CHURIA FORESTS *of* NEPAL

July 2014

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FOREST RESOURCE ASSESSMENT NEPAL

DEPARTMENT OF FOREST RESEARCH AND SURVEY

MINISTRY OF FORESTS AND SOIL CONSERVATION

GOVERNMENT OF NEPAL

July 2014

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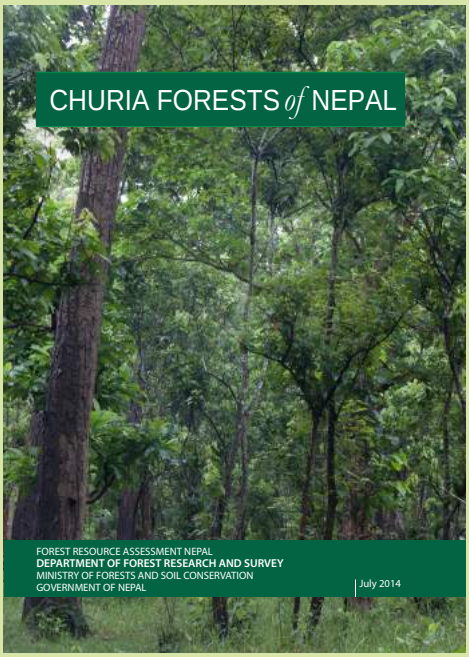
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Foreword

In Nepal, the first national level forest inventory (NFI) was conducted in the early sixties by the then Forest Resources Survey Office under the department of Forests with the technical and financial support from the USAID. Similarly the second NFI was accomplished by the Department of Forest Research and Survey (DFRS) in the nineties with the technical and financial support from the Government of Finland (GoF). Now, the third NFI is in progress with the support of the GoF. Undertaken jointly by the DFRS and the FRA Nepal Project (2010-2014). The current work is being conducted on the basis of the live physiographic regions viz, the Terai, the Churia, the Middle-hills, the High Mountains and the High Himal.

This report presents the results of the Churia forest resource assessment conducted during 2011-2013. This comprehensive report not only provides the information on growing stock and biomass, but also gives information on non-timber forest products, biodiversity
and soil carbon content.

The results of the study indicates that the forest resources of the Churia region is decreasing as compared to the result of the previous inventory. The Ministry as well as all those concerned must take appropriate measures to address this problem.

I would like to appreciate the efforts of all those involved in the FRA Nepal field inventory, mapping and in preparation of this report. I would also like to thank the FRA Nepal Validation Committee Members for assuring the quality of this report. I am thankful to the Government of Finland for providing both technical as well as financial support to accomplish the forest resource assessment of the Churia region. I hope this report will be usefull in planning and managing the invaluable Churia forest resources.

Ganesh R. Joshi, PhD
Secretary
July 2014.

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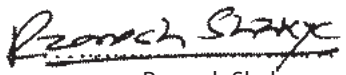
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Ramesh Shakya
Officiating Director General

Abbreviations

BRDF	Bidirectional Reflectance Distribution Function
C	Carbon
CCSP	Concentric Circular Sample Plot
CF	Community Forest
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora.
DBH	Diameter at breast height (1.3 m)
DCA	Detrended Correspondence Analysis
DFRS	correspond-ence analysis
DFRS	Department of Forest Research and Survey
DFO	District Forest Office/Officer
DHM	Department of Hydrology and Metrology
DNPWC	Department of National Parks and Wildlife Conservation
DoF	Department of Forests
DPR	Department of Plant Resources
DoS	Department of Survey
FAO	Food and Agriculture Organization
FRA	Forest Resource Assessment
FRS	Forest Resources Survey
GEF	Global Environmental Facility
GIS	Geographic Information System
GoFC-Gold	Global Observation of Forest and Land Cover Dynamics
GoN	Government of Nepal
ha	hectare
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JAFTA	Japan Forest Technical Association
KS/SK	Khair-Sissoo/Sissoo-Khair
LMH	Lower Mixed Hardwood
LRMP	Land Resources Mapping Project
MoFSC	Ministry of Forests and Soil Conservation
MPFS	Master Plan for Forestry Sector
MSS	Multi-Spectral Scanner
NDVI	Normalized Difference Vegetation Index
NFI	National Forest Inventory
NPWC	National Parks and Wildlife Conservation Act
NTFP	Non-timber Forest Product
OC	Organic Carbon
OWL	Other Wooded Land
PA	Protected Area
Pr	Pine Forest
RMSE	Root Mean Square Error
RS	Remote Sensing
S	Sal Forest
S.E.	Standard Error
SOC	Soil Organic Carbon
SOP	Standard Operating Procedure
STMH	Sal-Terai Mixed Hardwood
Tg	Teragram (1 tg = $1X10^{12}$ g)
TMH	Terai Mixed Hardwood
USAID	The United States Agency for International Development
WWF	World Wildlife Fund

Glossary

Above-ground biomass	Above-ground biomass refers to the biomass of trees and saplings (≥5cm DBH) above the soil. It includes dead wood but not stumps.
Alpha diversity	The diversity within a particular area or ecosystem, usually ex-pressed by the number of species (species richness) in that ecosys-tem. It is the mean number of species per plot.
Below-ground biomass	The biomass of trees and saplings (≥5cm DBH) contained within live roots and stumps.
Beta diversity	An index of the rate of increase of alpha diversity as new habitats is sampled, so is a measure of the turnover of species along a spatial gradient.
Biodiversity	The variability among living organisms from all sources including, inter alia, ter-restrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biomass	The biological material derived from living or recently living organ-isms. It in-cludes both the above- and below-ground biomass of trees and saplings.
Bulk density	Soil mass per unit volume, expressed in g/cm^3.
Canopy	The cover of branches and foliage formed by tree crowns.
Canopy cover/Closure	The percentage of ground covered by the vertical projection of the foliage of plants.
Carbon pool	Major components (above-ground, below-ground, and soil carbon) of carbon per unit area.
CITES	CITES is a multilateral treaty to protect endangered plants and ani-mals.
Appendix I (CITES)	A list of species whose trade in wild specimens is restricted except for registered scientific research.
Appendix II (CITES)	A list of species that are not necessarily now threatened with extinc-tion but that may become so unless their trade is closely controlled.
Appendix III (CITES)	A list of species whose trade at least one member country has re-quested other CITES parties for assistance in controlling.
Climber	Any plant which grows by trailing or climbing stems or runners.
Co-dominant	A tree with a medium-sized crown at the level of the general canopy which re-ceives full light from above and at least from one side.
Cull tree	A malformed tree that does not meet, and cannot be expected to meet regional merchantability standards.
Dead unusable	A dead tree that cannot be used, even as firewood.
Dead usable	A dead tree that can be used as firewood or for another purpose.
Debris	Fallen dead trees and the remains of large branches (<10 cm diame-ter) on the forest floor
Dominance (Do)	Measure of the relative importance of a plant species with respect to the degree of influence that the species exerts on the other compo-nents
Dominant	A tree whose crown is larger than average and lies at or above the level of the general canopy and receives full light from above and from more than one side.
Dominant species	Species that dominate (comprise > 60% of the basal area) an ecolog-ical commu-nity (e.g. forest).
Ecosystem	A dynamic complex community of plant, animal, micro-organism and their non-living environment interacting as a functional unit.
Fodder	Tree foliage fed to livestock.
Forest	An area of land at least 0.5 ha and a minimum width/length of 20 m with a tree crown cover of more than 10% and tree heights of 5 m at maturity.

Frequency	The occurrence of a species within a unit area.
Growing stock	The sum of all trees by number or volume or biomass growing with-in a unit area.
High-quality sound tree	Live tree which will yield saw logs at least 6 m long at present or in the future.
Intermediate	A tree whose crown is smaller than average, reaches the general level of the canopy but not above it, and receives some direct light from above but little, if any, from the side.
Land cover	The physical material covering the surface of the earth.
Land use	The arrangements, activities and inputs people undertake on an area with a certain land-cover type to produce, change or maintain it.
Litter	Dead plant materials such as leaves, bark, needles, and twigs that have fallen to the ground.
NTFPs	Non-Timber Forest Products encompasses all biological materials other than timber, which are extracted from forests for human use.
Other Land	All land that is not classified as Forest or other wooded land.
Other Wooded Land (OWL)	Land not classified as forest spanning more than 0.5 ha, having at least 20 m width and with a canopy cover of trees between 5% and 10%; trees should be higher than 5 m or able to reach 5 m *in situ*. or The canopy cover of trees less than 5% but the combined cover of shrubs, bushes and trees more than 10%; includes area of shrubs and bushes where no trees are present.
Precision	Refers to the size of deviations in the estimate of a population pa-rameter in repeated application of a sampling procedure. Standard errors and confi-dence limits are commonly quoted to quantify precision.
R^2 (R squared)	Indicates how well real data points fit a line or curve generated by a model.
Remote Sensing (RS)	The acquisition of data, such as total forest area, forest type, canopy cover and height, from sensors aboard aircrafts or space-based plat-forms.
Root Mean Square Error (RMSE)	A measure of the differences between values predicted by a model and the values actually observed of the parameter being estimated.
Sal Forest	A forest in which Sal *(Shorea robusta)* comprises more than 60% of the basal area.
Sal Terai Mixed Hardwood Forest (STMH)	A forest in which Sal comprises 33-60% of the basal area and other associated species are present.
Shannon diversity index ($\bar{H}$)	A commonly used diversity index that takes into account both the abundance and evenness of species present in the community.
Shrub	An area occupied by woody perennial plants, generally 0.5-5.0 m at maturity, and often without definite stems or crowns.
Sound Tree	A live tree not qualified as class 1 but with at least one 3 m saw log or two 1.8 m saw logs.
Stratification	Division of an area into homogenous units based on climate, physiography, vegetation, or other characteristics.
Stump	The remnant of a cut or fallen tree.
Suppressed	A tree with a crown that is smaller than normal for a tree of its age and size. It receives little or no direct sunlight and shows signs of retarded growth result-ing from competition with dominant trees.
Terai Mixed Hardwood (TMH)	A forest whose composition in the canopy layer is so mixed that none of the species has over 60% basal area.
Understory	A tree with a crown that is below the level of the general canopy and receives little or no direct sunlight though it does not show signs of suppressed or retarded growth.
Wall-to-wall mapping	Mapping that covers an entire area.

Main Results

The survey revealed the following results about the state of forests in the Churia region.

State of Land Cover in Churia

Forests covered the highest proportion of the total area of the Churia region (72.37%; 1,373,743 ha) followed by Other Land (26.44%; 501,848 ha) and OWL (1.19%; 22,672 ha).

Most of the forest area (76%) was outside the protected areas (PAs) but the rest was within PAs, 18% in core zones and 6% in buffer zones.

It appears that the total forest area decreased by 38,051 ha in the 15 years from 1995 to 2010 at the annual rate of 0.18%. Over this period, forest area decreased in 27 districts while slightly increased in the 9 districts.

Growing Stock

The number of stems per/ha (DBH ≥5 cm) was about 731 on forest land, slightly more than 180 on OWL and about 66 in the Other Land. Regeneration was 19,805/ha for seedlings and 958/ha for saplings. The basal area of stems (≥ 5cm DBH) in forest land was 18.77 m^2/ha, 2.37 m^2/ha of OWL and 1.55 m^2/ha for Other Land. The per hectare stem volumes for forest land and OWL were 153.99 m^3 and 17.16 m^3 respectively. The total stem volume of live trees was 153.99 m^3/ha, while those of standing dead trees and of dead wood and removal were 4.59 m^3/ha and 13.21 m^3/ha respectively. The total air-dried aboveground biomass was 186.48 t/ha; the total belowground biomass was 6.33 t/ha. Similarly, the potential sustainable production forest area was about 744 thousand hectare.

Carbon Pool

The total carbon stock was estimated to be 160.65 tg (116.94 t/ha). Tree, litter/debris and soil components comprised 84.73, 0.31 and 31.90 t/ha carbon respectively.

Biodiversity

A total of 281 tree species, 186 shrub species and 322 species of herbaceous plants (including flowering plants and Pteridophyte) were recorded. A total of 666 different species of flora (240 trees, 144 shrubs, 187 herbs, 70 climbers, 22 ferns and 3 epiphytes) and 74 species of animal derivatives were used as NTFPs.

Forest Disturbances

Government-managed forests appeared to be less subject to anthropogenic disturbances than community-managed buffer zones and community forests. The core zones of PAs were well protected from anthropogenic disturbances, perhaps because of their relative remoteness from the forest edge.



Sal forest in Churia

प्रमुख नतिजाहरू

वन क्षेत्र

- चुरेको कुल क्षेत्रफल १,८९८,२६३ हेक्टर मध्ये वन क्षेत्रले १,३७३,७४३ हेक्टर (७२.३७%), अन्य काष्ठ तथा बुट्यान क्षेत्र (Other Wooded Land) क्षेत्रले २२,६७२ हेक्टर (१.१९%) र अन्य क्षेत्र (Other land) क्षेत्रले ५०१,८४८ हेक्टर (२६.४४%) भाग ओगटेको पाइएको छ।
- चुरेको कुल वन क्षेत्रफलमध्ये संरक्षित क्षेत्र (Protected Areas) ले १८% र मध्यवर्ती क्षेत्र (Buffer Zones) ले ६% ओगटेको पाइएको छ।
- सन् १९९५ देखि सन् २०१० को बीचमा वन क्षेत्र ३८,०५१ हेक्टरले घटेको पाइएको छ र यो १५ वर्षको अवधिमा वार्षिक ०.१८% का दरले वन क्षेत्र घटेको देखिन्छ।

रुखको मौज्दात

- चुरे वन क्षेत्रमा ५ से.मी. र सो भन्दा बढी व्यास (१.३ मी. उचाईमा) भएको रुखहरूको कुल संख्या ७३१ गोटा प्रति हेक्टर रहेको पाइएको छ भने कुल आयतन १५३.९९ घन मिटर प्रतिहेक्टर रहेको पाइएको छ।
- चुरे वन क्षेत्रमा ५ से.मी. र सो भन्दा बढी व्यास (१.३ मी. उचाईमा) भएको रुखहरूको प्रति हेक्टर Basal Area १८.७७ वर्ग मी. रहेको पाईएको छ । त्यसैगरी अन्य काष्ठ तथा बुट्यान क्षेत्र र अन्य क्षेत्रको प्रति हेक्टर Basal Area क्रमशः २.३७ र १.५५ वर्ग मी. रहेको पाइएको छ।
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जैविक विविधता तथा मानवीय क्रियाकलाप

- चुरे वन क्षेत्रमा कुल २८१ वटा रुख प्रजाति, १८६ वटा बुट्यान (Shrub) प्रजाति र ३२२ वटा Herb प्रजाति रहेको पाइएको छ।
- गैह्रकाष्ठ वन पैदावारको रुपमा ६९९ वटा वनस्पति प्रजाति र ७४ वटा जीवजन्तु प्रजातिहरु प्रयोगमा आइरहेको पाइएको छ।
- सामुदायिक वन र मध्यवर्ति क्षेत्र सामुदायिक वनको तुलनामा यस क्षेत्रमा रहेका सरकारद्वारा व्यवस्थित वनमा मानवीय क्रियाकलापको चाप कम रहेको पाइएको छ।

Executive Summary



The Churia region extends over 1,898,263 ha, from 80° 9′ 25″ to 88° 11′ 16″ longitudes and from 26° 37′ 47″ to 29° 10′ 27″ latitudes, and occupies 12.84% of the area of the entire country. Low elevation fell in the sub-tropical climatic zone whereas high hill spurs fell in the warm temperate climatic zones. Intensity of rainfall is high in the Churia region where moisture regime is sub-humid in most of the area but humid in the southern aspects of the Western, Central, Eastern Development regions and dun valleys. The major forest types were Sal and mixed hardwood forests at low altitudes and Pine at high. Since the Churia hills are structurally weak and highly vulnerable to erosion and other hazards; this fragility poses a big challenge not just for people in the Churia but for those who leave in downstream lowland areas in the Terai.

Forest-cover maps were prepared and classified as Forest, Other Land (non-forest) and Other Wooded Land (OWL) including shrubs using RapidEye MSS satellite imagery, secondary images (Google Earth images, Landsat TM, etc.), ancillary maps (LRMP and topographical maps) and the FRA Nepal field inventory data. Images were classified by applying an automated method of object-based image analysis method on images segmented using eCognition software. Four spectral properties were considered: i) the mean pixel values of green, near-infrared and red-edge bands; ii) the derived Normalised Difference Vegetation Index; iii) the principal components; and iv) the homogeneity texture of the near-infrared band. Forest, Other Land and OWL areas were distinguished by defining a 'containment membership function' for threshold values for all four properties. In order to improve classification accuracy, interactive visual on-screen post-classification interpretation was carried out on the classified forest, other land and OWL (including shrub) areas using high resolution images in Google Earth.

All together 1,216 field sample clusters were laid out systematically at the nodes of 4 km x 4 km square grids across the entire Churia region of Nepal. Out of the total 1,216 clusters, 999 clusters occurred in the forest stratum while the remaining 217 clusters were in the non-forest (OWL and Other Land) stratum. Out of 999 clusters in forest stratum, 125 forest clusters were systematically selected but only 121 forest clusters were taken into ground measurement. Similarly, 27 of the 217 non-forest clusters were systematically sampled. Each cluster had six sub-plots and each sub-plot comprised four concentric circles of different radii, each of which was used to measure trees with a different DBH range.

According to forest-cover mapping, the Churia region comprised 72.37% (1,373,743 ha) forest, 1.19% (22,672 ha) OWL and 26.44% (501,848 ha) Other Land. The majority of the forest area (76%) was outside PAs whereas remaining forest (24%) occurred in PAs (core zones 18% and buffer zones 6%). It appears that the total forest area decreased by 38,051 ha in the 15 years from 1995 to 2010 at the annual rate of 0.18%. Twenty-seven districts saw a decrease in forest cover; nine, a slight increase. The results of forest-cover mapping were compared with 372 independent ground samples. The overall accuracy of the classification proved to be 82.8% with 82.72% and 87.88% the producer's accuracies for forest cover and OWL respectively. The Cohen's Kappa (κ) of 0.70 (standard error = 0.04) indicated the forest cover classification was highly reliable.

Regeneration was 19,805/ ha for seedlings and 958/ ha for saplings. On forest land, average number of stems (DBH ≥ 5 cm) was about 731/ha and the basal area 18.77 m^2/ha. The stem volumes were 153.99 m^3/ha, 17.16 m^3/ha and 9.32 m^3/ha on forest land, other land and OWL respectively. By forest type, Sal forest had the highest stem volume (192.26 m^3/ha), Pine the second (170.68 m^3/ha) and Khair/

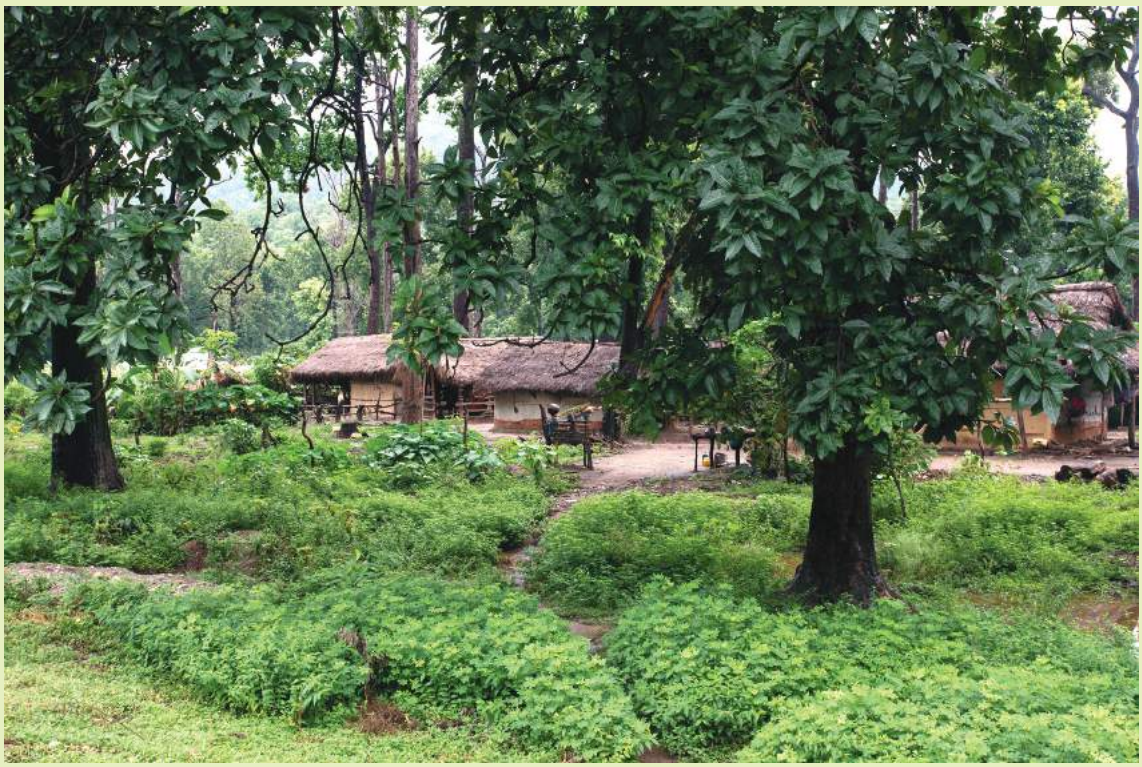
Sissoo the least (12.78 m^3/ha). For live trees, the trees above-ground air-dried biomass was 179 t/ha and below-ground biomass, 6.12 t/ha whereas the total (live trees, dead trees, dead wood) air-dried above-ground biomass of the Churia forests was 186.48 t/ha and the total below-ground biomass was 6.33 t/ha. It was found that, the potential sustainable production forest was about 54% (744 thousand hectare) in the Churia region. To assess the quality of the forest inventory, about 7.5% of the 477 total inventoried sub-plots were systematically selected, re-measured and compared with the regular field measurements using an independent sample t-test. No significant difference was found in either the total number of trees or the basal area ($p = 0.77$ and 0.98 respectively).

The total carbon stock in the Churia forest was estimated to be 160.65 tg with an average of 116.94 t/ha. Tree, litter/debris and soil components contribute 84.73, 0.31 and 31.90 t/ha of carbon respectively.

A total of 281 tree species belonging to 177 genera and 71 families; 186 shrub species belonging to 116 genera and 51 families and 322 species of herbaceous plants (including flowering plants and Pteridophyte) belonging to 226 genera and 75 families were recorded, as were 100 species of climbers and 11 species of epiphytic plants belonging to 26 families and 66 genera.

A total of 666 different species of flora (240 trees, 144 shrubs, 187 herbs, 70 climbers, 22 ferns and 3 epiphytes) and 74 species of animal derivatives were used as NTFPs.

Government-managed forests appeared to be less subject to anthropogenic disturbances than buffer zone community forests and community forests. Forest in PA core zones were least disturbed. The average plot showed evidence of approximately 4 categories of forest disturbance. Out of the total instances of disturbance (1831), about 50% were of low impact, 40% of medium impact, and 10% were of strong impact. The median distance to the forest edge significantly varied across management regimes (Kruskal Wallis, $p<0.001$). Community forests and buffer zone community forests tended to lie in relatively close proximity to the forest edge while government-managed forests and particularly PAs core zones were more remote.



Encroached forest area

सारांश

नेपालको दक्षिणतर्फ अवस्थित तराईको समथर भू-भाग र मध्य पर्वत श्रृंखलाको बीचमा अवस्थित कमजोर भौगोलिक बनावट भएका स-साना थुम्का, पहाड र दुन खण्ड सहितको भू-भागलाई चुरे प्रदेश (चुरे क्षेत्र) को रुपमा चिनिन्छ । पश्चिममा ८०°०९'२५" देखि पुर्वमा ८८°११'१६" देशान्तर सम्म र दक्षिणमा २६°३७'४७" देखि उत्तरमा २९°१०'२७" अक्षांश सम्म फैलिएर रहेको यस क्षेत्रले देशको कुल भू-भागको करिब १२.८४% ओगटेको छ । यस प्रदेशको तल्लो भू-भाग उप-उष्ण जलवायु प्रदेश (Sub-tropical climate zone) र माथिल्लो भू-भाग न्यानो-सितोष्ण जलवायु प्रदेश (Warm-temperate climate zone) मा पर्दछन । चुरे क्षेत्रको तल्लो उचाईमा मुख्यत: साल *(Shorea robusta)* र मिश्रित प्रजाती (Mixed species) को वन तथा माथिल्लो उचाईमा सल्ला प्रजातीको वन (Pine forest) विस्तारित छ ।

चुरे क्षेत्रको भू-आवरण (Land cover) लाई मुख्यत: वन क्षेत्र (Forest), अन्य काष्ठ तथा बुट्यान क्षेत्र (Other wooded land) र अन्य क्षेत्र (Other land) गरी ३ भागमा बर्गिकरण गरी नक्सांकन गरिएको थियो । यस क्रममा विभिन्न गुणस्तरका भु-उपग्रह चित्रहरु (जस्तै Rapid Eye, Landsat TM) र भू-उपयोग तथा आकृती नक्साहरु (जस्तै LRMP map तथा Topographic map) को प्रयोग गरिएको थियो भने बर्गिकरण तथा नक्सांकन कार्यको गुणस्तरीयता र विश्वसनियता कायम गर्न फिल्ड प्रमाणीकरण (Field verification) को अतिरिक्त Google Earth चित्रसंग समेत तुलनात्मक अध्ययन गरिएको थियो ।

वनस्रोत सर्वेक्षणको लागि नियमित नमूना सर्वेक्षण पद्दति (Systematic sampling design) अनुसार पहिलो चरणमा चुरे क्षेत्रभरी ४ कि.मि. X ४ कि.मि को दुरी कायम गरी जम्मा १,२१६ वटा नमूना सर्वेक्षण स्थल (Field sample cluster) पहिचान गरिएको थियो । जसमध्ये ९९९ नमुना सर्वेक्षण स्थलहरु वन क्षेत्रमा र २१७ नमुना स्थलहरु वनक्षेत्र बाहिर परेको थियो । सर्वेक्षणको दोस्रो चरणमा वनक्षेत्रभित्र परेका ९९९ नमुना स्थलहरुमध्ये जम्मा १२५ वटा मात्र र वनक्षेत्र बाहिरका २१७ नमुना स्थलहरु मध्ये २७ वटा मात्र स्थलगत नाप पैमाईस (Field measurement) को लागि छनौट गरिएको थियो । नमुना सर्वेक्षणको तेस्रो चरणमा पहिचान गरिएको प्रत्येक नमुना स्थलमा ६ वटा केन्द्रिकृत र वृत्ताकार नमुना नापी प्लटहरु (Concentric circular sampling plot) स्थापना गरी केन्द्रबाट ४, ८, १५ र २० मीटरका वृत्तीय घेराहरु बनाएर रुखको आकार अनुसार नाप पैमाईस गरिएको थियो । यसको अतिरिक्त सोहि नमुना नापी प्लटभित्र पर्ने गरी बुटयान प्रजाती र गैरकाष्ठ प्रजातीहरुको मापन र प्लटको चारवटा बाहिरी कुनाबाट माटोको नमुना संकलन समेत गरिएको थियो ।

भू-उपयोग नक्सांकनको आधारमा चुरे क्षेत्रको करिब ७२.३७% भू-भाग वन क्षेत्रले ओगटेको देखिन्छ भने अन्य काष्ठ तथा बुटयान क्षेत्र र अन्य क्षेत्र क्रमश: करिब १.१९% र २६.४४% भ-भागमा विस्तारित छ । सर्वेक्षणबाट मध्यवर्ति क्षेत्रमा करिब ६% र भित्री क्षेत्रमा १८% गरी चुरेको संरक्षित क्षेत्रभित्र करिब २४% वन रहेको देखिन आउछ भने दुई तिहाई भन्दा बढी (७६%) वनको भू-भाग सरंक्षित क्षेत्र वाहिर रहेको छ । विगत १५ वर्ष (१९९५-२०१०) को अवधिमा चुरेक्षेत्रको वन प्रति वर्ष ०.१८% को दरले घटेको देखिन्छ ।

वनको अवस्था आंकलन गर्दा चुरे क्षेत्रमा प्रति हेक्टर औसत विरुवा (Seedling) संख्या करिब १९,८०५ र औसत लाथ्रा (Sapling) को संख्या करिब ९५८ रहेको छ । रुखको प्रति हेक्टर औसत संख्या ७३१ देखिन आएको छ भने रुखहरुको १.३ मी. उचाइमा लिएको क्षेत्रफल (Basal area) १८.७७ वर्ग मी. प्रति हेक्टर रहेको छ । यसैगरी वन क्षेत्र, अन्य काष्ठ तथा बुटयान क्षेत्र र अन्य क्षेत्रमा रुखको आयतन (Stem volume) औसतमा क्रमश: करिब १५३.९९, ९.३२ र १७.१६ क्युविक मीटर प्रति हेक्टर देखिन आउछ । वन प्रजातीको आधारमा हेर्दा साल वनमा रुखको प्रति हेक्टर औसत आयतन सबै भन्दा बढी पाइएको छ भने त्यसपछि सल्ला प्रजातीको वन र सवैभन्दा कम खयर/सिसौको वन रहेका छन । चुरे क्षेत्रको वनमा औसत कार्वन संञ्चिती करिब ११६.९४ टन प्रति हेक्टर अनुमान गरिएको छ जसमा रुख, माटो र पातपतिगंर (Litter/Debris) को योगदान क्रमश: ८४.७३, ३१.९० र ०.३१ टन प्रति हेक्टर रहेको छ ।

नमुना सर्वेक्षणको क्रममा चुरे क्षेत्रमा कुल २८१ वटा रुखहरुको प्रजाति (१७७ जाति र ७१ परिवार) १८६ वटा वुट्यान (Shrub) प्रजाति (११६ जाति र ५१ परिवार) र ३२२ वटा Herb प्रजातिहरु (२६ जाति र ७५ परिवार), १०० प्रजातिका लहरा तथा ११ प्रजातिका इपिफाइटिक विरुवाहरु पाइएको छ । गैरकाष्ट वन पैदावारको रुपमा ६६६ प्रजातिका वोटविरुवा र ७४ प्रजातिका जीवजन्तु र तिनका अंगहरु प्रयोगमा आएको अध्ययनबाट देखिन आएको छ ।

मानवीय क्रियाकलापको आधारमा चुरे क्षेत्रमा रहेको सरकारद्धारा व्यवस्थित वन सबैभन्दा कम प्रभावित देखिन आएको छ भने सबैभन्दा बढी मानविय कृयाकलापहरुको चाप सामुदायिक वनमा रहेको अनुमान गरिएको छ ।

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1 INTRODUCTION

The Churia, also known as the Siwalik, is the youngest mountain range in the Himalayas. Just north of the Terai, it runs the entire length of southern Nepal, from east to west, skirting the southern flanks of the Himalayas. The geology of the Churia is tectonic in origin and its rocks comprise north-dipping, semi-consolidated, inter-bedded tertiary sandstone, siltstone, shale and conglomerate (LRMP, 1986). While different studies have delineated the Churia region differently, this study considered it to extend from 80° 9′ 25″ to 88° 11′ 16″ longitudes and from 26° 37′ 47″ to 29° 10′ 27″ latitudes based on LRMP (Figure 1). It is bounded to the north by the Main Boundary Thrust, which separates it from the older bedrock of the Mid-hills[1], and to the south by the Main Frontal Thrust (Figure 4), which separates it from the alluvium of the Terai (Upreti, 1999). Interior 'Dun valleys' form a conspicuous part of the Churia landscape. The main Dun valleys, which include Surkhet, Dang, and Chitwan, are major grain-producing areas. The region occupies 1,896,930 ha, or about 12.8 % of the total land area of the country, and covers parts of 36 of the nation's 75 districts (Survey Department, 2001).

In general, the Churia is characterised by the following features (LRMP, 1986):

- Steep, broken terrain
- Shallow, droughty soils with low surface-infiltration and percolation rates
- High intensity rainfall during the monsoon and tremendous overflow torrents regardless of the degree and nature of vegetation cover
- High insolation and air temperatures during the dry season
- Lack of irrigation and drinking water
- Streams with high rates of discharge during the rainy season and negligible rates of discharge at other times

The elevation of the Churia varies from 93 to 1,955 meters above sea level and has a stretches of 10-50 km in width. It was formed when fluvial sediments from the Himalaya accumulated during the Neogene (23–0.6 million years ago) and Quaternary (2.6 million years ago to recent times) eras (Upreti, 1999). Because the Churia is geologically speaking, the youngest mountain chain of the Himalaya, it is the most erodible and fragile.

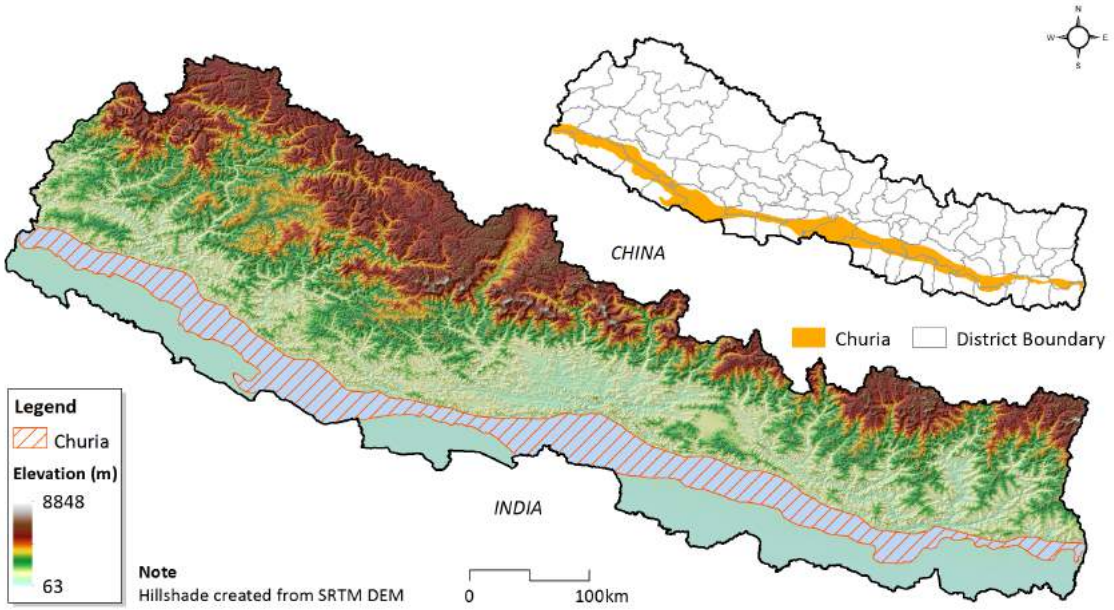


Figure 1. Spatial extent of the Churia Region in Nepal

[1] Mid hills and middle mountains are used interchangeably in this report

Most areas of the Churia are forested and have low population densities. However, several parts of the Churia have been encroached upon to establish settlements and cultivate crops. The soil in the Churia as a whole, and especially in areas of encroachment, is unable to retain the substantial and intense monsoon rain and is naturally prone to erosion and mass wasting (GoN, 2008). Settlements have been built in areas where the soil is relatively stable and water is consistently available throughout the year. These settlements benefit from the abundant timber, fuel wood and fodder of the Churia forests.

1.1. Historical Background, Policies and Programmes

Until 1950, Churia forests were dense, and most areas were controlled under *birta*[1] tenure by the then Rana rulers and their followers (Mahat, *et al.* 1986; Regmi, 1999). After the Rana regime was abolished in 1951, the government promulgated the Forest Act of 1957, which nationalised the forests, bringing them under government control but also, it is said, resulting in wide spread forest destruction as it alienated and dispossessed local people of their forest resources and disrupted traditional forest management systems (Barton, 2001; Blaikie and Springate-Baginski, 2007). Further degradation of the Churia forests took place due to the Land Tax Act of 1977, which, because it defined all forest land as government land, spurred local inhabitants to chop down the trees on their farms so their land would not be claimed by the government (Gilmour and Fisher, 1991; Hobley and Malla, 1996).

During the late 1960s and early 1970s, Nepal was portrayed as a country facing massive environmental degradation and deforestation in its hilly regions, including the Churia and blamed for flooding in the Terai and the Gangetic plains in India and Bangladesh (Ives and Messerli 1989). In response, the Government of Nepal (GoN) formulated the National Forestry Plan of 1976 and later promulgated the Panchayat Forest and Panchayat-Protected Forest Rules in 1978 to encourage local people to participate for forest conservation and management (Gilmour and Fisher, 1991; Hobley and Malla, 1996). Unlike in the Midhills, only a fraction of the total area of Churia forest was handed over under this regime; the rest was managed as government-protected forest (Hobley and Malla, 1996).

With the successful implementation of community forestry programmes in the Midhills under the Forest Act of 1993 and the Forest Rules of 1995, part of the Churia forest was also handed over as community forest. Currently, there are about 2,837 community forest user groups (CFUGs) with a total of 490,547 households members (DoF, 2013). Most of the remaining Churia forest is government-managed forest whereas a fraction of Churia forest is managed as leasehold forest and strictly protected in the PAs of the Parsa and Shukla Phanta wildlife reserves and the Chitwan, Banke, and Bardia national parks (Table 1).

The GoN has emphasized the need to protect the Churia forest since the fourth five-year periodic plan (1970-1975). The Land Resources Mapping Project (LRMP) of 1986 and the National Conservation Strategy of 1988 continue that effort, largely in response to the prevailing discourse, which claimed that uncontrolled extraction of sand, gravel and boulders from the riverbeds contributed to the degradation of the Churia causing frequent flashfloods and inundation in downstream areas (MoFSC, 2014). In recognition of the significance of the Churia forest for its ecosystem services and functions, the Ministry of Forest and Soil Conservation (MoFSC) prepared the "Churia Area Programme Strategy" in 2008 and initiated a special programme called the "President Churia Conservation Programme" in 2011. The latter programme covers 27 districts of the Churia

Table 1. Legal status of the Churia forests

Management regime	Ownership/User rights	Management authority
Private	Individuals and organizations	Individuals and organizations
National		
Government-managed	GoN	Department of Forest (DoF)
Community	Users' groups (land ownership: GoN)	Local communities/users' groups
Leasehold	Leaseholder (land ownership: GoN)	Leaseholder
Religious	Users' groups (land ownership: GoN)	Local communities/users' groups
Protected	GoN	DoF
Protected areas*	GoN	DNPWC
Buffer-zone community forests*	Users' groups (land ownership: GoN)	Local communities/users' groups

*Categorised according to NPWC Act of 1972

[1] The birta system owned its origin to the divestiture of the ownership of the land by the state show its appreciation of certain individuals.

region and emphasises the following programmes: the integrated management of land, water and forest resources for ecological balance; livelihood support through the appropriate management of resources; social harmonization, strengthening and involvement of local people from the Churia and the Terai for the management of cause-effect relationships (upstream-downstream linkages); site-specific and off-site (including trans-boundary) management of environmental systems (MoFSC, 2011). Recently, the GoN has declared the Churia a special protection region and formed the "President Chure-Terai Madhesh Conservation Development Committee" covering 36 districts (MoFSC, 2014). In addition, the project Sustainable Land Management in the Churia Range particularly in Makwanpur, Parsa, and Bara and Rautahat districts was started with the help of the Global Environment Facility (GEF). It is being implemented by World Wildlife Fund Nepal in coordination with the Ministries of Forests and Soil Conservation, Land Reform and Management, Agricultural Development, and Science, Technology and Environment covering the areas of Makawanpur, Parsa, Bara and Rautahat districts in the Churia. The main aim of the project is to empower local communities to sustainably manage the forest and promote community-based conservation (WWF, 2013).

