**Land use change trajectories, conservation status and social importance of dry forests in Nicaragua**

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**APPENDIX 1**



**Figure S1**Examples of classification of the land-use trajectoriesrecognized in the area. Each aerial photograph shows the changes of land use in a given area over four years. Note: AD = acute disturbance, CD = chronic disturbance, and LD = low disturbance.

**Table S1** List of social values ascribed to dry forest’ species and examples of prioritization of statements made by the focus group of elderly people and key informants.

|  |  |  |  |
| --- | --- | --- | --- |
| *Social values* | | | *Examples of statements* |
| Direct use | Timber and housing | * Use for housing * Timber products * Precious wood (specific uses) | ‘For farmer two trees are important among timber trees: *Zopilote (*Piscidia grandifolia) and Palo de arco (Apoplanesia paniculata). They are useful for pitchforks and other tools’ |
| Non timber forest products | * Fruits (animal and human use) * Medicinal use * Colouring matter * Honey | ‘The *Mora (Maclura tinctoria)* has multiple interesting values. It’s used as colouring matter (*caqui*), it’s very resistant and good timber’  ‘The *Aceituno de Guanacaste* *(Simarouba glauca)* has also good fruits, and for human use hasastringent properties. You can only find it in low lands*’* |
| Energy use | * Firewood | ‘There are several species goods for firewood. If I have to prioritize, I choose the *Mandagual (Caesalpinia velutina)* and *Miliguiste (Karwinskia calderonii)* which are good both for firewood and for timber’ |
| Indirect use |  | * Shade * Cool microclimate * Fences | ‘The *Aguacate monte* *(Persea caerulea)* is useful in the agro-forestry system with coffee’  ‘In this dry lowland the most appreciated tree for shade and animals’ feeding is the *Guacimo de ternera (Guazuma ulmifolia).* It has also medicinal properties’ |
| Ecological value |  | * Symbiosis * Mutualism * Allelopathy * Refugee * Wild animal feeding (trophic webs) * Epiphytes support * Ecological conditions * Tolerance to drier conditions * Capacity of regeneration * Water protection | ‘Birds and lots of animals love fruits of *Nispero (Manilkara zapota)’*  ‘We have a rich diversity in epiphytes, but they cannot survive without their tree’s holder, for example the *Guachipilin (Diphysa Americana)’*  ‘The *flor amarilla o vainillo (Senna atomaria)* host lots of bees and butterfly. It’s resistant and able toregenerate’  ‘…In addition the *Aguagacate monte* (*Persea coreulea)* protects water sources’ |
