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Seed sources and forest species of the tropical dry forests of northern Peru:

Current status and future priorities

Jéssica Cerrón, Rachel Atkinson, Evert Thomas, Jonathan P. Cornelius

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Abstract

The objective of this document is to provide an analysis of the existing seed sources in the tropical dry forest of northern Peru (Tumbes-Piura dry forests and Marañon dry forests), in addition to providing preliminary information on the conservation status of tree species of interest and those used in reforestation experiences and restoration. The information was generated primarily to inform the planning and implementation of future activities within the framework of the ICRAF project "Agroforestry seed sources for restoration and genetic conservation (FuenteS)". Information was collected on existing seed sources using a structured questionnaire completed with information from primary and secondary sources. In the case of conservation status, a list of interest was determined based on official categorizations and consultation with key actors in each ecoregion. 45 seed sources of 16 species were located in the Tumbes-Piura dry forests, but none in the Marañon dry forests. The sources are owned mainly by peasant communities, and are mostly of *Prosopis pallida* (47%) and *Bursera graveolens* (11%). There were 27 potential seed sources in conservation areas In the Tumbes-Piura dry forests, 12 and 23 species were identified as threatened according to respectively official threat and local experts. In the Marañon dry forests, seven species were present in official categories and 21 were considered to be of potential interest.

Keywords

Dry forests, Tumbes-Piura dry forests, Marañon dry forests, seed sources, forestry species, agroforestry, conservation status

Acknowledgements

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Contents

Acronyms

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COSUDE	Swiss Agency for Development Cooperation
EEA	INIA-Peru Experimental Sastion
FOSEFOR	Andean Forest Seeds Program
INIA	National Institution of Agrarian Innovation (Peru)
IUCN	International Union for the Conservation of Nature
MINAGRI	Peruvian Ministry of Agriculture and Irrigation
MINAM	Peruvian Environment Ministry
SENASA	Peruvian National Agricultural Health Service
SERFOR	Peruvian National Forest and Wildlife Service

Introduction

The tropical dry forests of northern Peru have a total area of 3.4 M ha, of which 63% is in degradation (MINAM 2011) as a result of deforestation, selective logging, agriculture and goat and bovine livestock (Angulo 2009). In this context, during the last few years various types of initiative have been carried out with the purpose of counteracting the degradation process and the loss of forest areas, such as reforestation, natural regeneration management, conservation, agroforestry, among others. However, the planting material used in these interventions mostly does not come from identified seed sources, but from improvised collection of seeds, in most cases to cover the demand of only a few species of commercial interest and about which sufficient technical knowledge exists. Also, many species are currently in different categories of threat, due to unsustainable use without any attempt at ensuring regeneration.

In that context, the present document has the following objectives:

- To provide an analysis of existing seed sources in the tropical dry forest of northern Peru (Tumbes-Piura dry forests and Marañon dry forests).
- To provide information on the conservation status of tree species of interest and those used in reforestation and restoration experiences.
- To facilitate reforestation and restoration through capacity building, research and technology transfer to key stakeholders.

Methods

Study area

Information was collected on existing seed sources and tree species in the ecoregions: Tumbes-Piura dry forests, in Lambayeque, Tumbes and Piura and in the Marañon dry forests in Cajamarca and Amazonas.

Tumbes-Piura dry forests

These extend along the northern coast of Peru, from sea level to 1500 m a.s.l. (Linares-Palomino 2004) in Piura, Tumbes, Lambayeque and small portions of La Libertad and

Cajamarca, with a total area of 3,235,012 ha (MINAM 2011). Tree species such as algarrobo (*Prosopis pallida*), sapote (*Colicodendron scabridum*), faique (*Vachellia macracantha*), and overo (*Cordia lutea*) dominate the coastal plain area. At higher altitudes, there is a greater diversity of trees, including palo santo (*Bursera graveolens*), hualtaco (*Loxopterygium huasango*) and pasallo (*Eriotheca ruizii*), among many others (Angulo 2009).

Marañon dry forests

These extend along the Marañon River basin, an important tributary of the Amazon, between 400 and 2200 m a.s.l. (Marcelo-Peña *et al.* 2015) in Ancash, Huánuco, La Libertad, Cajamarca, Amazonas and Piura with a total area of 372,915 ha (MINAM 2011). Prominent tree species include acerillo (*Aspidosperma polyneuron*), iguaguana (*Cordia iguaguana*), and shrubs such as *Calliandra mollissima*, *Coursetia maraniona*, *Jatropha humboldtiana* (huanarpo), among other species. It is considered that 33% of the plant species of this ecoregion are endemic. Many species are of high potential for reforestation in arid zones and as soil stabilizers (Marcelo-Peña *et al.* 2015).

Seed sources

Information on seed sources was compiled using two forms (Annex 1 and Annex 2[1]), one for sources located in conservation areas (national, regional and private) and another for those located in other zones. The forms cover (1) data on the person responsible, (2) characteristics of the area and (3) characteristics of the seed source.

The information gathered from seed sources was systematized according to the following variables:

- **Type of owner:** The categories "State Institutions" (national, regional and local government institutions), "Association or Cooperative" (registered local associations or cooperatives), "Private Property" (individual or family local actor) and "Village Community" (local communities) were used.
- **Period since establishment:** Determined according to the difference between the year of mapping (2018) and the date of establishment of the seed trees.

[1] Spanish versions only

- **Surface:** Area (ha) where the seed trees are distributed.
- **Density:** Total number of inventoried individuals of the species per ha.
- **Population size:** Calculated from available information on area (ha) and density (trees/ha) of each seed source.
- **Number of selected trees:** Number of trees selected as seed trees (information provided by owners).
- **Type of seed source:** Determined according to the density information per ha available for each source, considering the classification of MINAGRI (2006) and Cuellar et al. (2016) (Annex 3).

Type of reproductive material extracted: Two categories were used: (1) seeds and (2) cuttings.

It should be noted that in this compilation, the existing seed sources are mature individuals of tree and/or shrub forest species identified from phenotypic characteristics. On the other hand, potential seed[2] sources were determined in the context of national, regional and private conservation areas.

Conservation status of tree species

A list of agroforestry species was determined for the two types of dry forest: Tumbes-Piura dry forests and Marañon dry forests.

Tumbes-Piura dry forests

The list of woody species was determined based on their use in restoration and the list of existing seed sources. Conservation status was classified according to international categorizations (IUCN, 2018; CITES Appendices (2016)), official Peruvian categorizations (Ministerial Resolution 0505-2016-MINAGRI), and views of local experts (professionals and community members).

[2] Areas with the presence of mature woody species of individuals with phenotypic characteristics desirable to be considered seedlings that, according to local actors, have not yet been identified for this purpose

Marañon dry forests

In this ecoregion, there are few restoration experiences and seed sources. Therefore, the list of woody species of conservation interest was determined according to the bibliographic review of some studies of floristic composition (Marcelo-Peña 2008, Marcelo-Peña *et al.* 2010). From the resulting list of species, we assigned conservation status according to the same international and Peruvian categories. In the case of endemic species, the studies by León *et al.* (2006), Marcelo-Peña *et al.* (2010) and Marcelo-Peña *et al.* (2015) were used. In this region, local actors with sufficient knowledge of were not identified.

Results

Seed sources

Distribution of existing seed sources (N=45)

Figure 1 shows the distribution of the 45 existing seed sources, which were only identified in Tumbes-Piura dry forests, where Lambayeque predominated with 22 sources and, to a lesser extent, Piura and Tumbes. No seed source was identified in Marañon dry forests.

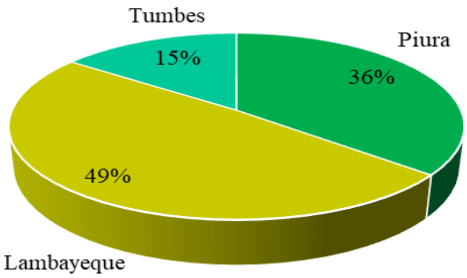

Figure 1. Distribution of existing seed sources (N=45) (excludes Marañon, where N=0)

Type of owner and period since establishment (N=45)

Figure 2 shows the predominance of village communities in terms of ownership with 25 sources. Periods since establishment of 3 to 5 years and from 6 to 15 years dominate (12 and 11 respectively). The second place is represented by private properties at the local level with 12 sources, where the period of 1 to 2 years predominated. This is due to the fact that they

are mature trees that were recently selected as seed trees within the framework of the Management Plans for the use of dry forests (mainly from 2016).