1.2. Population

Population density in the Churia is, in general, low except in Inner Terai valleys such as Chitwan and Dang (Springate-Baginski *et al.* 2010). The total population in the 2,509 VDCs and 12 municipalities of the Churia is estimated to be 3.6 million covering 14% of the total population of Nepal. The average population density of Churia region is about 173 individuals/km^2 (Figure 2).

The proportions of female and male are 53% and 47% respectively. The average household size is 4.6 individuals. The highest percentage of population lives in the Central development region (34%) followed by Mid-western (23%), Eastern (19%), Western (16%) and the least in the Far-western region 8% (Table 2).

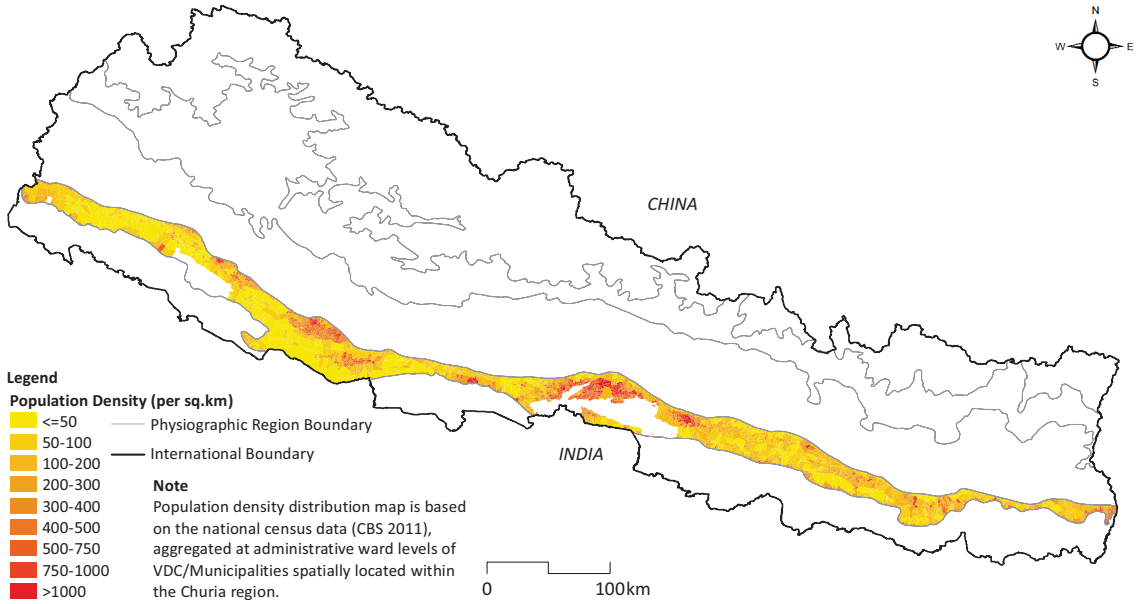


Figure 2. Population density distribution in the Churia region

Table 2. Population characteristics of the Churia by development region

Region	Male	Female	Total Population	%	Household	Population density/ km^2
Far-western	134,234	147,210	281,444	8	52,310	96.70
Mid-western	395,280	442,069	837,349	23	177,003	142.85
Western	279,211	319,433	598,644	16	134,529	203.47
Central	583,777	634,750	1,218,527	34	265,485	213.93
Eastern	327,492	370,245	697,737	19	154,425	196.97
Total	**1,719,994**	**1,913,707**	**3,633,701**	**100**	**783,752**	**173.42**

Source: CBS, 2011

1.3. Climate

The climate of the Churia region ranges from sub-tropical to warm temperate and is characterized by hot and sub-humid summers, intense monsoon rain, and cold dry winters. The average annual minimum temperature ranges from 12°C to 19°C; with the average annual maximum temperature ranging from 22°C to 30°C in this region.

The precipitation pattern in the Churia is variable, with the highest annual rainfall in the Eastern and Central development regions. The total annual rainfall varies from a minimum of 1,138 mm to the maximum of 2,671 mm (Figure 3).

land system 8-steeply to very steeply sloping hilly terrain (LRMP, 1986). Soils commonly found in the Churia region include cambisols (eutric and dystric), fluvisols, gleysols, phaezomes, regosols and luvisols (ISRIC 2009) (Figure 4).

Cambisols, both those with a high and a low base saturation (eutric cambisols and dystric cambisols respectively) are common in the high terraces of recent alluvial plains and ancient river terraces. The fluvisols, common on active and recent alluvial plains and fans are genetically young soils which develop on alluvial deposits and show signs of periodic fluvial action (flooding). Gleysols are wet soils with evidence of gleying, a state which reflects poor drainage conditions. Both fluvisols and gleysols in the Churia region are generally eutric and, in some

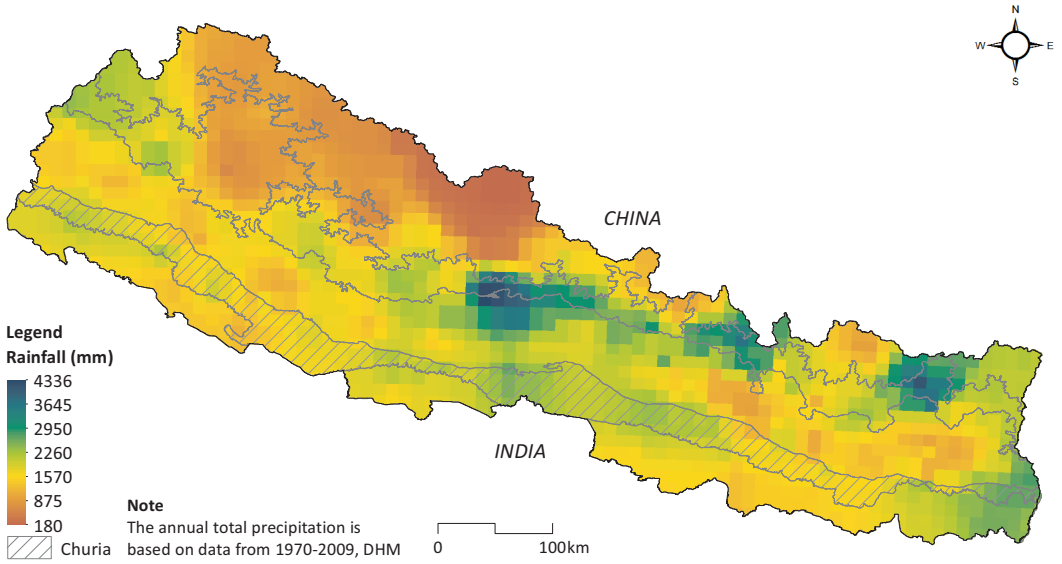


Figure 3. Total annual precipitation (1970-2009, DHM)

1.4. Soils

The Churia hills are geologically young. Their soils originated from soft rocks. The lower Churia is largely composed of very fine-grained sediments such as variegated mudstone, siltstone and shale with smaller amounts of fine-grained sandstone (Upreti, 1999). The middle Churia has thick beds of multi-storied sandstones alternating with subordinate beds of mudstone. The upper Churia is characterized by very coarse sediments such as loose boulder conglomerates.

The soils of the Churia are associated with land system 4-active and recent alluvial plains; land system 5-fans, aprons and ancient river terraces; land system 6-depositional basins (Dun valleys); land system 7-moderately to steeply sloping terrains; and

locations, calcaric. Gleysols are commonly found in depositional basins (Dun valleys).

Phaeozems are dark soils rich in organic matter. They are generally deep and have good sub-surface soils. They are generally found under grassland and deciduous forests and are highly arable. Their nature is generally of eutric and haplic and they are commonly found on gently sloping and undulating forest land. Regosols are weakly developed soils found in unconsolidated material. They are generally found on eroding land and places with gravels (leptic). Regosols are common on steep and very steep Churia hills; most are dystic (LRMP, 1986).

Luvisols are soils with a pedogenetic clay differentiation between the top and the sub-surface

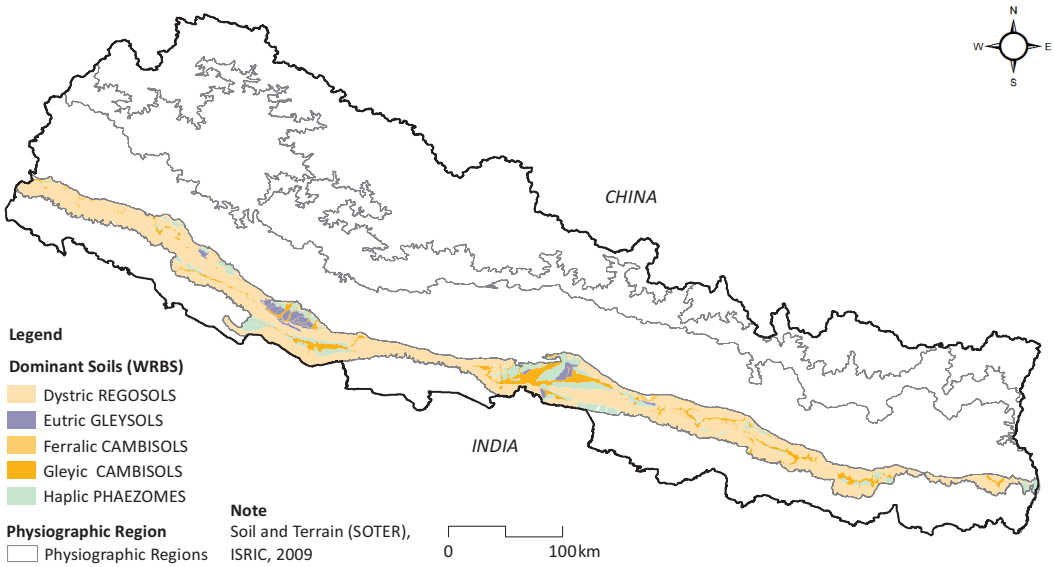


Figure 4. Soils in the Churia

soils (sub-surface soils have higher clay contents). Some luvisols are found in the Churia, mainly on ancient terraces but also in the hills. These luvisols are generally haplic and chromic.

1.5. Land system in relation to Churia Land Units

The Churia has been divided into five land systems and 11 land units based on geomorphology, degree of dissection, and slope. These land units have the specific land-use system and constraints. The land system comprises of steeply to very steeply sloping hilly and mountainous terrain comprise the largest portion of land (1,260,500 ha), followed by fans, aprons and ancient river terraces (308,700 ha), active and recent alluvial plains (163,800 ha), and moderately to steeply sloping hilly and mountainous terrain (88,800 ha). The smallest portion is covered by depositional basins or Duns (57,200 ha) (Table 3 and Figure 5).

Table 3. Churia land systems

Land system / Landform	Land unit	Dominant slope	Dominant texture	Drainage	Major land-use	Land unit area (ha)
4. Active and recent alluvial plains	4a Sand and gravel bars	<1°	Sandy cobbly	Subject to severe flooding	Gravel, sand	65,100
	4b Low terrace	<1°	Sandy	Variable/subject to severe flooding	Natural grasses	18,300
	4c High, undulating terrace	<1°	Variable	Variable/low areas subject to flooding	Rice, wheat	78,400
	4 Complex					2,000
5. Fans, aprons and ancient river terraces	5a Very gentle slopes	<1°	Loamy	Moderately good	Maize, mustard	89,100
	5b Gentle slopes	1-5°	Bouldery	Rapid	Sal forest	53,400
	5c Undulating	1-5°	Loamy	Good	Sal forest	98,600
	5d Rolling	0-20°	Loamy	Rapid	Sal forest	53,300
	5 Complex					14,300
6. Depositional basins (Duns)	6a Depressional	<0.5°	Fine loamy	Poor	Rice, fallow	14,000
	6b Non-dissected high position	<2°	Fine loamy	Imperfect	Rice, fallow	16,000
	6c Gently rolling	1-5°	Fine loamy	Variable	Maize, mustard	18,900
	6d Highly dissected	0-30°	Fine loamy	Rapid	Bad land	8,300
7. Moderately to steeply sloping hilly and mountainous terrain		<20°	Loamy skeletal	Well		88,800
8. Steeply to very steeply sloping hilly and mountainous terrain		>20°	Loamy skeletal	Rapid		1,260,500

Source: Modified from the LRMP, 1986

1.6. Drainage

Several large rivers originating in the High Himal cut the east-west Churia chain, while smaller, ephemeral rivers flow only during the monsoon. Water in the small rivers may dry up totally outside the monsoon season, probably because the soil in the river beds is highly permeable (Shrestha *et al*., 2008). The Churia region is the origin of third-grade rivers of Nepal. These rivers are characterized by their smaller sizes and low to almost no flow during the dry seasons. Flash floods commonly occur during monsoon season in these rivers and carry huge sediment loads to be deposited in the flood plains of the Terai. Bakra, Balan, Khutti, Patharaiya, Tinua, Baikaiya, Ratu, Kamala, Sirsia, Manusmara, Banganga, Sunsari etc. are the major rivers that originate in the Churia (Figure 6).

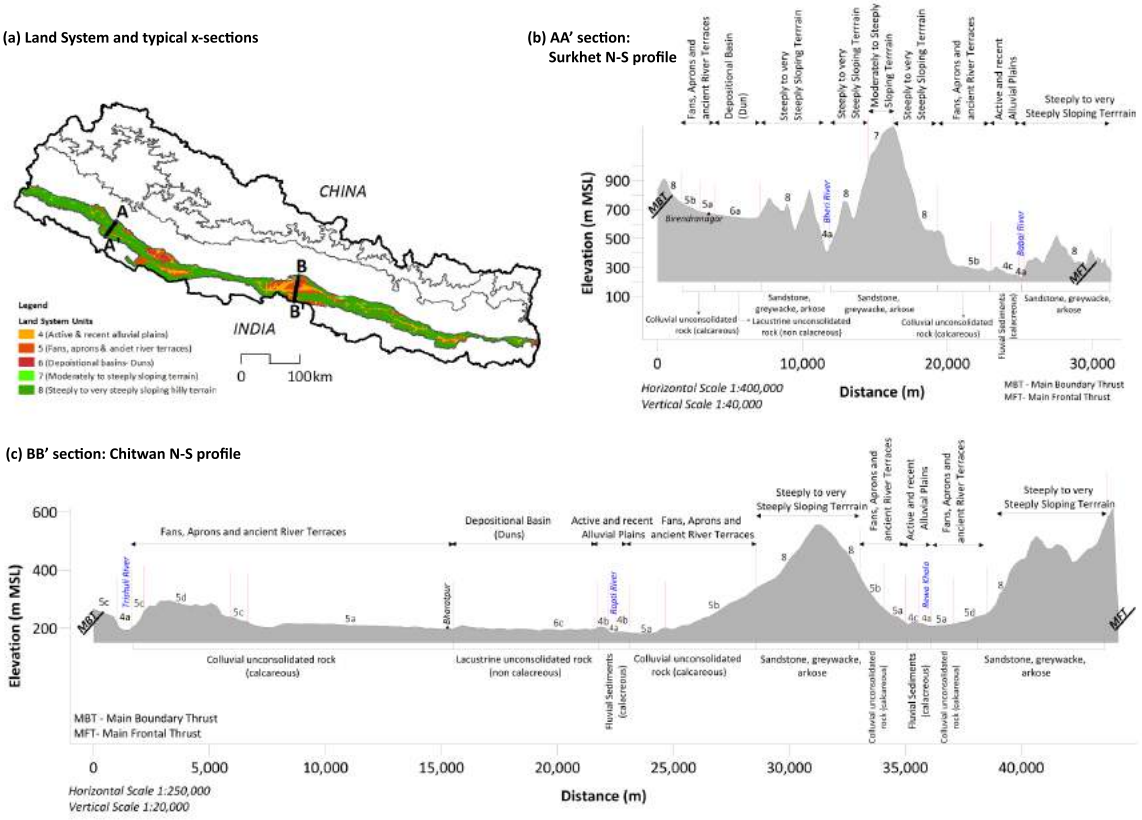


Figure 5. Churia land systems and its cross section AA'– Surkhet and BB'– Chitwan

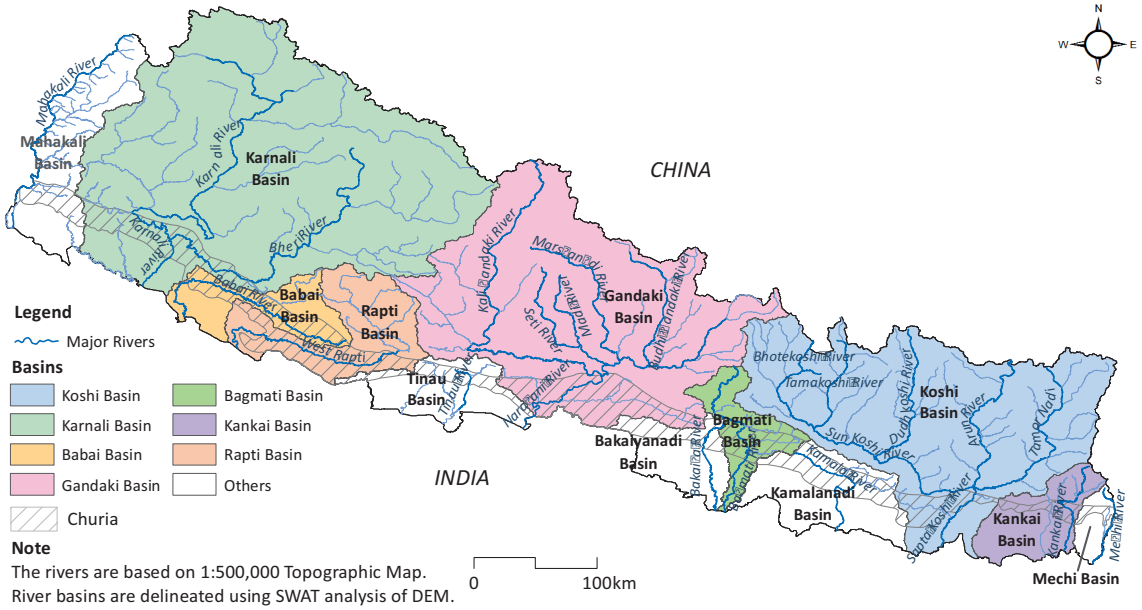


Figure 6. The river basins and drainage systems of Nepal

2 PREVIOUS FOREST INVENTORIES

The first national-level forest inventory was carried out in the 1960s. Since then, several forms of FRA activities have been carried out in different periods, each different in terms of purpose, scale, scope, design and technology used (technical reports of different projects). The second national-forest inventory was carried out in 1990s. The FRA Nepal (2010–2014) is the third comprehensive national-level forest resource inventory ever carried out.

2.1. Forest Resources Survey (1963–67)

The first national-level forest inventory was conducted between 1963 and 1967 with the support of the USAID (FRS, 1967). It covered areas classified as the Terai, Inner Terai and Churia Hills, as well as the southern faces of the Mahabharat Range but excluded most of the Chitwan Division, which was inventoried separately. After classifying forests as either commercial or non-commercial, the survey focused on collecting data from commercial forests, primarily on timber estimates of stock and the domestic consumption of wood products. Methodologically, it used the visual interpretation of aerial photographs taken in 1953–58 and again in 1963–64, mapping, and a field inventory. The inventory provided the first comprehensive assessment of commercial forests in the Terai and adjoining areas and in the hilly regions.

2.2. Land Resources Mapping Project (1977–79)

The LRMP was a whole-country assessment conducted using a variety of methods, including the interpretation of aerial photographs taken between 1977 and 1979, land survey, topographic maps and ground verification. It focused on mapping land cover and land use, producing forest-cover maps and assessing the type, size and crown cover of forests. Both high- and low-altitude forests were mapped by crown cover (0–10%, 10–40%, 40–70%, and 70–100%) and scrubland was mapped separately. Each forest was defined on the basis of the dominant species and forest type (coniferous, hardwood, or mixed). Land utilisation maps at the scale of 1:50,000 were produced using aerial photographs.

2.3. National Forest Inventory (1987–1998)

The Second National Forest Inventory was conducted by the DFRS with support from the Government of Finland from 1987 to 1998. It updated data on forest coverage and change as well as forest statistics for all accessible forests excluding those in protected areas using 1991 Landsat TM satellite images of the Terai and aerial photographs of the hills taken in 1989-1992 (DFRS, 1999). In the hills, photo-point sampling was used to estimate forest area as well as to carry out a forest inventory in the field. Forest land was defined as an area of at least one hectare with a crown cover of 10% or more.

2.4. Wide-Area Tropical Forest Resources Survey (2000)

In 2000/2001, the DFRS carried out a wide-area tropical forest resources survey of the entire nation using satellite imagery (Landsat TM images taken in 1998/99 and Indian remote-sensing images taken in 1999/2000) in technical collaboration with the Japan Forest Technical Association (JAFTA). It analysed land use, forest distribution, forest type, and conditions with the aim of providing the information required to prepare forest management plans. The total forest area of six different types of forest (Sal, Terai mixed hardwood (TMH), Upper mixed hardwood (UMH), chir pine, blue pine and fir/hemlock/spruce/cedar) was 5.51 million ha, and the total area of shrub land was, 1.28 million ha (JAFTA, 2001).

2.5. Forest Cover Change (2005)

In 2005, the DoF conducted a study of forest-cover change in the nation's 20 Terai districts using Landsat 1990/91 and Landsat 2000/01 satellite images and classifying land according to six main categories (forest, degraded forest, grass land, barren land, water bodies, and other land. Ground verification was done between September and November 2004. Although this report focused mainly on Terai forests, it also included certain parts of Churia and Mid-hills forests. According to the DoF (2005), the total forest cover in the Terai districts was 37% (1.3 million ha). Seven districts: Dang, Nawalparasi, Chitwan, Mahottari, Sarlahi, Rautahat and Saptari had a conspicuously greater proportion of forest cover than the other districts. The annual rate of forest cover change in all 20 Terai districts, excluding protected areas, was -0.06%.



Field crews heading for inventory in Ilam Churia

3 METHODOLOGY

3.1 The Churia Forest Resource Assessment

FRA Nepal used both field-based assessment and the interpretation of satellite images (which were later field-verified). The different methods adopted are described below.

Forest Inventory

The inventory design adopted was based largely on methods developed by Kleinn (1994) and finalised collaboratively by international and regional FRA experts and DFRS staffs. The design was created during the first year and tested in the field in three trial inventories and training sessions. After each test, the method was revised to improve its functionality. The variables measured were selected based on the suggestions made during a national-level data needs assessment (DFRS, FRA Nepal 2014) workshop held with FRA data partners in Nepal.

Sampling

Two-phase systematic sampling was adopted. In the first- phase sampling, a 4 km × 4 km grid was superimposed on a high-resolution RapidEye (5m × 5m) satellite image covering the entire country with the help of Google Earth images and topographic maps to create 9,180 clusters (grid-cells), each of which consisted of six concentric circular sample sub-plots, thereby making a total of 55,358 sample plots (Figure 7) to be visually analysed. The 7,132 sample plots in 1,216 clusters which lie in the Churia[1] physiographic region were visually interpreted using standardised procedures (FRA Nepal, 2010). These sub-plots were 150 m apart in the north-south direction and 300 m apart in the west-east direction. Starting in the southwest of far-western Nepal, the clusters were systematically numbered from south to north and west to east.

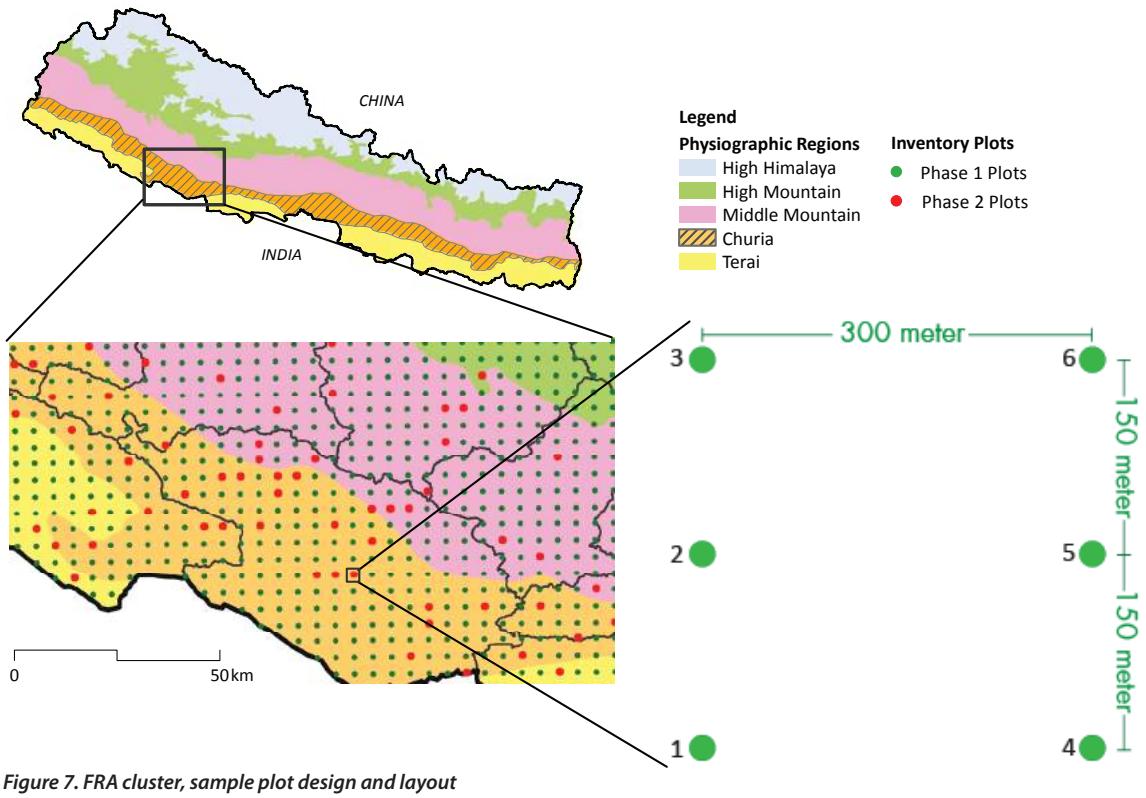


Figure 7. FRA cluster, sample plot design and layout

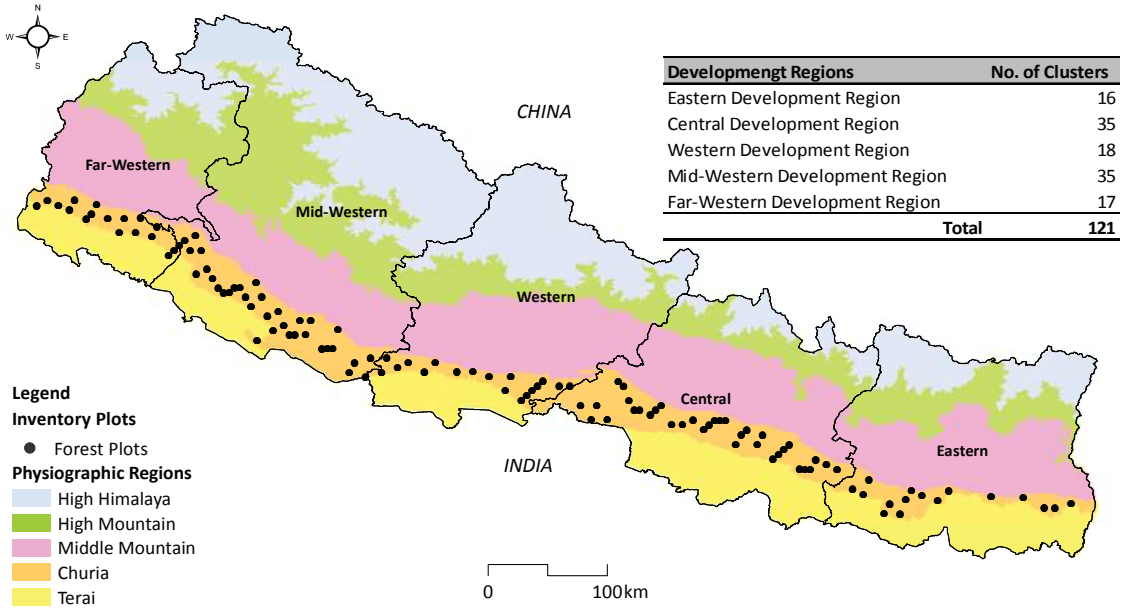
[1] The stratification of physiographic boundaries was based on a general physiographic (1:500,000) map produced by the LRMP.

The 1,216 clusters in the Churia were divided into two strata. Clusters in the first stratum had at least one sub-plot (out of six) with forest land; these were known as forest clusters and totalled 999. The remaining 217 clusters were second stratum (non-forest) clusters. During the second phase, field sample clusters, both forest and non-forest, were systematically selected at the nodes of the 4 km × 4 km square grids. Choosing every eighth forest cluster yielded a total of 125 forest clusters, four of which were inaccessible resulting a total of 121 total forest clusters. Of the 726 sub-plots in the 121 forest clusters, 632 were on forest land, of these, just 476 were inventoried because 156 could not be inventoried for various reasons, including being located in a core PA, dense rattan, or a creek. Of the remaining 94 sub-plots of forest stratum, 16 were occurred on the OWL and 78 were on the Other Land (rivers and agricultural land). Of those 16 sub-plots occurred on the OWL, just 10 were inventoried.

Twenty-seven non-forest clusters were selected by choosing every twelfth cluster. One of their 162 sub-plots was found to be a forest cluster, so it was added to the first stratum, making 477 forest sub-plots (Figure 8). All the sub-plots of each non-forest clusters were inventoried.

- Trees having DBHs of 20.0-29.9 cm were enumerated within a 15 m radius plot (area: 706.9 m^2)
- Trees having DBHs of 10.0-19.9 cm were enumerated within a 8 m radius plot (area: 201.0 m^2)
- Trees having DBHs of 5.0-9.9 cm DBH were enumerated within a 4 m radius plot (area: 50.3m^2)

Other sub-plots were established to assess the status of seedlings, saplings, shrubs and herbs. Seedlings, saplings and shrubs were measured in four circular sub-plots, each with a radius of 2 m, located 10 m away from the centre of the plot in each of the four cardinal directions (north, east, south and west). Species-wise stem counting and mean height estimations were carried out for tree and shrub species having DBHs less than 5 cm. Information on non-woody vascular plants was collected from four 1 m^2 plots, each located 5 m away from the centre in the four cardinal directions. Dead and decaying wood was assessed in a circular plot with a radius of 10 m from the plot centre. Fifteen categories of natural and anthropogenic forest disturbances were assessed through field observations of both their occurrence



Developmengt Regions	No. of Clusters
Eastern Development Region	16
Central Development Region	35
Western Development Region	18
Mid-Western Development Region	35
Far-Western Development Region	17
Total	**121**

Figure 8. Distribution of permanent sample clusters in the Churia Region

Sample Plot Design

Each sample plot had four concentric circles of different radii, which were used to measure trees with different diameters at breast height (DBH) (Figure 9) as indicated below:

- Trees having DBH of 30.0 cm or more were enumerated within a 20 m radius plot (area: 1256.6 m^2)

and intensity (high, medium, low) in the 20 m radius sub-plot. The presence of mammals was assessed using footprints, scat, calls and markings both inside each 20 m sub-plot as well as outside each sub-plot as teams moved from one sub-plot to the next. Information related to ethno-botanical uses of different NTFPs was obtained through social surveys conducted in villages near the clusters.

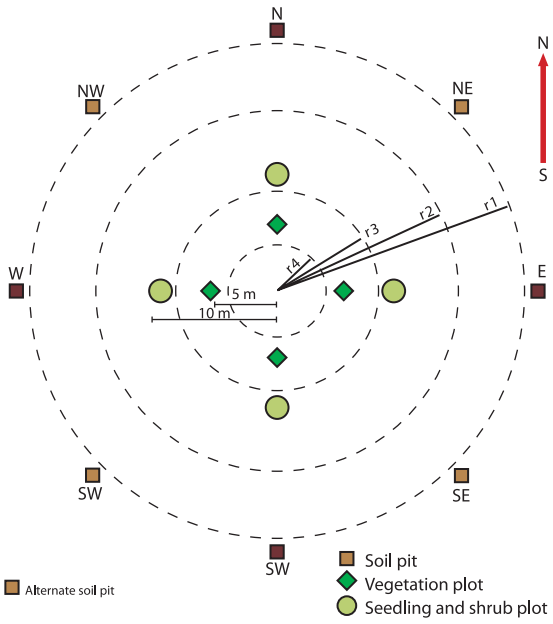


Figure 9. Layout of concentric circular plot with supplementary sub-plots used

3.2 Tree Resources on OWL and Other Land

Information regarding the tree resources on OWL and Other Land were obtained by measuring 230 sub-plots (11 OWL and 219 Other Land). They included all sub-plots located in both forest and non-forest strata. The concentric circular sub-plots used for tree assessment were the same as those used in forest plots but no other sub-plots (seedling, sapling, shrubs, herbs and soil) were defined and these were not made permanent.

Quality Assurance of Forest Inventory Data

Slightly more than 7.5% of the total sub-plots of forest sub-plots inventoried were systematically selected and re-measured in order to assess the quality of the initial forest inventory field measurement and provide feedback to the crew members and, in doing so, improve the FRA Nepal Field Manual.

3.3 Tree Height Modelling

The total height of trees is an important predictor of essential forest parameters such as volume and biomass but measuring height is time-consuming, in some cases, impractical. For this reason, height models were prepared for tree species and species groups in the Churia using the data collected from sample trees (every fifth tree) and additional ones as necessary to fill in data gaps-within each sample plot.

A non-linear mixed-model approach was used to establish the relationships between the DBHs and total heights of trees using the *Lmfor* package in R Software (Mehtatalo, 2012). Best fitting models are selected for all species using following functions: 'Naslund' for *Shorea robusta, Anogeissus latifolius,* etc.; 'Wykoff' for *Adina cordifolia, Lagerstroemia parviflora, Mallotus philippensis,* etc.; 'Ratkowsky' for *Terminalia alata;* 'Micment' for *Pinus roxburghii;* and so on (Annex 1).

Species with only a few sample trees were grouped according to their families, genera and existing height-diameter observations, and models were developed for each of these groups.

A model for predicting tree DBH from stump diameter was also developed so that the total volume and biomass of trees that had been felled could be estimated (Annex 2).

3.4 Volume and Biomass Estimation

The volume equations developed by Sharma and Pukkala (1990) and the biomass models prescribed by the MoFSC (1988) were used to estimate the volume and biomass of standing trees. The air-dried biomass values obtained using these equations were then converted into oven-dried biomass values using a conversion factor of 0.91 (Chaturvedi, 1982; Kharal and Fujiwara, 2012) and a carbon-ratio factor of 0.47 (IPCC, 2006).

Tree volume estimation: The following allometric equation (Equation 1) developed by Sharma and Pukkala (1990) was used to estimate tree volumes over bark:

Equation 1. Tree volume

$$\ln(v) = a + b \ln(d) + c \ln(h)$$

where,

ln = Natural logarithm to the base 2.71828.
V = Volume (dm^3) = exp [a + b × ln(DBH) + c × ln(h)]
d = DBH in cm
h = Total tree height in m
a, b and c are coefficients depending on species Values were divided by 1000 to convert them into cubic meters.

The regression parameters of Equation 1 are presented in Table 4.

The volumes of individual broken trees were estimated using a taper curve equation developed by Heinonen *et al*. (1996).

Tree stem biomass estimation: Tree-stem biomass was calculated using Equation 2 and species-specific wood-density values (Table 5).

Table 4. Species-specific coefficients used for calculating the volumes of individual trees

SN	Species	Local name	a	b	c
1	*Acacia catechu*	Khair	-2.3256	1.6476	1.0552
2	*Adina cordifolia*	Haldu/Karma	-2.5626	1.8598	0.8783
3	*Albizia* spp.	Siris	-2.4284	1.7609	0.9662
4	*Alnus nepalensis*	Uttis	-2.7761	1.9006	0.9428
5	*Anogeissus latifolia*	Banjhi	-2.272	1.7499	0.9174
6	*Bombax ceiba*	Simal	-2.3865	1.7414	1.0063
7	*Dalbergia sissoo*	Sissoo	-2.1959	1.6567	0.9899
8	*Eugenia jambolana*	Jamun	-2.5693	1.8816	0.8498
9	*Lagerstroemia parviflora*	Bot Dhaiyero	-2.3411	1.7246	0.9702
10	*Michelia champaca*	Chanp	-2.0152	1.8555	0.763
11	*Pinus roxburghii*	Khote Salla	-2.977	1.9235	1.0019
12	*Quercus* spp	Khasru	-2.36	1.968	0.7469
13	*Schima wallichii*	Chilaune	-2.7385	1.8155	1.0072
14	*Shorea robusta*	Sal	-2.4554	1.9026	0.8352
15	*Terminalia tomentosa*	Asana	-2.4616	1.8497	0.88
16	*Trewia nudiflora*	Gutel	-2.4585	1.8043	0.922
	Miscellaneous in Terai		-2.3993	1.7836	0.9546
	Miscellaneous in Hills		-2.3204	1.8507	0.8223

Source: Sharma and Pukkala, 1990

Table 5. Stem-wood density of Churia trees

SN	Species	Local name	Air-dried density (kg/m^3)
1	*Acacia catechu*	Khair	960
2	*Adina cordifolia*	Haldu/Karma	670
3	*Albizia* spp.	Siris	673
4	*Alnus nepalensis*	Utis	390
5	*Anogeissus latifolia*	Banjhi	880
6	*Bombax ceiba*	Simal	368
7	*Dalbergia sissoo*	Sissoo	780
8	*Eugenia jambolana*	Jamun	770
9	*Lagerstroemia parviflora*	Bot Dhaiyero	850
10	*Michelia champaca*	Chanp	497
11	*Pinus roxburghii*	Khote Salla	650
12	*Quercus* spp	Khasru	860
13	*Schima wallichii*	Chilaune	689
14	*Shorea robusta*	Sal	880
15	*Terminalia tomentosa*	Asana	950
16	*Trewia nudiflora*	Gutel	352
	Miscellaneous in Terai		674
	Miscellaneous in Hills		674

Source: Sharma and Pukkala, 1990

Equation 2. Tree stem biomass

Stem biomass = Vol. × Density

where,

Vol. = Stem volume in cubic meters
Density = Air-dried wood density

Tree branch and foliage biomass estimation: The separate branch-to-stem and foliage-to-stem biomass ratios prescribed by the MoFSC (1988) for small (DBH < 28 cm), medium (DBH 28– 53cm) and large (DBH > 53 cm) trees were used to estimate branch and foliage biomass from stem biomass (Table 6). Dead trees were not taken into account for this estimate. The total biomass of individual trees was estimated using Equation 3.

Equation 3. Total biomass of each individual tree

Total biomass = Stem biomass + Branch biomass + Foliage biomass

Tree stump and coarse root biomass estimation: This estimation was calculated using Equation 4 (Altrell *et al.*, n.d.), which assumes a cylindrical stump and a coarse root biomass which is half the biomass of the above-ground stump.