| Existence value | Aesthetic value | * Colour of flowers and fruits * Cultural landscape * Beauty of species | ‘The *Aceituno de Guanacaste* *(Simarouba glauca)* is a very beautiful tree’ |
| Cultural value | * Sense of belonging * Traditional ecological knowledge | ‘There are trees which represent our culture. Some place names derive from names of tree for their importance for our forefathers, such as el Quebracho *(Lysiloma divaricatum*), mainly in sloped rocky area, el Robledal (*Quercus segoviensis*)’ |

**Table S2** List of tree species, grouped per family, recorded for each land-use change trajectory (*n* = 36): prioritized values, degree of threat and percentage of relative frequency (RF) and dominance (RD). Note: AD = acute disturbance, CD = chronic disturbance, and LD = low disturbance value: direct use (T&H = timber and housing extraction; F = firewood; NTF = non-timber forest products); I = indirect use; Eco = ecological value; E = existence value. \*Estimated from the defined five degrees of threat expressed in linguistic terms adopted from IUCN categories (IUCN 2001)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Family* | *Species* | *Species*  *prioritized*  *social value* | *Species*  *prioritized*  *threat degree* \* | *AD* | | *CD* | | *LD* | |
| *RF* | *RD* | *RF* | *RD* | *RF* | *RD* | |
| *(%)* | | *(%)* | | *(%)* | |
| Anacardiaceae | *Rhus terebinthifolia* |  |  | 2.7 | 1.7 | 0.6 | 0.3 | 1.1 | 0.2 |
|  | *Spondias mombin* |  |  |  |  | 0.1 | 0.7 | 0.6 | 1.0 |
|  | *Spondias purpurea* | Eco, NTFP | 0.60 | 1.1 | 2.9 | 2.1 | 3.6 | 2.9 | 4.9 |
|  | *Tapirira guianensis* | T&H, NTFP, I |  |  |  | 0.5 | 1.7 |  |  |
| Annonaceae | *Anona purpurea* | T&H | 0.80 | 1.5 | 0.8 | 2.8 | 2.8 | 5.2 | 2.1 |
| Apocynoceae | *Plumeria rubra* |  |  |  |  | 0.1 | 0.5 |  |  |
| Araliaceae | *Oreopanax capitatus* |  |  | 0.4 | 0.7 | 0.4 | 0.3 | 2.0 | 2.5 |
| Asteraceae | *Bidens pilosa* |  |  |  |  | 0.1 | 0.0 |  |  |
| Bignoniaceae | *Parmentiera trunciflora* | NTFP, Eco | 0.83 | 0.4 | 0.9 | 1.6 | 2.6 |  |  |
|  | *Tecoma stans* | T&H, E | 0.48 |  |  | 0.2 | 0.1 |  |  |
| Boraginaceae | *Cordia alliodora* | T&H, NTFP, Eco | 0.88 | 0.2 | 0.7 | 1.4 | 0.9 |  |  |
|  | *Cordia gerascanthus* |  |  | 0.4 | 0.1 | 0.4 | 0.1 | 2.9 | 3.5 |
| Burseraceae | *Bursera graveolens* |  | 0.56 | 3.7 | 5.1 | 1.1 | 2.9 | 2.6 | 9.4 |
|  | *Bursera simaruba* | T&H, Eco | 0.48 | 4.6 | 7.5 | 6.1 | 8.7 | 11.2 | 13.7 |
| Caesalpiniaceae | *Cassia grandis* |  |  |  |  | 0.1 | 0.4 |  |  |
| Cecropiaceae | *Cecropia insignis* |  |  |  |  | 0.1 | 0.1 |  |  |
| Clusiaceae | *Clusia rosea* |  |  |  |  | 0.9 | 0.7 |  |  |
| Combretaceae | *Terminalia oblonga* | T&H, NTFP, F, Eco, I | 0.83 |  |  | 3.6 | 3.6 | 1.4 | 1.4 |