During 2003, the Andean Program for the Promotion of Forest Seeds (FOSEFOR), financed by COSUDE, identified seven seed sources in Piura, two of which are owned by the Manga Manga Agrarian Association from Salitral. The sources identified were the following species: palo santo (*Bursera graveolens*) and hualtaco (*Loxopterygium huasango*). The seed trees were identified based on their phenotypic characteristics and their potential use.

In lesser proportion, seed sources were presented that are managed by an association or cooperative. They were designated in the framework of a project that aimed to strengthen local capacities for the production of seeds of six forest species from the dry forests in Piura. Finally, state institutions (INIA-EEA Vista Florida and the Wildlife Refuge of Laquipampa) manage seed sources of algarrobo (*Prosopis pallida*) and tara (*Caesalpinia spinosa*) species in both cases.

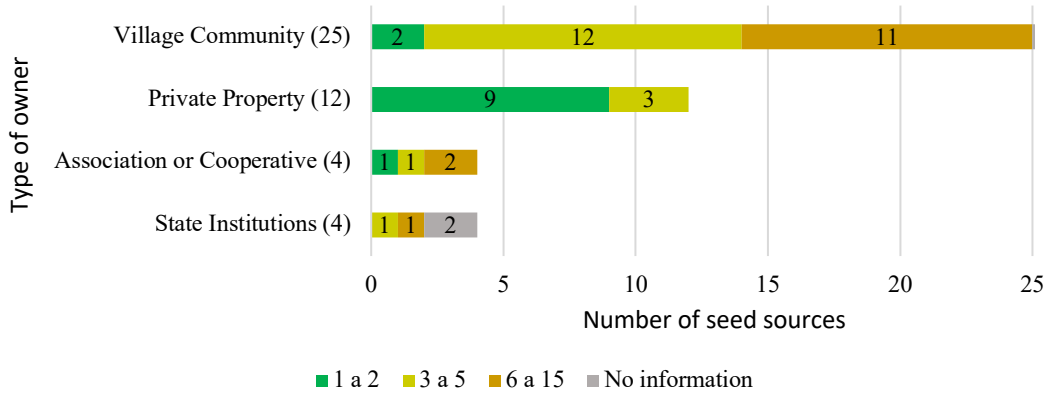

Figure 2. Number of seed sources by type of owner and period since establishment (N=45)

Species and period since establishment (N=45)

Regarding species, Figure 3 shows the predominance of algarrobo (*Prosopis pallida*) with 47% (21 out of 45), where the period since establishment of 1 to 2 years with 11 sources (recently identified in the framework of Management Plans mainly) was highlighted. Second, palo santo (*Bursera graveolens*), which presented sources in the three periods. The range of 6 to 15 years was only presented in some species, such as: sapote (*Colicodendron scabridum*), charán (*Caesalpinia paipai*), hualtaco (*Loxopterygium huasango),* almendro (*Geoffroea spinosa*) and pasallo (*Eriotheca ruizii*), which were designated in the framework of a specific project[3], with the exception of the charán. Likewise, in the case of the 3-5 year period, only one seed source was identified for the other species (Figure 3).

Three seed sources of sapote (Colicodendron scabridum) were identified. The species has a great capacity for natural regeneration and multiple uses.

Sapote tree. Photography: Jéssica Cerrón

[3] Project: Strengthening of local capacities for the production of seeds of six forest species from the dry forests of the Piura region (University of Piura and Centro Ideas 2003).

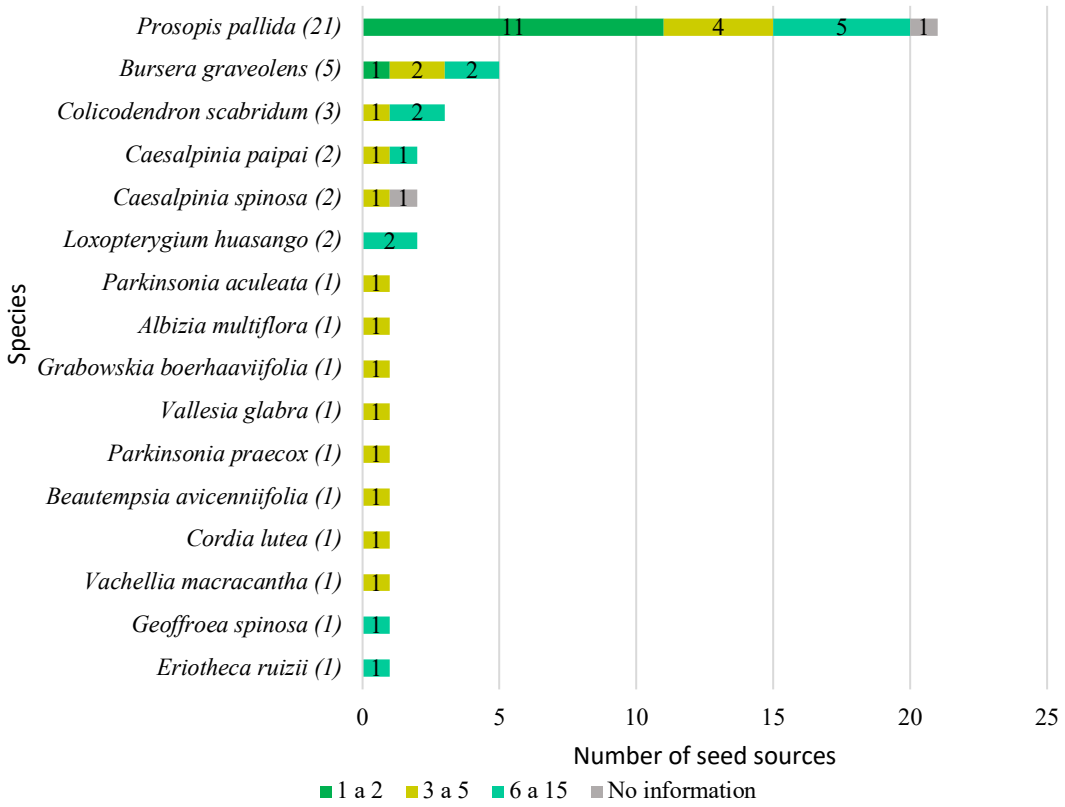

Figure 3. Number of seed sources by species and period since establishment (N=45)

Population size and number of selected trees (n=21)

Of the 45 existing seed sources, information on population size and number of selected trees (seed trees) was available for only 21 (Figure 4). The population size of >300 trees with 11 sources predominated, followed by the range of 101 to 300 with nine sources, and finally the ranges of 51 to 100 and <50 trees with one source. Likewise, in the case of the number of trees selected, the predominance of the range of 21 to 40 is observed with five sources, where algarrobo stood out with four of these. However, it should be noted that there is no information on the production of seeds from these, so it would be appropriate to make a more detailed study of this variable.