Table 6. Branch-to-stem and foliage-to-stem biomass ratios of various tree species

SN	Species	Local name	Branch-to-stem			Foliage-to-stem		
			Small	Medium	Large	Small	Medium	Large
1	*Alnus nepalensis*	Utis	0.803	1.226	1.510	0.169	0.089	0.060
2	*Dalbergia sissoo*	Sissoo	0.684	0.684	0.684	0.010	0.010	0.010
5	*Pinus roxburghii*	Khote Salla	0.189	0.256	0.300	0.101	0.046	0.033
6	*Quercus spp*		0.747	0.960	1.060	0.229	0.215	0.202
4	*Schima wallichii*	Chilaune	0.520	0.186	0.168	0.064	0.035	0.033
3	*Shorea robusta*	Sal	0.055	0.341	0.357	0.062	0.067	0.067
7	Other species	-	0.400	0.400	0.400	0.070	0.057	0.040

Source: MPFS, 1988

Equation 4. Stump volume estimation

$$Vol_{stump} = (D_{sh2})/4 \times H_{stump} \times \pi \times F_{stump}$$

where,

D_{sh} = Stump diameter (at stump height or at 1.3 m if stump height exceeds DBH)

H_{stump} = Stump height

F_{stump} = Stump form factor 1.5 (stump form factors range from 1.3 to 2.0)

3.5 Analysis of Remote Sensing Data

Forest-cover maps were prepared using RapidEye MSS Satellite Imagery (Level 1b, radiometrically corrected), secondary images (Google Earth images, Landsat TM etc.), ancillary maps (LRMP and topographical maps) and the FRA Nepal field inventory data.

Geometric and Atmospheric Corrections of Satellite Images

The RapidEye Level 1b imagery (17 scenes acquired in February and March 2010/11) was ortho-rectified using Toutin's Model (Toutin, 2004), with ground control points and digital elevation model. The ground control points were collected using road and river features and the digital elevation model, generated using contours and spot levels from the National Topographical Base Map Data. Independent check points were collected to assess the level of accuracy (Figure 10). The planimetric accuracy of the ortho-rectified images was 9.81 m (≈1.96 pixels RMSE) for the 1,355 ground-control points collected for 48 RapidEye scenes covering the entire nation.

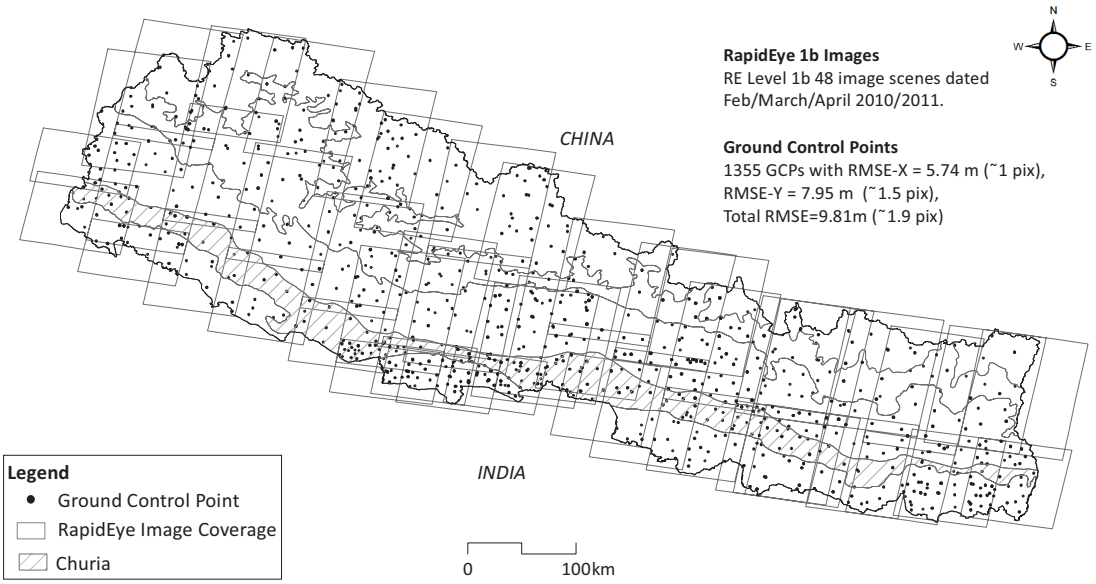


Figure 10. RapidEye image tiles and ground control points used for mapping

Atmospheric Correction of the Satellite Images

Atmospheric corrections were made to minimise the effects of atmospheric haze and terrain shadows using topographical normalisation and Bidirectional Reflectance Distribution Function (BRDF) correction of the ATCOR3 model (Figure 11), defined by Richter (1998) and given in Equation 5.

Equation 5. Bidirectional Reflectance Distribution Function (BRDF)

$$G = (\cos\beta_i / \cos\beta_T)^{1/2}$$

where,

G = BRDF factor
β_i = threshold angle
β_T = incidence angle

and iv) homogeneity texture of the near-infrared band. Randomly sampled reference training sets from the Phase 1 plots were used to classify land as forest, OWL and other land (non-forest) along with additional field observation data for OWL and shrub classification. Forest, other land and OWL areas were classified by defining a 'containment membership function' for threshold values for all four properties. In order to improve classification accuracy, on-screen post-classification visual interpretation was carried out on the classified forest, other land and OWL (including shrub) areas using high resolution images in Google Earth. In addition, mapping field survey missions were undertaken throughout the Churia region during first and second week of May 2014 in order to delineate OWL (including shrub) as well as to rectify error for the forest cover classification.

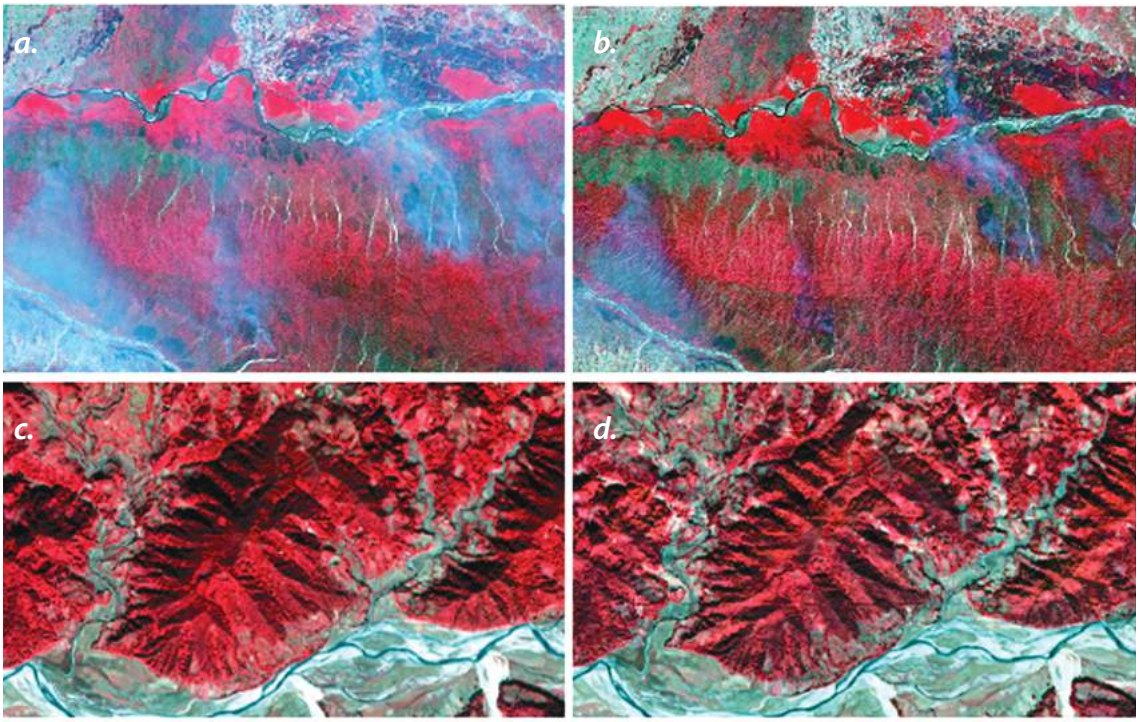


Figure 11. Haze and atmospheric correction
(a) Image before and (b) after haze correction in Far-western region; (c) image before and (d) after atmospheric and BRDF corrections

3.6 Forest-cover mapping

Forest cover was mapped adopting a hybrid approach which used automated image classification supported by extensive visual interpretation (GOFC-GOLD 2013). Images were classified by applying segmentation and the automated object-based image analysis method (Baatz and Schape 2000) using eCognition software (Version 8). Four spectral properties were considered: i) mean pixel values of green, red, red-edge and near-infrared bands; ii) derived Normalised Difference Vegetation Index (NDVI); iii) principal components;

The accuracy of the forest-cover map was assessed by comparing the area classified as forest cover with 154 randomly selected FRA inventory plots and 218 additional purposively sampled field observation plots. In addition, 1,186 randomly selected Phase 1 sampling plots were independently assessed.

Forest Cover Change Mapping

Forest cover changes (1995-2010) were analysed and mapped by spatially comparing the 1995 forest cover data[1] published by Department of Survey (DoS) in 2001 with the forest cover produced by

[1] Forest cover data according to the 1:25,000 scale National Topographic Map based on 1:50,000 scale aerial photographs of the period 1992-1996. The year 1995 was considered the nominal year for this analysis.

FRA. The definition of 'forest' used by DoS to make National Topographic Maps was harmonised with the definition used by FRA by generalizing other land cover classes such as bush, plantation etc., which were found to be degraded or regenerating forest patches during the field verification. Forest patches registering a gain or loss of more than 0.25 ha were analysed and mapped and then sampled and verified in the field using observations and Participatory GIS approaches involving local CFUG members and DFO personnel (Figure 12).

Calculation of annual rate of change in forest cover

The annual rate of change in forest cover was calculated by using following formula (FAO, 1995).

Equation 6. Annual rate of change in forest cover

$$q = \left(\frac{A_2}{A_1}\right)^{1/(t_2-t_1)} - 1$$

Where,

q = Annual rate of change
A_1 = Forest cover at time t^1
A_2 = Forest cover at time t^2

Forest Fragmentation Mapping

Fragmentation of forest patches and their sizes were analysed and mapped from the classified forest cover of Churia using RapidEye images. Spatially contiguous forest patches outside the PAs that fulfilled the forest definition criteria were categorized based on their sizes ranging from less than 2 ha to greater than 50,000 ha. Their frequency of occurrence and area coverage in each size category were analysed to assess the distribution and the area of the forest fragments.

Distribution of Churia forest according to slope classes

The forest slopes were spatially analysed using Digital Elevation Model (DEM)[2] created from the National Topographic dataset (DoS, 2001). Elevations for each forest pixel (rasterized at 20 m pixel size) created from the classified forest cover using the RapidEye images of Churia were analysed. Then, the forest elevations were classified into the groups of < 15%, 15-35%, 35-60%, 60-100% and > 100% to produce forest slope map of the Churia. Forest area under each slope class was also calculated.



Figure 12. Identification and verification of forest cover changes with stakeholders

[2] DEM at 20 m resolution was created using the National Topographic Map contour and spot height datasets using the ANUDEM algorithm.

3.7 Forest Disturbances

Ecologists in the field assessed the 477 forest sample plots (20 m radius) for 15 types of disturbances and four levels of intensity on the ground.

Forest disturbances were categorised as follows.

No disturbance: No signs of significant disturbance observed

Landslide: Signs of landslide and/or flooding observed

Grazing: Presence of the hoof marks and dung of animal, broken tops of seedlings and saplings, signs of trampling, disturbed forest litter

Lopping: Cutting of side branches of trees for fodder

Leaf litter collection: Collection of leaf litter on the ground

Bush cutting: Sign of cuttingbushes

Forest fire: Sign of forest fire observed

Encroachment: Encroachment on forest for cultivation and plantation

Resin tapping: Tapped trees, ordinarily pines, were identified by cuts made in the boles of trees to enable resin to ooze out

Lathra cutting: Cutting of saplings and pole-sized stems

Tree cutting: Targeted to trees with > 25 cm DBH

Insect attacks: Plant leaves bearing signs of insect attacks (e.g. holes, nests, etc)

Plant parasites: Presence of parasitic plants in trees

Plant disease: Diseases to the plant mainly by fungi (e.g. black rot), or some bacteria (e.g. rotting). Note: if tree was rotting due to resin tapping the disturbance was recorded as resign tapping, not as plant disease

Wind, storm, hail

Other human- induced disturbances: Disturbances by humans other than those described above (e.g. removing the bark from the base of a tree, snaring, foot trails, forest road, etc.)

The intensity levels of these above-mentioned disturbances were classified as below:

Intensity level 0: No significant disturbance.

Intensity level 1: Minor disturbance. Little or no effect on trees and regeneration. Less than 10% of trees and seedlings affected.

Intensity level 2: Moderate disturbance. Tangible effect on trees and regeneration. 10–25 % of trees and seedlings affected or some trees felled or dead.

Intensity level 3: Severe disturbance. Significant effect on trees and regeneration. More than 25% of trees and seedlings affected or several trees felled or dead.

3.8 Biodiversity Analysis

The lists of flora and fauna species obtained from the field sample plots and social surveys were verified using various sources, including Edwards, 1996, *Medicinal Plants of Nepal* (DPR, 2007), *Flora of Nepal* (www.eflora.org) and Bhuju *et al*. 2007. Annotated lists were prepared by incorporating both sample plots and social survey data. For social survey, focus group discussions were carried out with executive member of CFs, women, dis-advantaged groups, local healers and NTFPs collectors by the field crew members.

Detrended correspondence analysis (DCA) with default options in CANOCO Version 4.5 (Hill and Gauch, 1980; terBraak and Smilauer, 1998, 2002) was used to identify the compositional gradient length in standard deviation units of plots. All ordination diagrams were produced using CANODRAW Version 4.5 (terBraak and Smilauer, 2002).

Tree species frequencies (the proportion of sampling units containing a given species) were calculated using Equation 7.

Equation 7. Tree species frequency

$$f = (\frac{n_i}{N}) X\ 100$$

where,

f_i = Frequency of species i,

n_i = Number of sub-plots on which species i occurred, and

N = Total number of sub-plots studied

Alpha diversity (α) was calculated using Equation 8.

Equation 8. Alpha diversity

α = Total number of all species/Total number of plots

Beta diversity was calculated using Equation 9.

Equation 9. Beta diversity

Beta (β) diversity = Total species richness/average species richness

$$\beta = \frac{N}{a} - 1$$

where,

β = Beta diversity
N = Number of species encountered
α = Alpha diversity

The Shannon-Weaver diversity index was used to calculate species diversity as shown in Equation 10.

Equation 10. Shannon-Weaver diversity index

$$\bar{H} = -\sum_{i=1}^{s} (pi)(ln(pi))$$

where,

$\bar{H}$ = Shannon-Weaver index of diversity (for trees and shrubs)

P_i = Proportion of total number of individual of species *i* (i.e. n_i/N)

S = Total number of individual species

n_i = Number of individual species *i*, ranging from 1to S.

N = Total number of all species

ln = Natural logarithm

3.9 Forest Soil Assessment

The top 30 cm layer of soil of forest stand was sampled and assessed in order to determine soil characteristics and soil organic carbon (SOC) stocks. Fieldwork included the collecting of litter and debris, preparing a soil pit, identifying the soil texture, and determining soil stoniness. Organic carbon stock in both the litter and debris fractions was obtained on the basis of the total mass collected from a known area in the field. The dry mass of litter and debris and SOC content were analyzed in the laboratory, then the results calculated per hectare were combined with the characteristics representing the forest stand and inventory cluster.

The final SOC value was obtained after correcting laboratory values with a consideration of the degree of stoniness determined in the field. This correction was needed because no organic carbon is found within stones and because laboratory analyses give the organic carbon content only for the fine soil fraction (that fraction with particles less or equal to 0.5 mm in diameter). Since a steel rod soil penetration method following Finnish and Estonian empirical studies, is not entirely applicable to the Churia conditions in Nepal, the FAO (2006) field key was used. Because Churia soils are rich in stone, so using uncorrected SOC data would have markedly overestimated the SOC stock in this physiographic zone.

Assessment of Composite Samples of Litter and Woody Debris

Litter and debris fractions were collected from the 1 m^2 circular plots located on the surface of each soil pit before it was dug. Litter and woody debris from all four soil pits (one in each cardinal direction) were collected separately to make three composite samples taken at three 10 cm depths (0-10, 10-20, and 20-30) (Figure 13). A value of zero was used for pits without any litter or woody debris on the surface to ensure that the estimate of average litter and debris mass per unit area would be accurate.

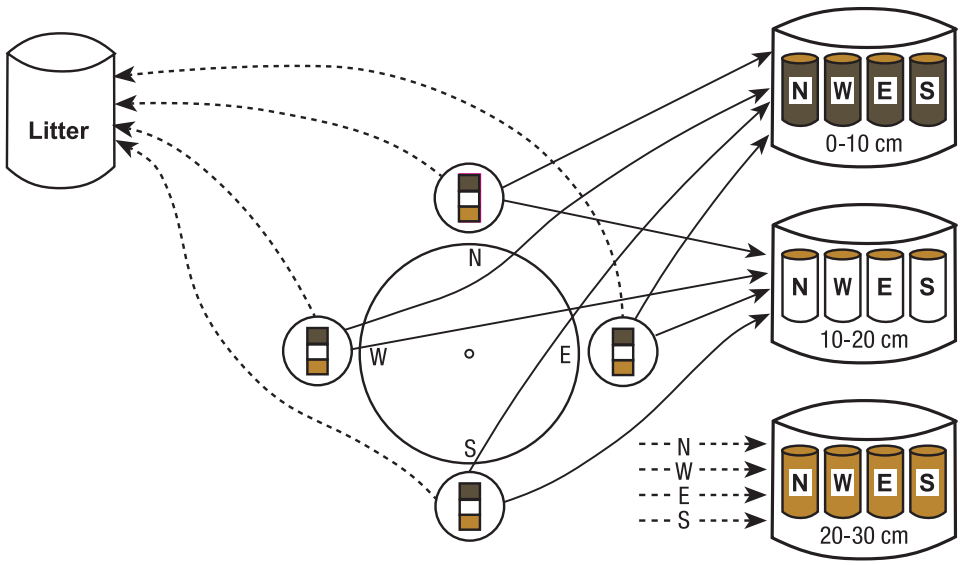


Figure 13. Collection of composite samples of litter, debris and soil from a plot

The total composite fresh masses of both litter and debris were weighed in the field to an accuracy of 1.0 g. As the total volume of all 4 m^2 areas (the total of four 1 m^2 plots) was very large, small representative sub-samples were set aside so that their dry masses could be determined in the laboratory.

Sampling of Soil

Soil samples were collected from all soil pits each dug within a 2 x 2 m area, located 1 m outside of the 20 m plot radius and sized to ensure that the samples would be of undisturbed soil. The samples were collected using a 100 mm long, slightly conical cylinder corer with lower diameter 37 mm (at its cutting edge) and 40 mm upper diameter, so the volume of each soil sub-sample collected was 107.5 cm^3.

A composite soil sample was collected from each sub plot; it included soil from each soil pit unless the designated pit turned out to be on cropland, a steep slope (>100%), riverbank, or road or in a rocky area or water body. If a cardinal point was inaccessible, the sub-cardinal point (northeast, southeast, southwest, and northwest) clockwise of that point was substituted. In all cases, there were at least three soil-sampling points within each forest stand of each plot, even if there were several stands.

Separate plastic bags were used to collect the composite soil samples for each of three layers (0–10 cm, 10–20 cm, and 20–30 cm) (Figure 13), and the fresh mass of the composite sample was weighed to an accuracy of 1 gram. The bags were transported from the field to the laboratory, where they were stored separately in order to facilitate the assessment of the vertical variability of SOC.

Determination of Soil Characteristics

The soil pits were used to determine soil characteristics; including texture and stoniness, by observing the soil profiles impressed upon the soil-pit walls (Figure 14) with the help of the FAO's guidelines 2006.

3.10 Analyses in the Laboratory

Determination of Physical Parameters

The composite samples of soil and sub-samples of litter and woody debris were analyzed in the DFRS Soil Laboratory in Babarmahal, Kathmandu. SOC stock was calculated using the dry soil bulk density (g/cm^3) and the proportion of SOC. The dry bulk-density of the fine soil fraction (<2 mm) was determined from the volumetric composite samples in order to calculate the SOC stock in each of three 10 cm deep layers collected in the field. Soil is void of organic



Figure 14. Soil sample pit

carbon with respect of the volume occupied by coarse fraction particles such as pebbles, gravel, and stones. The volume of any larger particles, typically less that 20 mm in diameter that could be found in the volumetrically cored samples, was eliminated when calculating the bulk density of the fine fraction.

Litter, Woody Debris, and Soil Carbon

The preparation of the samples and the SOC analysis followed the procedures detailed in the Laboratory Standard Operative Procedures (FRA Nepal, 2011), as summarized below.

The ≥ 2 mm coarse fraction was separated with a 2 mm sieve, and its volume was measured using water displacement and the volume was used for calculation of bulk density of the fine fraction. The fine fraction that passed the sieve was homogenized sieving it further using a 0.5 mm sieve, and analyzed for OC%.

Litter and woody debris were not analyzed for OC%, but a constant carbon content of 50% (following a recent review by Pribyl, 2010) was applied together with an estimate of dry mass / m^2. The dry mass of litter and woody debris measured in the field as fresh mass was estimated using the dry mass obtained by oven-drying of the subsamples, sent to the laboratory, see the description of field procedures above.

When soil samples arrived at the laboratory still in field moisture conditions, free-air drying was used to immediately stabilize them. Then they were oven-dried to achieve a constant mass and moisture content. Because of limited supplies of electricity and, in some cases oven capacity, the oven-drying period was shortened from the conventional over-night to, in some cases a single hour only. The resultant error that may occur in the dry bulk density figures calculated will be reflected in the final SOC results as well, but because the fieldwork was done during the dry season, the degree of error is considered to be low, especially as air-drying is also used.

Walkley-Black wet combustion method with titration analytics was applied in the analysis of the proportion of organic C (OC%) in soil. The method can recover only about 77% of SOC, and a correction factor of 133 has been routinely applied. An excel application was produced in order to collect all laboratory calculations and to help to organize and speed up the laboratory calculations. The application also calculated the carbon stocks of litter, woody debris, and soil fine fraction.

The methods of SOC analysis, applied in the DFRS Soil Laboratory for Churia soil samples, were cross-evaluated against an independent, authorized dry combustion method in the METLA laboratory, Finland. It was concluded that the FRA results were comparable with those obtained by the reference laboratory (DFRS, 2014). The methods applied for Churia soil samples are the same and are partly overlapping in time of laboratory work. Thereby the Churia SOC analysis data were also deemed reliable.

Quality Assurance of SOC Analysis

In order to validate the soil carbon analytical methodology, the Institutional Cooperation Instrument Nepal-Project compared the SOC results between the DFRS Soil Laboratory and the Metla Soil Laboratory (Finland). The former laboratory used the Walkley-Black wet combustion method; the Metla laboratory, dry combustion LECO CHN Analysis. Dry combustion methods may overestimate SOC if a sample contains inorganic carbonates as it analyses the CO_2 emitted from the sample burned at high temperature. So, additional steps were taken in the Metla Soil Laboratory to eliminate the carbonates (CO_3) by using Hydrochloric Acid. The chlorides, harmful for the analyzer, were washed out with water (Westman *et al*. 2006).

The results of the two laboratories were consistence for low values of SOC% (0-3%), so there is no need for additional correction coefficients or changes in procedures. However, it was different for the single high value (>3%). This high value reappeared both times it was replicated and may suggest a slight under-estimation by the Walkley-Black Method. In order to recognize a possible systematic bias in cases of high SOC%, more comparisons should be made with sample from Mid hills physiographic regions which have similarly high values.

Estimating of Soil Organic Carbon Stock

Multiple site categorisations and soil sampling were accomplished so as to determine SOC stocks in the top 30 cm soil layer. The soil characteristics recorded in the field including organic C-content, bulk density and stoniness were used to estimate the SOC stocks in the 0-30 cm topsoil layer. The results were used to estimate the overall forest C-stock together with the standing biomass estimates obtained from the tree stand measurements and the biomass models.

Estimation of Mean and Standard Errors

The carbon contents of soil, litter and debris were all calculated using ratio estimates (Cochran, 1977) in order to account for intra-cluster correlations, or more pronounced similarities among nearby clusters than among distant clusters.



Rhododendron in Churia Hill Western Nepal

4 TECHNICAL CHALLENGES AND LIMITATIONS

4.1. Forest Inventory

The methodology was designed to collect national-level data on tree volume and biomass with 95% confidence of being within plus or minus 10% of the actual value. The confidence levels for sub-populations such as individual development regions and physiographic zones were naturally anticipated to be lower (FRA Nepal, 2010).

Sampling errors can be assessed accurately only if estimated values are distributed normally and there is no bias. Besides these distortions, other sources of inaccuracy included errors in identifying species, taking field measurements, entering field results in the database, and deriving and calculating mathematical formulae. Errors in the estimates of areas used to convert average density values to total values for the Churia as a whole also arose.

It is extremely difficult to conduct a temporal analysis of forest parameters without well-established permanent samples plots and well documented base line data. Another problem is that errors in the values being compared may be large in comparison with any changes measured. The data analysis relied on biomass equations developed by Sharma and Pukkala (1990) using data measured in the 1960s. In addition, there were insufficient species specific wood densities available for the tree species. Stem-to-branch and stem-to-foliage biomass ratios were available only for few tree species, and the values in the biomass tables were only for air-dried biomass. All of these limitations made it difficult to precisely estimate above and below-ground biomass and carbon content in the Churia forests.

4.2. Remote Sensing

Visual Interpretation in Phase-1 Plot Sampling

On-screen visual interpretation as a pre-processing step makes it possible for an interpreter to easily integrate the different characteristics of objects (e.g. surface texture) visible in an image and profit from direct knowledge of the context. Unlike digital classification methods, such interpretation does not require specialized software though it did face following challenges:

- Some of the images interpreted in 2010 were partly from 2003–2005, and land-cover changes in the intervening years could have caused discrepancies with fieldwork results.
- Google Earth Images might have some local geometrical distortions which can lead to misinterpretation of the boundaries between two land-cover types, and visual interpretation may be distorted by human error in classifying land cover.

4.3. Forest-Cover Mapping

Remote sensing-based mapping of vegetation and its types is a challenging task to begin with and these challenges are exacerbated by the difficult and varied terrain and climate of Nepal. With a scientific and technically sound approach, appropriate remote sensing materials and the support of reliable and extensive ground samples, multi-source mapping of vegetation/forest can be achieved with a good degree of accuracy and reliability. The FRA faced several technical limitations and challenges while mapping forest and non-forest areas in the Churia region. The limitations encountered during the mapping process were:

- The fact that image acquisition months (December, February, March and April) varied means that atmospheric conditions differed, thus creating challenges for carrying out atmospheric correction and normalizing automated image analysis. It may also have leaded the FRA team's making certain errors in forest-cover mapping.
- The classification and analysis of forest cover was complicated by the fact that some deciduous trees, eg. *Shorea robusta, Acacia catechu and Anogeissus latifolius* were defoliated during the period of image acquisition (Figure 15), therefore classification and analysis of such forest cover was challenging. Although, secondary images and maps were used as reference for classification, there still may have been errors.



Figure 15. Defoliated Anogeissus latifolius and Acacia catechu forest in Mid-western Nepal

- The spatial heterogeneity of forest stands and the fuzziness of their boundaries might have introduced errors into their classification and delineation.
- Mapping of shrub areas was extremely challenging due to the limitations of the images used and the insufficiency of field reference data. In particular, areas visually interpreted and mapped as shrub areas in the high resolution images were mostly found to be patches of regenerating Sal and degraded forests (Figure 16). Ground verification and mapping also indicated that shrub patches were extremely fragmented and small (< 0.25 ha).
- Similarly, differentiating OWL (including shrub) was made difficult by the limitations of the images used, so misclassification of OWL to shrub or vice versa cannot be ruled out (Figure 17).
- Young regeneration and recent plantation might have been classified as Other Land because they are not spectrally different from the surrounding land cover.
- Mapping of encroached forested areas have not been undertaken due to the limitations in scope of the FRA works.



Figure 16. Regenerating Sal forest (left) and degraded forest (right) classified as forest.



Figure 17. Degraded forest patches mistakenly mapped as OWL/shrub in Dang

4.4. Biodiversity Assessment

The main limitation of the biodiversity assessment was the very low sampling intensity (< 0.00013%), which suggests that sparsely distributed species, were likely, missed. The species richness value and index included information about woody plants, climbers and epiphytes but those for herbaceous plants and other taxa might be erroneous because such species are seasonal. In addition, the study focused on higher taxa, so its methodology might not be appropriate for assessing biodiversity in detail.

4.5. Soil Analysis

- Comparison of SOC in different forest types suffers from unbalanced number of inventory clusters in the systematic sampling when the soil laboratory results are combined to the database of stand characteristics. For example, 70 Sal were sampled, just half of the number of LMH plots (135). Other forest types were represented in far fewer numbers among the remaining 229 plots which had valid soil data.

- When litter and woody debris data were considered in combination with forest stand and SOC results, only 199 plots had figures for all the critical variables.
- The soil sampling density was not designed to cover all the geological variations encountered in the Churia, so the standard error was high. The results were highly varied and cannot be considered to be an adequate SOC mapping of the Churia. They can, however, be used to explore links between the most prevalent Churia forest types, characteristics, and management regimes.



5 RESULTS

5.1. Area Statistics

Land Cover in the Churia

According to forest-cover mapping, 72.37% (1,373,743 ha) of the total area of the Churia region was covered by forest land and 1.19 % (22,672 ha) was under OWL, making a grand total of 73.56% under forests and OWL together (Table 7).

Spatial distribution of Churia forest is presented in Figure 18. Selected district-level[2] forest-cover maps of Churia region are presented in Annex 3.

Table 7. Churia land-cover classes

Land cover class	(ha)	Area (%)
Forest	1,373,743	72.37
Other Wooded Land (OWL) :		
- *Tree Crown Cover (5 - 10 %)*	*22,336*	*1.17*
- *Shrub*	*336*	*0.02*
OWL sub-total	22,672	1.19
Other Land	501,848	26.44
Grand Total (Forest + OWL + Other Land)	**1,898,263** [1]	**100.00**



Churia Forest Cover Inside and Outside PAs

Out of the total 1,373,743 ha of forest area in Churia, 76% falls outside PAs, and of the 24% within, 18% is in core and 6% in buffer zones. While a negligible area of Churia forest was in PAs in the Eastern development region, a large proportion of the total area of Churia forest in the Central and Mid-western development region was PAs (Table 8).

Table 8. Churia forest area inside and outside protected areas (ha)

Development Region	Protected Area		Outside Protected Area	Total Area	Percentage
	Buffer Zones	Core Zones			
Eastern	~0	~0	173,298	173,298	13
Central	39,405	134,067	256,557	430,029	31
Western	4,508	5,955	164,669	175,133	13
Mid-western	38,310	104,772	271,713	414,795	30
Far-western	1,576	1,955	176,957	180,489	13
Grand Total	**83,799**	**246,750**	**1,043,194**	**1,373,743**	**100**
Percentage	**6**	**18**	**76**	**100**	

[1] The official area of the Churia physiographic region is 1,896,930 ha (Survey Department, 2001)
[2] District level forest map did not present for those districts which occupy ≤ 1000 ha area in Churia region.

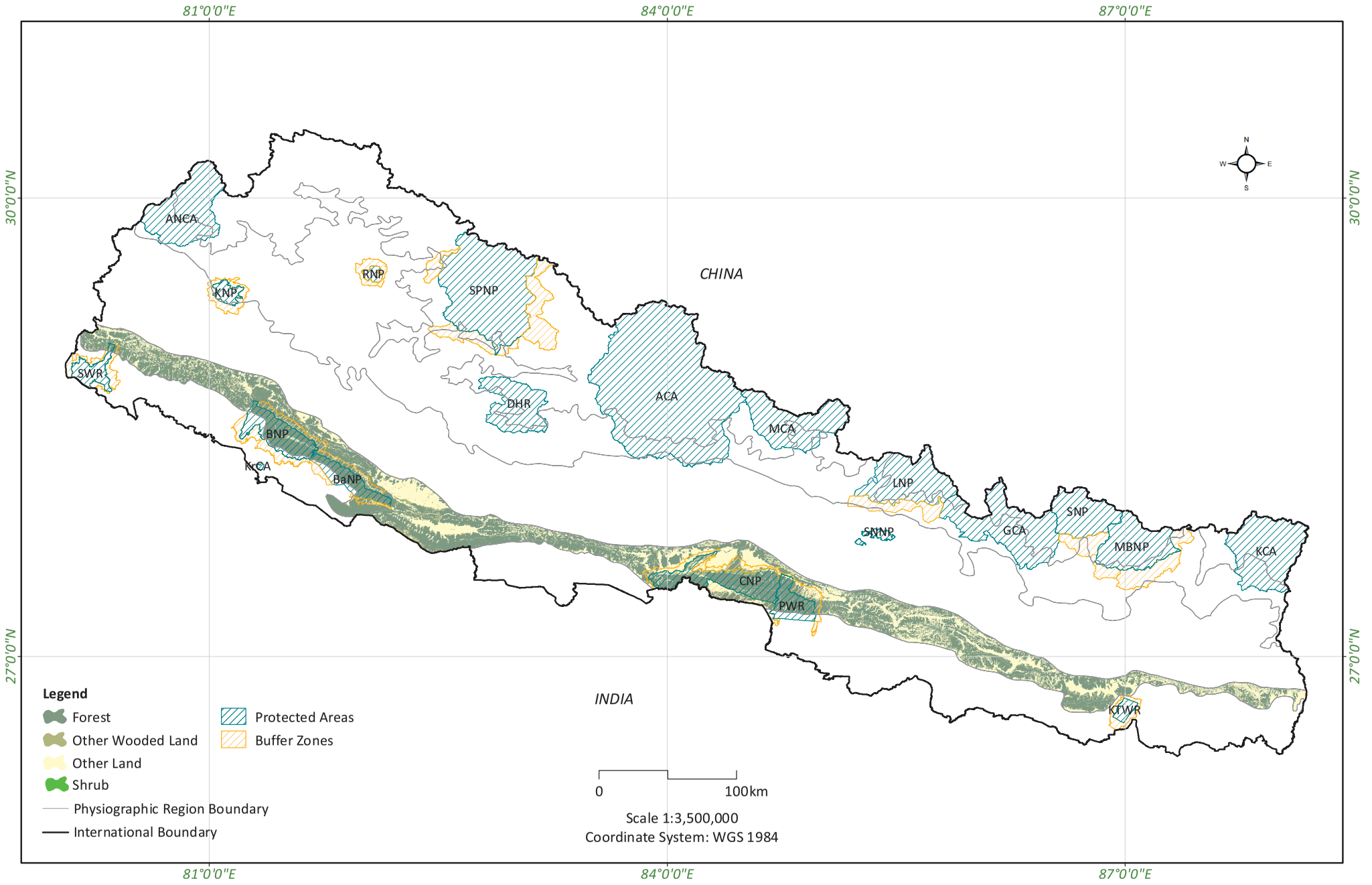


Figure 18. Spatial distribution of Churia forest

5.2. Forest Types, Altitudinal Variation and Slope

Terai mixed hardwood (TMH) forests were found between the elevations of 144 m and 1,221 m and on slopes averaging 16°. Sal forests were found on slightly lower and flatter land ranging from 172 m to 1,016 m and averaging a slope of 13°, while lower mixed hardwood (LMH) forests were distributed from 221 m to 1,640 m on slightly steeper slopes (22° on average). Khair-Sissoo and Sissoo-Khair (KS/SK) forests were distributed at the lowest range (256 m to 627 m) on relatively flat areas with an average slope of just 4.7°, and Chir pine forests were on the highest slopes (1,380 m to 1,574 m) with the second-highest average slope (21°) (Figure 19)

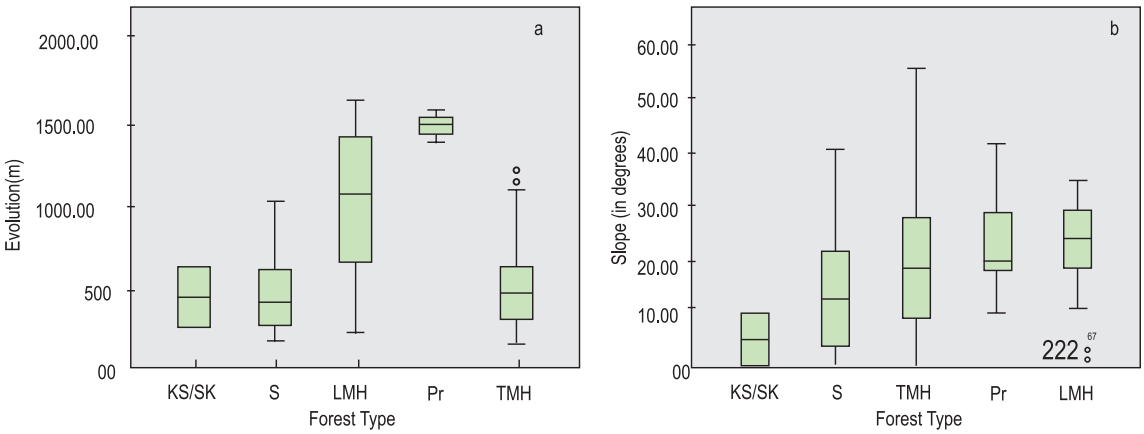


Figure 19. Distribution of forest types by elevation (a) and slope (b)

Distribution of Churia forest according to slope classes

About 31% of the Churia forest occurred in the slope class of 35-60%, followed by 28% on 0-15%, 26.02% on slopes of 15-35%, 13.46% on slopes of 60-100%. Only about 1% was on the steepest slope (> 100%) (Table 9, Figure 20). Steep slopes, forest management regimes and poor access limit the potential production of saw logs in Churia forests. While evidence of tree removals was common in all slope classes up to 100%, the FAO recommends that tree harvesting using humans and draught animals on erosion prone sites should be limited to slopes of less than 35% indicating potential production forest of about 54% (744 thousand hectare).

Table 9. Churia forest according to slope class

Slope (%)	Slope (°)	Area (ha)	Percentage
< 15%	< 8.5	387,170	28.18
15-35%	8.5-19.0	357,502	26.02
35-60%	19.0-31.0	431,257	31.39
60-100%	31.0-45.0	184,896	13.46
> 100%	> 45.0	12,917	0.94
Total		**1,373,743**	**100.00**

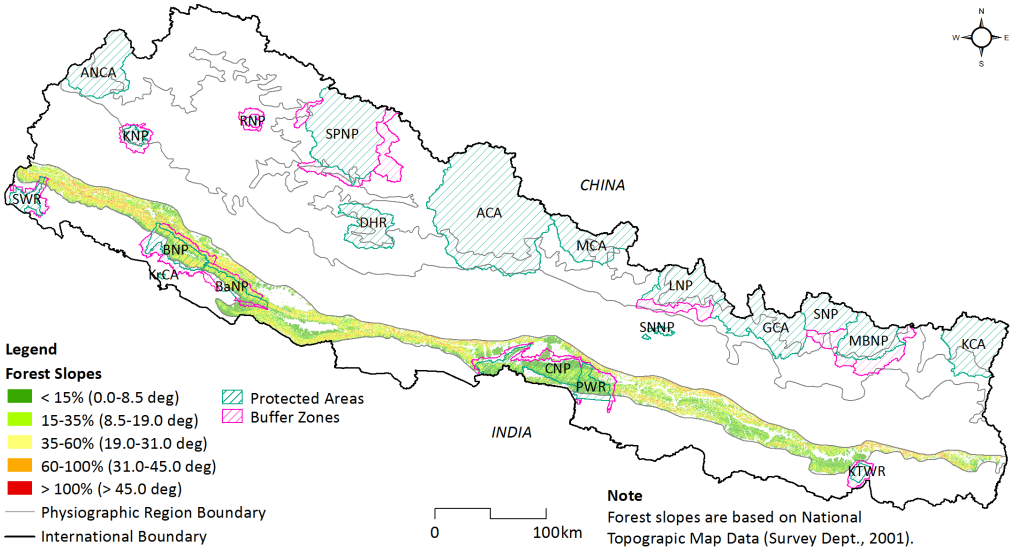


Figure 20. Distribution of slope class in Churia region

About 75% of Phase-2 forest plots lay on steeply and very steeply sloping hilly and mountainous terrain (land system 8), 3.4% lay on moderately to steeply sloping hilly and mountainous terrain (land system 7), and 18.2% occurred on fans, aprons and ancient river terraces (land system 5). Only 15 plots (3%) occurred on land that is considered suitable for agriculture. Of them, six were classified as land system 6b, which is suitable for rice/fallow agriculture, and 9 as land system 5a, which is suitable for maize and mustard). Forest type classification was not independent of land system, (Chi-square, p = 0.001). The forest types found on different land systems are shown in Table 10.