| Convolvulaceae | *Hipomoea incarnata* |  |  |  |  | 0.7 | 0.9 | 0.6 | 0.1 |
| Ebenaceae | *Diospyros salicifolia* |  |  |  |  | 0.4 | 0.2 |  |  |
| Euphorbiaceae | *Cnidoscolus urens* |  |  | 0.2 | 0.1 | 0.2 | 0.1 | 1.4 | 0.6 |
|  | *Croton niveus* |  | 0.35 | 3.1 | 0.6 | 3.4 | 0.7 | 0.3 | 0.1 |
|  | *Croton panamensis* |  |  |  |  | 0.1 | 0.0 | 0.3 | 0.1 |
|  | *Euphorbia schlechtendalii* |  |  |  |  |  |  | 0.3 | 0.0 |
|  | *Sapium macrocarpum* |  |  |  |  |  |  | 0.9 | 0.2 |
| Fabaceae | *Acacia collinsii* | Eco | 0.35 | 0.7 | 0.3 | 0.1 | 0.0 |  |  |
|  | *Acacia pennatula* |  |  | 18.3 | 12.2 | 4.2 | 5.2 | 2.9 | 2.0 |
|  | *Albizia adinocephala* |  | 0.23 | 2.4 | 3.3 | 2.0 | 3.2 | 0.9 | 1.7 |
|  | *Apoplanesia paniculata* | T&H, E | 0.77 | 0.5 | 0.2 | 0.6 | 1.1 | 2.3 | 1.6 |
|  | *Caesalpinia exostemma* |  |  | 2.6 | 1.0 | 0.2 | 0.1 | 0.3 | 0.1 |
|  | *Caesalpinia velutina* | T&H, F, Eco | 0.74 | 0.4 | 0.2 | 1.2 | 0.6 |  |  |
|  | *Calliandra calothyrsus* |  |  | 3.1 | 0.7 | 1.4 | 0.3 | 0.6 | 0.1 |
|  | *Diphysa americana* | E, Eco | 0.67 | 0.2 | 0.3 |  |  |  |  |
|  | *Dipteryx panamensis* |  | 0.83 |  |  | 0.1 | 0.3 |  |  |
|  | *Enterolobium cyclocarpum* | NTFP | 0.48 |  |  | 0.4 | 0.7 |  |  |
|  | *Erythrina berterona* |  |  |  |  | 0.1 | 0.1 | 0.6 | 1.4 |
|  | *Hymenaea courbaril* | T&H |  |  |  |  |  | 0.3 | 0.9 |
|  | *Leucaena leucocephala* |  |  |  |  | 0.2 | 0.1 |  |  |
|  | *Lonchocarpus minimiflorus* |  | 0.65 | 0.2 | 0.2 |  |  |  |  |
|  | *Lysiloma divaricatum* | NTFP, E, I | 0.77 | 0.9 | 0.3 | 0.6 | 0.2 | 1.1 | 1.1 |
|  | *Mimosa acantholoba* |  |  | 0.5 | 0.2 | 0.4 | 0.1 |  |  |
|  | *Piscidia grandiflora* | T&H | 0.69 | 0.7 | 0.7 | 1.1 | 1.5 | 0.9 | 5.8 |
|  | *Senna atomaria* | F, Eco | 0.94 | 3.1 | 2.1 | 1.0 | 1.0 | 4.3 | 1.9 |
|  | *Senna papillosa* |  | 0.52 |  |  | 1.7 | 1.3 |  |  |
|  | *Zapoteca portoricensis* |  | 0.25 |  |  | 0.4 | 0.9 |  |  |
|  | *Quercus segoviensis* | T&H, NTFP, F, E | 0.40 |  |  |  |  | 2.0 | 8.9 |
| Flacourtiaceae | *Casearia corymbosa* |  |  | 4.4 | 4.5 | 3.1 | 1.4 | 2.0 | 1.2 |
| Lauraceae | *Persea coerulea* | T&H, NTFP, E, Eco, I | 0.54 |  |  |  |  | 4.0 | 2.5 |
|  | *Phoebe mexicana* |  |  | 0.2 | 0.1 |  |  |  |  |
| Loganiaceae | *Plocosperma buxifolium* |  |  | 0.7 | 2.1 |  |  |  |  |
| Malpighiaceae | *Malpighia stevensii* |  |  | 0.2 | 0.2 | 3.1 | 1.7 | 1.7 | 0.6 |
| Malvaceae | *Ceiba pentandra* | T&H, Eco | 1 | 0.1 | 0.6 |  |  |  |  |
|  | *Ceiba aesculifolia* | T&H, E | 0.86 | 0.5 | 4.0 |  |  | 0.3 | 0.1 |
| Meliaceae | *Cedrella odorata* | T&H, F, E | 0.81 | 0.9 | 4.0 | 1.2 | 2.0 | 8.3 | 9.6 |