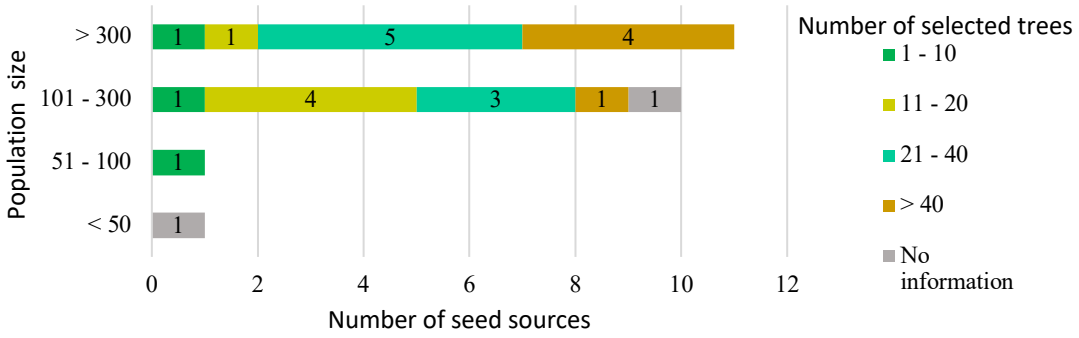

Figure 4. Number of seed sources by population size and number of selected trees (n=21)

Density (trees/ha) and type of seed source (n=24)

Of the 45 existing seed sources, information on density was available for only 24. Of these, the category "identified source" predominated (Figure 59). In 36 sources, only seed is collected, while both seeds and cuttings are extracted from nine. This is related to the ease of vegetative propagation by cutting of the following species: palo santo (*Bursera graveolens*), hualtaco (*Loxopterygium huasango*), overo (*Cordia lutea*), cuncun (*Vallesia glabra*) and canutillo (*Grabowskia boerhaaviifolia*).

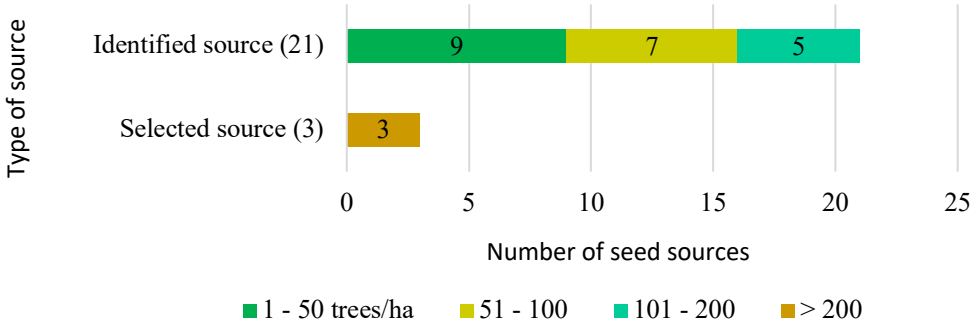

Figure 5. Density and type of seed source (n=24)

Distribution of potential seed sources (N=27)

27 potential seed sources of 324 species were identified (Annex 4) in national, regional and private conservation areas, understanding the term "potential" as areas with the presence of mature woody species of individuals with phenotypic characteristics desirable to be considered seedlings. However, according to local actors, these have not yet been identified for this purpose. In relation to this, Figure 6 shows the distribution of these possible sources, with Piura being the preliminary one with the highest proportion of 12 conservation areas, followed by Lambayeque, Tumbes and, to a lesser extent, Cajamarca, Amazonas and La Libertad.

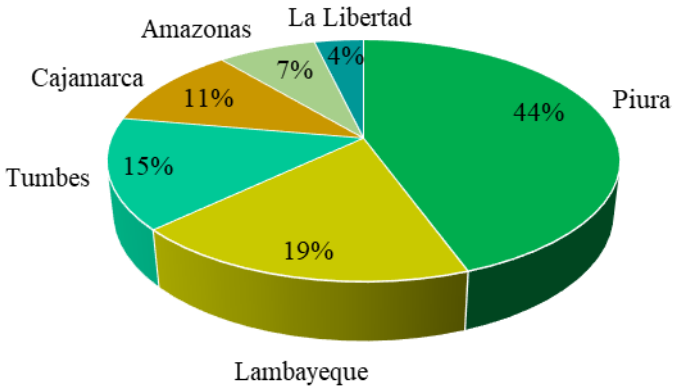

Figure 6. Distribution of potential seed sources (N=27)

Conservation status of tree species

Tumbes-Piura dry forests

Annex 5 shows the state of conservation of all the species determined for Tumbes-Piura dry forests. Table 1 shows only those species considered threatened.

Table 1. Tumbes-Piura dry forests species in threat status

Source	Conservation status and/or threat of species
IUCN (2018)	**Least Concern:** Alnus acuminata (aliso), Caesalpinia paipai (charán), Geoffroea spinosa (almendro) and Vallesia glabra (cuncun)
CITES Appendices (2016)	None
Ministerial Resolution 0505-2016-MINAGRI	Critically Endangered (CR): *Bursera graveolens* (palo santo), Loxopterygium huasango (hualtaco) **Endangered (EN):** Colicodendron scabridum (sapote) y *Prosopis pallida* (algarrobo) **Vulnerable (VU):** *Beautempsia avicenniifolia* (vichayo), Grabowskia boerhaaviifolia (canutillo) and Vachellia macracantha (faique) **Near Threatened (NT):** *Alnus acuminata* (aliso)

The species of Tumbes-Piura dry forests considered threatened by local experts are presented in Table 2, classified according to the main factors that influence their current state.

Table 2. Tumbes-Piura dry forest species in threat status according to local experts

Species cited by local experts	Influencing factors of the current threat status of cited species					
	Use of the wood for its commercial value	Restricted geographical distribution	Susceptibility to prolonged drought, affecting flowering	Poor natural regeneration	Food and habitat of specific fauna	Multiple uses for the benefit of the population
Albizia multiflora (angolo)						x
Bursera graveolens (palo santo)	x		x			x
Caesalpinia paipai (charán)		x				x
Ceiba trischistandra (ceibo)		x				x
Celtis loxensis (palo blanco)	x	x			x	
Colicodendron scabridum (sapote)	x				x	x
Cordia lutea (overo)					x	x
Eriotheca ruizii (pasallo)		x			x	x
Ficus nymphaeifolia (higuerón)					x	
Geoffroea spinosa (almendro de pepa)				x		
Grabowskia boerhaaviifolia (canutillo)		x			x	
Handroanthus billbergii (guayacán)	x		x	x		
Handroanthus chrysanthus (guayacán)	x		x			
Leucaena trichodes (shapa)					x	
Loxopterygium huasango (hualtaco)	x	x	x	x		
Maclura tinctoria (sota, chamelico)	x					x
Piscidia carthagenensis (barbasco)	x					
Pithecellobium excelsum (chaquirón)					x	
*Prosopis pallida (*algarrobo*)*	x		x		x	x
Terminalia valverdeae (huarapo)	x					
Vachellia macracantha (faique)	x					x
Ziziphus thirsiflora (ébano)	x					

In relation to the species cited by local experts for Tumbes-Piura dry forests, in the case of algarrobo (*Prosopis pallida*) mortality of adult and young individuals was observed during field visits in Lambayeque and to a lesser extent in Piura. In this regard, SENASA (2016) mentions that the greatest number of these deaths occur in Piura and Lambayeque and to a lesser extent in Tumbes, where the percentage of algarrobo deaths ranges from 30% to 100% of individuals in the different areas that make up the dry forest, namely there are populations of dead trees, as well as areas where there are populations of trees in a less critical situation. In this context, diverse studies have been carried out to know the factors that are causing mortality of this species, including phytosanitary evaluations between September 2014 and 2016. These studies have identified pests that, individually, would not cause mortality of the scale currently being observed. Possibly, the current mortality is caused by interaction of

several of these pests with each other and with extreme environmental conditions. It could be speculated that climate change is favouring the proliferation of pathogenic fungi and insect pests, decreasing their flowering and fructification and later killing them, adding to this the drastic effect of years of prolonged drought which limits the growth of new populations (Llontop 2013, Whaley *et al*. 2010, SENASA 2016).

Regarding sapote (*Colicodendron scabridum*), its great capacity for natural regeneration and the absence of individuals with diameters greater than 10 cm were observed in some areas of Lambayeque (Mórrope and Ferreñafe) and Piura (Morropón and Paita). It is considered that this is due to the use of the species for firewood, charcoal and handicrafts (Cabrejos *et al.* 2006 and Albán 2005).