Distribution of Sample Plots by Forest Types

Of the total 726 sub-plots (six plots on each of 121 clusters), 477 were forested with one of four different forest types (KS/SK, S, LMH and Pr). The majority (62.5%) were TMH and S, the dominant forest types in the Churia (Table 11).

Table 11. Distribution of sample sub-plots by forest types

SN	Forest type	No. of sub-plots	Proportion (%)
1	KS/SK	3	0.60
2	LMH	22	4.60
3	Pr	8	1.70
4	S	146	30.60
5	TMH	298	62.50
	Total	**477**	**100.00**

Table 10. Major forest types in relation to land systems

Land System/Landform	Land Unit	Dominant Slope	Plots	Plots by Major Forest Type (%)			
				LMH	Pine	Sal	TMH
3. Alluvial fan apron complex "upper piedmont" (erosional)	Very gentle slopes	<1°	4		-	100	
	Gentle slopes	1-5°	13			15.40	84.60
	Undulating	1-3°	2		-		100
	Highly dissected	0-20°	0		-	-	-
4. Active and recent alluvial plains	Sand and gravel bars	<1°	2				100
	Low terrace	<1°	6				100
	Higher terrace, undulating	<1°	0				
5. Fans, aprons and ancient river terraces	Very gentle slopes	<1°	15			22.20	77.80
	Upper terraces					100	0
	Gentle slopes	1-5°	5			40	60
	Undulating	1-5°	19			42.10	57.90
	Rolling	0-20°	22	4.50		59.10	36.40
	Complex		6			50	50
6. Depositional basins (Duns)	Depressional	<0.5°	0				
	Non-dissected high position	<2°	6			100	
	Gently rolling	1-5°	0				
	Highly dissected	0-30°	0				
7. Moderately to steeply sloping hilly and mountainous terrain		<20°	17	29.40	5.90	35.30	29.40
8. Steeply to very steeply sloping hilly and mountainous terrain		>20°	357	4.50	1.70	25.80	67.20

Source: Modified from LRMP, 1986

Proportion of Development Status

Small saw-timber stands comprised the greatest proportion of land (46.5%), followed by pole (25.80) and large-saw timber stand (25.40%). Seedling and sapling stands comprised the least proportion of forest (2.3%) (Table 12).

Table 12. Distribution of sample sub-plots in forest stand by development status

SN	Stand Development Status	No. of Sub-plots	Proportion (%)
1	Seedling and sapling stand (<12.5 cm DBH)	11	2.30
2	Pole timber stand (12.5–25.0 cm DBH)	123	25.80
3	Small saw timber stand (25.0–50.0 cm DBH)	222	46.50
4	Large saw timber stand (>50.0 cm DBH)	121	25.40
	Total	**477**	**100.00**

Proportion of Canopy Closure

In terms of canopy closure, 49% of forest stands were well-stocked whereas 41% were moderately stocked and 9.4%, poorly stocked (Table 13).

Table 13. Distribution of sample sub-plots in forest stands by canopy closures

SN	Canopy closure	No. of sub-plots	Proportion (%)
1	Poorly stocked forest (0-39%)	47	9.80
2	Moderately stocked forest (40–69.9% canopy closure)	196	41.10
3	Well-stocked forest (≥70% canopy closure)	234	49.10
	Total	**477**	**100.00**

State of land cover in Churia districts in 2010/2011

Out of the total 1,898,263 ha in the Churia, Dang District occupies the largest area (248,331 ha) followed by Chitwan (188,697 ha) and Kailali districts (145,367 ha). Bhojpur District has the smallest area (63 ha). Likewise, the largest areas of forest cover were recorded in Dang District (155,181 ha) followed by Kailali (126,203 ha) and Chitwan (115,386 ha). The Other land was also largest in Dang District (85,887 ha), followed by Chitwan (67,703 ha) and Makwanpur (48,623 ha). OWL was again highest in Dang (7,085 ha), followed by Chitwan (5,608 ha) and Kailali (1,900 ha) (Table 14).

Table 14. District-wise state of land-cover (ha) in the Churia in 2010

Dev. Region	Districts	Forest	Other Land	OWL*	OWL (Shrub)	Total
Eastern	Bhojpur	3	60	0		63
	Dhankuta	316	246	0		563
	Ilam	27,308	11,776	55		39,140
	Jhapa	6,288	12,900	19		19,207
	Morang	11,652	7,044	36		18,732
	Saptari	18,327	5,218	116		23,661
	Siraha	15,793	5,174	117		21,085
	Sunsari	6,158	4,225	13		10,396
	Udayapur	87,452	39,178	531		127,161
	Bara	15,177	5,131	219		20,527
Central	Chitwan	115,386	67,703	5,608		188,697
	Dhanusha	26,685	7,367	53		34,105
	Kavre	516	229	0		746
	Lalitpur	242	348	1		591
	Mahottari	12,772	3,498	36		16,306
	Makwanpur	89,996	48,623	1,682		140,301
	Parsa	51,282	5,918	96		57,296
	Rautahat	7,234	2,619	128		9,982
	Sarlahi	14,090	9,384	40		23,513
	Sindhuli	96,649	46,670	337		143,657
	Arghakhanchi	39,866	6,411	308	26	46,611

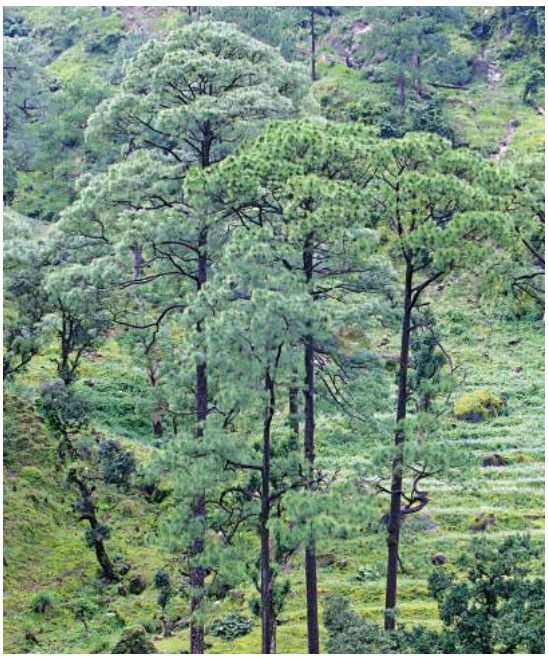
Dev. Region	Districts	Forest	Other Land	OWL*	OWL (Shrub)	Total
Western	Kapilbastu	21,550	760	77		22,387
	Nawalparasi	75,877	46,272	865		123,014
	Palpa	19,241	5,596	241		25,078
	Rupandehi	18,593	4,767	128		23,488
	Tanahu	4	558	0		562
	Banke	77,368	3,528	87		80,984
Mid-western	Bardiya	64,924	3,981	1,274	95	70,273
	Dang	155,181	85,887	7,085	178	248,331
	Pyuthan	1,991	1,061	0		3,052
	Salyan	28,308	4,275	113		32,696
	Surkhet	87,023	26,921	916	10	114,871
	Dadeldhura	29,936	8,574	117		38,627
Far-western	Doti	2,879	894	26	1	3,800
	Kailali	126,203	17,238	1,900	27	145,367
	Kanchanpur	21,471	1,815	108		23,394
	Grand Total	**1,373,743**	**501,849**	**22,336**	**336**	**1,898,263**

*Note * Crown cover 5-10%*

District-wise forest-cover change between 1995 and 2010

It appears that the total forest area in Churia was decreased by 38,051 ha over the period of 15 years from 1995 to 2010. The annual rate of forest cover change was about -0.18% per year during this period (Table 15).

Over the 15 years from 1995 to 2010, the area of forest cover found to be decreased in 27 districts (Nawalparasi, Dang, Sindhuli, Surkhet, Makwanpur, Kailali, Udayapur, Rautahat, Dhanusa, Siraha, Dadeldhura, Rupandhehi, Palpa, Salyan, Bardiya, Parsa, Bara, Kanchanpur, Sarlahi, Mahottari, Doti, Lalitpur, Jhapa, Tanahu, Saptari, Kavre and Bhojpur). In contrast, forest cover area increased in the remaining 9 districts (Arghakhanchi, Banke, Morang, Ilam, Sunsari, Chitwan, Kapilbastu, Dhankuta and Pyuthan) (Table 15). The annual rates of change between the current FRA study and previous DoF studies of selected districts are presented in Annex 4.



Pinus roxburghii Forest in Churia Region

Table 15. District-wise forest cover-change (ha) during the period from 1995 to 2010

Dev. Region	Districts	Forest 1995*	Forest 2010**	Change in Area (ha)	Annual Rate of Change (%)	Land proportion of district within Churia (%)
Eastern	Bhojpur	7	3	-4	***	0.04
	Dhankuta	294	316	23	0.5	0.62
	Ilam	26,861	27,308	447	0.11	23.14
	Jhapa	6,349	6,288	-62	-0.07	11.93
	Morang	10,861	11,652	791	0.47	10.25
	Saptari	18,372	18,327	-45	-0.02	18.44
	Siraha	16,978	15,793	-1185	-0.48	18.49
	Sunsari	5,720	6,158	438	0.49	8.7
	Udayapur	89,470	87,452	-2017	-0.15	55.28
	Bara	15,580	15,177	-403	-0.17	16.13
Central	Chitwan	115,145	115,386	241	0.01	84.25
	Dhanusha	28,018	26,685	-1333	-0.32	28.67
	Kavre	541	516	-25	-0.31	0.53
	Lalitpur	305	242	-64	-1.54	1.49
	Mahottari	12,865	12,772	-94	-0.05	16.28
	Makwanpur	93,277	89,996	-3281	-0.24	57.41
	Parsa	51,779	51,282	-497	-0.06	40.74
	Rautahat	8,719	7,234	-1485	-1.24	9.61
	Sarlahi	14,409	14,090	-320	-0.15	18.6
	Sindhuli	100,883	96,649	-4234	-0.29	57.79
	Arghakhanchi	38,941	39,866	924	0.16	37.62
Western	Kapilbastu	21,516	21,550	35	0.01	13.56
	Nawalparasi	85,374	75,877	-9498	-0.78	57.16
	Palpa	20,249	19,241	-1008	-0.34	17.15
	Rupandehi	19,641	18,593	-1048	-0.36	18.01
	Tanahu	56	4	-52	***	0.36
	Banke	76,477	77,368	891	0.08	43.02
Mid-western	Bardiya	65,827	64,924	-904	-0.09	35.07
	Dang	160,532	155,181	-5351	-0.23	81.16
	Pyuthan	1,988	1,991	3	0.01	2.31
	Salyan	29,227	28,308	-919	-0.21	17.38
	Surkhet	90,455	87,023	-3432	-0.26	46.16
	Dadeldhura	31,087	29,936	-1151	-0.25	25.65
Far-western	Doti	2,968	2,879	-88	-0.2	1.85
	Kailali	129,168	126,203	-2966	-0.15	44.15
	Kanchanpur	21,851	21,471	-381	-0.12	14.42
	Grand Total	**1,411,794**	**1,373,743**	**-38,051**	**-0.18**	**12.84**

*Area statistics based on forest data of the National Topographic Map, DoS, 2001
** Area statistics based on recent FRA data, 2010/11
*** Annual rate of change did not present for those districts which occupy ≤ 100 ha area in Churia region.

5.3. Forest Cover Changes according to Development Region

Major areas of changes were spatially analysed and mapped by comparing the FRA Nepal forest cover data for 2010 for 36 districts with that of the DoS collected for National Topographic Map in 2001. Development region-wise patches of forest gain and loss greater than 0.25ha are shown in the Figures 21, 22, 24, 25, 26.

The Far-western Development Region

Over the last 15 years (1995-2010), an annual forest loss of about 0.17% has occurred in the Far-western development region. Dadeldhura has seen the highest annual loss of forest (0.25%), followed by Doti (0.2%), Kailali (0.15%) and Kanchanpur (0.12%). Most of the forest changes have occurred within the large forest patches within the proximity of human settlements indicating forest loss or degradation (into OWL/Shrub) due to anthropogenic activities. Forest gains and regeneration were noticed in small patches in the Far-western region (Figure 21).

The Mid-western Development Region

Mid-western region has experienced annual rates of forest loss of 0.15% (1995-2010) with the highest annual rates in Surkhet (0.26%), Dang (0.23%) and

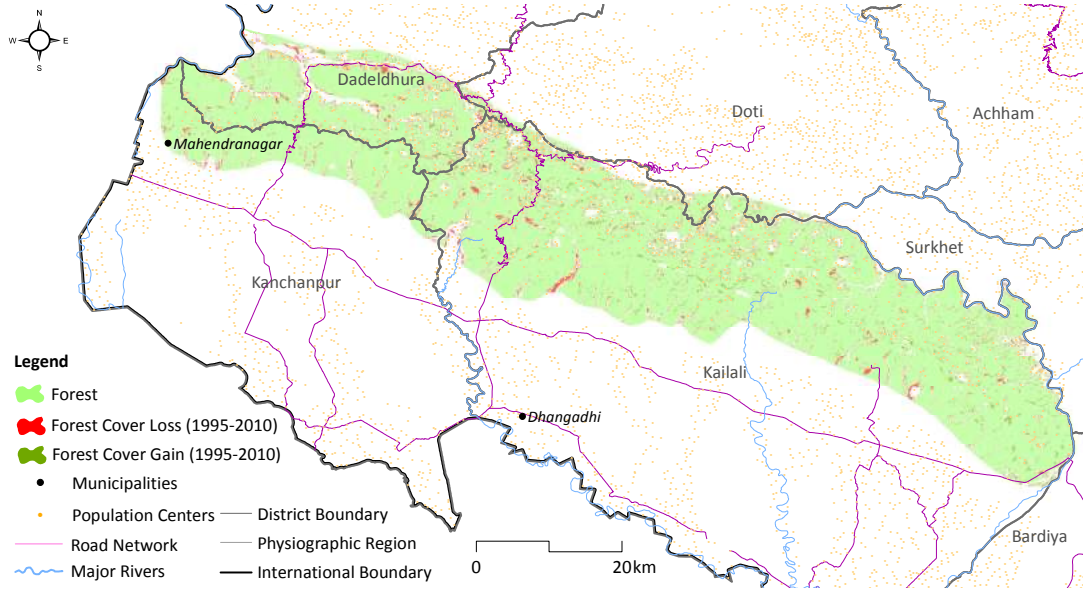


Figure 21. Forest cover changes in the Far-western region

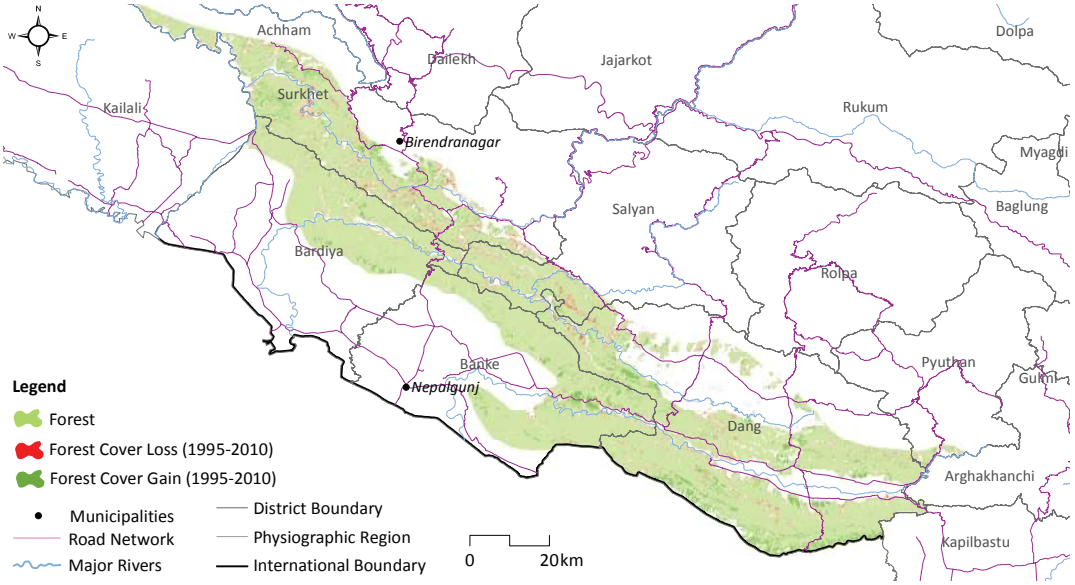


Figure 22. Forest cover change in the Mid-western Development Region

Salyan (0.21%). Consequently, Banke and Pyuthan have experienced forest gains. The fact that forest losses are more evident in forest close to settlements, including those along the Bheri and Babai Rivers, indicates human activities as major drivers of change (Figure 22). Within large forest areas, small patches of forest gains have also been observed; they are attributed primarily to conservation through community-based management practices as illustrated in Figure 23.

The Western Development Region

The Western development region in the Churia has experienced the highest annual forest loss of any of the five regions. Its average rate between 1995 and 2010 was 0.39%, with the highest rates in Nawalparasi (0.78%) Rupandehi (0.36%) and Palpa (0.34%). In Arghakhanchi, in contrast, forest cover increased at the rate of 0.16%. The spatial patterns of loss suggest that proximity to settlements (and thereby human activities) is a primary factor in high rates of loss (Figure 24).



Figure 23. Gain in forested cover in Bhawani Community Forest Regeneration (left) and plantation (right), Dang district

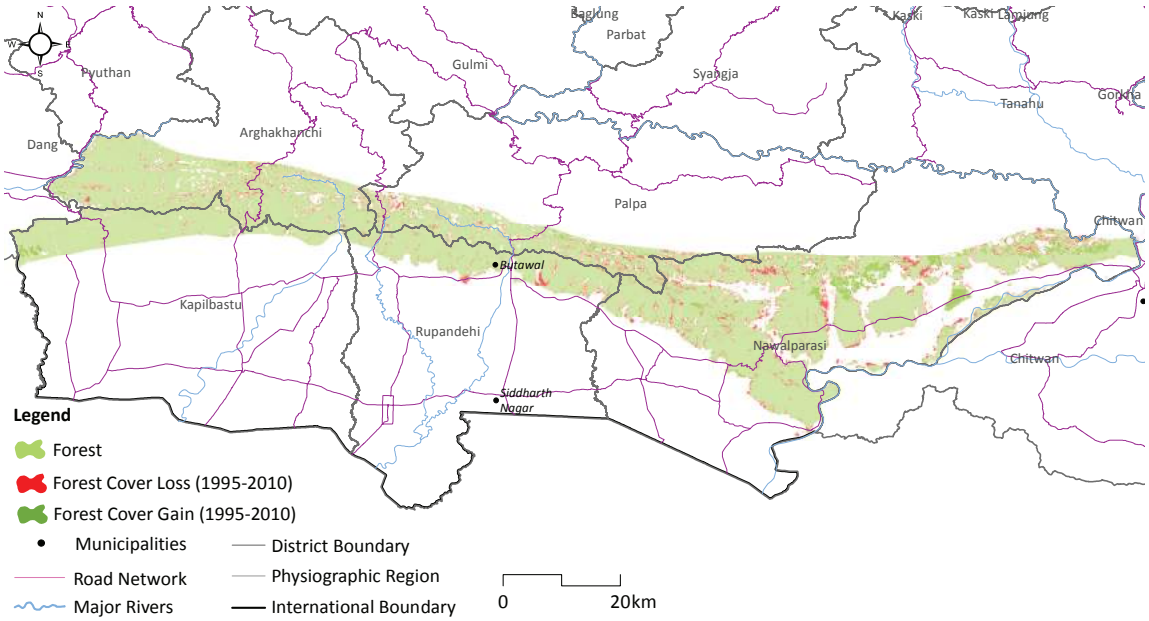


Figure 24. Forest cover change in the Western Development Region

The Central Development Region

The Central development region experienced an annual loss of 0.18% (1995-2010), with 0.32%, the rate in Dhanusha district, the highest annual loss followed by Sindhuli (0.29%) and Makawanpur (0.24%) respectively. The slight gain in forest cover found in Chitwan was attributed to the shifting of Padampur VDC outside the PA, in contrast a large patch was lost due to the establishment of the Shaktikhor cantonment (Figure 25). Throughout the Central development region, losses are evident in small clusters within large patches close to existing settlements.

The Eastern Development Region

The loss of Churia forest cover in the Eastern development region, at an annual rate of 0.06% during the period from 1995 to 2010, was the least in the nation. Ilam district observed the greatest gain 0.11% and Udaypur, the greatest loss (0.15%). Losses occurred in small patches close to settlements in river plains while gains were usually far from settlements (Figure 26).

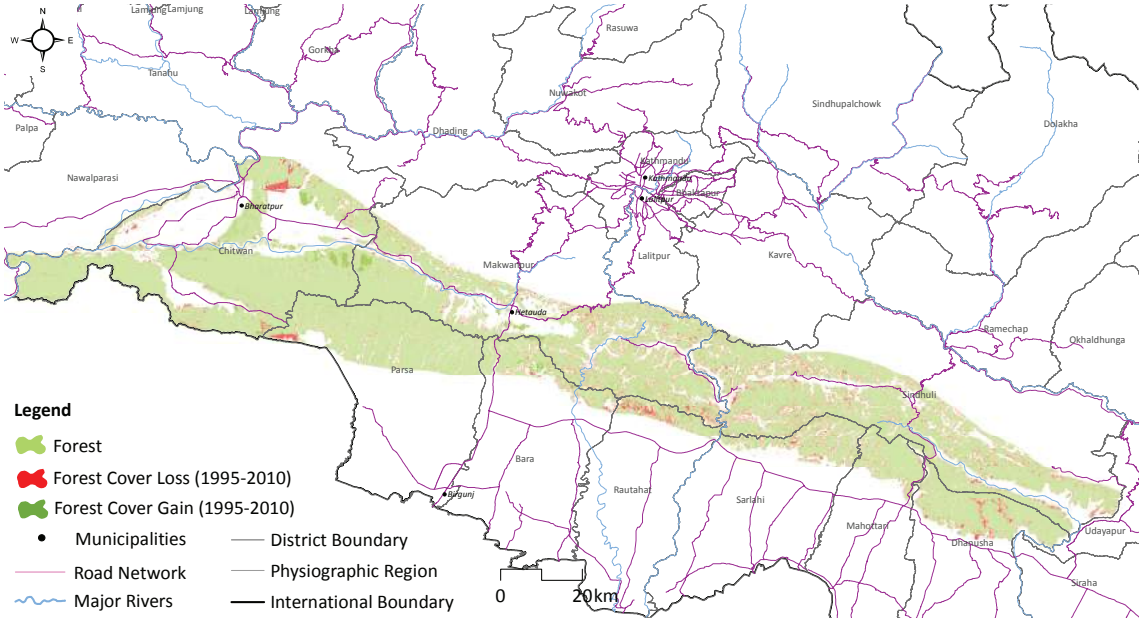


Figure 25. Forest cover change in the Central Development Region

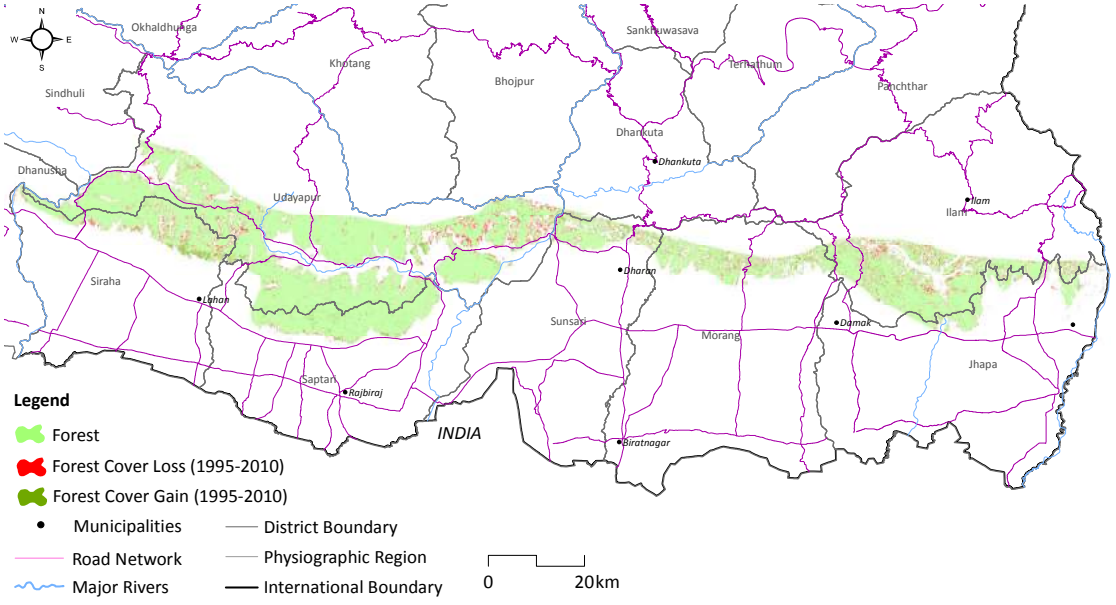


Figure 26. Forest covers change in the Eastern Development Region

Assessment of extent of forest fragmentation in the Churia (outside of PAs and buffer zone) found that the average size of the forest patch was 448 ha. The degree of fragmentation was high: about 43% of forest patches were less than 2 ha and 36% were just 2-10 ha. While 7% of forest patches were 10-20 ha and 5%, 20-50 ha, only 3% of the patches greater than 1000 ha (Figure 27). Based on development region, proportion of fragmentation of forest was recorded highest in the Central (37%), followed by Eastern (23%), Mid-western (16%), the Western (13%). Forests in the Far-western development region are least fragmented (12%). The average size of forest patches was largest in the Mid-western region (726 ha) followed by the Far-western (643 ha), Western (549 ha), Eastern (323 ha) and Central (305 ha) respectively (Annex 5).

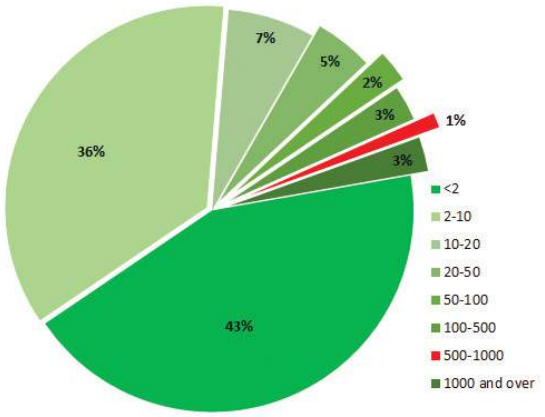


Figure 27. Proportion of forest fragmentation by the size class (ha)

The area occupied by the patches <2 ha (n=1,013) is found relatively smaller with only 1,063 ha. (0.1% of the total forest outside PAs). Area occupied by the forest patches 2-50 ha (n=1,111) is found to be about 9,308 ha (0.89%) and that occupied by 50-1,000 ha (n=152) is 38,229 ha (3.65%). Patches with sizes 1000-10000 ha (n=34) covered 136,550 ha (13%) and that by the patches with sizes 10,000-50,000 ha (n=26) covered 552,978 ha (53%). Forest patches with the sizes more than 50000 ha (n=4) covered 309,292 ha (30%) of the forested area in the Churia (Figure 28). This implies that there are significant numbers of smaller forest patches in the Churia but it only covers very small area. In contrast, there are fewer numbers of large patches which contains significant proportion of Churia forests.

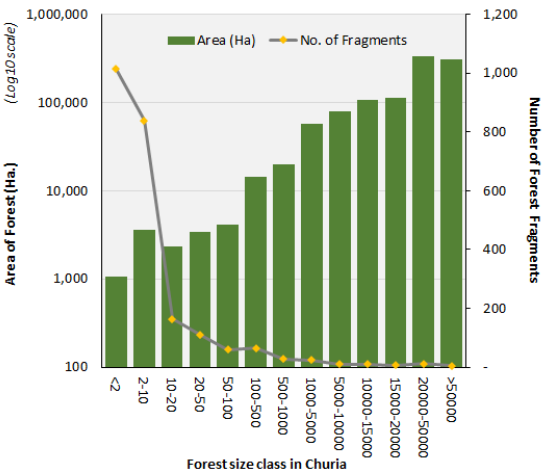


Figure 28. Forest fragment sizes of Churia

Accuracy Assessment

The results of the FRA Churia forest-cover mapping were compared to 372 independent ground samples, 154 of which were inventory sub-plots and 218, purposively sampled observation plots. Additional purposively selected observation plots were used to supplement the limited number of OWL plots in the inventory so that maps could be updated and verified. The land-cover classes (forest, OWL and Other Land) observed in the field were compared with the classified land-cover classes (Forest, OWL and Other Land), revealing an overall accuracy of 82.8%, a Cohen's kappa (κ) of 0.70, and a kappa standard error of 0.04. These figures indicate that the FRA's image-based forest-cover classification was very reliable (Table 16).

Table 16. Error matrix for forest-cover map using independent ground verification samples

Classified Class	Land Cover Class (Ground Truth)				User's Accuracy	Error of Commission
	Forest	OWL	Other Land	Total		
Forest	67	11	4	82	81.71%	18.29%
OWL (including shrub)	1	203	18	222	91.44%	8.56%
Other Land	13	17	38	68	55.88%	44.12%
Total	81	231	60	372		
Producer's Accuracy	82.72%	87.88%	63.33%			
Error of omission	17.28%	12.12%	36.67%			
Overall Accuracy	82.80%					

Cohen's Kappa = 0.7. Kappa Standard Error = 0.04

The producer's accuracies for forest cover and OWL were 82.72% and 87.88% respectively. An accuracy assessment of shrub classification was excluded for three reasons: the number of sample plots was insufficient for conducting an unbiased accuracy assessment, shrubs were classified using ground observation plots, and the classification of shrubs was challenging given the nature of the remote-sensing material used and the limited ground observation data.

An independent verification of the reliability of the above accuracy test for forest cover was conducted using Phase I inventory plots (n=1,186), which resulted in 84.6% overall accuracy (κ=0.66, S.E.= 0.03), and 89% producer's accuracy.

Both of the comparisons described above showed that the FRA's forest-cover classifications of the Churia complied with the required standards (Standard Guidelines for Forest Cover Mapping, DFRS/FRA, 2014).

5.4. Forest Inventory

Number of Stems

Number of Stems (DBH ≥ 5 cm)

The number of stems with a diameter ≥ 5 cm per hectare was approximately 731 on forest land, 180 on OWL and 66 on Other Land (Table 17).

Table 17. Number of stems/ha by land-cover class

Land-cover class	No. of sub-plots	No. of stems/ha
Forest Land	477	731.45
OWL	11	180.17
Other Land	219	65.72

In the Churia forests, co-dominant trees comprised the greatest number of stems per hectare. There were about 27 standing dead trees per hectare (Table 18) and, on average, about three trees per hectare had been removed every year.

Table 18. Number of stems per hectare according to crown class

Tree status	Crown class	No. of stems/ha
Live trees	Dominant	199.18
	Co-dominant	205.77
	Intermediate	202.01
	Suppressed	60.43
	Understory	24.27
	Broken	39.78
Sub-total		**731.45**
Standing dead trees	Dead usable*	22.60
	Dead unusable	4.81
Sub-total		**27.41**
Removal		17.06**
Dead wood		N/A

*Tree stems that can be used at least for firewood
** A five year estimate

In terms of the number of stems (≥ 5 cm DBH) per hectare, Shorea robusta was the dominant species (222.55/ha), followed by *Terminalia alata* (52.57/ha). The average weighted DBH of *Adina cordifolia* was the largest (61.14 cm), followed by *Terminalia alata* (52.50 cm). The average weighted height of *Pinus roxburghii* was the greatest (23.72 m) followed by *Adina cordifolia* (22.56 m) in Table 19.

Table 19. Characteristics of common tree species (in average/ha)

SN	Scientific Name	No. of stems/ha	Weighted [1] DBH (cm)	Weighted1 height (m)
1	*Shorea robusta*	222.55	43.19	20.27
2	*Terminalia alata*	52.57	52.50	21.76
3	*Pinus roxburghii*	10.87	43.36	23.72
4	*Anogeissus latifolius*	33.89	25.55	15.48
5	*Lagerstroemia parviflora*	35.48	25.12	14.69
6	*Adina cordifolia*	4.72	61.14	22.56
7	*Buchanania latifolia*	24.57	21.03	11.42
8	*Syzygium cumini*	12.03	33.39	14.36
9	*Schima wallichii*	7.95	39.32	18.42
10	*Desmodium oojenense*	15.19	25.09	12.23
	Other species	311.63	-	-
	Total	**731.45**		

[1] Weighted on the basis of basal area

A consideration of tree DBHs revealed that, on average, there were 18 mature trees (≥50 cm), 111 small saw-timber trees (20-50 cm), 216 pole trees (10-20 cm), and 389 saplings (5-10 cm) per hectare (Table 20).

In terms of species and quality, the average number of stems per hectare comprised 160 high-quality sound trees (quality class 1), 186 sound trees (quality class 2), and 385 cull trees (quality class 3). *Shorea robusta* had the greatest number of stems per hectare in all three quality classes. *Terminalia alata* was second for the first and second quality classes, but *Lagerstroemia parviflora* was second among cull trees (Table 21).

Table 20. Number of stems/ha in Churia forests by species and DBH class

SN	Scientific Name	DBH Class (cm)				
		5-10	10-20	20-50	≥ 50	Total
1	*Shorea robusta*	108.02	62.00	43.50	9.03	222.55
2	*Terminalia alata*	26.69	11.47	10.90	3.61	52.68
3	*Lagerstroemia parviflora*	19.60	11.32	4.45	0.10	35.48
4	*Anogeissus latifolius*	17.93	9.59	6.40	0.21	34.13
5	*Buchanania latifolia*	11.68	9.49	3.40	0.00	24.57
6	*Desmodium oojenense*	6.67	5.73	2.74	0.03	15.18
7	*Syzygium cumini*	5.00	3.44	3.37	0.22	12.03
8	*Pinus roxburghii*	3.75	4.38	2.20	0.54	10.87
9	*Schima wallichii*	2.92	3.13	1.70	0.20	7.95
10	*Adina cordifolia*	1.25	1.77	1.31	0.38	4.72
	Other species	185.46	93.45	30.59	1.80	311.30
	Total	**388.99**	**215.78**	**110.55**	**16.12**	**731.45**

Table 21. Number of stems/ha in Churia forest by species and quality classes

SN	Scientific Name	Number of Stems/ha			
		Quality-1	Quality 2	Quality 3	Total
1	*Shorea robusta*	89.79	68.54	64.21	222.54
2	*Terminalia alata*	18.37	14.60	19.71	52.68
3	*Anogeissus latifolius*	6.50	11.26	16.37	34.13
4	*Lagerstroemia parviflora*	6.23	8.89	20.36	35.48
5	*Pinus roxburghii*	4.80	1.98	4.08	10.86
6	*Buchanania latifolia*	4.76	10.69	9.11	24.56
7	*Schima wallichii*	1.77	2.55	3.63	7.95
8	*Syzygium cumini*	1.33	3.32	7.39	12.04
9	*Adina cordifolia*	1.24	1.22	2.26	4.72
10	*Desmodium oojenense*	0.48	3.21	11.49	15.18
	Others	25.07	59.5	226.73	311.30
	Total	**160.36**	**185.76**	**385.33**	**731.45**

Number of stems (DBH < 5 cm)

Regenerationin the Churia forests was adequate with 19,805 seedlings (height<1.3m) per hectare and 908 saplings (height >1.3m and DBH <5cm) per hectare. *Shorea robusta* was the dominant species for both seedlings (12,140/ha) and saplings (227/ha), followed by *Terminalia alata* (seedlings 912/ha and saplings 57/ha) (Table 22).

In KSforests, *Anogeissus latifolius was* the dominant sapling species (199/ha) and *Acacia catechu* the dominant seedling species (5,173/ha). In Sal forests, *Shorea robusta* dominated both seedlings (24,833 /ha) and saplings (422/ha). In LMH and TMH forests, *Terminalia alata* and *Shorea robusta* were the dominant seedling species respectively while *Shorea robusta* was the dominant sapling in both forest types (Table 23).

Table 22. Species composition of seedlings and saplings per hectare

Scientific Name	Seedlings (No./ha)	Saplings (No./ha)	Total (No./ha)
Shorea robusta	12140	227	12367
Terminalia alata	912	57	969
Buchanania latifolia	560	23	583
Syzygium cumini	548	9	557
Mallotus phillippensis	368	63	431
Anogeissus latifolius	333	22	355
Lagerstroemia parviflora	209	35	244
Desmodium oojenense	166	12	178
Acacia catechu	128	9	137
Schima wallichii	45	6	51
Dalbergia latifolia	39	5	44
Pinus roxburghii	34	6	40
Adina cordifolia	10	2	12
Dalbergia sissoo	5	0	5
Others	4,309	484	4,793
Total	**19,805**	**958**	**20,763**

Table 23. Species composition of seedlings and saplings in different forest types

Scientific name	KS/SK		LMH		Pr		S		TMH	
	Sp	Sd	Sp	Sd	Sp	Sd	Sp	Sd	Sp	Sd
Acacia catechu	0	5173	0	0	0	0	26	98	1	105
Adina cordifolia	0	0	0	0	0	0	0	19	3	6
Anogeissus latifolius	199	928	0	335	0	0	11	75	27	462
Buchanania latifolia	0	0	18	109	0	0	44	981	13	408
Dalbergia latifolia	0	0	0	0	0	0	0	15	7	55
Dalbergia sissoo	0	0	0	0	0	0	1	10	0	3
Desmodium oojenense	0	0	36	181	0	0	14	109	9	200
Lagerstroemia parviflora	0	0	0	244	0	50	61	233	26	201
Mallotus phillippensis	0	0	9	109	0	0	46	324	78	422
Pinus roxburghii	0	0	27	371	75	323	11	37	0	0
Schima wallichii	0	0	0	0	0	0	8	65	5	39
Shorea robusta	0	0	45	3753	0	75	422	24,833	153	6,986
Syzygium cumini	0	0	9	380	0	945	16	827	5	418
Terminalia alata	0		63	723	0	0	74	1101	51	867
Others	1,194	1,923	488	3,925	224	7,634	492	4,039	480	4,405
Total	**1,393**	**8,024**	**695**	**10,130**	**299**	**9,027**	**1,226**	**32,766**	**858**	**14,577**

Note: Sp = Saplings and Sd = Seedlings

Regeneration was highest in the Sal forests, followed by TMH, LMH and pine forests. Regeneration in SK/KS forests was the lowest. The number of seedlings was greatest in those forests with the highest crown covers while the greatest number of saplings was found in mature stands of large and small saw-timber. Regeneration was the greatest in buffer zone forests followed by community forests, government-managed forests, PAs. It was least in collaborative forests (Table 24).

Regeneration in Churia forests was highest in the Western Development Region, followed by the Eastern and Central regions. Regeneration was lowest in the Far-western Development Region (Table 25).

