957	It does not mention orchids or plants, but covers general import-export rules, including for forest products. This includes a requirement that these should follow CITES legislation, be properly tagged to enable tracking, letters from exporting countries.
Plant Protection Act, 2007	Focuses on plant quarantine and the prevention of biological pests during the import/export of plants and plant products, particularly on phytosanitary, tracing signs/codes, certifications of plants or plant products. This includes a minimum of genus-level identification.
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	on phytosanitary, tracing signs/codes, certifications of plants or plant products. This includes a minimum of genus-level identification.
Plant Protection Process Manual, 2011	Focuses on plant quarantine and the prevention of biological pests during the import/export of plants and plant products, particularly on phytosanitary, tracing signs/codes, certifications of plants or plant products. This includes a minimum of genus-level identification.
Export Import Code Guideline, 2021	It does not specifically mention orchids
Policing and enforcement	
The National Criminal Procedure Act, 2017	Identifies wildlife trade crimes as having high importance. It states that once cases are filed in court, they cannot be withdrawn. It is not clear if this applies to plants, but plants and orchids are not specifically mentioned.
Designated rights and responsibilities under the federal system	
Local Government Operation Act, 2017	This Act does not specifically mention orchids but it mentions details on the natural resource use/revenue generation including NTFPs at the local level The local government authorities have their own policy and programs, for eg: ● Policy and Program of Annapurna Rural Municipality 2020: Prioritizes the cultivation and promotion of medicinal plants (strategy 1.10)

Five year development plan of municipal government	There are five year management plans to govern the harvest and trade of NTFPs including orchids. For examples: ● Gorkha Division Forest Office Management Plan 2021 ● Dharche Rural Municipality Five-year Plan (2019 - 2024): This FYP indicates that they will promote NTFPs including orchids cultivation/trade, etc. to support the livelihood of locals thereby generating the opportunities for income and employment (Article 6.1.5) ● 10 year operational plan of Bhume Mantuli Devisthan Community Forest in Dharche 4, Gorkha (2075/76-2084/85)

Note: Regulations of each protected area. Each of the protected areas has its own regulations and management plans which controls the conservation and use of wildlife including orchids. For example:

- Himali NP Regulation, 2009 (first amendment 2014) provisions the harvest and trade of NTFP are allowed for a maximum of 30 days/ /harvest season/year from protected areas in the mountain region. However, this excludes banned/restricted species and species that do not have a national CITES Management Plan. They also collect a royalty and other permission from the Division Forest Office (Article 24, Ka)
- Panchase Protected Forest 2012 was established specifically to protect orchid species. Does not allow for harvest of orchids at this site
- Chitwan Annapurna Landscape (CHAL) Strategy and Action Plan 2016-2025 identifies unsustainable and illegal harvest and trade of orchids including extensive habitat loss, climate change as biggest threats (pg. 32) and it calls for science-based management of orchid resources (pg. 47)