On the other hand, in the Salitral-Piura area, adult individuals with diameters greater than 20 cm of palo santo (*Bursera graveolens*) and hualtaco (*Loxopterygium huasango*) were observed, which is attributed to the fact that they are found in a Private Conservation Area, which limits their use. Also, according to Albán (2005) the number of trees per ha of *Bursera graveolens* and *Loxopterygium huasango* has been reduced by 75% and 40% respectively in Piura as a result of selective logging, which represents a danger to their survival; furthermore, Cabrejos *et al.* (2006) mention that *Loxopterygium huasango* does not have great natural regeneration capacity and in the case of *Bursera graveolens*, natural regeneration is limited to rainy periods.

In relation to guayacán (*Handroanthus billbergii*) and polo (*Cochlospermum vitifolium*), they were not observed in the field; however, Odar (2010) recorded the lowest density values in the dry forests of the "El Angolo" hunting reserve[4], concluding that it may be due to the fact that these species are highly used for their commercial value and that they have a restricted distribution. Cabrejos *et al.* (2006) mention that *Cochlospermum vitifolium* is located in semi-dense dry mountain forests and semi-dense dry hill forests and Albán (2005) highlights that a representative sample of *Handroanthus billbergii* is found in Suyo - Piura (Pampa Larga Village Community).

[4] Natural Protected Area with category of hunting preserve located in Piura, whose objective is the conservation of the equatorial dry forest and the sustainable management of the wild fauna.

In the case of overo (*Cordia lutea*), great capacity of natural regeneration was observed. The species is used by the population in perimeter fences and fences for protection of natural regeneration of algarrobo and sapote, and it is not considered threatened. Cabrejos *et al*. (2006) mention that this species is distributed in dry plain forests, dry hill forests and is used to make tool handles, furniture, barrels, posts for fences and as firewood.

In the case of almendro de pepa (*Geoffroea spinosa*), Cabrejos *et al.* (2006) emphasize that, due to the figure of the wood, it is a species of commercial interest and heavily exploited; in addition, they mention that its natural regeneration is not abundant and that it forms part of the semi-dense dry mountain forests and semi-dense dry hill forests. The same authors mention that the wood of charán (*Caesalpinia paipai*) is extracted for uses such as carpentry, firewood and charcoal and that it is forms part of different types of dry forests.

With regard to faique (*Vachellia macracantha*), few individuals with diameters greater than 15 cm were observed, which, according to community members in the area, is due to the fact that adult individuals have been extracted to make use of their wood. Cabrejos *et al.* (2006) mention that this species is distributed in the coastal strip and is part of the dry semi-dense mountain forests, dry sparse to very sparse mountain forests, among others, and is heavily extracted for use as material for craft boats, firewood, charcoal and manufacture of tool handles.

Some young individuals of the following species were observed in dispersed form in the Laquipampa Wildlife Refuge: palo blanco (*Celtis loxensis*), higuerón (*Ficus nymphaeifolia*), pasallo (*Eriotheca ruizii*), chaquirón (*Pithecellobium excelsum*) and shapa (*Leucaena trichodes*). According to the Refuge administration, these are seedlings that were planted to improve ecological connectivity of habitat of the *pava aliblanca* (*Penelope albipensis*), a bird that is in critical danger according to D.S. N°004-2014-MINAGRI. In relation to *Celtis loxensis* Cabrejos *et al.* (2006) mention that this species is distributed in semi-dense mountain forests and semi-dense hill forests and is extracted for use in drawers and crafts.

Regarding canutillo (*Grabowskia boerhaaviifolia*), Lazo (2014) mentions that in the forests of the Pómac Historic Sanctuary there is only 10% coverage of this species and highlights its ecological to the *cortarrama peruana* (*Phytotoma raimondii*), a bird that is catalogued as "endangered" according to D.S. N°004-2014-MINAGRI. Finally, ceibo (*Ceiba trischistandra*) according to Castro (2007) is pressured by the expansion of the agricultural frontier and is

considered endemic of the so-called "tumbesina region" that includes western Ecuador and north-western Peru (DarwinNet 2005, cited by Castro 2007), forming part of the hill dry forest and mountain dry forest (INRENA 1995, cited by Castro 2007). It has multiple uses from wood, bark, seeds and fibre called "kapok", the latter is a product with great commercial potential, but with deficient promotion and market in Peru.

Marañon dry forests

Annex 6 presents the complete list of woody species of conservation interest that should be taken into account, based on their state of threat and endemism. Table 3 presents only those species in some state of threat.

Table 3. Marañon dry forests species in threat status

Source	Conservation status and/or threat of species
IUCN (2018)	Critically Endangered: *Parkinsonia peruviana* **Endangered:** Aspidosperma polyneuron **Vulnerable:** Bauhinia augusti and Piptadenia weberbaueri **Least Concern:** Geoffroea spinosa
Ministerial Resolution 0505-2016-MINAGRI	**En peligro (EN):** *Prosopis juliflora* **Vulnerable (VU):** Vachellia macracantha
Marcelo-Peña *et al.* (2010) *	**Critically Endangered:** Esenbeckia cornuta, Maraniona lavinii and Pseudobombax cajamarcanus **Endangered:** Abutilon pedunculare, Bauhinia augusti, Cordia varronifolia, Mimosa incarum and Tetrasida serrulata **Vulnerable:** Cordia iguaguana, Coursetia maraniona, Jatropha humboldtiana, Ruprechtia aperta, Tecoma rosifolia and Tetrasida chachapoyensis **Least Concern:** Mimosa pectinatipinna

*Marcelo-Peña *et al.* (2010) categorize from their field observations.

Endemic species are presented in Table 4.

Table 4. Woody species endemic to the Marañon dry forests

León *et al.* (2006)	Marcelo Peña *et al.* (2010)	Marcelo Peña *et al.* (2015)
Abutilon pedunculare	Bauhinia augusti	Abutilon pedunculare
Albizia multiflora	Cordia iguaguana	Allamanda weberbaueri
Allamanda weberbaueri	Cordia varronifolia	Bauhinia augusti
Aristolochia chachapoyensis	Coursetia maraniona	Cordia iguaguana
Aristolochia xerophytica	Croton adipatus	Cordia varronifolia
Cordia iguaguana	Esenbeckia cornuta	Coursetia maraniona
Cordia varronifolia	Jatropha humboldtiana	Croton adipatus
Coursetia maraniona	Maraniona lavinii	Croton rubiginosus
Croton adipatus	Mimosa incarum	Esenbeckia cornuta
Croton rubiginosus	Mimosa pectinatipinna	Jatropha humboldtiana
Esenbeckia cornuta	Pseudobombax cajamarcanus	Maraniona lavinii
Jatropha humboldtiana	Ruprechtia aperta	Mimosa incarum
Maraniona lavinii	Tecoma rosifolia	Mimosa pectinatipinna
Mimosa incarum	Tetrasida chachapoyensis	Parkinsonia peruviana
Mimosa pectinatipinna	Tetrasida serrulata	Piptadenia weberbaueri
Parkinsonia peruviana		Pseudobombax cajamarcanus
Piptadenia weberbaueri		Ruprechtia aperta
Ruprechtia aperta		Tecoma rosifolia
Tetrasida chachapoyensis		Tetrasida chachapoyensis
Tetrasida serrulata		Tetrasida serrulata

In the case of Marañon dry forests, no key local actors with sufficient knowledge of the species were identified; however, from the bibliographic review of the floristic composition study carried out by Marcelo-Peña *et al.* (2010) it was possible to determine a list of species of interest for their use in various agroforestry practices (Table 5). Some of these species are categorized as under threat and/or are endemic (see detail in Annex 7).