Basal Area

The basal area of stems (≥ 5cm DBH) was 18.77 m^2/ha on forest land, 2.37 m^2/ha on OWL and 1.55 m^2/ha on Other Land (Table 26).

Table 24. Seedling and sapling stocks

Description	No. of sub- plots	Seedlings/ha	Saplings/ha	Total (No./ ha)
Forest Type				
SK/KS	3	8,024	1,393	9,417
LMH	22	10,128	696	10,824
Pine	8	9,027	298	9,325
Sal	146	32,766	1226	33,992
TMH	298	14,577	860	15,437
Total/Average	**477**	**19,805**	**958**	**20,763**
Crown Cover				
< 40%	47	9,570	1,020	10,591
40–69%	196	19,367	882	20,249
>70%	234	22,227	1,010	23,237
Total/Average	**477**	**19,805**	**958**	**20,763**
Development status				
Seedling and sapling stand (<12.5 cm DBH)	11	7,976	904	8,880
Pole-timber stand (12.5–25.0 cm DBH)	123	16,415	933	17,349
Small saw-timber stand (25.0 – 50.0 cm DBH)	222	18,238	931	19,169
Large saw-timber stand (>50.0 cm DBH)	121	27,199	1.039	28,238
Total/Average	**477**	**19,805**	**958**	**20,763**
Management Regime				
Government-managed	110	15,407	548	15,955
Protected area	83	13,523	772	14,295
Buffer zone	28	37,153	995	38,147
Community forest	249	22,294	1,216	23,511
Collaborative forest	7	6,565	149	6,714
Total/Average	**477**	**19,805**	**958**	**20,763**

Table 25. Status of regeneration of Churia forests in different development regions

Development region	No. of sub-plots	Seedlings/ ha	Saplings/ ha
Far-western	75	12661	491
Mid-western	137	17023	672
Western	64	26571	1399
Central	138	22029	1263
Eastern	63	22610	1023
Total/Average	**477**	**19805**	**958**

Table 26. Basal area per ha by land-cover class

Land-cover class	No. of sub-plots	Basal Area (≥5 cm DBH) (m^2/ha)
Forest Land	477	18.77
OWL	11	2.37
Other Land	219	1.55

The total basal area of live trees in the Churia forests was slightly more than 18 m^2/ha, of which about two-thirds comprised of the dominant trees.The total basal areas of both standing dead trees and trees that had been removed (assessed by the presence of stumps) were minimal (Table 27).

Table 27. Basal area per ha by crown class

SN	Tree status	Crown class	Basal area (≥5 cm DBH), m^2/ha
1	Live trees	Dominant	11.94
2		Co-dominant	3.72
3		Intermediate	1.88
4		Suppressed	0.51
5		Understory	0.14
6		Broken	0.58
	Sub Total		**18.77**
7	Standing dead trees	Dead usable*	0.59
8		Dead unusable	0.08
	Sub-total		**0.67**
9	Removal		0.41**
10	Dead wood		N/A

**Tree stems that can be used at least for firewood*
*** A five years estimate*

In terms of diameter classes, per hectare basal area was 1.6 m^2/ha for saplings (5-10 cm), 3.36 m^2/ha for pole timber(10-20 cm), 8.56m^2/ha for small saw-timber (20-50 cm), and 5.25 m^2/ha for mature trees (≥50 cm). *Shorea robusta* had the largest basal area, approximately 48% of the total, followed by *Terminalia alata*, with approximately 11% (Table 28).

Volume

The per-hectare stem volumes were 153.99 m^3on forest land and 17.16 m^3 on OWL (Table 29). The level of accuracy for estimating the stem volume per ha of forest landat aconfidence level of 95% was 8.0% and the standard mean error was 6.28.

Table 29. Stem volume per ha by land-cover classes

Land-cover Class	No. of sub-plots	Stem vol. (≥5 cm DBH), m^3/ha	SE of mean stemVol. (%)
Forest Land	477	153.99	4.08
OWL	11	17.16	43.09
Other Land	219	9.32	20.35



Table 28. Basal areas by species and DBH class

SN	Scientific name	DBH Class(cm) and Basal Area (m^2/ha)				
		5-10	10-20	20-50	≥ 50	Total
1	*Shorea robusta*	0.45	0.94	3.82	2.83	8.05
2	*Terminalia alata*	0.11	0.18	0.99	1.28	2.55
3	*Lagerstroemia parviflora*	0.08	0.2	0.31	0.03	0.61
4	*Anogeissus latifolius*	0.07	0.16	0.42	0.05	0.71
5	*Buchanania latifolia*	0.05	0.16	0.19	0.00	0.40
6	*Desmodium oojenense*	0.03	0.09	0.18	0.01	0.31
7	*Pinus roxburghii*	0.02	0.07	0.19	0.17	0.45
8	*Syzygium cumini*	0.02	0.06	0.23	0.06	0.37
9	*Schima wallichii*	0.01	0.05	0.14	0.07	0.27
10	*Adina cordifolia*	0.00	0.03	0.11	0.17	0.31
	Other species	0.76	1.42	1.98	0.58	4.74
	Total	**1.6**	**3.36**	**8.56**	**5.25**	**18.77**

The total stem volume of the live trees in the Churia forests was153.99 m^3/ha.The total volumes of standing dead trees and dead wood were 4.59 m^3/ha and 13.21 m^3/ha, respectively (Table 30).The stem volume of removed trees was estimated to be 0.44 m^3/ha/year.

Table 30. Stem volume per ha by crown class

Tree status	Crown class	Tree stem vol. (m^3/ha)
Live trees	Dominant	111.63
	Co-dominant	25.66
	Intermediate	10.36
	Suppressed	2.76
	Understory	0.64
	Broken	2.94
Sub-total		**153.99**
Standing dead trees	Dead usable*	4.14
	Dead unusable	0.45
Sub-total		**4.59**
Removal		2.18**
Dead wood		13.21

**Tree stems that can be used at least for firewood*
*** A five year estimate*

Based on forest types, Sal forestshad the greatest stem volume (192.26 m^3/ha), followed by pine forests. KS/SK forest had the least stem volume (12.8 m^3/ha) (Table 31).

Table 31. Stem volume based on forest type

S. No	Forest type	No. of sub-plots	Stem volume (m^3/ha)
1	KS/SK	3	12.78
2	LMH	22	138.35
3	Pine	8	170.68
4	Sal	146	192.26
5	TMH	298	137.37

In terms of DBH classes, the stem volumes per hectare were 6.5m^3/ha for saplings (5-10 cm), 19.56 m^3/ha for pole timber (10-20 cm), 71.16 m^3/ha for small saw-timber (20-50 cm), and 56.78 m^3/ha for mature trees (≥50 cm). *Shorea robusta* had the highest stem volume, approximately 49% of the total, followed by *Terminalia alata* with approximately 15% (Table 32).

Table 32. Stem volumes by species and DBH class (m^3/ha) in Churia forests

SN	Scientific Name	DBH Class(cm) and Basal Area m^3/ha				
		5-10	10-20	20-50	≥ 50	Total
1	*Shorea robusta*	2.04	6.29	34.66	31.91	74.91
2	*Terminalia alata*	0.38	1.09	8.59	12.96	23.02
3	*Pinus roxburghii*	0.08	0.42	2.04	2.70	5.24
4	*Anogeissus latifolius*	0.30	0.98	3.24	0.46	4.98
5	*Lagerstroemia parviflora*	0.32	1.22	2.43	0.21	4.19
6	*Adina cordifolia*	0.01	0.13	0.83	1.65	2.61
7	*Buchanania latifolia*	0.19	0.88	1.38	0.00	2.45
8	*Syzygium cumini*	0.06	0.28	1.46	0.52	2.32
9	*Schima wallichii*	0.05	0.26	1.04	0.78	2.13
10	*Desmodium oojenense*	0.11	0.48	1.21	0.06	1.86
	Other species	2.96	7.52	14.28	5.53	30.29
	Total	**6.50**	**19.56**	**71.16**	**56.78**	**153.99**

In terms of quality class, the total stem volume of high-quality sound trees (quality class 1) was 101.75 m^3/ha. *Shorea robusta* comprised the major proportion (about 58 m^3/ha, or 57%), followed by *Terminalia alata* (about 19 m^3/ha, or 19%) (Table 33).

The total stem volume under bark was about 107 m^3/ha for 10 cm top diameters and about 84 m^3/ha for 20 cm top diameters. *Shorea robusta* comprised the highest total stem volumes at both top diameters and *Terminalia alata* was the second highest (Table 35).

SN	Scientific Name	DBH Class(cm) and Basal Area m³/ha				
		5-10	10-20	20-50	≥ 50	Total
1	*Shorea robusta*	58.14	12.07	4.7	74.91	8.74
2	*Terminalia alata*	19.09	3	0.93	23.02	1.94
3	*Pinus roxburghii*	4.99	0.12	0.12	5.23	0.67
4	*Anogeissus latifolius*	2.55	1.63	0.8	4.98	0.49
5	*Lagerstroemia parviflora*	1.85	1.27	1.07	4.19	0.55
6	*Adina cordifolia*	1.68	0.75	0.17	2.6	0.95
7	*Schima wallichii*	1.43	0.4	0.31	2.14	0.62
8	*Syzygium cumini*	0.76	0.75	0.81	2.32	0.30
9	*Buchanania latifolia*	0.73	1.05	0.67	2.45	0.33
10	*Desmodium oojenense*	0.27	0.64	0.95	1.86	0.40
	Others	10.26	8.85	11.18	30.29	3.39
	Total	**101.75**	**30.52**	**21.73**	**153.99**	**18.38**

Table 33. Stem volumes by species and quality class (m³/ha) in Churia forest

Table 34. Stem volume, basal area, number of stems by quality class

Quality class	Stems (No./ha)	Basal area (m²/ha)	Stem vol. (m³ /ha)	10 cm top vol. (m³/ha)	20 cm top vol. (m³/ha)
High-quality sound tree	160.36	10.50	101.75	76.49	66.72
Sound tree	185.76	4.24	30.52	19.80	12.59
Cull tree	385.33	4.03	21.73	10.69	4.73
Total	**731.45**	**18.77**	**153.99**	**106.98**	**84.04**

The largest proportions of the total stem volume without bark both for 10 cm and 20 cm top diameters were comprised by high-quality sound trees, followed by sound trees (Table 34).

Consideration of size classes revealed that the proportion of small trees was higher than that of large ones (Figure 29). This fact indicated that Churia forests were characterised by normal size class distributions for natural forests.

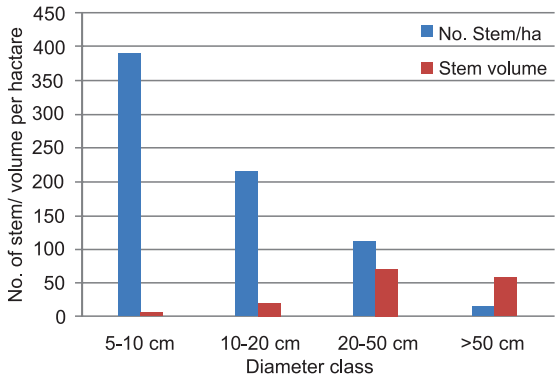


Figure 29. Number of stems and volume per ha by DBH class

Table 35. Stem volume (without bark) in m³/ha by minimum top diameter

SN	Scientific name	Vol. 10 cm top dia.	Vol. 20 cm top dia.
1	*Shorea robusta*	52.88	44.85
2	*Terminalia alata*	17.25	15.13
3	*Pinus roxburghii*	3.85	3.44
4	*Anogeissus latifolius*	3.74	2.13
5	*Lagerstroemia parviflora*	2.62	1.42
6	*Adina cordifolia*	1.94	1.75
7	*Buchanania latifolia*	1.5	0.59
8	*Syzygium cumini*	1.56	1.12
9	*Schima wallichii*	1.32	1.1
10	*Desmodium oojenense*	1.14	0.61
	Other species	19.19	11.9
	Total	**106.99**	**84.04**

Analysis of stem volumes according to management regime revealed in uneven median stem volumes (Kruskall-Wallis, p = 0.010), with PA core zones having the highest median stem volume (165 m³/ha, n= 88), followed by CF buffer zone (158 m³/ha, n=28), community forest (148 m³/ha, n = 248) and government-managed forest (130 m³/ha, n = 110) (Figure 30).

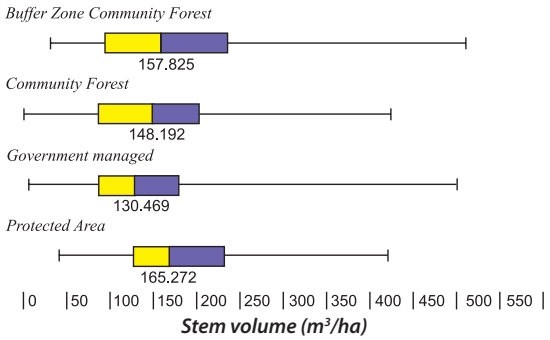


Figure 30. Stem volume (m³/ha) according to management regime

As expected forest type had an impact on stem volume (Kruskall-Wallis p>0.001) with sal forest showing the highest median volume (185 m³/ha, n =146), followed by pine (139 m³/ha, n= 8), LMH (134 m³ / ha, n = 22) and TMH (132 m³ / ha, n = 298) (Figure 31).

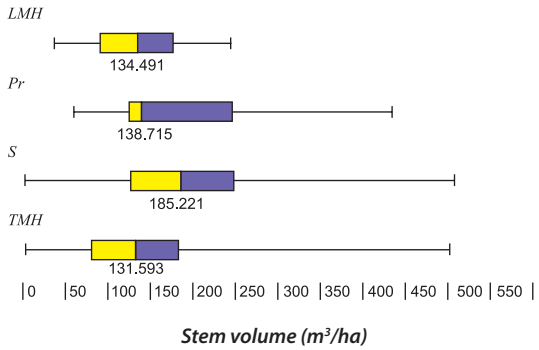


Figure 31. Median stem volume (m³/ha) by forest type

Biomass

For live trees, the above-ground air-dried biomass was 179.00 t/ha and the below-ground biomass 6.12 t/ha. The total air-dried above-ground biomass of the Churia forests was 186.48 t/ha; the total below-ground biomass was 6.33 t/ha (Table 36).

Table 36. Above- and below-ground biomass

I. Live Trees	Biomass Components	Air Dried Biomass (t/ha)
Above Ground	Stem	127.28
	Branch	43.99
	Foliage	7.73
Below Ground	Stump and Coarse Roots	6.12
II. Dead Trees		
Above Ground	Stem	3.74
	Branch	0
	Foliage	0
Below Ground	Stump and Coarse Roots	0.21
III. Dead Wood		
Above Ground	Stem	8.90
Total above Ground biomass		186.48
Total below Ground biomass		6.33
Total biomass		192.81
Total oven dry biomass/ha		175.28

The biomasses of stems, branches, and foliage were approximately 127 t/ha, 44 t/ha, and 8 t/ha respectively. *Shorea robusta* was the species with the greatest biomass; *Terminalia alata* had the second highest value (Table 37).

Table 37. Species-wise tree component biomasses (air dried, t/ha) in Churia forests

SN	Scientific Name	Tree component Biomass (Air Dried, t/ha) in Churia Forests			
		Stem	Branch	Foliage	Total
1	*Shorea robusta*	65.92	19.58	4.36	89.86
2	*Terminalia alata*	21.87	8.75	1.04	31.66
3	*Pinus roxburghii*	3.41	0.91	0.16	4.47
4	*Anogeissus latifolius*	4.38	1.75	0.25	6.39
5	*Lagerstroemia parviflora*	3.56	1.42	0.21	5.19
6	*Adina cordifolia*	1.75	0.70	0.08	2.53
7	*Buchanania latifolius*	1.65	0.66	0.10	2.41
8	*Syzygium cumini*	1.78	0.71	0.10	2.59
9	*Schima wallichii*	1.47	0.37	0.06	1.90
10	*Desmodium oojenensis*	1.25	0.50	0.07	1.83
	Other species	20.24	8.63	1.29	30.16
	Total	**127.28**	**43.98**	**7.72**	**178.99**

High-quality sound trees comprised a large proportion of stem volume in the DBH classes 20–50 cm and >50 cm but not in the smaller classes (5–10 cm and 10–20 cm) (Figure 32).

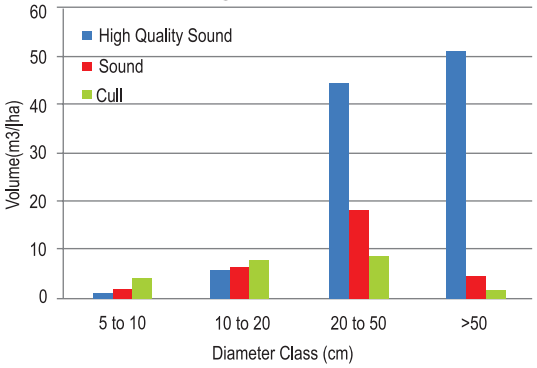


Figure 32. Distribution of volume by stem-quality class and tree size

Quality Assurance of Forest Inventory

Of the 36 plots that were re-measured, 19 had the same number of trees as were originally measured, and the maximum difference in the other plots was just three. The total number of trees measured during the quality-assurance measurements was 598, four more than the original count. The maximum difference in the number of trees per ha was 398. Basal areas were almost the same for two of the 36 plots and the maximum difference in the first and second measurement of basal areas was just 11.2 m^2/ha. The average per hectare decreased from 16.81 m^2/ha originally to 16.77 m^2/ha during the quality assurance measurements. None of these differences were found statistically significant when an independent sample t-test (P=0.985) was performed. Further information on the quality assurance measurements is presented in Annex 6.



Social Survey in Makwanpur District

5.5. Soils of Churia Forests

Soil Organic Carbon in Churia Forests

Of the 376 plots whose soil was analyzed, 74% had sandy loam. Soils with clay components (sandy clay loam, clay loam, and silty clay loam) comprised less than 10% of the total. The topography and high rate of water infiltration in the Churia, results in the transport of clayey soils deep into the ground and, ultimately, by alluvial processes to the lower elevations of the Terai physiographic zone. Since the soil-forming potential in the Churia is poor, the feasibility of farming the land is limited. As a result, local populations are relatively small except in the valleys of the Inner Terai. The soil profiles of the banks of small ephemeral rivers in the Churia are commonly soft boulder conglomerate soils (Figure 33).



Figure 33. A typical soil profile of an ephemeral river in the Churia region

The mean abundance of stones in the top 30 cm soil in the Churia is greater than it is in the Terai physiographic zone, making an accurate estimate of stoniness all the more crucial (FRA/DFRS, 2014). On average, stoniness reduces the SOC content in the fine soil fraction obtained in laboratory by 10–12% in all development regions except in the Western development region, where average stoniness was less than 4%.

Soil bulk-density is a critical variable used to extrapolate SOC stores (t/ha) from 30 cm deep volumetric soil samples collected. In the Churia this density averaged 1.28 g/cm^3 (SE=0.002). The minimum bulk-density calculated, 0.82 g/cm^3, represent rather loose topsoil, while the maximum, 1.77 g/cm^3 and was dense soil. A typical reason for a soil to have low bulk-density is it's having high proportion of organic content in the soil, but though high OC proportions were confined to low bulk-density soils as expected, there were nonetheless large variations in the OC proportions of soils of all bulk-density levels. Relatively low OC values occurred in soils of almost all densities, and no soil denser than 1.5 g/cm^3 had a high SOC concentration. While there was no clear relationship between forest types and soil OC values within the Churia, only Sal forests grew on the densest of soils (Figure 34).

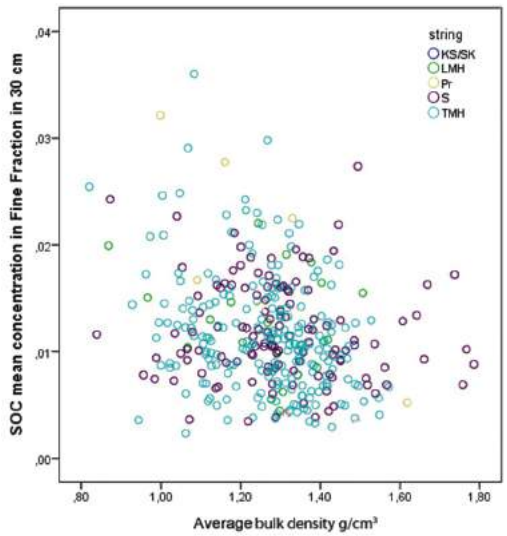


Figure 34. Relationship between organic carbon in the fine soil fraction and soil bulk-density

The relationship between final SOC stores and bulk-density was less obvious than that between forest type and SOC for two additional reasons: first, low bulk-density values contributed to low volumetric SOC stores and, second, the laboratory stock estimate had to be further corrected for stoniness. Stones larger than about 2 cm in diameter were not included in the volumetric soil samples. A low OC in a dense soil might have resulted in a SOC stock estimate similar to that for a loose but organically rich soil. A high volume of stones (in a few cases as high as 40–80%) decreases SOC stock by a corresponding percentage. The large variability in SOC with respect to soil bulk-density suggests that other physical or biotic factors may control the stocks of SOC. One possible such factor is the management dynamics of the forest.

Mixed models can be used to analyze the random variability within and between clusters. In a mixed model regression which considers within-cluster variation as random, the role of stand development status (the fixed variable) in explaining the variability in the logarithmic-transformed SOC was significant ($F = 4.674$, $p = 0.003$, $df = 3$). Multiple comparison tests revealed that seedling and sapling stands had significantly lower SOC contents than the more developed timber stands (LSD, $p \leq 0.003$). Just one stage of maturity later, at the pole-timber development status, there were no significant differences in SOC content. This may mean that new stand development rapidly recharges the SOC, restoring what was lost when soil was exposed during harvest.

Organic carbon in soil, litter and woody debris in each development region

The data on soil of the Churia were collected across Nepal's five development regions: 12, 13, and 14 soil analyses were carried out in the Eastern, Western, and Far-western regions and twice as many in the Mid-western and Central regions 30 and 31 respectively. In most regions, the standard error estimates were less than 30% of the mean SOC estimates. The average SOC in the Churia region was 31.9 t/ha (SE ± 0.43), with the far-western development region having the highest value and the Mid-western, the lowest (Figure 35). The average carbon content in litter and debris was 0.31 t/ha, with the East and the Far-Western development regions having the highest and lowest values respectively (Figure 36).

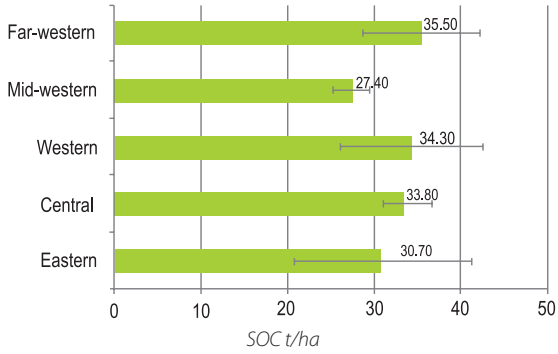


Figure 35. Average organic carbon in soil by development region

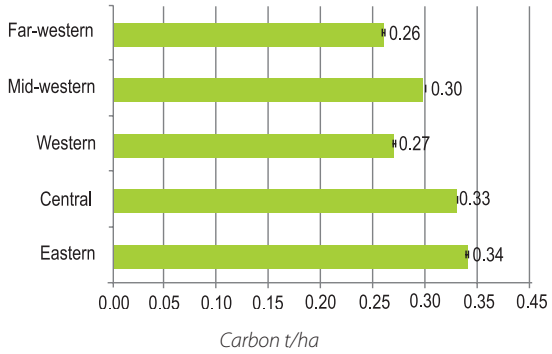


Figure 36. Average organic carbon in litter and woody debris by development region

Organic carbon in soil, litter and woody debris by forest types

Soil was sampled in 77 TMH forests, 46 Sal and 11 LMH. No other forest type was represented by more than three plots (Table 38). Making comparisons regarding with these infrequently appearing forest types is risky because the data are not balanced. Sal and TMH forests had very similar SOC densities and the average SOC density. The average SOC density of pine forests was slightly higher though its standard error was also larger.

Table 38. Distribution of organic carbon in soil, litter and debris by forest type

Forest type	Bulk - density (g/cm^3)	SOC % (fine fraction)	Stones (%)	SOC (t/ha)	Litter & woody debris (t/ha)
KS/SK	1.34 (0.07)	1.33 (0.12)	31.2	19.7 (43.06)	0.17 (0.0002)
LMH	1.25 (0.01)	1.58 (0.02)	5.2	36.1 (10.13)	0.28 (0.0010)
Pine	1.24 (0.07)	2.42 (0.54)	15.6	52.6 (295.24)	0.13 (-)
Sal	1.30 (0.001)	1.54 (0.003)	11.8	31.85 (1.42)	0.29 (0.0001)
STMH*	1.25 (-)	1.78 (-)	15.0	36.30 (-)	0.36 (-)
Shrub	1.38 (0.02)	0.96 (0.12)	2.5	20.40 (51.39)	0.31 (-)
TMH	1.26 (0.0002)	1.42 (0.001)	8.1	31.44 (0.66)	0.32 (0.0001)

Note: The values given in parentheses are the standard errors of the corresponding values.
** No value of SE has been provided for STMH forest as there was only one plot in that forest type.*

5.6. Carbon Stock in the Churia Forests

The total carbon stock in the Churia forests was estimated to be 160.65 tg (116.94 t/ha). The carbon pool in the forest was 84.73 t/ha whereas litter and debris and soil contributed 0.31 t/ha and 31.90 t/ha respectively (Table 39).

Table 39. Carbon pool in Churia forests

Tree component	
Carbon (t/ha)	84.73
Total Carbon in million ton	116,397,244.39
Total Carbon in tree component (tg)	116.40
Litter and Debris	
Carbon (t/ha)	0.31
Total Carbon in ton	425,860.33
Total Carbon in litter and debris component (tg)	0.43
Soil	
Carbon (t/ha)	31.90
Total Carbon in ton	43,822,401.70
Total Carbon in soil component (tg)	43.82
Total Carbon in Churia Forests (tg)	**160.65**

5.7. Churia Forest Biodiversity

Tree species diversity

Altogether 281 tree species belonging to 177 genera and 71 families were recorded in the Churia forests. This figure constitutes 40% of the 696 total tree species reported by Press *et al.* (2000). *Fabaceae,* with 16 genera and 29 species was the largest family, and *Moraceae,* with three genera and 18 species, the second largest. Of those genera, *Ficus*, which comprises 13 species, was the largest genera (Annex 7). The average tree species (α-diversity) recorded per sub-plot was 15.00. The length of gradient (the β-diversity as determined by DCA analysis) was 6.89 standard deviation units, a high value indicating that there was a very high tree species turnover from one sub-plot to the next. However, the fact that this β-diversity value was not as high as the α-diversity value indicates the existence of disturbances which may enhance species richness and high α-diversity (O'Dea *et al.,* 2006).

The high eigenvalues (DCA first axis = 61.5 % and DCA second axis = 48.8 %) indicate that tree species heterogeneity was explained mostly by the environmental variability of the Churia. Most of the species are concentrated towards the bottom left-hand corner of the DCA graph, indicating a high β-diversity. Some tree species, such as *Careya arborea, Miliusa velutina, Cleistocalyx operculatus* and *Dillenia pentagynae*, exhibited a strong positive correlation with soil water content, while others, like *Mallotus philippensis, Lagerstroemia parviflora, Shorea robusta* and *Casearia graveolens*, exhibited a strong negative correlation with this variable. High altitude and LMH forests are very strongly correlated. Major species in LMH forest were *Terminalia chebula, Desmodium oojenense* and *Schima wallichii*. LMH forests are rich in both tree and herb species and have high percentages of organic carbon and carbon. Altitude has strong negative correlation with *Shorea robusta, Acacia catechu*, *Semecarpus anacardium* and *Garuga pinnata*, but these same species are strongly correlated with bulk-density, nitrogen and soil mass. Areas of high soil bulk-density are dominated by *Shorea robusta, Acacia catechu* and *Lannea coromandelica*, but in areas of loose soil, in contrast the diversity of tree species is high. Tree species like *Terminalia bellerica, Dillenia pentagyna* and *Shorea robusta* are associated with a high crown cover whereas *Wendlandia exserta, Terminalia alata* and *Lagerstroemia parviflora* are associated with low crown cover. Crown cover is positively correlated with soil moisture but has almost no correlation with altitude (Figure 37).

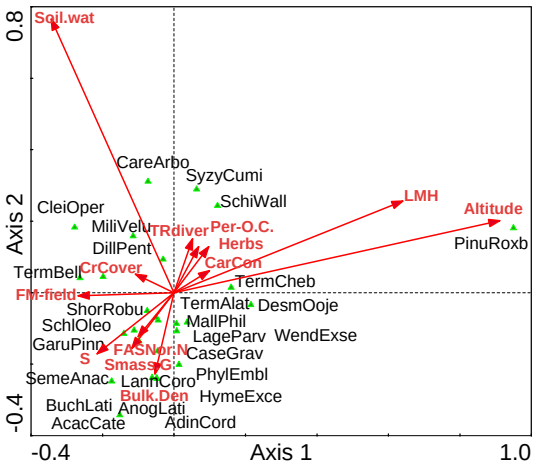


Figure 37. Ordination plot for tree species and environmental variables

Note: Environmental variables are represented by red arrows and species by green triangles. The species are listed by the first four letters of both the genus and the species. They include *PinuRoxb = Pinus roxburghii, CareArbo = Careya arborea, SyzyCumi = Syzygium cumini, CleiOper = Cleistocalyx operculatus, DillPent = Dillenia pentagyna, ScimWall = Schima wallichii, ShorRobu = Shorea robusta, TermChebu = Terminalia chebula, TermBell = Terminalia bellirica, TermAlat = Terminalia alata, DesmOoje = Desmodium oojenense, MallPhil = Mallotus philippensis, SchlOleo = Schleichera oleosa, GaruPinn = Garuga pinnata, LageParv = Lagerstroemia parviflora, WendExse = Wendlandia exserta, CaseGrav = Casearia graveolens, SemeAnac = Semecarpus anacardium, LannCoro = Lannea coromandelica, PhylEmbl = Phyllanthus emblica, HymeEXce = Hymenodictyon excelsum, BuchLati = Buchanania latifolia, AnogLati = Anogeissus latifolius, Aca-cat = Acacia catechu, and AdinCord = Adina cordifolia*

Tree species diversity ranged from 1 to 30 per cluster and from 1 to 15 per sub-plot. The sub-plots in the Ayodhyapuri**,** Chitwan, and Baspani, Bardiya had the maximum tree species richness (14 species). Details about the abundance of tree species in the Churia region are presented in Annex 8.

Tree species occurrence

Shorea robusta, *Terminalia alata*, and *Lagerstroemia parviflora* were the dominant tree species on 98, 87, and 70 sub-plots out of the total 477 sub-plots respectively. On 18 sub-plots, only one tree species was found. Of which 12 were inhabited by *Shorea robusta* and the remaining six by *Acacia catechu*, *Anogeissus latifolius*, *Lanneacoro mandelica* and *Terminalia alata. Shorea robusta* is the dominant tree species and is found at very high frequencies. The distribution curve of tree species is unimodal and bell shaped. Significant associating tree species are *Terminalia alata*, *Anogeissus latifolius*, *Lagerstroemia parviflora*, *Buchanania latifolia*, *Desmodium oojenense* and *Syzygium cumini* (Figure 38). Fifty-six species occurred only a single time.

The average value of the Shannon-Weaver diversity index ($\bar{H}$) for the Churia region was 1.93 whereas the indices for TMH (n=298 and 185 species), LMH (n=22 and 66 species), Sal (n=146 and 96 species) and pine (n=8 and 14 species) were 1.77, 1.64, 1.48, and 1.02 respectively. The fact that Shannon-Weaver diversity index for natural forest communities often falls between 1.0 and 6.0 indicates that both species richness and species evenness were high in Churia forest.

Shrub species diversity

Altogether, 186 shrub species belonging to 116 genera and 51 families were recorded in Churia forest plots. *Fabaceae,* with 10 genera and 21 species, was the largest family. Eighteen families included only a single genus and a single species (Annex 9). *Clerodendrum viscosum* and *Woodfordia fruticosa* were the most abundant shrub species. The other major shrub species of the region were *Inula cappa*, *Millettia extensa* and *Colebrookea oppositifolia* (Figure 39). The sub-plots in Jogbuda and Bhagmati (Kanchanpur); Rampur and Jaldevi (Udayapur); Naya Belhan and, Arunkhola (Nawalparasi); Phulbari and Siddadev Leruwa (Dang) and Chinnchu and Newlakainpani (Surkhet) had high shrub densities. Of the total 193 shrub species, three *Lantana camara*, *Ipomoea carnea*, and *Cassia occidentalis* were invasive (Siwakoti, 2012). There was only a single occurrence each of *Acacia pennata, Clerodendrum lasiocephalum, Helicteres isora, Holarrhena pubescens*, and *Mussaenda incana.*

The shrub species turnover from one sub-plot to the next (the length of the gradient, or β-diversity) was 9.64 standard deviation units, a high value indicating a very high shrub species turnover from one sub-plot to the next. The high eigenvalues (DCA first axis = 80% and DCA second axis = 76.7%) indicated that the shrub species heterogeneity was explained mostly by environmental variability. Most

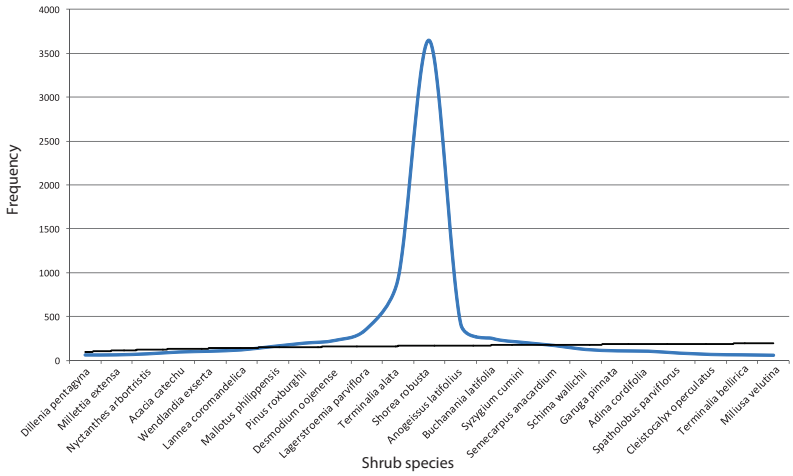


Figure 38. Frequency of major tree species in the sub-plots

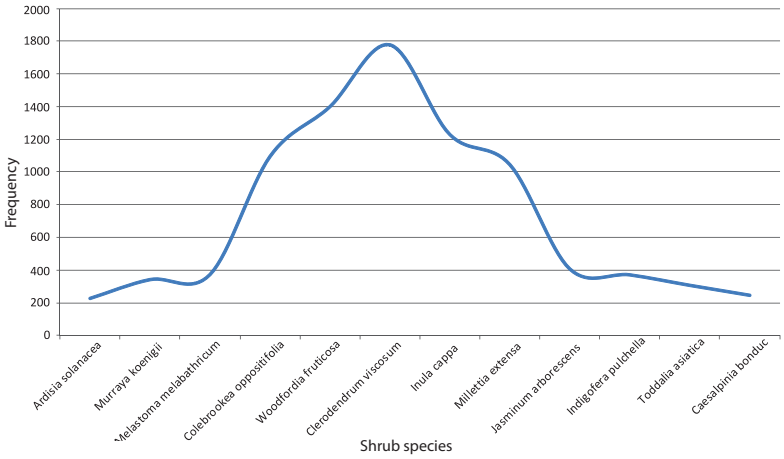


Figure 39. Frequency of major shrub species in the sub-plots

species were concentrated towards the centre of the DCA graph, indicating high β-diversity.

The ordination graph shows that the maximum species abundance was found along the second axis. *Inula cappa*, *Indigofera pulchella* and *Colebrookea oppositifolia* are strongly positively correlated with trees and high altitudes whereas species like *Ardisia solanacea, Leea macrophylla* and *Murraya koenigii* had strong negative correlations with both these variables. Species like *Antidesma acidum* and *Woodfordia fruticosa* showed no correlation with either trees or altitude, but they did show strong negative correlations with saplings, soil moisture content and soil carbon. Saplings, soil moisture, and carbon showed strong positive correlations with *Millettia extensa, Sambucus hookeri, Thespesia lampas, Melastoma melabathricum*, and *Indigofera atropurpurea* (Figure 40).

Herbaceous species diversity

Altogether, 322 species of herbaceous plants (including flowering plants and pteridophytes) belonging to 226 genera and 75 families were recorded in the Churia. Of the 75 families, 61 were flowering plants divided into 205 genera and 287 species and the remaining 14 families were pteridophytes belonging to 21 genera and 35 species. *Poaceae,* comprising 40 genera and 60 species, was the largest family, and *Orchidaceae,* which falls under the CITES II Appendix and comprised 19 genera and 28 species, was the second largest family. For 36 herb families, there was only one genus and one species. Of the 477 sub-plots, two had the exotic and invasive species *Chromolena odoratum* and 53 *Ageratina adenophora*. The most abundant herb species were *Cyperus rotundus*, *Capillipedium assimile*, *Pogostemon benghalensis*, *Cheilanthes dalhousiae* and *Crotalaria alata* (Figure 41). The sub-plot with the greatest species richness was found in Phulbari, Dang; following it was Yangshila, Morang; Piple, Chitwan; Kapilakot, Sindhuli; and Mahniyal, Kailali district, in decreasing order (Annex 10). The length of gradient of the first axis of the DCA analysis (the β-diversity value) was 7.84 standard deviation units, a high value indicating that a very high turnover of herbaceous species from one sub-plot to the next. The high eigenvalues (DCA first axis = 75.7% and DCA second axis = 58.7%) indicate that the heterogeneity of herb species was explained mostly by environmental variability. Most of the species were concentrated towards the centre of the graph, indicating the high β-diversity in the region.