|  | *Trichilia americana* |  |  | 0.7 | 0.2 | 0.2 | 0.2 | 0.3 | 0.1 |
| Moraceae | *Brosimum alicastrum* | T&H, F | 0.78 | 2.2 | 0.6 | 4.2 | 1.5 | 1.7 | 0.6 |
|  | *Ficus cotinifolia* | NTFP, E, Eco, I |  | 0.5 | 4.9 |  |  |  |  |
|  | *Ficus isophlebia* | NTFP, Eco, I | 0.72 |  |  | 0.4 | 1.5 | 0.3 | 0.7 |
|  | *Ficus pertusa* | NTFP, I | 0.56 | 0.4 | 1.1 | 1.7 | 5.4 | 2.9 | 1.3 |
|  | *Ficus trigonata* | N&H | 0.83 | 1.3 | 0.3 | 1.6 | 1.8 | 0.3 | 0.1 |
|  | *Maclura tinctoria* | T&H, NTFP | 0.74 | 0.2 | 0.2 |  |  |  |  |
|  | *Trophis racemosa* | NTFP |  | 1.6 | 3.2 | 1.5 | 1.1 | 0.6 | 0.1 |
| Myrsinaceae | *Ardisia revoluta* | E | 0.83 |  |  | 1.0 | 0.6 |  |  |
| Myrtaceae | *Eugenia guatemalensis* |  | 0.18 | 3.3 | 0.9 | 8.8 | 4.1 |  |  |
|  | *Eugenia salamensis* |  | 0.74 | 0.7 | 0.3 | 1.1 | 0.4 | 6.9 | 2.7 |
|  | *Myrcia splendens* |  |  | 0.2 | 0.0 | 0.2 | 0.1 |  |  |
| Nyctaginaceae | *Pisonia macranthocarpa* |  |  | 0.5 | 4.0 | 0.9 | 3.2 | 0.6 | 2.6 |
| Olacaceae | *Schoepfia schreberi* |  |  | 0.4 | 0.1 | 0.1 | 0.0 |  |  |
| Paixaceae | *Cochlospermum vitifolium* |  |  |  |  | 0.1 | 0.1 |  |  |
| Phytolaccaceae | *Rivina humilis* |  |  |  |  | 0.5 | 0.3 |  |  |
| Rhamnaceae | *Karwinskia calderonii* | T&H, F | 0.45 | 6.8 | 4.7 | 4.1 | 2.8 | 2.3 | 0.8 |
| Rubiaceae | *Guettarda macrosperma* |  |  | 7.9 | 6.5 | 4.4 | 4.8 | 6.0 | 2.1 |
|  | *Psychotria horizontalis* |  |  | 0.2 | 0.1 | 0.9 | 0.4 |  |  |
|  | *Psychotria pubescens* | E, Eco |  |  |  | 0.4 | 0.2 |  |  |
|  | *Randia sp* |  |  |  |  | 0.2 | 0.0 |  |  |
| Rutacea | *Casimiroa sapota* |  |  |  |  | 0.1 | 0.3 |  |  |
|  | *Esenbeckia pentaphylla* |  |  | 0.7 | 1.3 |  |  | 0.6 | 0.2 |
|  | *Zanthoxylum procerum* |  |  | 0.5 | 0.4 | 2.8 | 3.7 | 4.0 | 2.1 |
| Sapindaceae | *Thouinidium decandrum* |  |  | 1.6 | 5.3 |  |  | 0.9 | 2.0 |
| Sapotaceae | *Bumelia obtusifolia* |  |  |  |  | 0.2 | 0.3 |  |  |
| Solanaceae | *Solanum erianthum* |  |  |  |  | 0.1 | 0.1 |  |  |
| Sterculiaceae | *Guazuma ulmifolia* | T&H, NTFP, F, E, I | 0.53 |  |  | 2.1 | 1.2 |  |  |
| Thymelaeaceae | *Daphnopsis americana* | T&H | 0.73 | 0.5 | 0.3 | 0.6 | 0.4 | 0.6 | 0.4 |
| Tiliaceae | *Heliocarpus appendiculatus* |  |  | 3.3 | 5.5 | 4.8 | 4.5 | 2.6 | 3.9 |
|  | *Luehea candida* |  | 0.65 | 0.7 | 0.5 | 0.5 | 0.8 |  |  |
| Ulmaceae | *Phyllostylon rhamnoides* |  |  |  |  |  |  | 0.3 | 0.1 |
|  | *Trema micrantha* |  |  | 0.2 | 0.2 | 0.1 | 0.1 |  |  |
| Urticaceae | *Myriocarpa longipes* |  |  | 5.5 | 1.4 | 2.5 | 1.6 | 1.4 | 0.4 |
| Verbenaceae | *Bitex gaumeri* |  |  |  |  | 0.2 | 0.1 |  |  |
| Zapotaceae | *Manilkara zapota* | T&H, NTFP, Eco | 0.90 |  |  | 0.2 | 1.2 |  |  |