Table 5. Woody species of Marañon dry forests with agroforestry use

Scientific name	Uses in agroforestry practices
Acacia aroma	Silvopastoral systems, shade
Albizia multiflora	Silvopastoral systems, shade
Albizia niopoides	Shade
Anadenanthera colubrina	Agroforestry and silvopastoral systems
Aspidosperma polyneuron	Silvopastoral systems, shade
Cordia iguaguana	Silvopastoral systems, shade
Cyathostegia matthewsii	Live fences
Geoffroea spinosa	Shade, riparian defense
Guazuma ulmifolia	Silvopastoral systems, shade
Leucaena trichodes	Coffee shade
Mimosa incarum	Living hedges, slope fixing
Mimosa pectinatipinna	Slope stabilization
Muntingia calabura	Slope fixing
Prosopis juliflora	Silvopastoral systems, shade
Sapindus saponaria	Silvopastoral systems, shade, fences
Senegalia polyphylla	Shade
Senna mollissima	Shade
Sideroxylon obtusifolium	Silvopastoral systems, shade
Tecoma rosifolia	Slope stabilization
Tessaria integrifolia	Riparian defense
Vachellia macracantha	Silvopastoral systems, shade

Conclusions

Forty-five seed sources of 16 species were identified in Tumbes-Piura dry forests and none in Marañon dry forests; however, there are 27 potential seed sources of 324 species in the conservation areas.

Existing seed sources are mainly owned by village communities and to a lesser extent by private properties, local associations and state institutions.

Seed sources of algarrobo (*Prosopis* spp.) dominated with 47% and palo santo (*Bursera graveolens*) with 11% due to their uses and commercial interest. The predominant population size was greater than 300 trees and the number of selected seed trees tended to be from 21 to 40 individuals.

Existing seed sources are mostly identified sources by density and selection characteristics. No orchards or seed stands were found.

In Tumbes-Piura dry forests, 11 species were preliminarily identified under different categories of threat from official classifications. Likewise, 22 species were identified under threat by local experts, of which seven are in some category of official threat.

In Marañon dry forests, seven species were preliminarily identified under different categories of threat from the official classifications. In addition, 21 species were identified as being of potential interest for use under various agroforestry practices, of which nine are in some category of official threat and six are endemic.

Recommendations

It is important to take into account the level of interest of village communities for the establishment and maintenance of seed sources, so it is essential to know the current status and potential interest of a network of actors for the purchase and sale of forest seeds in dry forests. Preliminarily, some local actors agree that there is no formal market for the supply and demand of forest seeds and that the commercialization of these seeds would not be a profitable business unless an attractive strategy is found for the local population. It should be noted that what predominates in the current market is the production and sale of seedlings, especially of algarrobo trees, since other species exist in minimal quantities and are only

temporarily activated according to specific projects or programs of the state or the private sector.

Although there is availability of dry forest area with species of interest for the establishment of seed sources, it is indispensable to select the zones to prioritize considering the local level of organization of the village communities that can commit to the management of these in the long term, which guarantees their sustainability. In this context, it is suggested that village communities that already have identified seed sources of species representative of the dry plain forest (*Prosopis pallida* and *Colicodendron scabridum*) and the dry hill forest (*Loxopterygium huasango, Bursera graveolens, Eriotheca ruizii* and *Geoffroea spinosa*) be involved in capacity building activities and registration of their sources.

On the other hand, despite the variety of species in Marañon dry forest with high potential for reforestation in arid zones, uses under agroforestry practices and as soil stabilizers, there is no record of seed sources of these species. Therefore, it is suggested to first prioritize a list of interest contrasting the state of threat, endemism, uses, phenological behaviour and information on propagation methods of these species and then map the availability and production of seeds to plan future activities.

For the prioritization of species, it is suggested not only to contrast information on conservation status with the demand of these species for reforestation, recovery and restoration projects or others, but also the availability and production of seeds or other planting materials of the selected species.

The tropical dry forests of northern Peru present a variety of species; however, there is selective logging of only some species, such as *Prosopis pallida, Colicodendron scabridum, Vachellia macracantha, Bursera graveolens, Handroanthus billbergi* and *H. chrysanthus*. These high value species are often extracted from dry forests illegally and only in some cases within the framework of management plans. Therefore, there is widespread perception of a discrepancy between what has been extracted and what has been reforested, since most of the projects focus mainly on *Prosopis pallida, Bursera graveolens* and to a lesser extent *Colicodendron scabridum*, leaving aside the other species, due, according to local actors, mainly to the deficiency of reproductive material and knowledge of their propagation. It would be opportune, as far as possible, to carry out a mapping of the main deficiencies of

technical knowledge of collection, storage and propagation of the species of interest, which allows to approach the subject in a more dynamic way and to plan future activities.

Annexes

Annex 1. Form for seed sources in conservation areas

1. Nombre del área

1.1 Código: (Ej. CPIU1)
1.2 Título:

2. Características del área

2.1 ¿Cuándo fue declarada como área de conservación?
2.2 ¿Qué tipo de administración presenta el área?, y de ser posible mencionar el nombre de la persona o entidad administradora

( ) Áreas de Administración Nacional
( ) Áreas de Conservación Regional
( ) Áreas de Conservación Privada
Nombre del administrador:
Nombre del responsable:
Correo electrónico:
Teléfono fijo o móvil:

2.3 ¿Dónde se encuentra localizada y cuál es su extensión?

- Departamento:
- Provincia:
- Distrito:
- Localidad, caserío u otro:
- Coordenadas geográficas y/o UTM:
- Datum:
- Extensión (ha):

2.4 ¿Existe alguna lista de especies de flora presentes en el área de conservación?

( ) Si
( ) No

2.5 En caso hubiese la lista de especies, ¿Con qué variables cuenta? (Puede marcar más de una)

( ) Altura
( ) Diámetro
( ) Densidad o abundancia relativa
( ) Frecuencia
( ) Dominancia
( ) Estado fitosanitario
( ) Coordenadas
( ) Ninguna
( ) Otros (especifique):

3. Características de las fuentes semilleras

3.1 ¿Se tienen identificados fuentes semilleras de éstas especies? Especificar para qué especie (s)

( ) Si
( ) No

3.2 ¿Dónde se encuentran localizadas las fuentes semilleras? Especificar para cada especie

- Coordenadas: Latitud…….Longitud…….Datum
- Altitud:

3.3 Características de la fuente semillera para cada especie

- Fecha de establecimiento o identificación:
- Período desde su establecimiento:
- Superficie (ha):
- Densidad (árb/ha):

- Tamaño poblacional:
- Número de árboles seleccionados:

3.2 ¿Qué criterios se utilizaron para identificarlas? Especificar para cada especie
( ) Accesibilidad y topografía
( ) Condición del rodal (estado fitosanitario, capacidad de producir semillas)
( ) Número de árboles y tamaño de fuente
( ) Edad de los árboles
( ) Especies únicas
( ) Ninguna
( ) Otros (especifique):

3.3 ¿Qué tipo de fuente semillera es? Especificar para cada especie
( ) Rodal semillero a partir de plantación existente (natural)
( ) Rodal semillero a partir de una nueva plantación (establecido)
( ) Fuente seleccionada
( ) Fuente identificada

3.4 En las fuentes semilleras, ¿Qué características se tomaron en cuenta para identificar los árboles plus? (Puede marcar más de una) Especificar para cada especie
( ) Fustes rectos
( ) Forma de copa regular
( ) Ausencia de bifurcaciones en la base
( ) Estado fitosanitario bueno
( ) Ser dominante (excepcionalmente codominante)
( ) Ninguna
( ) Otros (especifique):

3.5 ¿Qué tipo de material reproductivo se extraen de las fuentes semilleras? Especificar para cada especie
( ) Semillas
( ) Estacas
( ) Otros (especifique):

Annex 2. Form for seed sources in other areas

1. Datos generales

1.1 Código: (Ej. SPIU1)

1.2 Nombre de la fuente semillera:

1.3 ¿A quién le pertenece la fuente semillera? De ser posible, mencionar su nombre

( ) Comunidad local
( ) Asociación
( ) Empresa privada
( ) ONG
( ) Centro de investigación
( ) Universidad
( ) Otro (especifique)
Nombre del propietario:
Nombre del responsable:
Correo electrónico:
Teléfono fijo o móvil:

1.4 ¿Dónde se encuentra localizada y cuál es su superficie?