Multivariate analysis of the herbaceous species revealed that altitude was positively correlated with *Cheilanthes dalhousiae*, *Ageratum conyzoides*, *Cyperus rotundus* and *Capillipedium assimile*, but negatively correlated with *Asparagus racemosus*, *Thysanolaena maxima*, *Barleria cristata* and *Digitaria*

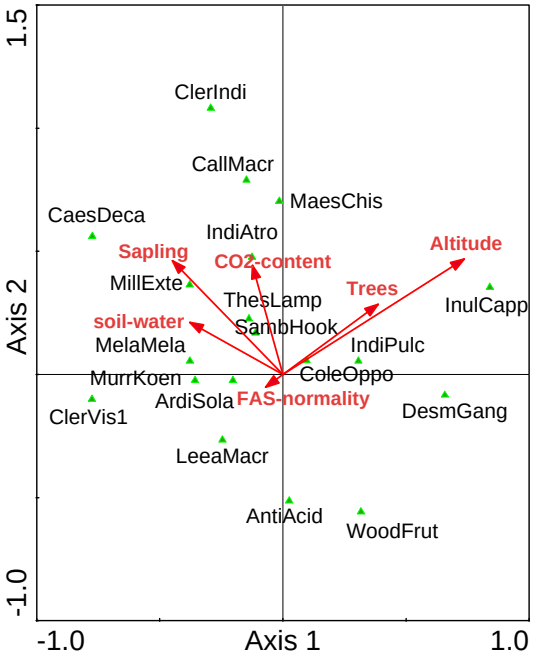


Figure 40. Relationships among shrub species and environmental variables

Note: Environmental variables are represented by red arrows and species by green triangles. The species are listed by the first four letters of both the genus and the species. They include *ClerIndi = Clerodendrum indicum, CaesDeca = Caesalpinia decapetala, CallMacr = Callicarpa macrophylla, MaesChis = Maesa chisia, IndiAtro = Indigofera atropurpurea, MillExte = Millettia extensa, ThesLamp = Thespesia lampas, InulCapp = Inula cappa, SambHook = Sambucus hookeri, MelaMela = Melastoma melabathricum, IndiPulc = Indigofera pulchella, MurrKoen = Murraya koenigii, ColeOppo = Colebrookea oppositifolia, ArdiSola = Ardisia solanacea, ClerVis1 = Clerodendrum viscosum, DesmGang = Desmodium gangeticum, LeeaMacr = Leea macrophylla, AntiAcid = Antidesma acidum and WoodFrut = Woodfordia fruticosa*

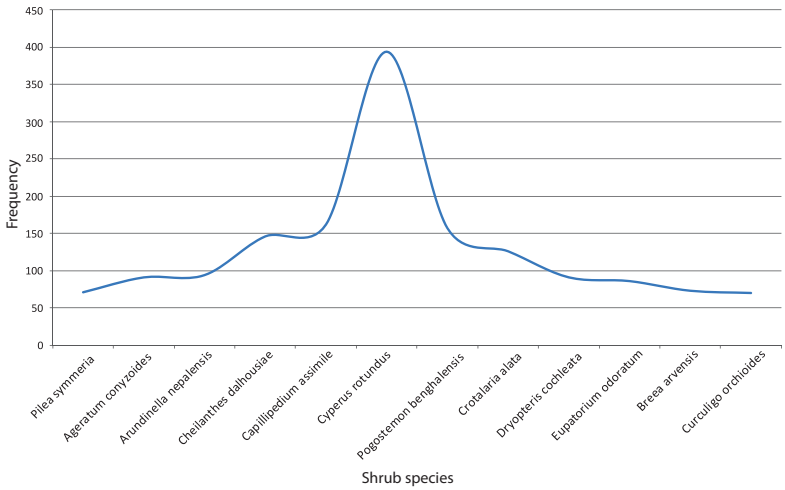


Figure 41. Frequency of the major herb species in the sub-plots

ciliaris. The number of tree species, the density of crown cover, and carbon content are also positively correlated with altitude, and there are significantly fewer species at high altitudes than at lower altitudes. The shrubs *Cheilanthes bicolor*, *Typha angustifolia* and *Cyperus rotundus* were found in areas with high tree diversity while *Imperata cylindrica*, *Elephantopus scaber*, *Eupatorium odoratum*, and *Pogostemon benghalensis* were found in areas with few species of trees. Areas with high soil moistures harboured *Dicranopteris linearis*, *Eupatorium adenophorum*, *Bidens pilosa*, and *Dryopteris cochleata,* while dry soil best supports *Typha angustifolia*, *Cheilanthes bicolor* and *Arundinella nepalensis* (Figure 42).

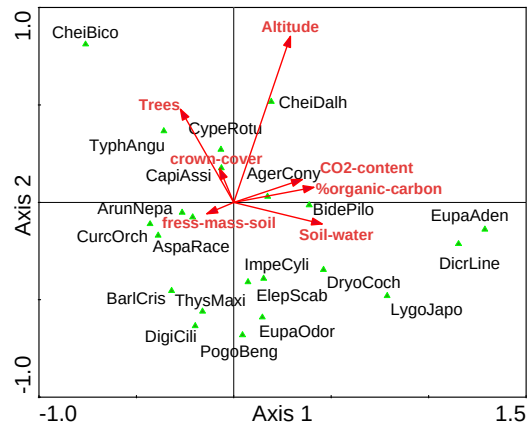


Figure 42. Relationships among herbs, trees and shrubs

Note: Environmental variables are represented by red arrows and species by green triangles. The species are listed by the first four letters of both the genus and the species. They include *CheiBico = Cheilanthes bicolor, CheiDalh = Cheilanthes dalhousiae, CypeRotu = Cyperus rotundus, TyphAngu = Typha angustifolia, CapiAssi = Capillipedium assimile, AgerCony = Ageratum conyzoides, ArunNepa = Arundinella nepalensis, BidePilo = Bidens pilosa, EupaAden = Eupatorium adenophorum, CurcOrch = Curculigo orchioides, AspaRace = Asparagus racemosus, ImpeCyli = Imperata cylindrica, DicrLine = Dicranopteris linearis, ElepScab = Elephantopus scaber, DryoCoch = Dryopteris cochleata, BarlCris = Barleria cristata, ThysMaxi = Thysanolaena maxima, EupaOdor = Eupatorium odoratum, LygoJapo = Lygodium japonicum, DigiCili = Digitaria ciliaris and PogoBeng = Pogostemon benghalensis.*

Climbers and epiphytes and their host species

Altogether, 100 species of climbers and 11 species of epiphytic plants belonging to 26 families and 66 genera were found in the Churia. Among the climbers, *Vitaceae*, with six genera and 12 species, was the largest family and *Dioscoraceae,* with eight species, was the largest monogeneric taxa. The most common climbers were *Bauhinia vahlii*, *Dioscorea bulbifera*, *Spatholobus parviflorus*, *Smilax ovalifolia*, and *Dioscorea pentaphylla*. Nine of the epiphytic plants belonged to the family *Orchidaceae* and two of *Schizaeaceae*. *Mikania micrantha*, a very problematic alien invasive plant species, was found in Karkatta, Chitwan National Park Nawalparasi District; Birendranagar, Chitwan District and Yangshila, Morang District, growing on *Syzygium cumini*, *Litsea lancifolia*, *Mallotus philippensis*, *Colebrookea oppositifolia*, and *Schima wallichii* trees. The sub-plots with the largest number of climber species were in Seti Community Forest, Godawari in Kailali district; Dwangdwange and Tulsi in Dhanusa district; Ratomate Danda and Ayoudhayapuri in Chitwan district and Dharmashala and Betini in Makwanpur District. The most common host tree species were *Shorea robusta*, *Terminalia alata*, *Lagerstroemia parviflora*, *Anogeissus latifolius*, and *Syzygium cumini* (Annex 11).

Non-timber forest products

According to the social survey, 666 different species of flora were used as non-timber forest products (NTFPs) in the Churia. Altogether, 240 species of trees belonging to 142 genera and 61 families; 144 species of shrubs belonging to 106 genera and 51 families; and 187 species of herbs belonging to 138 genera and 49 families were used as NTFPs, as were 22 species of ferns and fern-allies belonging to 15 genera and 12 families. In addition, three species of epiphytes and 70 species of climbers belonging to 42 genera and 18 families were also used as NTFPs. Among the floral communities, the *Fabaceae* family, with 38 genera and 61 species, was the largest, and *Poaceae*, with 31 genera and 44 species was the second largest.

A total of 305 species of NTFPs were used for medicinal purposes in the Churia region. The most commonly used were *Terminalia chebula* (found on 83% of plots), *Terminalia bellerica* (75%) and *Phyllanthus emblica* (65%). Of these medicinal NTFPs, 143 species found on 110 plots were mentioned

only once. One hundred and three species of NTFPs were used for religious purposes, of them, *Ficus religiosa, Aegle marmelos* and *Ficus benghalensis* were most significant. Altogether, 166 species of NTFPs were consumed as fruit and nuts. *Phyllanthus emblica* and *Syzygium cumini* (each found on 84% of plots), followed by *Mangifera indica* (55%) were the tree species whose fruit was most consumed. Fodder was derived from 374 plant species, most commonly *Terminalia alata* (found on 89% of plots), and *Desmodium oojenense* and *Ficus semicordata* (each 66%). There were 81 species of fiber and fiber-yielding plants. The most common were *Bauhinia vahlii* (found on 80% of plots) and *Eulaliopsis binata* (60%). Respondents reported using 83 different species of trees and shrubs as supports for climbing vegetables. The most common of these were *Mallotus philippensis, Woodfordia fruticosa*, and *Lagerstroemia parviflora*. *Shorea robusta* was used for leaf-plates and cups as well as for resin and seed-oil and agricultural implements. The most-used multipurpose NTFPs in the region were, in order of decreasing usage, *Shorea robusta*, *Acacia catechu*, *Diploknema butyracea*, *Bauhinia purpurea, Bauhinia vahlii*, *Terminalia alata*, *Lagerstroemia parviflora* and *Phyllanthus emblica*. The plant species used as NTFPs for different purposes are listed in Annex 12.

Animal-derivative

Altogether 74 species (38 genera from 19 families) of animals were used as animal derivatives in Churia. Of them, 34 species were mammals, 15 were birds and two were reptiles (Annex 12).

Conservation status of important plant species

Fifty-five species were important according to their international as well as national conservation and trade statuses. Of them, three species (*Hypericum cordifolium, Homalium napaulense* and *Borinda chigar*) are endemic. Five species - *Rauvolfia serpentina*, *Dalbergia latifolia*, *Pterocarpus marsupium, Juglans regia* and *Shorea robusta* are legally protected under the 'Forest Regulations of 1995' (amended in 2001) and three - *Dalbergia latifolia, Cycas pectinata* and *Pterocarpus marsupium* are classified as 'vulnerable' on the IUCN Red List (IUCN, 2013). Plants with high medicinal value and those medicinal plants prioritised for research and development (MPRD) or for agro-technology development (MPAD) by the Department of Plant Resources are listed in Table 40. Similarly, Thirty-eight species are considered as appendix II of CITES list (Annex 13).

Table 40. List of endemic, protected, and threatened plant species

Local Name	Botanical Name	Endemic	P	IUCN	MPRD	MPAD
Sarpagandha*	*Rauvolfia serpentina (L.)* Benth. ex Kurz		√		√	√
Satawari, Kurilo	*Asparagus racemosus* Willd.				√	√
Areto, Kelang	*Hypericum cordifolium* Choisy	√				
Kalbal, Thakal	*Cycas pectinata* Griff.			VU		
Bhyakur	*Dioscorea deltoidea* Wall. ex Griseb.				√	
Sal, Sakhuwa**	*Shorea robusta* Gaertn.		√			
Patpate, Dhasingare	*Gaultheria fragrantissima* Wall.				√	
Amala, Yabara	*Phyllanthus emblica* Linn.				√	
Bijaya Sal**	*Pterocarpus marsupium* Roxb.		√	VU		
Satisal**	*Dalbergia latifolia* Roxb.		√	VU		
Phalame Kande	*Homalium napaulense* (DC.) Benth.	√				
Okhar	*Juglans regia* L.				√	
Tejpat, Shisi	*Cinnamomum tamala* (Buch.-Ham.)				√	
Gurjo, Guruj	*Tinospora sinensis* (Lour.) Merr.				√	√
Pipla, Sano Pipla	*Piper longum* L.				√	√
Chigar	*Borinda chigar* Stapleton	√				
Majito	*Rubia manjith* Roxb. ex Fleming				√	
Timur, Yerma	*Zanthoxylum* armatum DC.				√	√
Rittha	*Sapindus mukorossi* Gaertn.				√	
Pashanbhed	*Bergenia ciliata (Haw.)* Sternb.				√	

Note:
P = Legally protected under the Forest Regulations of 1995 (amended in 2001)
** = Species whose export outside the country without processing is banned*
*** = Species whose felling, transport, and export are banned*
MPRD = Medicinal plant prioritised for research and development by DPR, 2012
MPAD = Medicinal plant prioritised for agro-technology development by DPR, 2012
VU = Vulnerable according to the IUCN Red List

5.8. Forest Disturbances

Incidence of observed disturbances in forest plots in the Churia

Altogether 1,831 disturbances were recorded among the forest sub-plots in Churia. Some plots had no sign of disturbance whatsoever while at the opposite extreme, one plot showed signs of 13 types of disturbances. On average a plot showed evidence of 3.8 categories of forest disturbance. While most disturbances were zero- or low-impact (intensity levels 0 and 1, respectively), 736 instances had a moderate impact (intensity level 2) and 186 had a severe impact (intensity level 3). Distance from the forest edge was considered to be a possible predictor of disturbance levels, so the proximity of each forest plot to the nearest forest edge was measured using Google Earth. While forest blocks appear massive in nature, they were, in fact, fragmented and the average distance between the forest plots and the nearest cultivated land was 1.14 km (Figure 43).

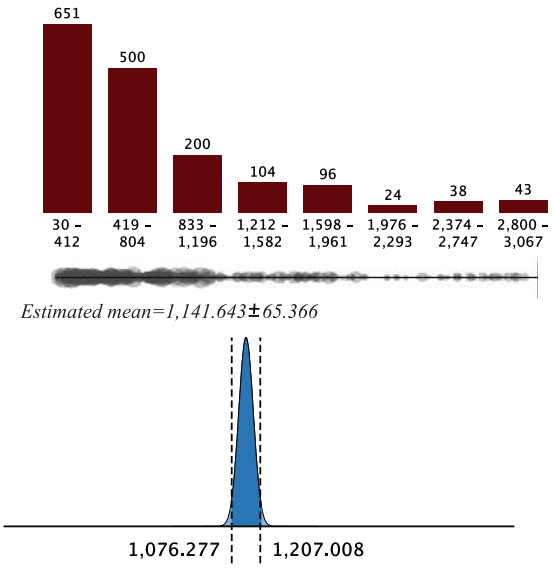


Figure 43. Observed disturbances in forested plots

Management regimes and their proximity to the forest edge

Management regimes were considered to be another possible predictor of forest disturbances that might or might not be independent of the distance from the forest edge. Using the available data, the relationships among the mode of governance of a forest plot and the forest edge was analysed where records permitted for 248 community forests, 25 buffer zone community forests, 84 protected area core zones, and 111 government-managed forests. The median distance to the forest edge varied across management regimes (Kruskal Wallis, p<0.001). Community forest and buffer zone community forest sub-plots tended to be closer to the forest edge than the government-managed forest and particularly protected area core zones were more remote (Figure 44).

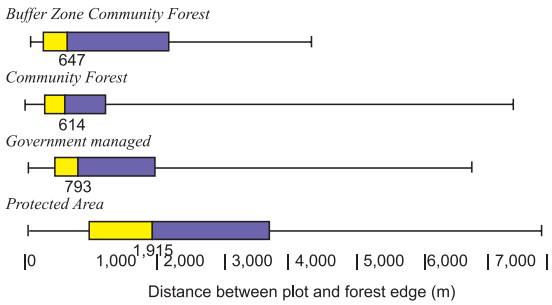


Figure 44. Management regimes and their proximity to the forest edge

Forest disturbances and their proximity to the forest edge

Researchers recorded 60 instances of bush cutting, 11 of encroachment, 75 of forest fires, 38 of leaf litter collection, 135 of livestock grazing, 61 of lopping, 47 of other human disturbances, one of resin–tapping, and 88 of tree-cutting which had a significant impact (moderate or severe). The median distance from the nearest settlement varied across these types of disturbance (Kruskal-Wallis, p <0.001). The mean distance between anthropogenic disturbances and the forest edge was 963 m, but that distance ranged from as little as 30 m to as much as 7,500 m (Figure 45).

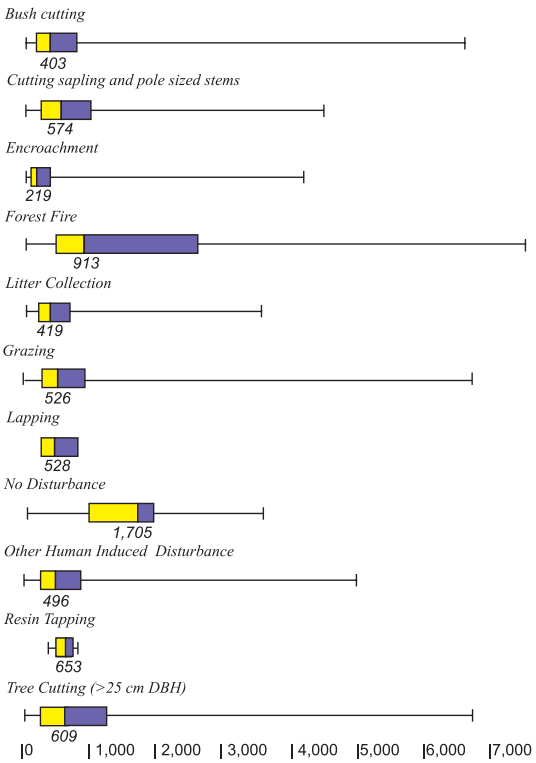


Figure 45. Distance to settlement by cause of disturbance

Forest disturbances and their relation to management regime

Forest disturbances in the Churia were fewer and less intense than in the Terai, and the relationships between forest governance and anthropogenic disturbances was different. In the Churia, government-managed forests appeared to be less subject to anthropogenic disturbance than community-managed forests (community forests and buffer zones community forest). The core zones of PAs were well protected from anthropogenic disturbances, perhaps because of their relative distance from the forest edge.

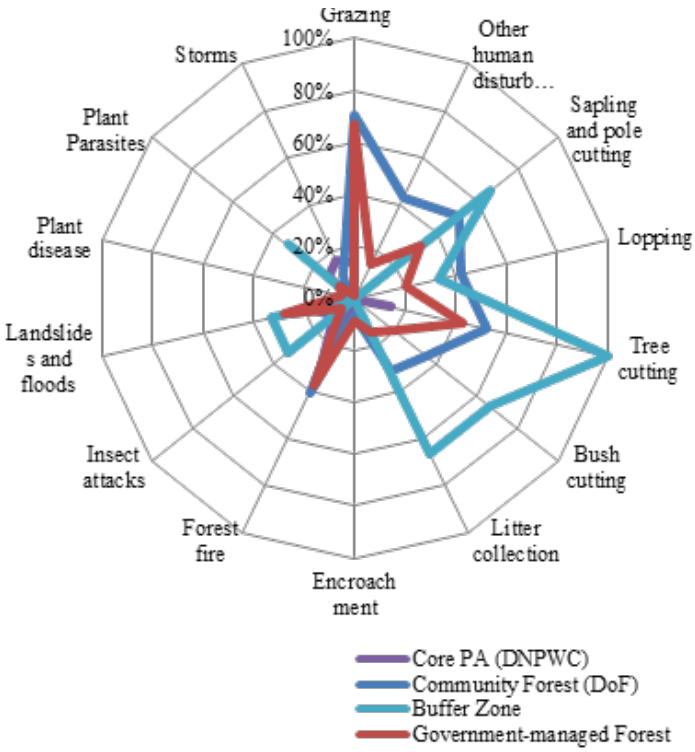


Figure 46. Forest disturbances and their relation to management regime

Landslides were a major source of forest disturbance in the Churia not present in the Terai but changes in river alignment, a major source of disturbance in the Terai, did not occur in the Churia (Figure 46).

Encroachment

Moderate and severe levels of encroachment (intensity levels 2 and 3) were recorded for 11 out of the 476 (2.3%) forest sample plots visited. Five of these plots were in community forests, four in government-managed forest, one in a private forest and one had not been classified. No encroachment was recorded in PAs or their associated buffer zones. Encroached-upon forest plots mostly showed reasonable stocks of tree stems, shrubs, saplings and seedlings (Table 41).

Impact of forest disturbances on forest sustainability

Excessive forest disturbance can lead to changes in forest structure and composition and eventually to forest loss. We analysed the stocks of tree stems, saplings and seedlings on plots characterised by moderate and severe anthropogenic disturbances (livestock grazing, forest fire, tree cutting and encroachment). In order to reduce variability, we considered only 84 TMH plots with forest development statuses of 3 and 4 (small and large saw-timber respectively). Despite the disturbance, there was generally plenty of regeneration. That said, there were also many cases, particularly where the disturbance was most extreme, in which seedling and sapling stocks were inadequate, a fact suggesting that these forests could gradually degrade if corrective action is not taken.

Table 41. Stocks on the 11 forest plots exhibiting encroachment at intensity levels 2 and 3

Forest type	Stand development status	No. of stems / ha	Basal area (m^2/ ha)	Stem volume (m^3/ha)	Shrubs/ ha	Saplings / ha	Seedlings / ha
TMH	Small saw timber	883.80	23.40	190.20	198.90	#N/A	8156.70
Pine	Pole	440.50	4.90	99.50	19894.40	198.90	8952.50
TMH	Large saw timber	39.80	10.30	102.00	1591.50	#N/A	#N/A
Sal	Small saw timber	416.20	12.50	89.10	596.80	1193.70	7758.80
Sal	Pole	205.80	4.70	25.10	6366.20	1591.50	6963.00
TMH	Pole	1015.70	6.20	33.90	5172.50	596.80	14323.90
TMH	Small saw timber	163.10	13.50	120.80	16711.30	795.80	14125.00
TMH	Small saw timber	143.70	7.70	53.00	6764.10	198.90	1790.50
TMH	Small saw timber	89.50	3.00	37.50	5172.50	2188.40	11538.70
TMH	Pole	1326.10	12.70	96.30	397.90	795.80	2586.30
TMH	Pole	362.70	9.00	58.60	198.90	2984.20	1193.70



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Steep slope and rugged terrian affecting vegetation cover in Churia

Annexes

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Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Heights of only sampled trees in FRA field inventory were measured to reduce the time consumption in field work. Therefore, diameter and height relation of sampled trees has been used to develop the height models/curves so as to predict heights for remaining tallied trees. Also, diameter at breast height has been considered as easily measurable tree parameter which can be used to predict the more time consuming variables like 'height'.

Every fifth tree was selected as a sample tree of tallied trees using systematic sampling. To avoid the chances of missing any species, additional sample trees were also selected from among tallied trees (i.e. species-specific median tree).

The objectives of developing height models are mainly to predict the heights for those trees whose heights were not measured in field and use predicted height in volume and biomass calculation.

Non-linear mixed effect approach in R was used to develop the diameter-height models by using Lmfor package of Lauri Mehtatalo (2012). Variability between plots or clusters was considered as random component of the model. Best fitting models are selected for all species like 'Naslund' function for *Shorea robusta, Anogeissus latifolius,* etc.; 'Wykoff' function for *Adina cordifolia, Lagerstroemia parviflora, Mallotus philippensis,* etc.; 'Ratkowsky' for *Terminalia alata;* 'Micment' for *Pinus roxburghii;* and so on. For species having too few number of sample trees for modeling alone, grouping has been done based on their family, genus and existing height-diameter observations.

The parameters of fixed models are presented in annex whereas the plot level (random) parameters will be available in the library of Department of Forest Research and Survey.

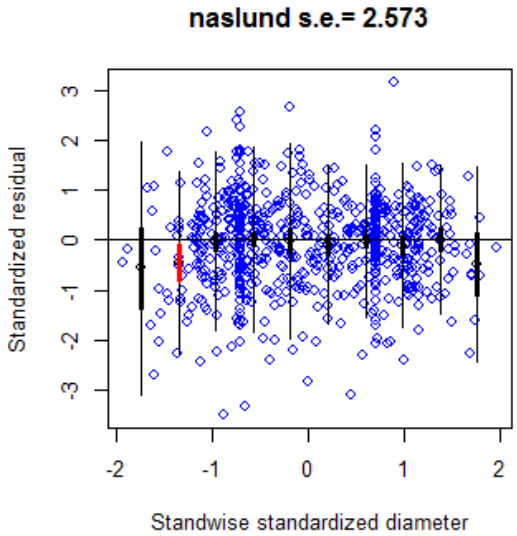
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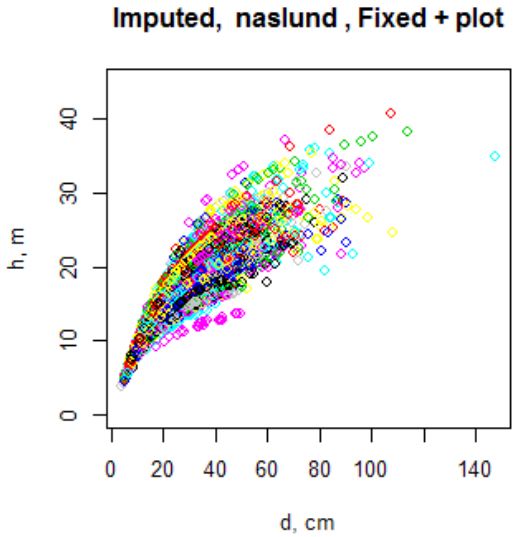
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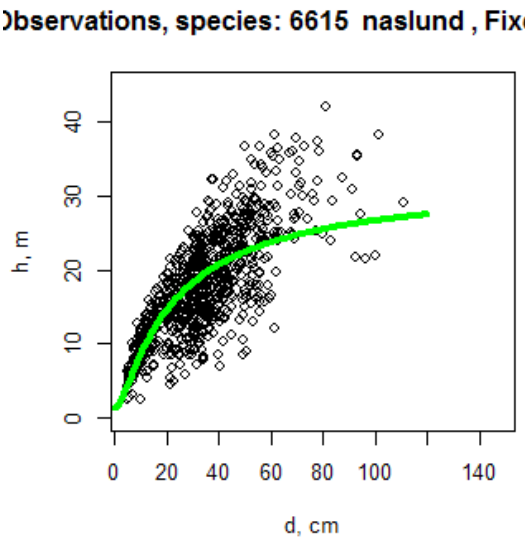
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

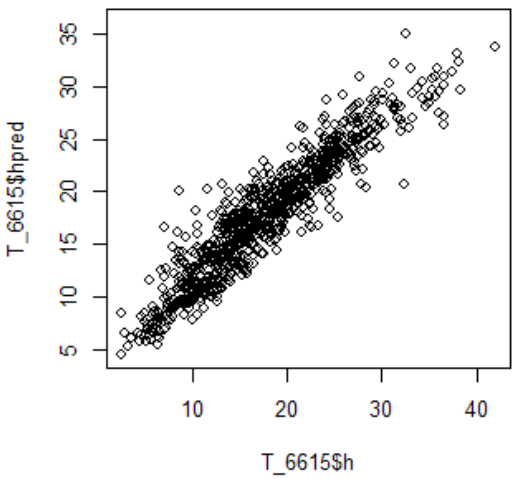
Species: *Shorea robusta*
Local name: Sal, Shakhuwa
FRA database code: 6615
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=2.573
bh = breast height (=1.3)	Adj. R^2=0.88 (for mixed model only)
d = diameter at breast height	F-statistic: 6286 on 1 and 861 DF, p-value: < 2.2e-16
a = 1.8823145 b = 0.1795935	Residuals: min= -3.50 Q1= -0.58 med=0.027 Q3=0.48 max= 3.16





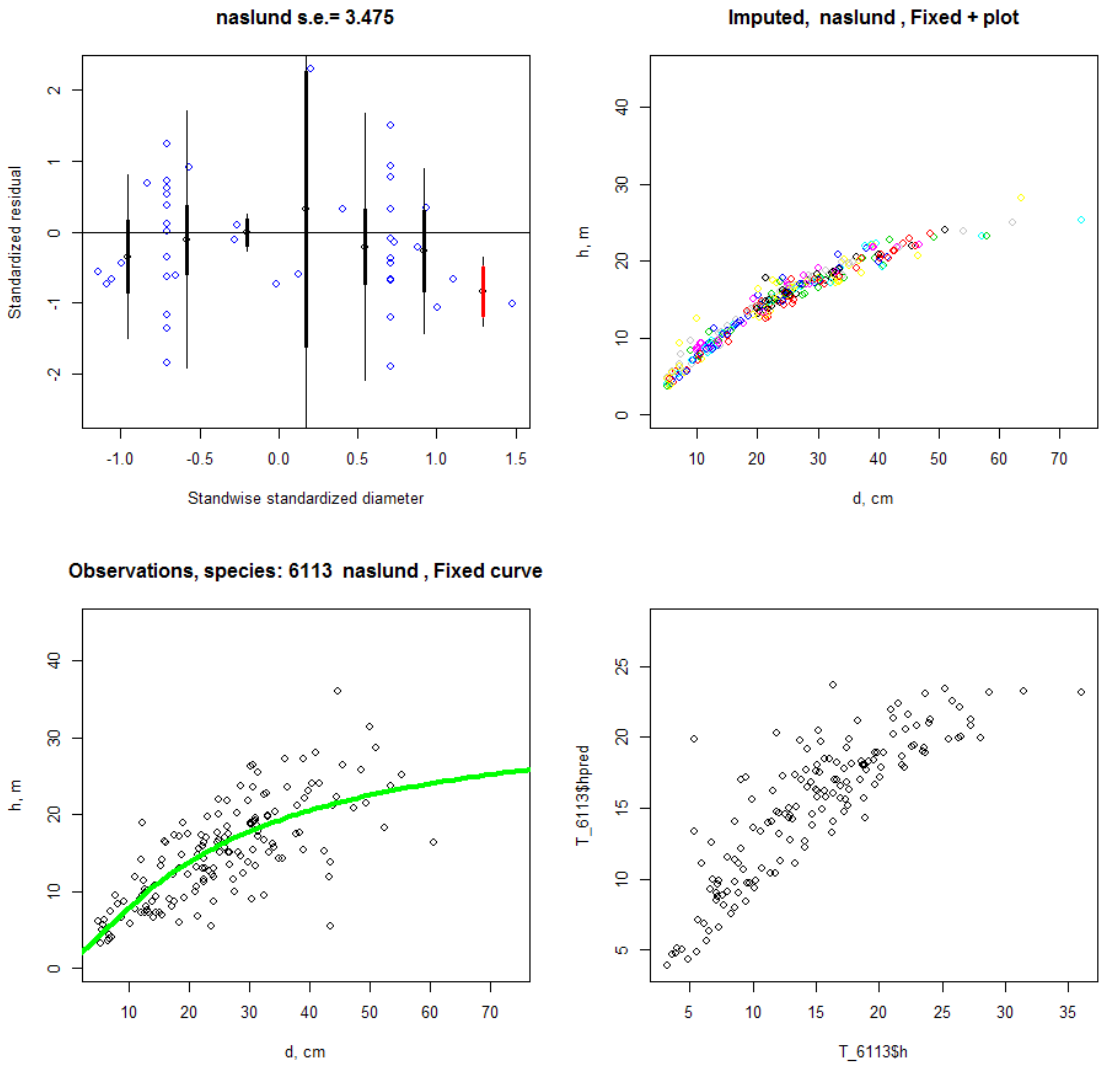




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Anogeissus latifolius*
Local name: Gumghatti, Banjhi, Dhabadane, Kath khajuwa
FRA database code: 6113
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

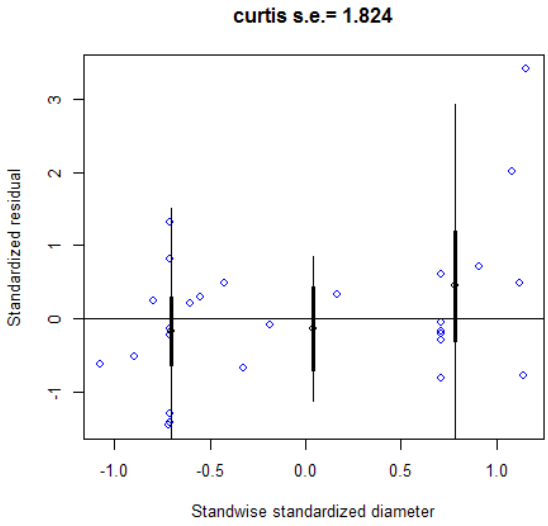
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=3.475
bh = breast height (=1.3)	Adj. R^2=0.72 (for mixed model only)
d = diameter at breast height	F-statistic: 399.4 on 1 and 154 DF, p-value: < 2.2e-16
a = 2.1896691 b = 0.1732536	Residuals: min= -2.57 Q1= -0.69 med= -0.05 Q3=0.54 max= 2.29

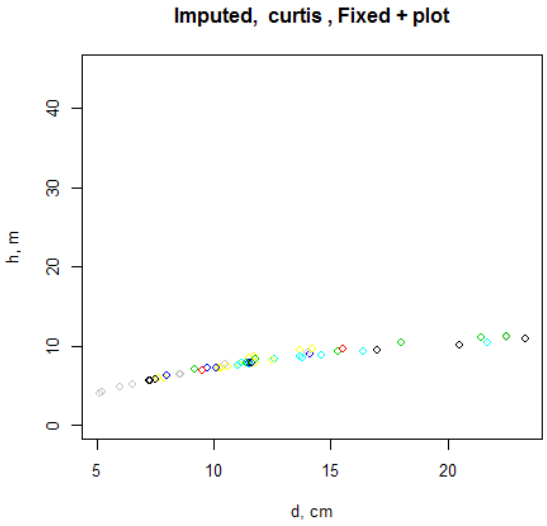


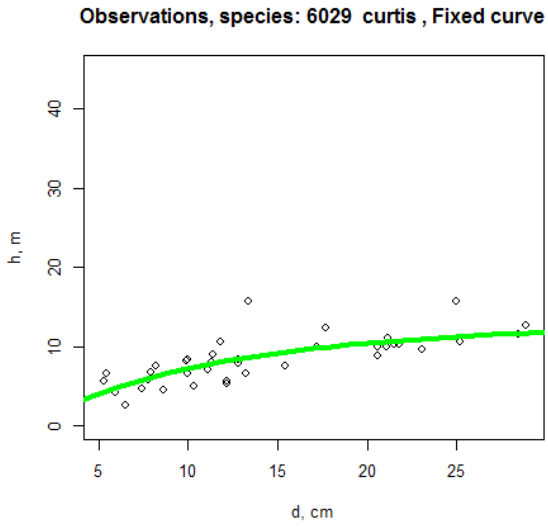
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

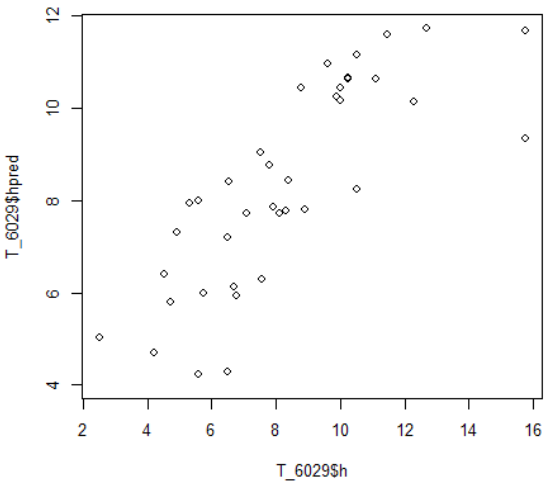
Species: *Wendlandia exserta*
Local name: Rato kaiyo, Ban Kaiyo,Badhuwa, Chaulai, Tilko, Tiluko
FRA database code: 6029
Model = Curtis
Equation: $h(d) = bh + a\ (d/(1 + d))^{\wedge}b$

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.824
bh = breast height (=1.3)	Adj. R^2=0.62 (for mixed model only)
d = diameter at breast height	F-statistic: 61.24 on 1 and 36 DF, p-value: 2.8e-09
a = 14.19278 b = 9.13616	Residuals: min= -1.45 Q1= -0.59 med= -0.16 Q3=0.44 max= 3.41





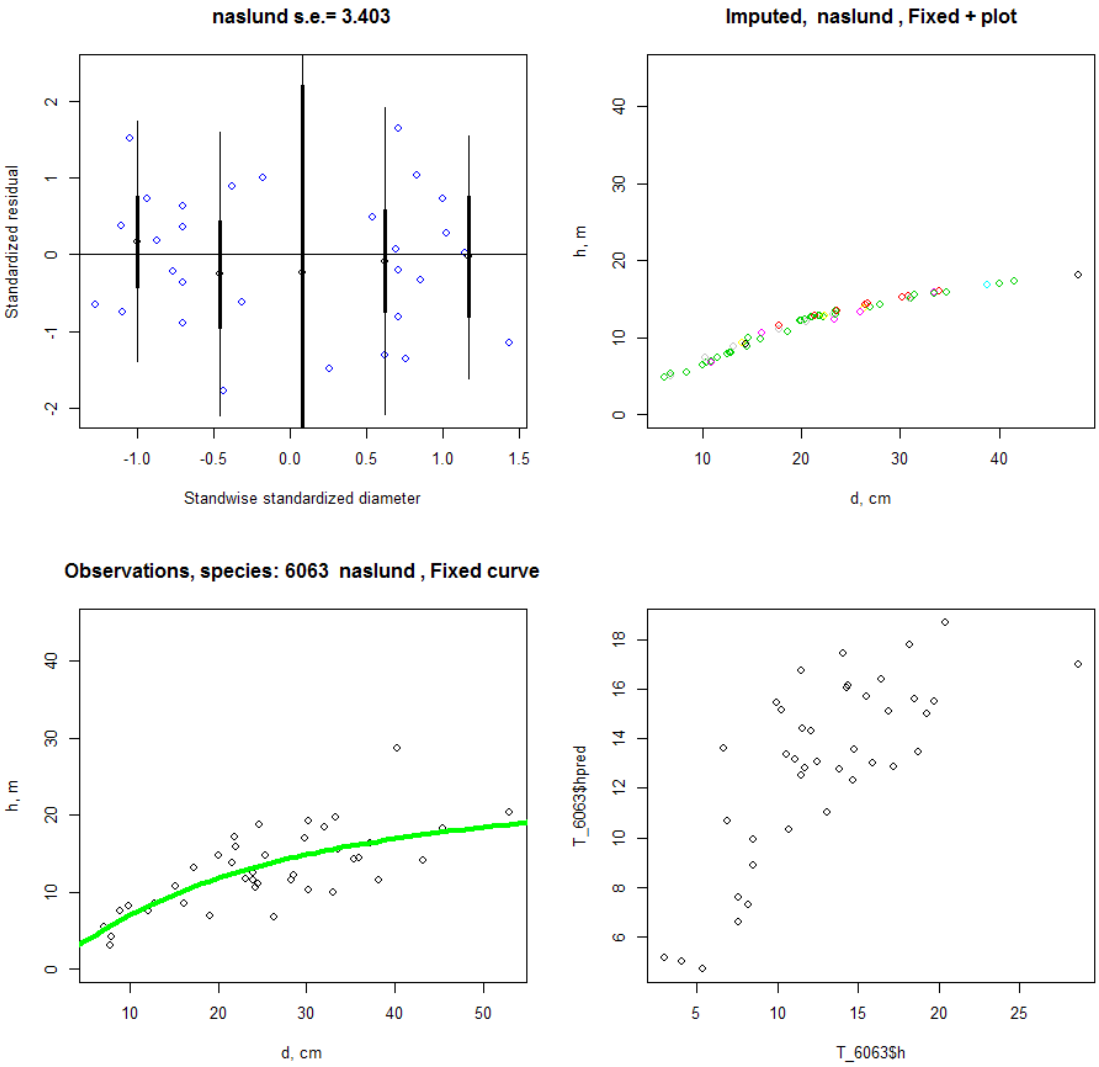




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Acacia catechu*
Local name: Khair, Khayer
FRA database code: 6063
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