- Departamento:
- Provincia:
- Distrito:
- Localidad, caserío u otro:
- Altitud (msnm):
- Coordenadas geográficas y/o UTM:
- Datum:
- Superficie (ha):
- Superficie total del PGMF* (ha):

2. Características de las fuentes semilleras

2.1 Información técnica de la (s) especies. Especificar para cada especie

- Nombre científico:
- Nombre común:
- Fecha de establecimiento o identificación:
- Período de identificación:
- Tamaño poblacional:
- Densidad (árb/ha):
- Número de árboles seleccionados:

2.2 ¿Qué criterios se utilizaron para identificar las fuentes semilleras? Especificar para cada especie

( ) Accesibilidad y topografía
( ) Condición del rodal (estado fitosanitario, capacidad de producir semillas)
( ) Número de árboles y tamaño de fuente
( ) Edad de los árboles
( ) Especies únicas
( ) Ninguna
( ) Otros (especifique):

2.3 ¿Qué tipo de fuente semillera es? Especificar para cada especie

( ) Huerto semillero forestal comprobado
( ) Huerto semillero forestal no comprobado
( ) Rodal semillero a partir de plantación existente (natural)
( ) Rodal semillero a partir de una nueva plantación (establecido)
( ) Fuente seleccionada
( ) Fuente identificada

2.4 En las fuentes semilleras, ¿Qué características se tomaron en cuenta para identificar los árboles plus? (Puede marcar más de una) Especificar para cada especie

( ) Fustes rectos
( ) Forma de copa regular
( ) Ausencia de bifurcaciones en la base
( ) Estado fitosanitario bueno
( ) Ser dominante (excepcionalmente codominante)
( ) Ninguna
( ) Otros (especifique):

2.5 ¿Qué tipo de material reproductivo se extraen de las fuentes semilleras? Especificar para cada especie

( ) Semillas
( ) Estacas
( ) Otros (especifique):

Annex 3. Seed Source Categories

SEED SOURCE: According to MINAGRI (2006) and Cuellar *et al*. (2016), they are individuals selected on the basis of desirable phenotypic and genetic characteristics that provide quality reproductive material (generally seeds). Seed sources are classified into five categories:	
Categories	**Characteristics**
Genetically tested seed orchard	Plantation of intensively selected clones or progenies, isolated to reduce pollen contamination from inferior trees and intensively managed for seed production. Supported by progeny testing and genetic thinning (rogued).
Untested seed orchard	Orchard that has not been subjected to genetic thinning (unrouged), either because of the absence of genetic trials or because of the young age of the trials. Although this garden is not supported by genetic tests, the high intensity of selection to which the parents have been subjected guarantees a genetic gain superior to that of other types of sources.
Seed stand	They can be planted or natural, isolated or managed to reduce pollen contamination from lower trees and have been subjected to improvement thinning to leave 75 to 200 trees per hectare with desired phenotypic characteristics. The seed stand must have a minimum area of 1ha, smaller groups or trees in rows cannot be considered in this category. One of the main differences between seed stands and seed orchards is the intensity of selection: in seed stands the trees have been selected at an intensity of 1:10 - 1:20, while in the case of orchards, each tree has been selected from several thousand trees evaluated.
Selected Source	They are sources that do not comply with the requirements established for seedling stands, mainly because they present isolation problems, and contain less than 75 acceptable trees per hectare or because they have not been subjected to purification thinning (they contain more than 200 trees per hectare).
Identified Source	These are groups of trees that because of their low density, because they occupy a small area and/or because they do not contain a sufficient number of trees with desirable characteristics per hectare, do not fall into the previous category, but should be used temporarily in the absence of more selected sources. Typically found in this group are: experimental plots represented by a limited number of individuals, small plantation blocks, small genetic or silvicultural trials, natural forest species that by their nature or due to the elimination of forests, occur at low densities or do not reach the minimum number of acceptable trees per hectare.

Annex 4. List of species with potential seed sources

Species			
Acalypha cuspidata	*Aspidosperma polyneuron*	*Cariniana parvifolia*	*Coccoloba obovata*
Acalypha padifolia	*Bauhinia aculeata*	*Casearia aculeata*	*Coccoloba padiformis*
Acalypha villosa	*Bauhinia augusti*	*Casearia obovalis*	*Coccoloba ruiziana*
Acanthosyris glabrata	*Beautempsia avicenniifolia*	*Cavanillesia platanifolia*	*Cochlospermum vitifolium*
Achatocarpus pubescens	*Bonellia mucronata*	*Cecropia garciae*	*Cocos nucifera*
Acnistus arborescens	*Bonellia sprucei*	*Cecropia membranacea*	*Colicodendron scabridum*
Aeschynomene tumbezensis	*Bougainvillea pachyphylla*	*Cedrela angustifolia*	*Cordia alliodora*
Agonandra excelsa	*Bougainvillea peruviana*	*Cedrela fissilis*	*Cordia eriostigma*
Albizia guachapele	*Briquetia spicata*	*Cedrela molinensis*	*Cordia iguaguana*
Albizia multiflora	*Brosimum alicastrum*	*Ceiba insignis*	*Cordia lutea*
Albizia niopoides	*Brugmansia versicolor*	*Ceiba trischistandra*	*Cordia panamensis*
Allophylus punctatus	*Bunchosia plowmanii*	*Celtis iguanaea*	*Cordia saccellia*
Alnus acuminata	*Bursera graveolens*	*Celtis loxensis*	*Cordia varronifolia*
Aloysia scorodonioides	*Byttneria glabresens*	*Celtis schippii*	*Coursetia maraniona*
Alseis eggersii	*Byttneria parviflora*	*Centrolobium ochroxylum*	*Crescentia amazonica*
Alseis peruviana	*Caesalpinia cassioides*	*Cestrum auriculatum*	*Critoniopsis woytkowskii*
Ampelocera macphersonii	*Caesalpinia glabrata*	*Chrysophyllum cuneifolium*	*Croton adipatus*
Amyris pinnata	*Caesalpinia spinosa*	*Chrysophyllum lucentifolium*	*Croton erythrochilus*
Anadenanthera colubrina	*Calliandra angustifolia*	*Cinchona pubescens*	*Croton glabellus*
Annona montana	*Calliandra mollissima*	*Citharexylum chartaceum*	*Croton schiedeanus*
Annona muricata	*Callianthe geminiflora*	*Citharexylum gentryi*	*Croton thurifer*
Aphelandra attenuata	*Callianthe pauciflora*	*Clavija euerganea*	*Cupania latifolia*
Aphelandra glabrata	*Capparicordis crotonoides*	*Clusia elliptica*	*Cyathostegia mathewsii*
Aralia soratensis	*Capparidastrum petiolare*	*Clusia peruviana*	*Cybistax antisyphilitica*
Armatocereus digogonus	*Capsicum hookerianum*	*Cnidoscolus jaenensis*	*Cynophalla flexuosa*
Armatocereus matucanensis	*Capsicum rhomboideum*	*Coccoloba densifrons*	*Cynophalla heterophylla*
Aspidosperma excelsum	*Cardiospermum halicacabum*	*Coccoloba mollis*	*Cynophalla sclerophylla*

Species			
Ditaxis dioica	*Fridericia dichotoma*	*Krameria lappacea*	*Muntingia calabura*
Ditaxis katharinae	*Gallesia integrifolia*	*Ladenbergia amazonensis*	*Myrcia splendens*
Drypetes amazonica	*Geoffroea spinosa*	*Leucaena trichodes*	*Myrcianthes rhopaloides*
Duranta erecta	*Grabowskia boerhaaviifolia*	*Lonchocarpus atropurpureus*	*Myroxylon balsamum*
Eriotheca discolor	*Guazuma ulmifolia*	*Lonchocarpus floribundus*	*Myroxylon peruiferum*
Eriotheca ruizii	*Gymnosporia emarginata*	*Loxopterygium huasango*	*Neea spruceana*
Erythrina smithiana	*Hamelia patens*	*Luehea paniculata*	*Ochroma pyramidale*
Erythrina velutina	*Handroanthus billbergii*	*Lycianthes stenoloba*	*Ocotea aurantiodora*
Erythrochiton odontoglossus	*Handroanthus chrysanthus*	*Lysiloma latisiliquum*	*Ocotea piurensis*
Erythroxylum glaucum	*Heliocarpus americanus*	*Machaerium millei*	*Pachira patinoi*
Erythroxylum pacificum	*Heliotropium rufipilum*	*Maclura tinctoria*	*Pachira trinitensis*
Erythroxylum patens	*Hilleria secunda*	*Macrosamanea amplissima*	*Parkinsonia aculeata*
Esenbeckia cornuta	*Hura crepitans*	*Malpighia glabra*	*Parkinsonia praecox*
Eugenia biflora	*Inga acrocephala*	*Malvaviscus arboreus*	*Phyllanthus mocinianus*
Eumachia microdon	*Inga codonantha*	*Mansoa hymenaea*	*Phytolacca dioica*
Faramea capillipes	*Inga feuillei*	*Maraniona lavinii*	*Phytolacca weberbaueri*
Faramea occidentalis	*Inga ruiziana*	*Margaritaria nobilis*	*Picramnia sellowii*
Ficus americana	*Inga sapindoides*	*Mauria heterophylla*	*Piper arboreum*
Ficus citrifolia	*Inga stenoptera*	*Maytenus durifolia*	*Piper umbellatum*
Ficus gomelleira	*Inga striata*	*Melochia lupulina*	*Piptadenia flava*
Ficus insipida	*Ipomoea carnea*	*Miconia laevigata*	*Piscidia carthagenensis*
Ficus jacobii	*Ipomoea pauciflora*	*Mimosa acantholoba*	*Pisonia aculeata*
Ficus maxima	*Ipomoea philomega*	*Mimosa myriadenia*	*Pithecellobium excelsum*
Ficus nymphaeifolia	*Jacquemontia floribunda*	*Mimosa pectinatipinna*	*Platymiscium dimorphandrum*
Ficus obtusifolia	*Jatropha clavuligera*	*Monteverdia retusa*	*Pleuropetalum pleiogynum*
Ficus pertusa	*Jatropha curcas*	*Morus celtidifolia*	*Pleuropetalum sprucei*
Ficus sarmentosa	*Jatropha humboldtiana*	*Mouriri myrtilloides*	*Poiretia punctata*

Species			
Sapium glandulosum	*Sorocea trophoides*	*Pouteria glomerata*	*Triplaris cumingiana*
Sapium laurifolium	*Sphinctanthus aurantiacus*	*Pouzolzia occidentalis*	*Triplaris peruviana*
Schaefferia serrata	*Spondias mombin*	*Pradosia montana*	*Triplaris weigeltiana*
Schrebera americana	*Stigmaphyllon ellipticum*	*Pradosia mutisii*	*Triumfetta semitriloba*
Seguieria americana	*Tabebuia chrysea*	*Prestonia mollis*	*Urera baccifera*
Senegalia polyphylla	*Tabebuia impetiginosa*	*Prockia pentamera*	*Urera caracasana*
Senegalia riparia	*Tabebuia ochracea*	*Prosopis juliflora*	*Vachellia aroma*
Senegalia tenuifolia	*Tartagalia roseorum*	*Prosopis pallida*	*Vachellia macracantha*
Senegalia weberbaueri	*Tecoma rosaefolia*	*Prunus subcorymbosa*	*Vallesia glabra*
Senna atomaria	*Tecoma stans*	*Pseudobaccharis inamoena*	*Varronia macrocephala*
Senna galegifolia	*Tecoma weberbaueriana*	*Pseudobombax cajamarcanus*	*Vasconcellea parviflora*
Senna macranthera	*Terminalia valverdeae*	*Psidium guajava*	*Verbesina lopez-mirandae*
Senna mollissima	*Tessaria integrifolia*	*Psidium rostratum*	*Vernonanthura phosphorica*
Senna ruiziana	*Tetrasida chachapoyensis*	*Psidium rutidocarpum*	*Vernonia patens*
Senna spectabilis	*Tetrasida serrulata*	*Psychotria horizontalis*	*Vitex gigantea*
Serjania ampelopsis	*Tournefortia maculata*	*Pterocarpus amazonum*	*Wissadula excelsior*
Sideroxylon obtusifolium	*Tournefortia ternifolia*	*Pterocarpus rohrii*	*Witheringia solanacea*
Simira ecuadorensis	*Toxosiphon carinatus*	*Quararibea wittii*	*Ximenia americana*
Simira rubescens	*Toxosiphon macropodus*	*Randia ferox*	*Xylosma benthamii*
Simira williamsii	*Trema micrantha*	*Ricinus communis*	*Zamia poeppigiana*
Solanum caripense	*Tricerma octogonum*	*Rinorea viridifolia*	*Zanthoxylum caribaeum*
Solanum hutchisonii	*Trichilia elegans*	*Rudgea cornifolia*	*Zanthoxylum fagara*
Solanum leucocarpon	*Trichilia hirta*	*Ruprechtia aperta*	*Zanthoxylum martinicense*
Solanum monadelphum	*Trichilia moschata*	*Ruprechtia tenuiflora*	*Zanthoxylum rigidum*
Solanum pachyandrum	*Trichilia pallida*	*Salix humboldtiana*	*Zanthoxylum sprucei*
Solanum umbellatum	*Trichilia rubra*	*Salvia consobrina*	*Zapoteca caracasana*
Sorocea sprucei	*Trichilia surinamensis*	*Sapindus saponaria*	*Ziziphus thyrsiflora*

Annex 5. List of species of Tumbes-Piura dry forests with conservation status

Species					State of conservation and/or threat			
ID	Family	Scientific name cited	Scientific name accepted	Common name	IUCN (2018)	CITES Appendices (2016)	MINAGRI (2006)	MINAGRI (2016)
1	Fabaceae	*Acacia huarango*	*Vachellia aroma*	Aromo	None	None	Near Threatened (NT)	None
2	Fabaceae	*Acacia macracantha*	*Vachellia macracantha*	Faique	None	None	Near Threatened (NT)	Vulnerable (VU)
3	Betulaceae	*Alnus acuminata*	*Alnus acuminata*	Aliso	Least Concern	None	Vulnerable (VU)	Near Threatened (NT)
4	Burseraceae	*Bursera graveolens*	*Bursera graveolens*	Palo santo	None	None	Critically Endangered (CR)	Critically Endangered (CR)
5	Fabaceae	*Caesalpinia paipai*	*Caesalpinia paipai*	Charán	Least Concern	None	None	None
6	Fabaceae	*Caesalpinia spinosa*	*Caesalpinia spinosa*	Tara	None	None	Vulnerable (VU)	None
7	Capparaceae	*Capparis avicenniifolia*	*Beautempsia avicenniifolia*	Vichayo	None	None	None	Vulnerable (VU)
8	Capparaceae	*Capparis ovalifolia*	*Beautempsia avicenniifolia*	Vichayo	None	None	None	None
9	Malvaceae	*Ceiba trischistandra*	*Ceiba trischistandra*	Ceibo	None	None	None	None
10	Cannabaceae	*Celtis triflora*	*Celtis iguanaea*	Palo blanco	None	None	Critically Endangered (CR)	None

Species					State of conservation and/or threat			
ID	Family	Scientific name cited	Scientific name accepted	Common name	IUCN (2018)	CITES Appendices (2016)	MINAGRI (2006)	MINAGRI (2016)
11	Fabaceae	*Cercidium praecox*	*Parkinsonia praecox*	Palo verde	None	None	None	None
12	Bixaceae	*Cochlospermum vitifolium*	*Cochlospermum vitifolium*	Polo polo	None	None	Endangered (EN)	None
13	Capparaceae	*Colicodendron scabridum*	*Colicodendron scabridum*	Sapote	None	None	Critically Endangered (CR)	Endangered (EN)
14	Boraginaceae	*Cordia lutea*	*Cordia lutea*	Overo	None	None	None	None
15	Malvaceae	*Eriotheca ruizii*	*Eriotheca ruizii*	Pasallo	None	None	None	None
16	Fabaceae	*Erythrina smithiana*	*Erythrina smithiana*	Porotillo, huayrul	None	None	None	None
17	Moraceae	*Ficus nymphaeifolia*	*Ficus nymphaeifolia*	Higuerón	None	None	None	None
18	Fabaceae	*Geoffroea striata*	*Geoffroea spinosa*	Almendro de pepa	Least Concern	None	None	None
19	Solanaceae	*Grabowskia boerhaaviifolia*	*Grabowskia boerhaaviifolia*	Canutillo	None	None	None	Vulnerable (VU)
20	Fabaceae	*Leucaena trichodes*	*Leucaena trichodes*	Shapa	None	None	None	None