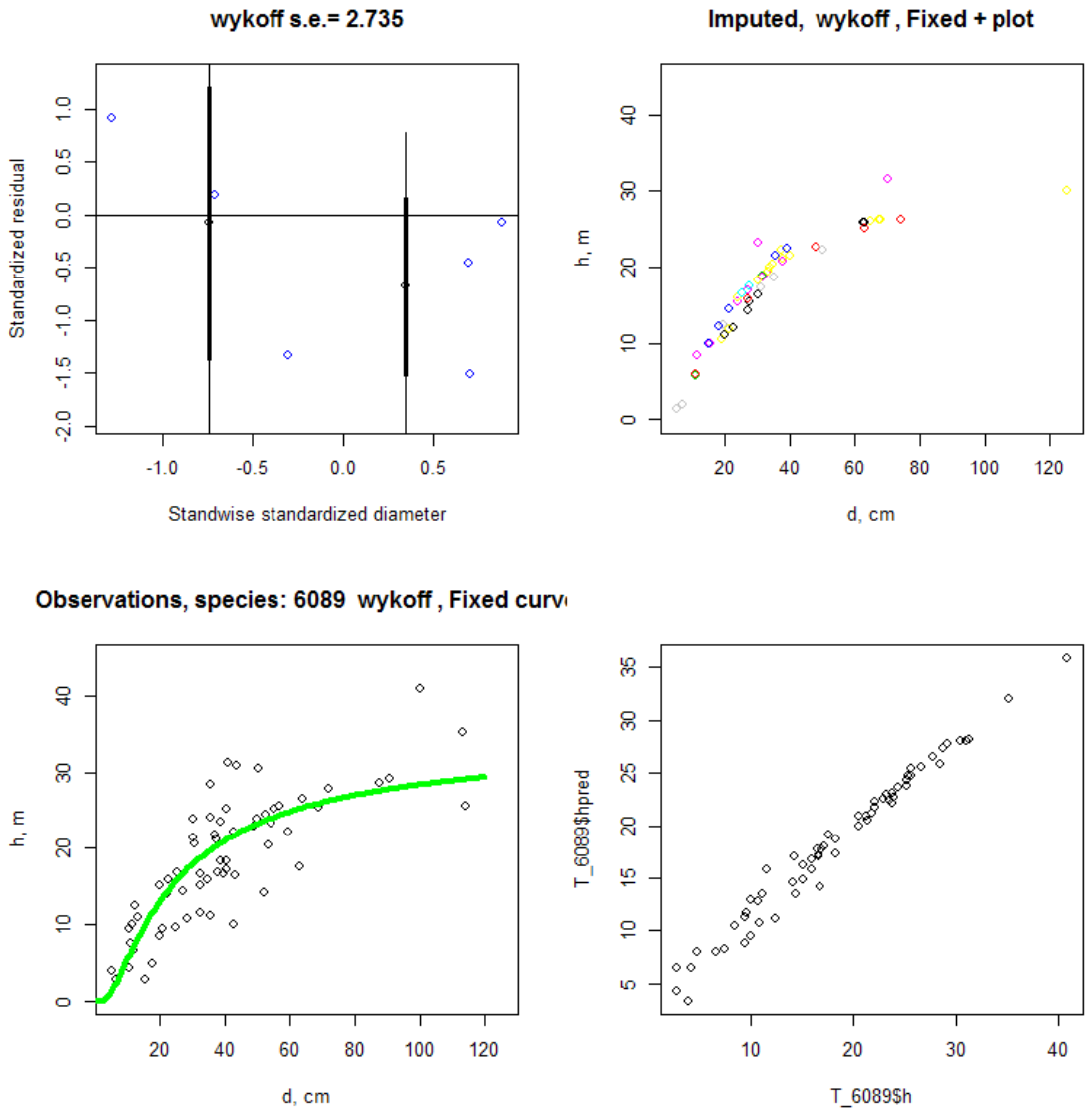
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=3.403
bh = breast height (=1.3)	Adj. R^2=0.60 (for mixed model only)
d = diameter at breast height	F-statistic: 47.95 on 1 and 38 DF, p-value: 3.108e-08
a = 2.2244498 b = 0.1973486	Residuals: min= -2.07 Q1= -0.65 med= -0.02 Q3=0.65 max= 2.43



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: ***Adina cordifolia***
Local name: Haldu
FRA database code: 6089
Model = Wykoff
Equation: *h(d) = bh + exp(a + b/(d + 1))*

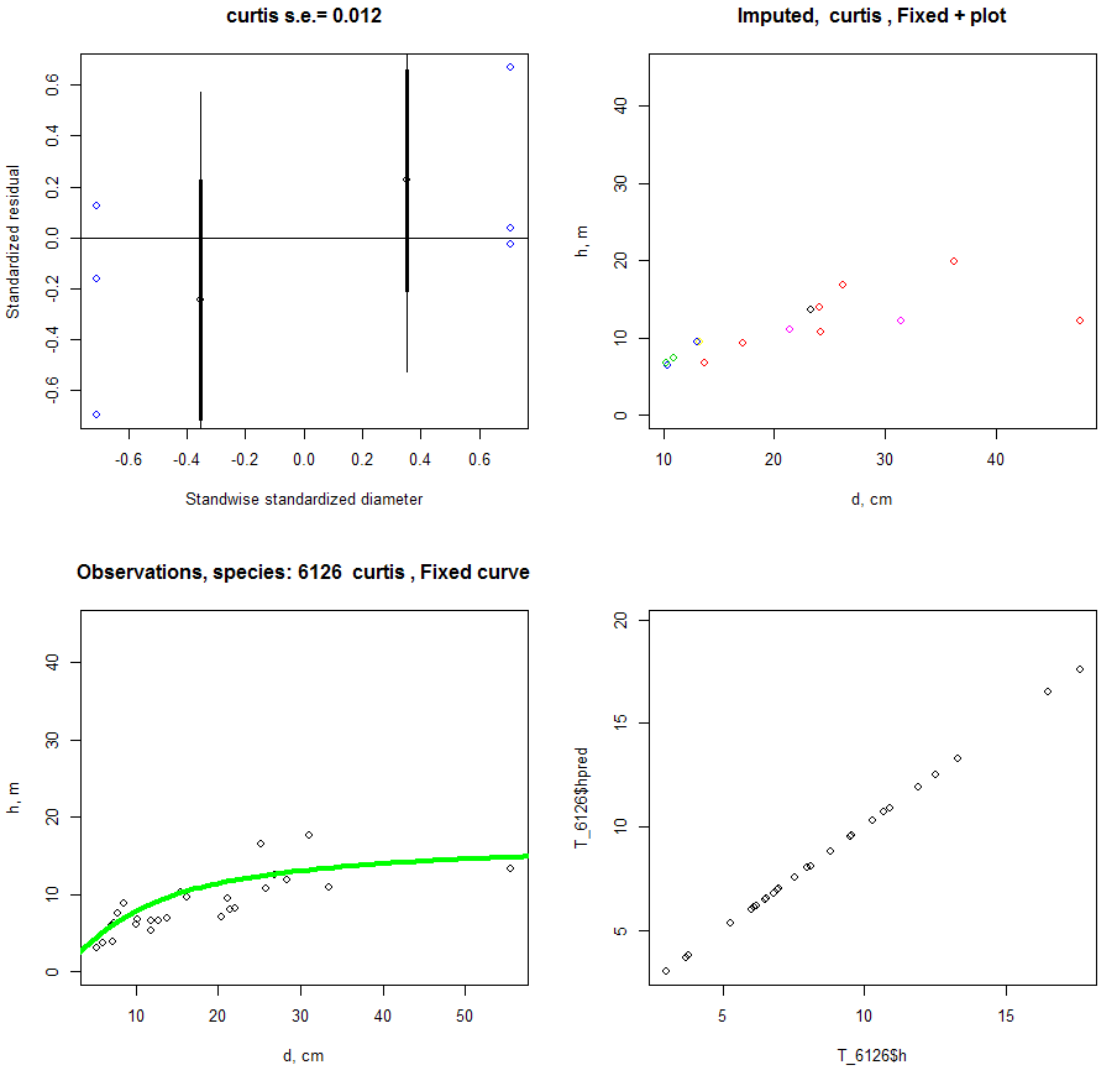
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=2.735
bh = breast height (=1.3)	Adj. R^2=0.97 (for mixed model only)
d = diameter at breast height	F-statistic: 2504 on 1 and 61 DF, p-value: < 2.2e-16
a = 3.550365 b = -20.552001	Residuals: min= -1.93 Q1= -0.50 med= 0.098 Q3=0.43 max= 1.31



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: ***Bauhinia malabarica***
Local name: Tanki,, Amil Tanki, Asoti, Khatta Jhinjhora, Jhinjhora, Khatuwa
FRA database code: 6126
Model = Curtis
Equation: *h(d) = bh + a (d/(1 + d))^b*

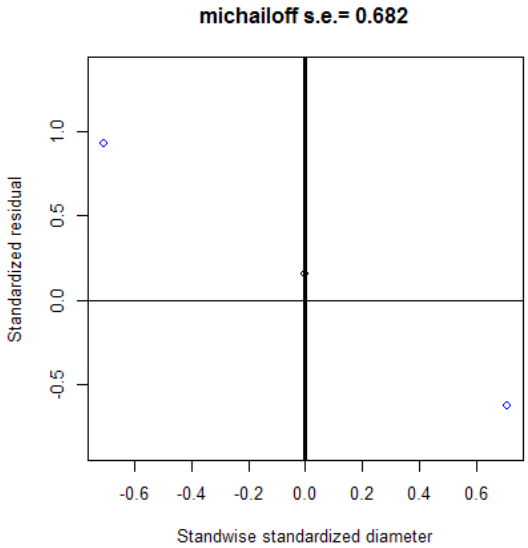
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=0.012
bh = breast height (=1.3)	Adj. R^2=1 (for mixed model only)
d = diameter at breast height	F-statistic: 2.371e+06 on 1 and 24 DF, p-value: < 2.2e-16
a = 15.935546 b = 9.314965	Residuals: min= -0.69 Q1= -0.04 med= -0.007 Q3=0.003 max= 0.67

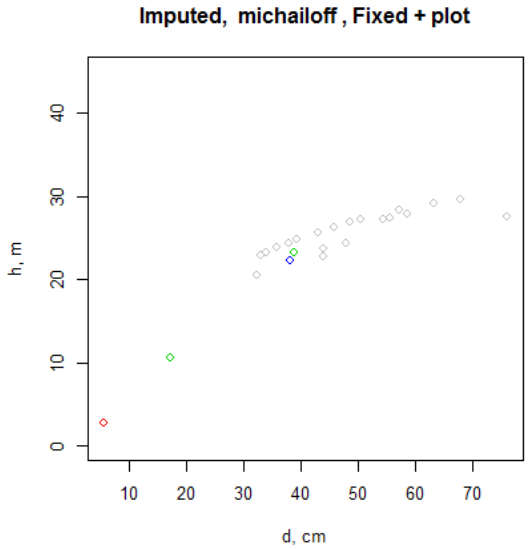


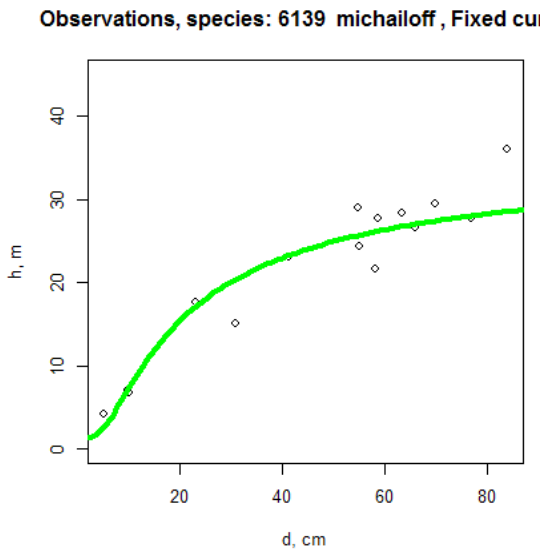
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

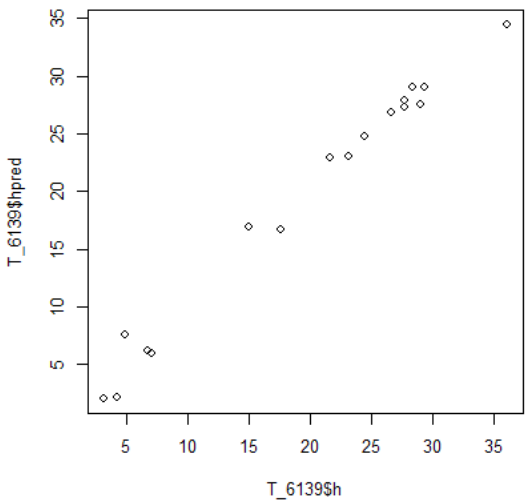
Species: *Bombax ceiba*
Local name: Simal, Simar
FRA database code: 6139
Model = Michailoff
Equation: *bh + a e^(-b d^(-1))*

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=0.682
bh = breast height (=1.3)	Adj. R^2=0.98 (for mixed model only)
d = diameter at breast height	F-statistic: 1072 on 1 and 15 DF, p-value: 2.284e-15
a = 33.48998 b = 17.44296	Residuals: min= -0.87 Q1= -0.29 med= -0.026 Q3=0.17 max= 1.36





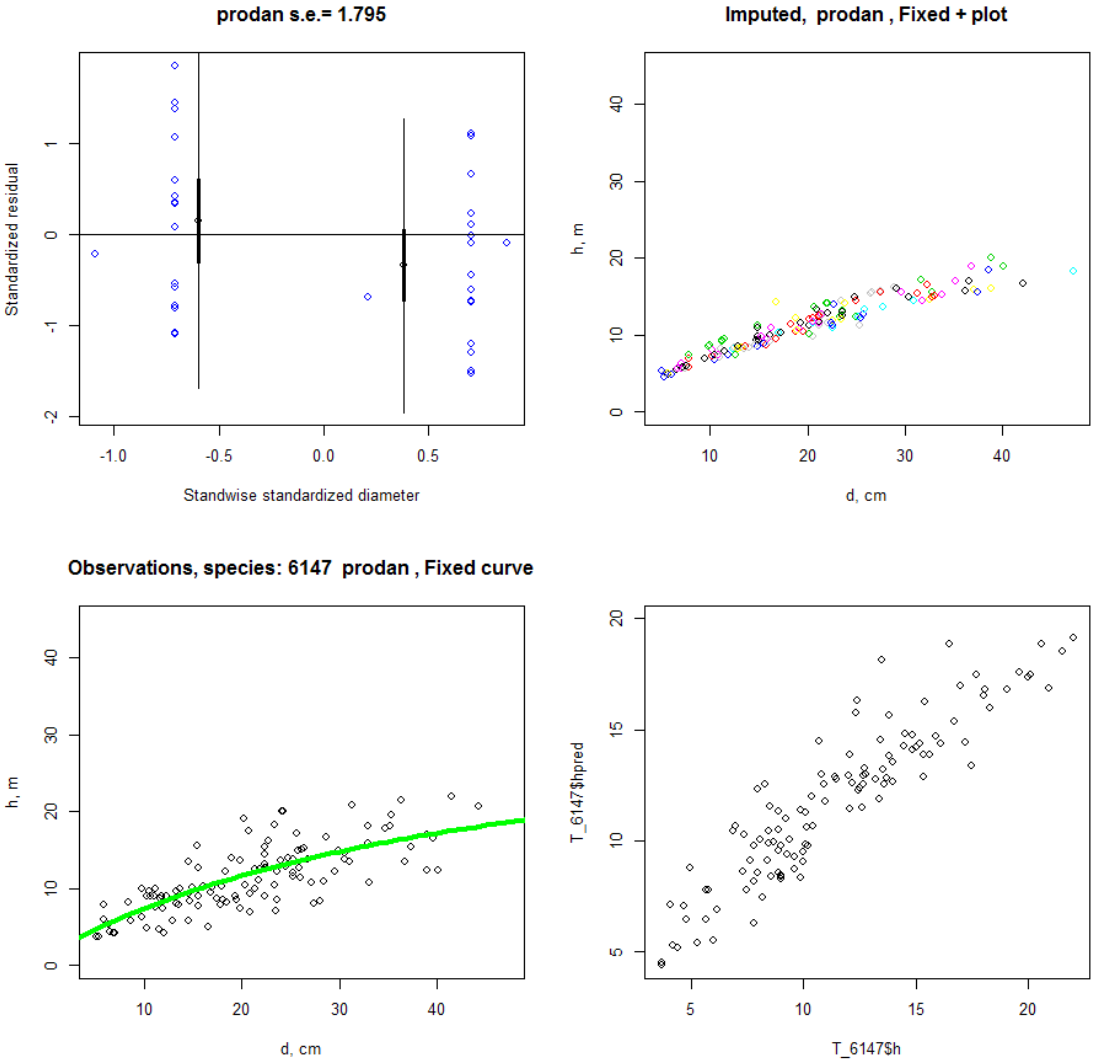




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Buchanania latifolia*
Local name: Piyari, Kaja, Char, Piyal
FRA database code: 6147
Model = Prodan
Equation: *h(d) = bh + d^2/(a + bd + c d^2)*

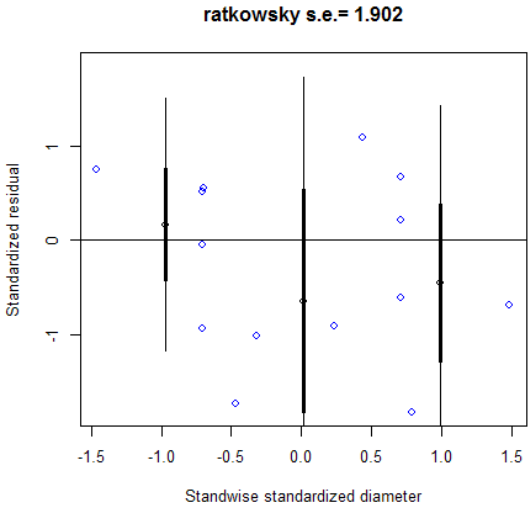
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.795
bh = breast height (=1.3)	Adj. R^2=0.84 (for mixed model only)
d = diameter at breast height	F-statistic: 617.9 on 1 and 115 DF, p-value: < 2.2e-16
a = -0.0755541 b = 1.3526182 c = 0.0291974	Residuals: min= -1.94 Q1=-0.73 med=-0.10 Q3=0.41 max= 1.84

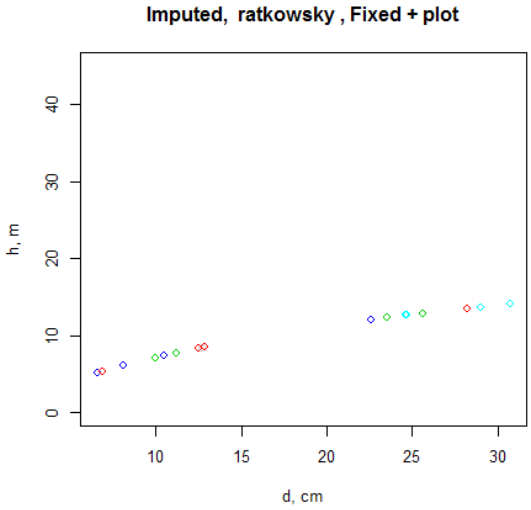


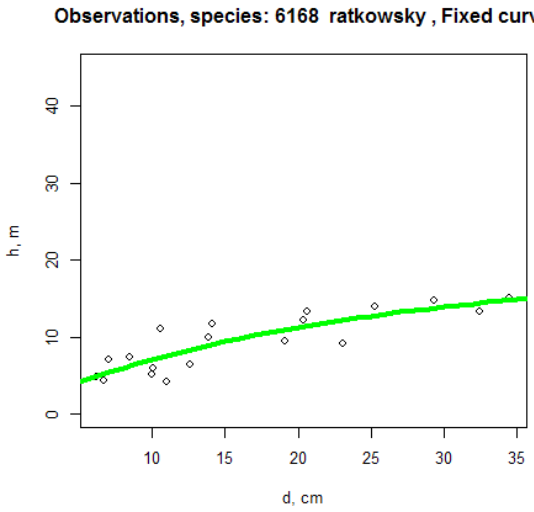
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

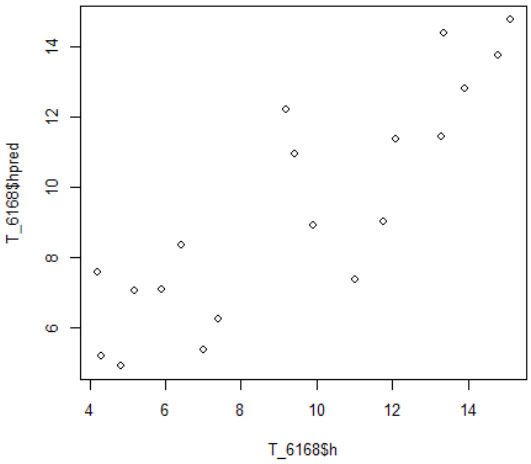
Species: *Casearia elliptica*
Local name: Thulo Deri, Sano Bethe, Chilla, Deri, Beri
FRA database code: 6168
Model = Ratkowsky
Equation: $h(d) = bh + a\ exp(-b/(d + c))$

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.902
bh = breast height (=1.3)	Adj. R^2=0.72 (for mixed model only)
d = diameter at breast height	F-statistic: 48.53 on 1 and 17 DF, p-value: 2.273e-06
a=22.736376 b=20.662046 c=5.049571	Residuals: min= -1.82 Q1=-0.79 med=0.21 Q3=0.66 max= 1.84





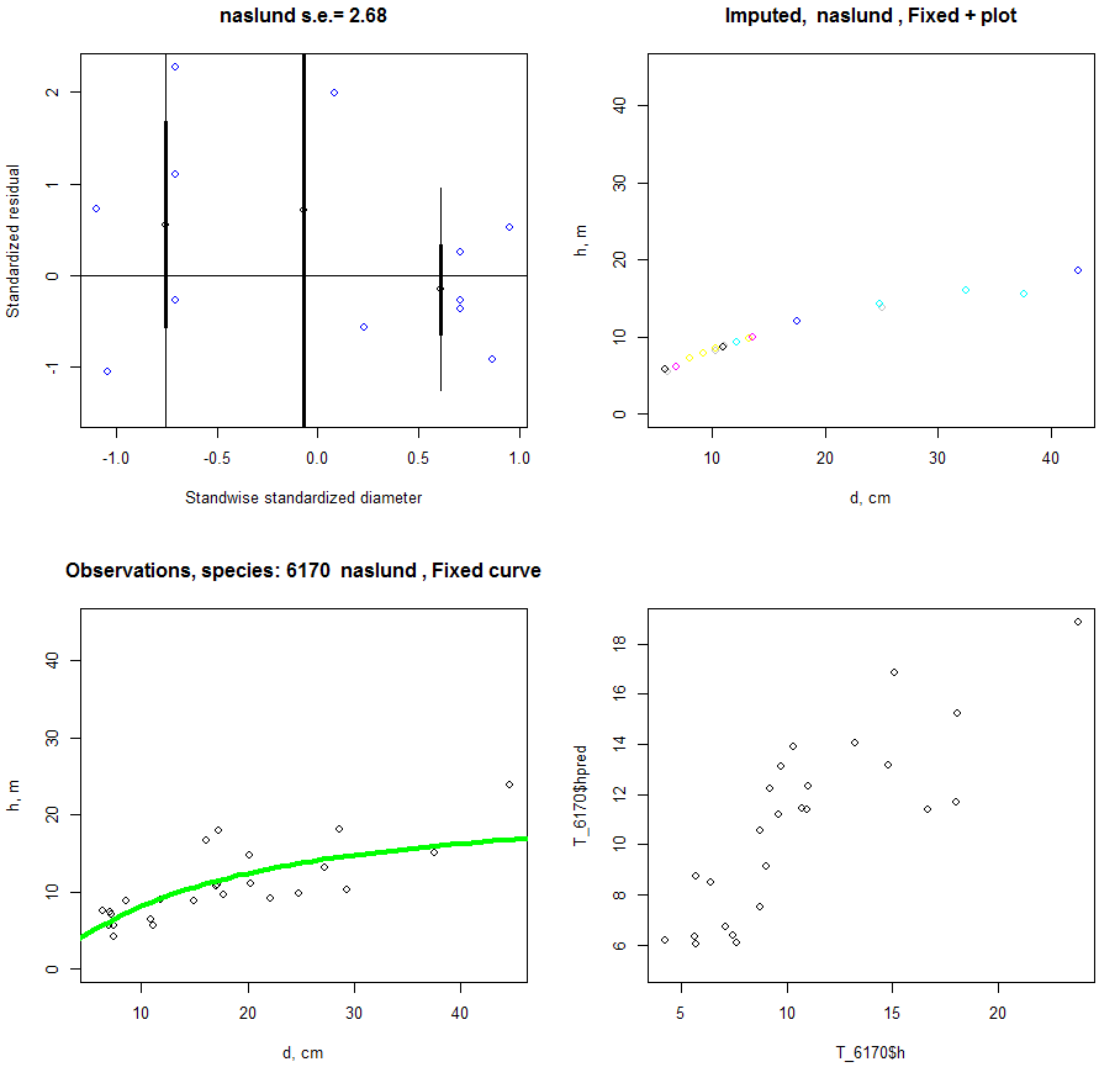




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Casearia graveolens*
Local name: Badkaule, Pipane
FRA database code: 6170
Model = Naslund
Equation: *h(d) = h(d) = bh + d^2/(a + b d)^2*

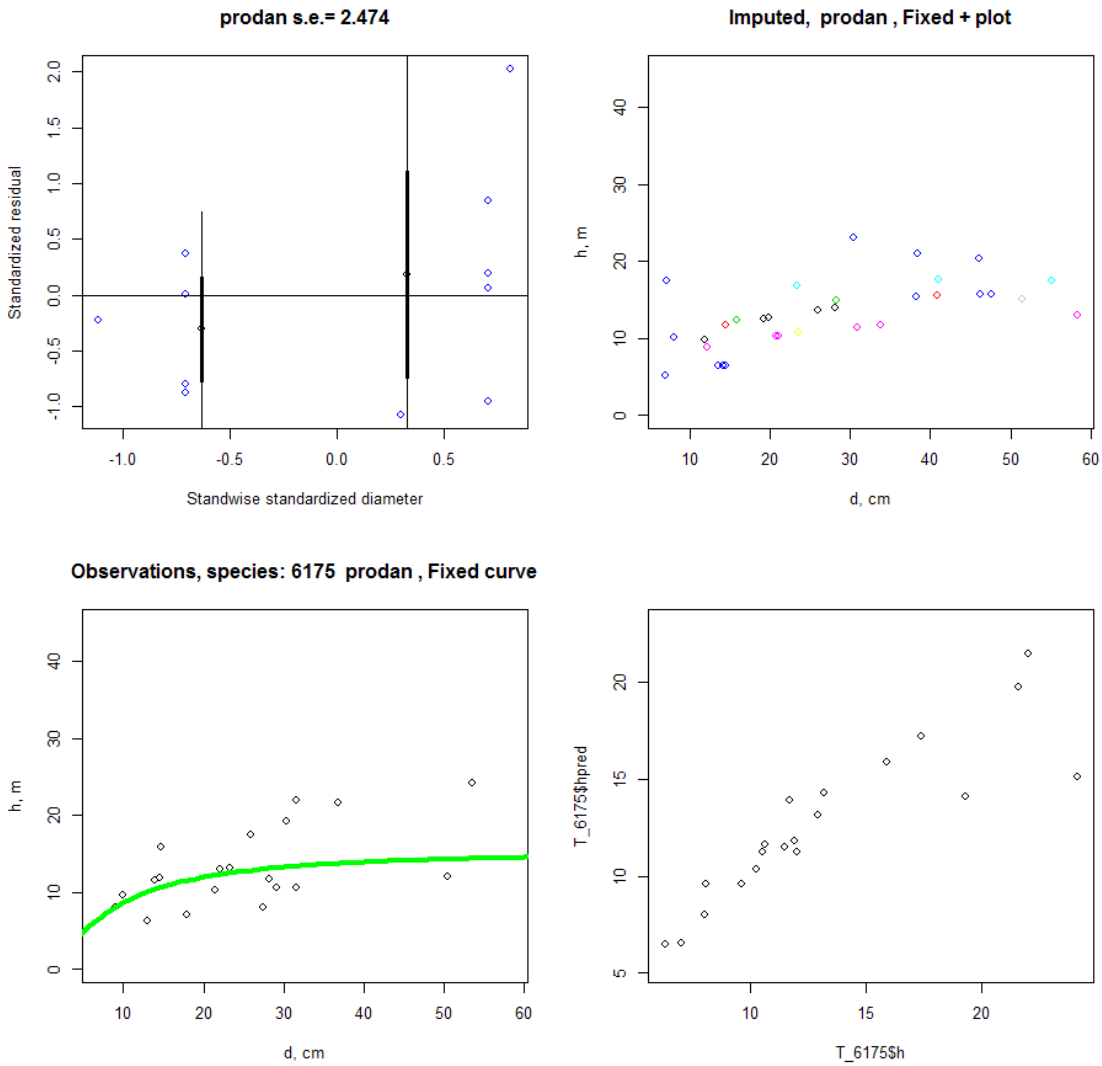
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=2.68
bh = breast height (=1.3)	Adj. R^2=0.68 (for mixed model only)
d = diameter at breast height	F-statistic: 51.15 on 1 and 23 DF, p-value: 2.774e-07
a= 1.6557216 b= 0.2172067	Residuals: min= -1.50 Q1=-0.71 med=-0.26 Q3=0.69 max= 2.27



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Castanopsis indica*
Local name: Dhale katus, Katus, Dhalne Katus, Banjh Katus, Chyakpal
FRA database code: 6175
Model = Prodan
Equation: *h(d) = bh + d^2/(a + bd + c d^2)*

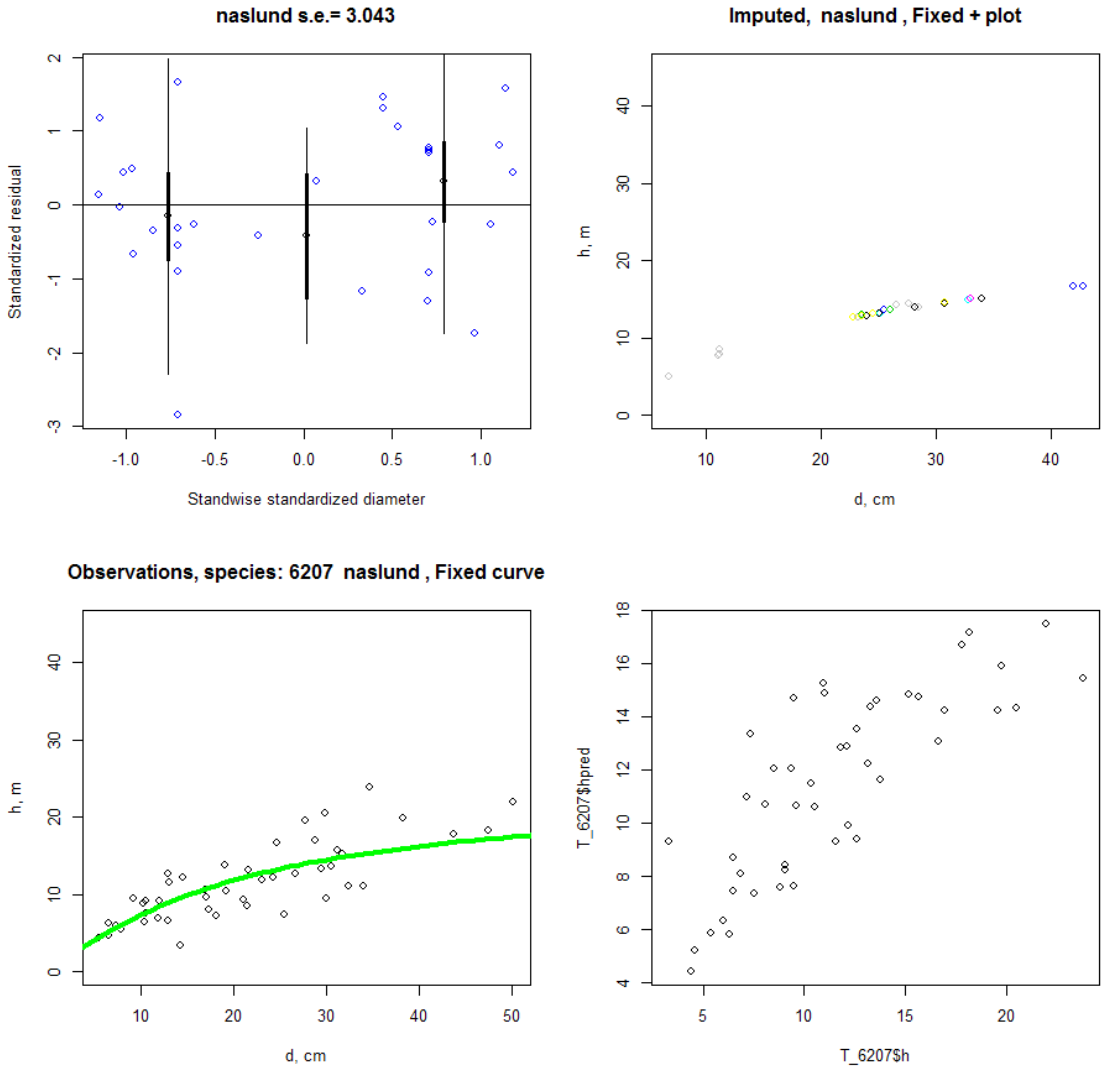
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=2.474
bh = breast height (=1.3)	Adj. R^2=0.78 (for mixed model only)
d = diameter at breast height	F-statistic: 67.12 on 1 and 18 DF, p-value: 1.744e-07
a= 3.812560 b= 0.290423 c= 0.069804	Residuals: min= -1.07 Q1=-0.32 med=0.012 Q3=0.24 max= 2.02



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Cleistocalyx operculata*
Local name: Kyamuna, Rani, Kusum, Phulepa
FRA database code: 6207
Model = Naslund
Equation: *h (d) = bh + d^2/(a + b d)^2*

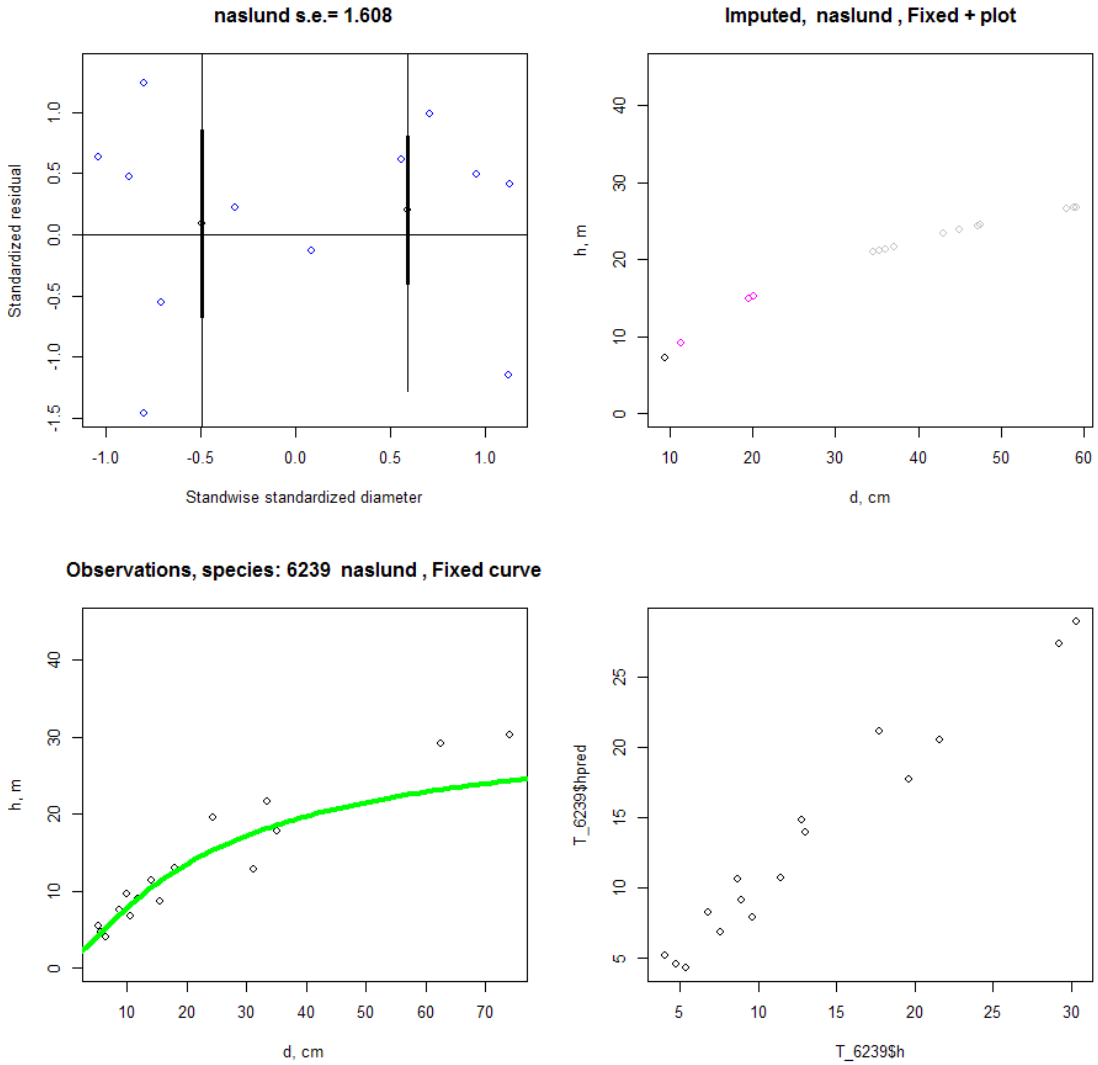
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=3.043
bh = breast height (=1.3)	Adj. R^2=0.63 (for mixed model only)
d = diameter at breast height	F-statistic: 76.1 on 1 and 44 DF, p-value: 3.783e-11
a= 1.9720122 b= 0.2095963	Residuals: min= -2.84 Q1=-0.57 med= -0.01 Q3= 0.72 max= 1.85



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Dalbergia sissoo*
Local name: Sissoo, Sissau
FRA database code: 6239
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

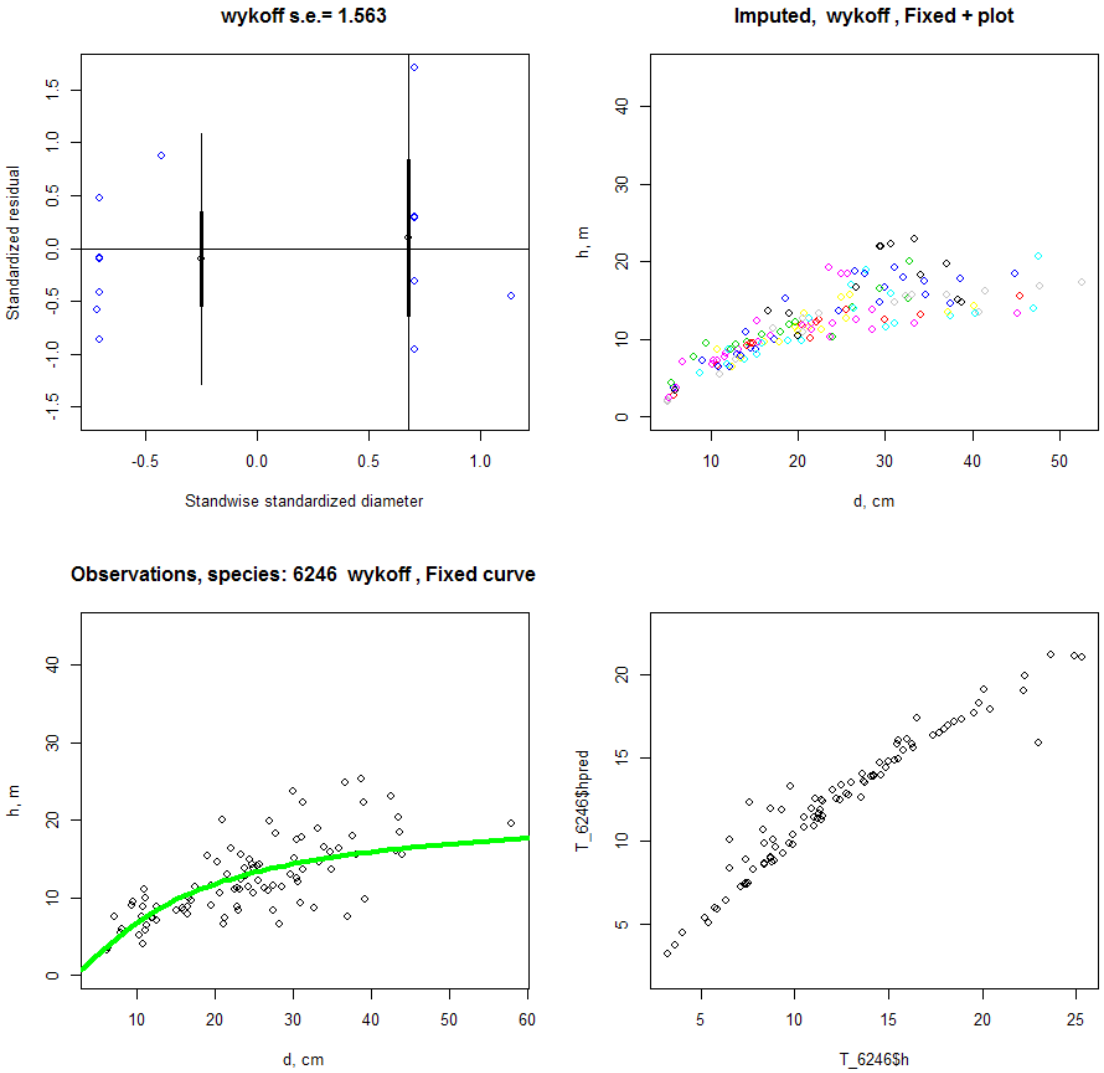
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.608
bh = breast height (=1.3)	Adj. R^2=0.96 (for mixed model only)
d = diameter at breast height	F-statistic: 364.4 on 1 and 14 DF, p-value: 2.022e-11
a=2.141552 b=0.179556	Residuals: min= -1.46 Q1= -0.95 med= 0.32 Q3=0.62 max= 1.37