Species					State of conservation and/or threat			
ID	Family	Scientific name cited	Scientific name accepted	Common name	IUCN (2018)	CITES Appendices (2016)	MINAGRI (2006)	MINAGRI (2016)
21	Anacardiaceae	*Loxopterygium huasango*	*Loxopterygium huasango*	Hualtaco	None	None	Critically Endangered (CR)	Critically Endangered (CR)
22	Muntingiaceae	*Muntingia calabura*	*Muntingia calabura*	Cerezo	None	None	None	None
23	Fabaceae	*Parkinsonia aculeata*	*Parkinsonia aculeata*	Palo verde, azote de cristo	None	None	None	None
24	Fabaceae	*Parkinsonia praecox*	*Parkinsonia praecox*	Palo verde	None	None	None	None
25	Fabaceae	*Pithecellobium excelsum*	*Pithecellobium excelsum*	Chaquiro, Chaquirón	None	None	None	None
26	Fabaceae	*Pithecellobium multiflorum*	*Albizia multiflora*	Angolo	None	None	None	None
27	Fabaceae	*Prosopis limensis*	*Prosopis pallida*	Algarrobo	None	None	Vulnerable (VU)	Critically Endangered (CR)
28	Fabaceae	*Prosopis pallida*	*Prosopis pallida*	Algarrobo	None	None	Vulnerable (VU)	Endangered (EN)
29	Bignoniaceae	*Tabebuia billbergii*	*Handroanthus billbergii*	Guayacán	None	None	None	None
30	Bignoniaceae	*Tabebuia chrysantha*	*Handroanthus chrysanthus*	Madero negro	None	None	None	None
31	Apocynaceae	*Vallesia glabra*	*Vallesia glabra*	Cun cun	Least Concern	None	None	None

Annex 6. List of species of interest in the Marañon dry forests

Species			State of conservation and/or threat			Endemism			Uses in agroforestry practices
ID	Family	Scientific name	IUCN (2018)	MINAGRI (2016)	Marcelo Peña *et al.* (2010)	León *et al.* (2006)	Marcelo Peña *et al.* (2010)	Marcelo Peña *et al.* (2015)	Marcelo Peña *et al.* (2010)
1	Malvaceae	*Abutilon pedunculare*	None	None	Endangered	Yes	No	Yes	No information
2	Fabaceae	*Acacia aroma*	None	None	None	No	No	No	Silvopastoral systems, shade
3	Fabaceae	*Albizia multiflora*	None	None	None	Yes	No	No	Silvopastoral systems, shade
4	Fabaceae	*Albizia niopoides*	None	None	None	No	No	No	Shade
5	Apocynaceae	*Allamanda weberbaueri*	None	None	None	Yes	No	Yes	No information
6	Fabaceae	*Anadenanthera colubrina*	None	None	None	No	No	No	Agroforestry and silvopastoral systems
7	Aristolochiaceae	*Aristolochia chachapoyensis*	None	None	None	Yes	No	No	No information
8	Aristolochiaceae	*Aristolochia xerophytica*	None	None	None	Yes	No	No	No information
9	Apocynaceae	*Aspidosperma polyneuron*	Endangered (EN)	None	None	No	No	No	Silvopastoral systems, shade
10	Fabaceae	*Bauhinia augusti*	Vulnerable (VU)	None	Endangered	No	Yes	Yes	No information
11	Boraginaceae	*Cordia iguaguana*	None	None	Vulnerable	Yes	Yes	Yes	Silvopastoral systems, shade
12	Boraginaceae	*Cordia varronifolia*	None	None	Endangered	Yes	Yes	Yes	No information
13	Fabaceae	*Coursetia maraniona*	None	None	Vulnerable	Yes	Yes	Yes	No information
14	Euphorbiaceae	*Croton adipatus*	None	None	None	Yes	Yes	Yes	No information

Species			State of conservation and/or threat			Endemism			Uses in agroforestry practices
ID	Family	Scientific name	IUCN (2018)	MINAGRI (2016)	Marcelo Peña *et al.* (2010)	León *et al.* (2006)	Marcelo Peña *et al.* (2010)	Marcelo Peña *et al.* (2015)	Marcelo Peña *et al.* (2010)
15	Euphorbiaceae	*Croton rubiginosus*	None	None	None	Yes	No	Si	No information
16	Fabaceae	*Cyathostegia matthewsii*	None	None	None	No	No	No	Live fences
17	Rutaceae	*Esenbeckia cornuta*	None	None	Critically Endangered	Yes	Yes	Yes	No information
18	Fabaceae	*Geoffroea spinosa*	Least Concern (LC)	None	None	No	No	No	Shade, riparian defense
19	Malvaceae	*Guazuma ulmifolia*	None	None	None	No	No	No	Silvopastoral systems, shade
20	Euphorbiaceae	*Jatropha humboldtiana*	None	None	Vulnerable	Yes	Yes	Yes	No information
21	Fabaceae	*Leucaena trichodes*	None	None	None	No	No	No	Coffee shade
22	Fabaceae	*Maraniona lavinii*	None	None	Critically Endangered	Yes	Yes	Yes	No information
23	Fabaceae	*Mimosa incarum*	None	None	Endangered	Yes	Yes	Yes	Living hedges, slope fixing
24	Fabaceae	*Mimosa pectinatipinna*	None	None	Least Concern	Yes	Yes	Yes	Slope stabilization
25	Muntingiaceae	*Muntingia calabura*	None	None	None	No	No	No	Slope fixing
26	Fabaceae	*Parkinsonia peruviana*	Critically Endangered (CR)	None	None	Yes	No	Yes	No information
27	Fabaceae	*Piptadenia weberbaueri*	Vulnerable (VU)	None	None	Yes	No	Yes	No information

28	Fabaceae	*Prosopis juliflora*	None	Endangered (EN)	None	No	No	No	Silvopastoral systems, shade

Species			State of conservation and/or threat			Endemism			Uses in agroforestry practices
ID	Family	Scientific name	IUCN (2018)	MINAGRI (2016)	Marcelo Peña *et al.* (2010)	León *et al*. (2006)	Marcelo Peña *et al*. (2010)	Marcelo Peña *et al*. (2015)	Marcelo Peña *et al.* (2010)
29	Malvaceae	*Pseudobombax cajamarcanus*	None	None	Critically Endangered	No	Yes	Yes	No information
30	Polygonaceae	*Ruprechtia aperta*	None	None	Vulnerable	Yes	Yes	Yes	No information
31	Sapindaceae	*Sapindus saponaria*	None	None	None	No	No	No	Silvopastoral systems, shade, fences
32	Fabaceae	*Senegalia polyphylla*	None	None	None	No	No	No	Shade
33	Fabaceae	*Senna mollissima*	None	None	None	No	No	No	Shade
34	Sapotaceae	*Sideroxylon obtusifolium*	None	None	None	No	No	No	Silvopastoral systems, shade
35	Bignoniaceae	*Tecoma rosifolia*	None	None	Vulnerable	No	Yes	Yes	Slope stabilization
36	Asteraceae	*Tessaria integrifolia*	None	None	None	No	No	No	Defensa ribereña
37	Malvaceae	*Tetrasida chachapoyensis*	None	None	Vulnerable	Yes	Yes	Yes	No information
38	Malvaceae	*Tetrasida serrulata*	None	None	Endangered	Yes	Yes	Yes	No information
39	Fabaceae	*Vachellia macracantha*	None	Vulnerable (VU)	None	No	No	No	Silvopastoral systems, shade

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