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Desmodium oojenense*
Local name: Sadan, Pandan, Tinkire, Sandan pipli, Sadhan, Panjan, Panan
FRA database code: 6246
Model = Wykoff
Equation: $h(d) = bh + exp(a + b/(d + 1))$

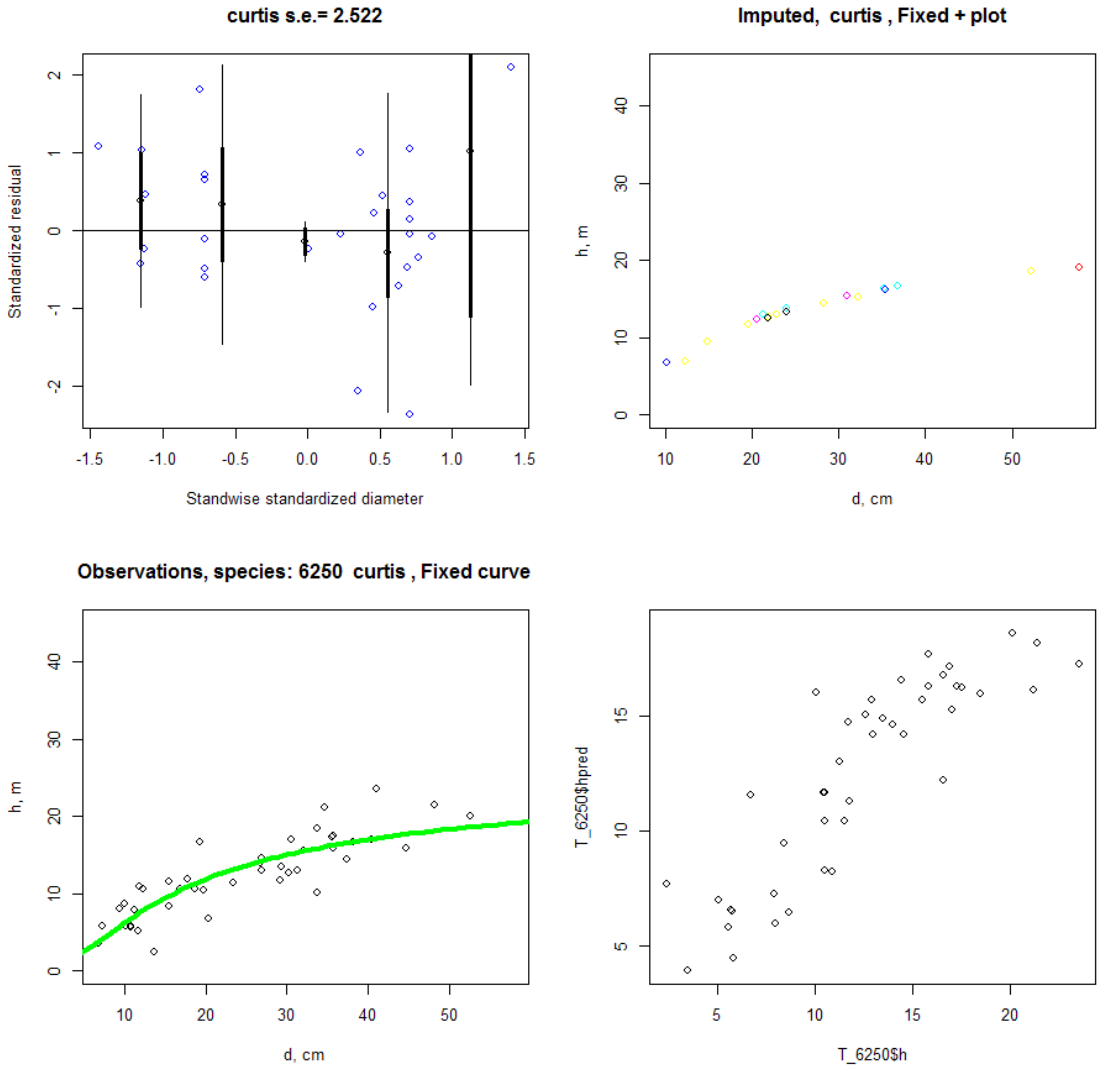
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.563
bh = breast height (=1.3)	Adj. R^2=0.92 (for mixed model only)
d = diameter at breast height	F-statistic: 1110 on 1 and 90 DF, p-value: < 2.2e-16
a= 3.079509 b=-12.902204	Residuals: min= -1.59 Q1= -0.34 med= -0.07 Q3=0.26 max= 1.71



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Dillenia pentagyna*
Local name: Tantari, Agai, Chalta
FRA database code: 6250
Model = Curtis
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

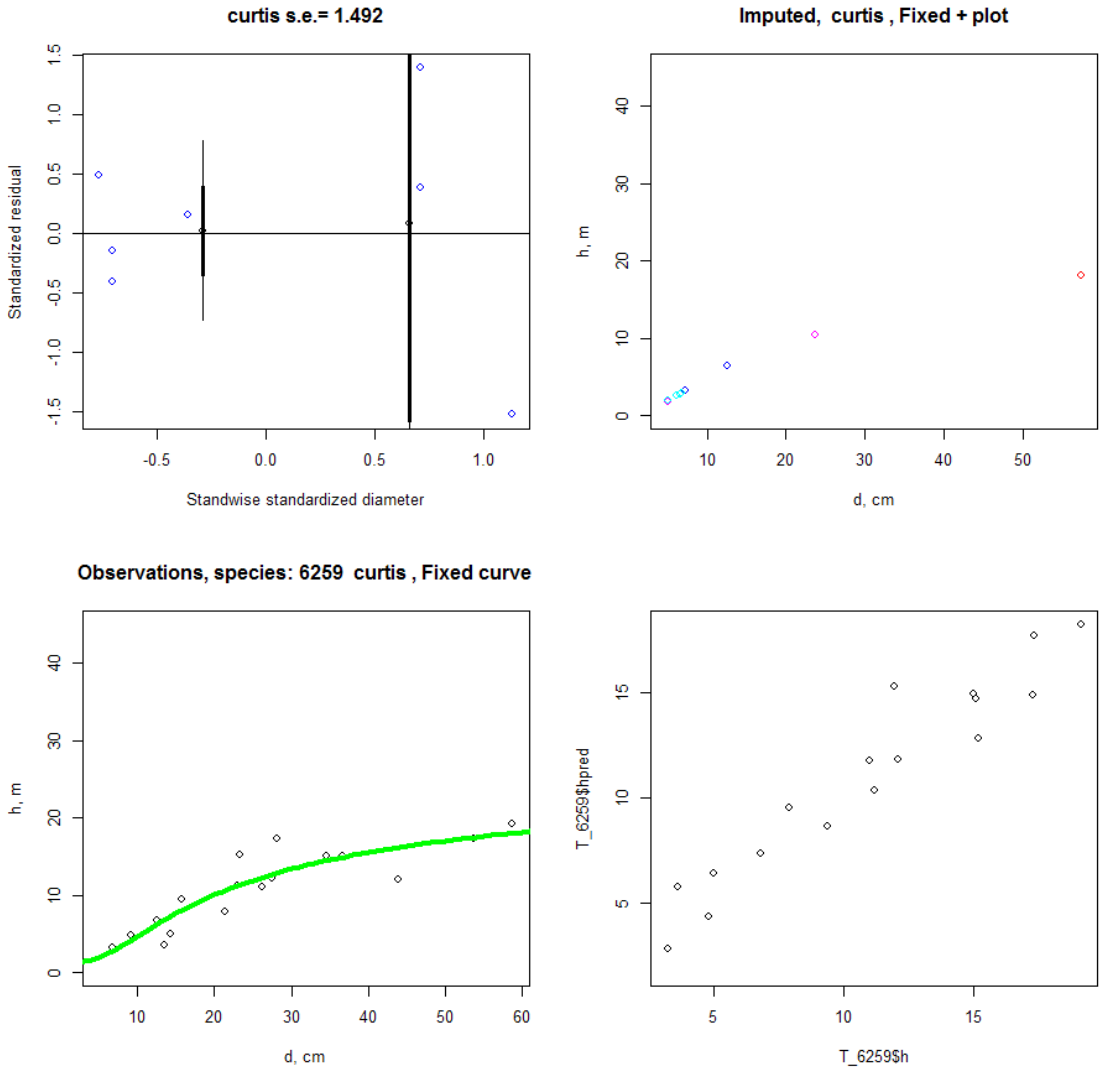
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=23.52646 b=16.40537	s.e.=2.522 Adj. R^2=0.75 (for mixed model only) F-statistic: 126.4 on 1 and 41 DF, p-value: 4.218e-14 Residuals: min= -2.36 Q1=-0.49 med= -0.07 Q3=0.56 max= 2.09



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Diospyros tomentosa*
Local name: Abinas,Bidi Pat, Tendu
FRA database code: 6259
Model = Curtis
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

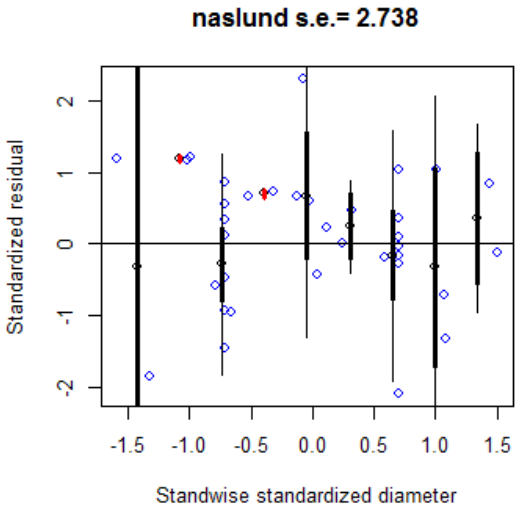
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=23.49862 b=20.30173	s.e.=1.492 Adj. R^2=0.91 (for mixed model only) F-statistic: 166.9 on 1 and 15 DF, p-value: 1.567e-09 Residuals: min= -1.53 Q1=-0.43 med= 0.16 Q3=0.38 max= 1.39

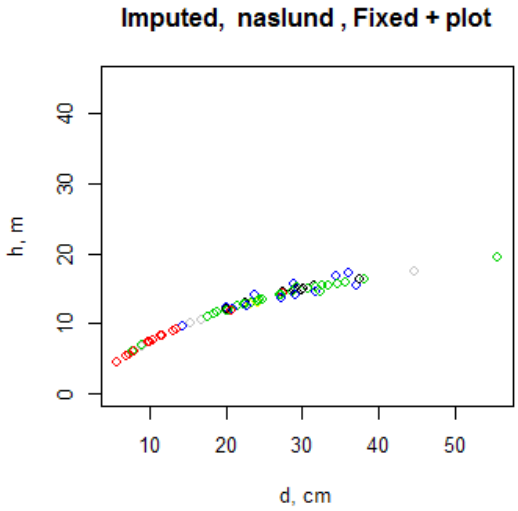


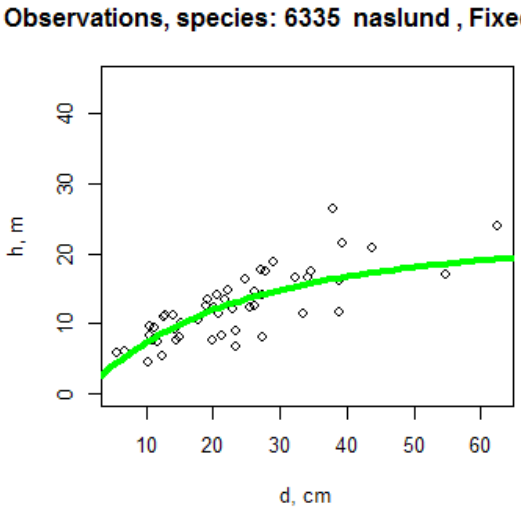
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

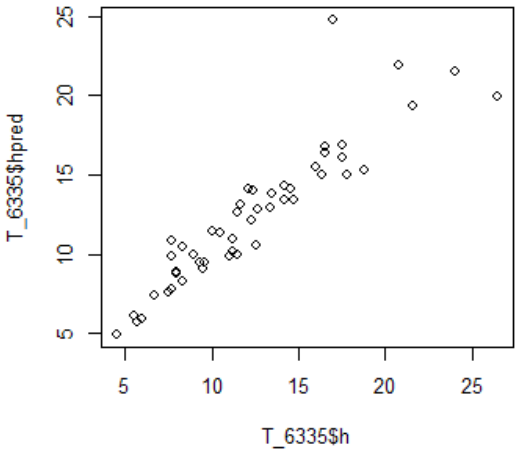
Species: *Garuga pinnata*
Local name: Dabdabe, Ramsin, Aule Dabdabe, Kharpat
FRA database code: 6335
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.0406124 b=0.2034714	s.e.=2.738 Adj. R^2=0.83 (for mixed model only) F-statistic: 242.5 on 1 and 47 DF, p-value: < 2.2e-16 Residuals: min= -2.09 Q1=-0.59 med= 0.11 Q3=0.67 max= 2.30





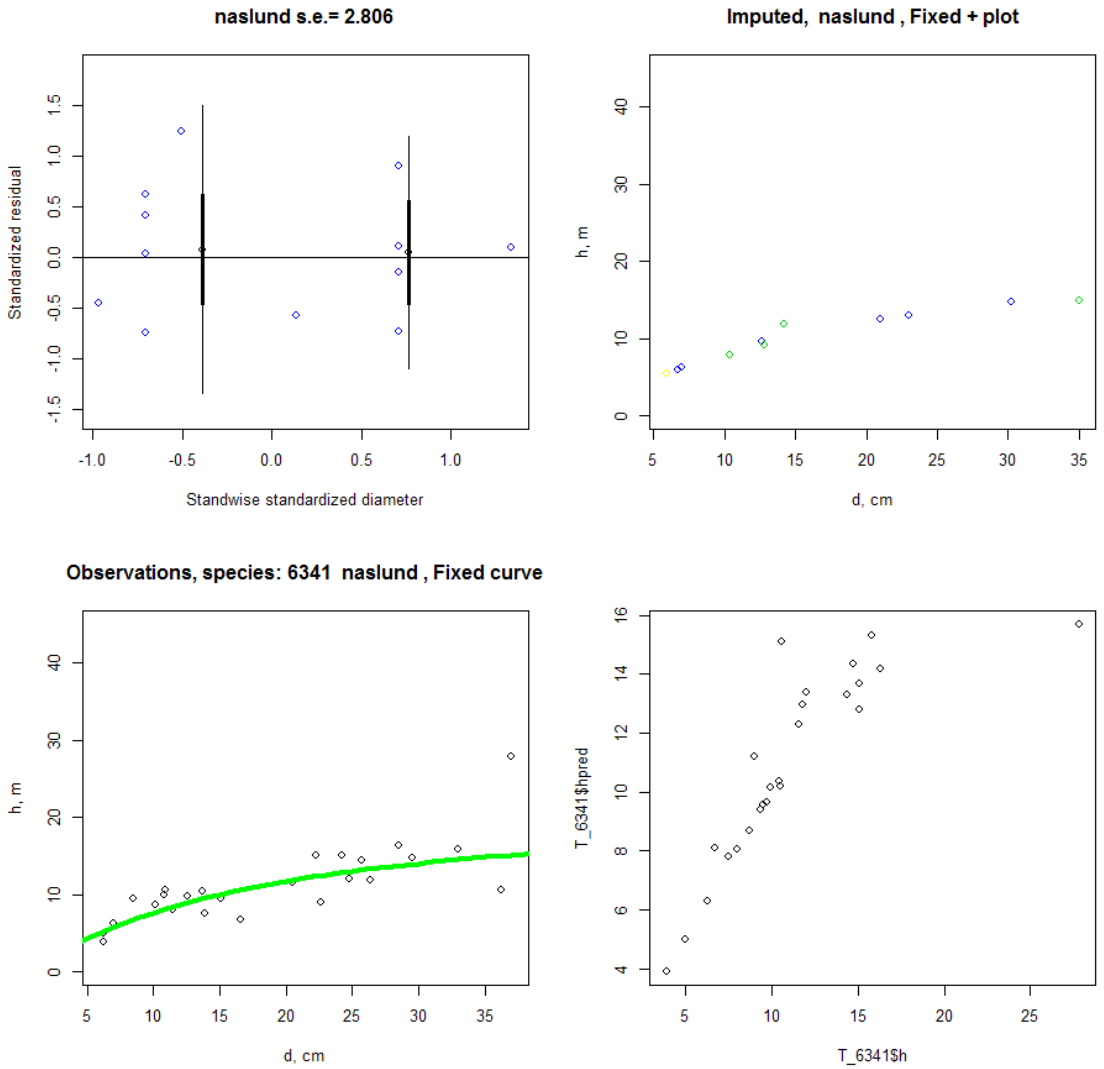




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Grewia subinaequalis*
Local name: Falsa, Fussi, Syal Phusro, Phosro, Harsa-Pharsa, Phalsa
FRA database code: 6341
Model = Naslund
Equation: $h(d) = bh + d\text{^}2/(a + b\,d)\text{^}2$

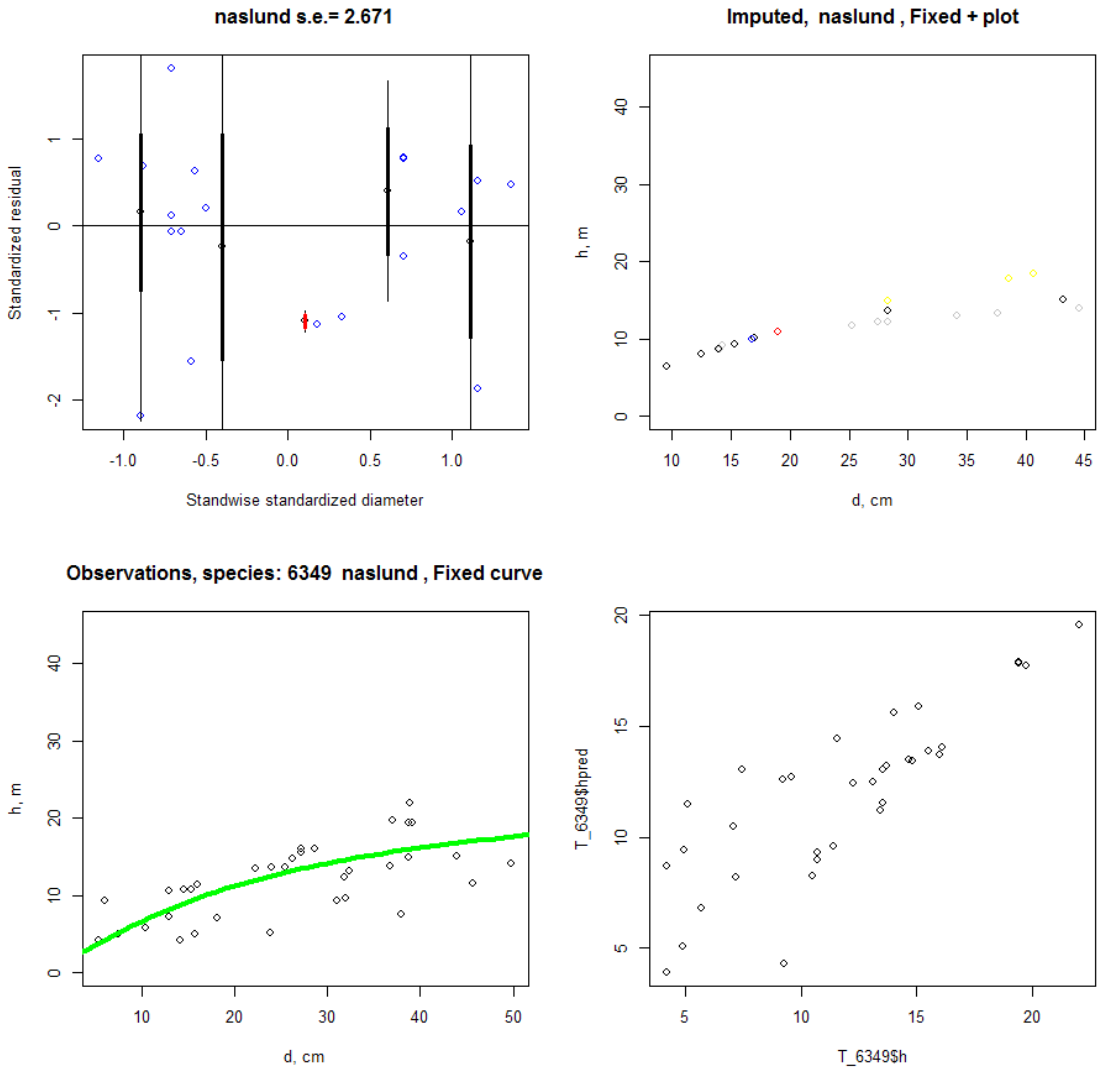
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a= 1.7844608 b= 0.2210147	s.e.=2.806 Adj. R^2=0.67 (for mixed model only) F-statistic: 50.34 on 1 and 23 DF, p-value: 3.154e-07 Residuals: min= -1.56 Q1=-0.46 med= 0.03 Q3=0.15 max= 1.86



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Hymenodictyon excelsum*
Local name: Lati Karam, Seti Kath, Bhurkul,Bhudkul
FRA database code: 6349
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

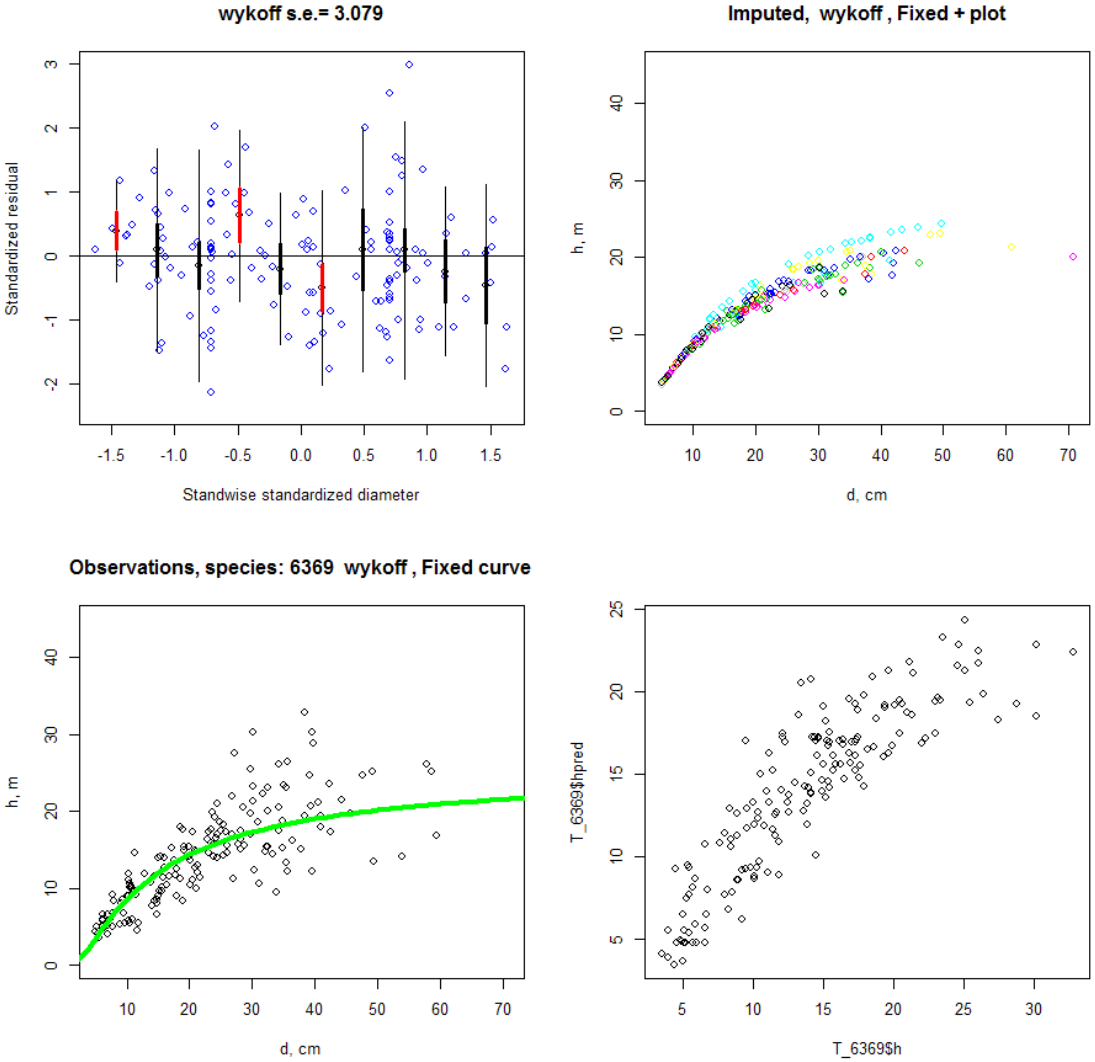
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.324285 b=0.201348	s.e.=2.671 Adj. R^2=0.68 (for mixed model only) F-statistic: 70.84 on 1 and 32 DF, p-value: 1.286e-09 Residuals: min= -2.18 Q1=-0.49 med= 0.18 Q3=0.62 max= 1.80



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Lagerstroemia parviflora*
Local name: Bot dhangero, Sidda, Hade
FRA database code: 6369
Model = Wykoff
Equation: $h(d) = bh + exp(a + b/(d + 1))$

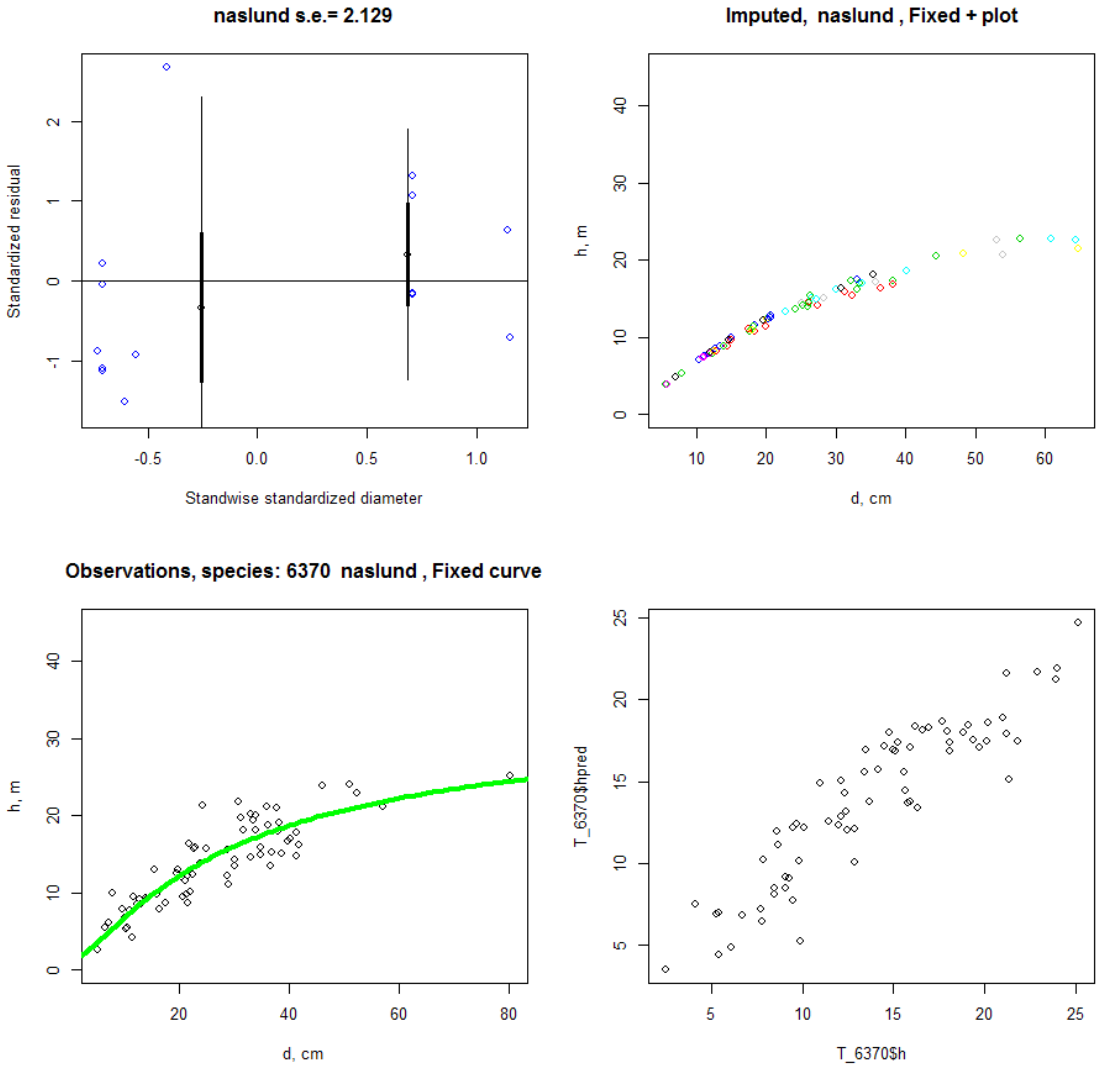
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=3.079
bh = breast height (=1.3)	Adj. R^2=0.77 (for mixed model only)
d = diameter at breast height	F-statistic: 545.4 on 1 and 165 DF, p-value: < 2.2e-16
a=3.237074 b=-12.011123	Residuals: min= -2.42 Q1=-0.67 med= 0.07 Q3=0.57 max= 2.98



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Lannea coromandelica*
Local name: Dabdabe, Chainchuinge, Hallure, Jhighat
FRA database code: 6370
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

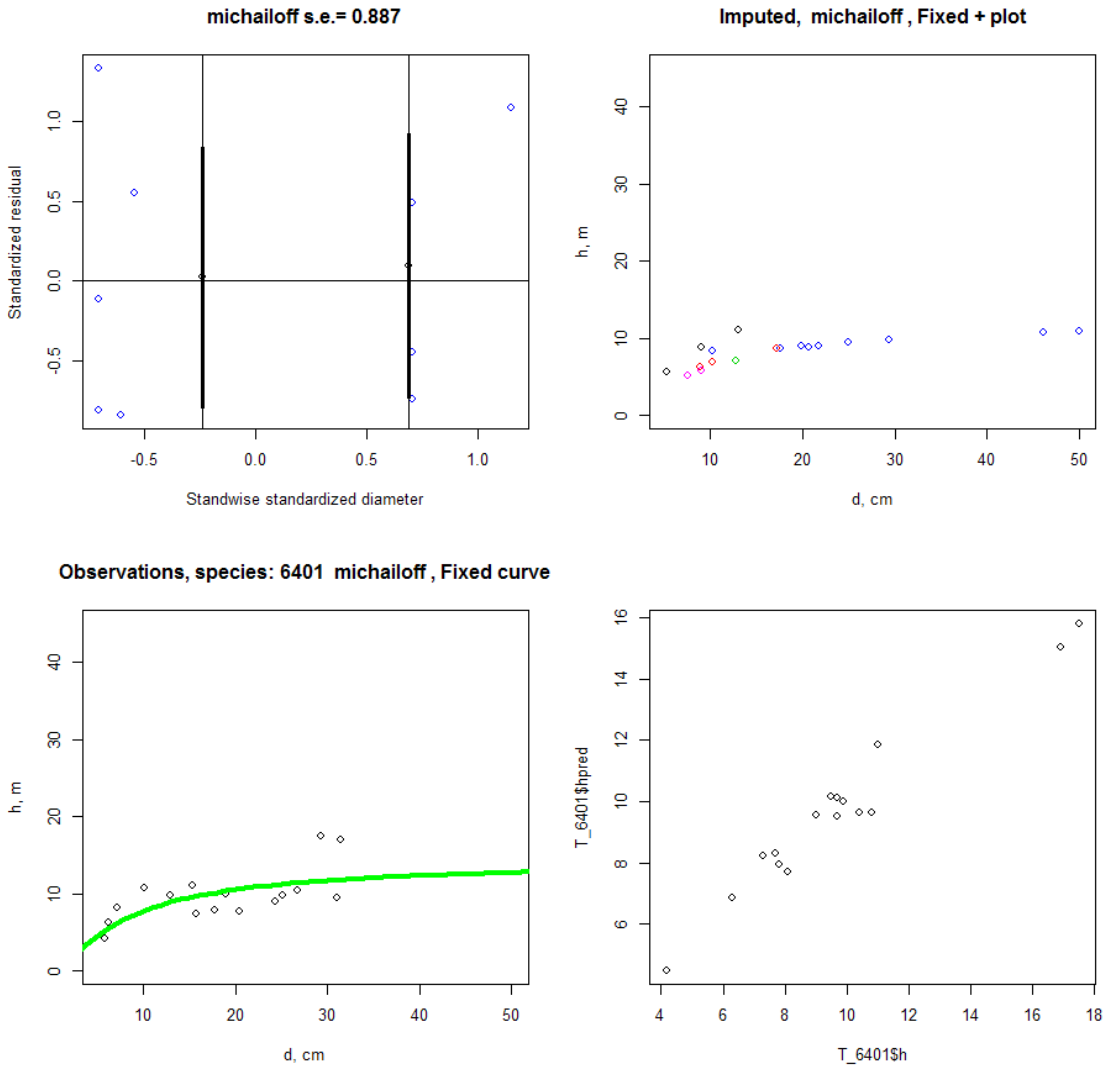
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=2.129
bh = breast height (=1.3)	Adj. R^2=0.84 (for mixed model only)
d = diameter at breast height	F-statistic: 362.5 on 1 and 68 DF, p-value: < 2.2e-16
a=2.5228107 b=0.1764886	Residuals: min= -1.66 Q1= -0.79 med=-0.03 Q3=0.61 max= 2.67



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Litsea monopetala*
Local name: Kutmero, Ghante Phool, Ratmate, Kadmero, Putmero
FRA database code: 6401
Model = Michailoff
Equation: *h(d) = bh + a e^(-b d^(-1))*

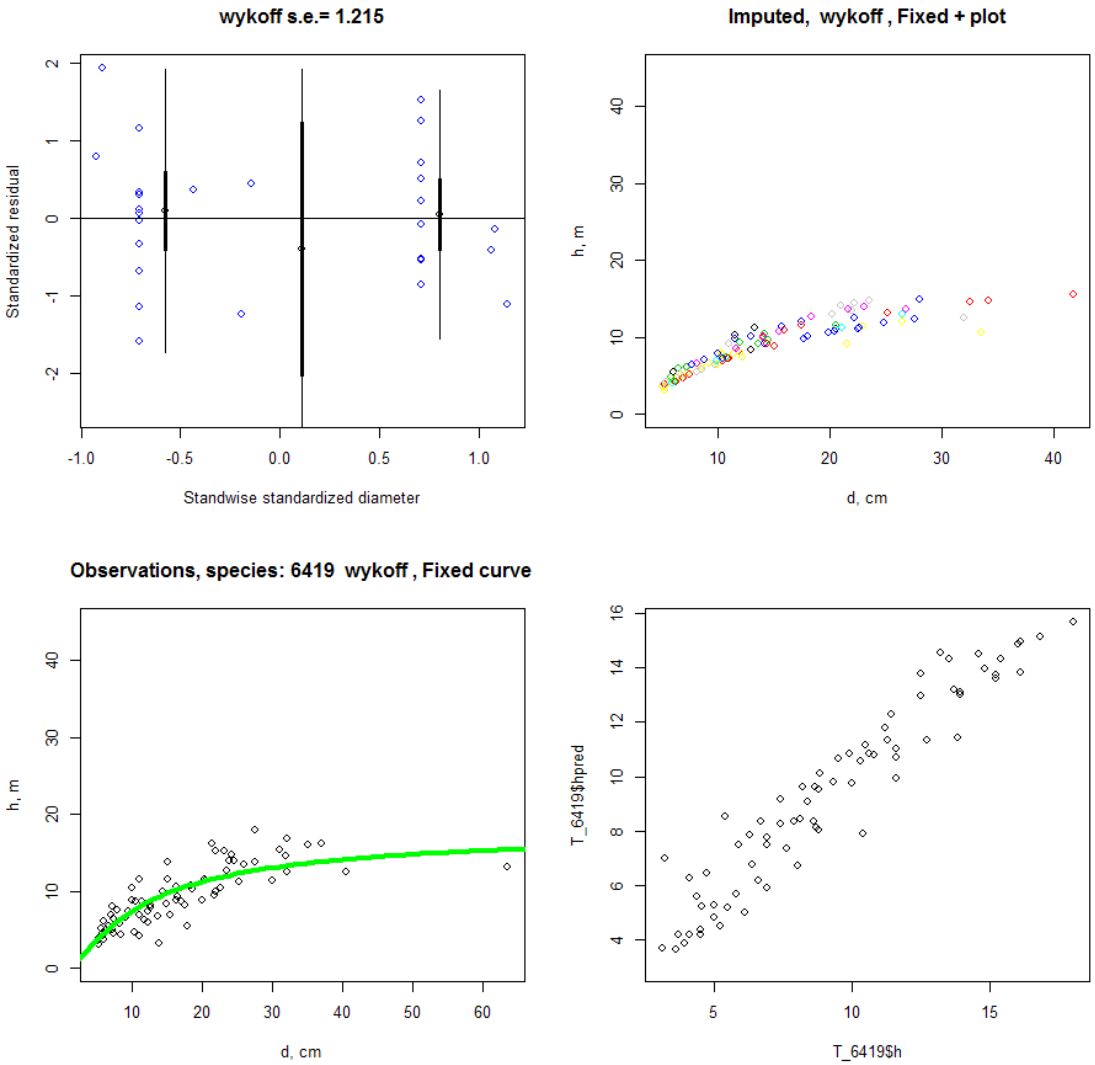
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=0.887
bh = breast height (=1.3)	Adj. R^2=0.95 (for mixed model only)
d = diameter at breast height	F-statistic: 320.5 on 1 and 14 DF, p-value: 4.803e-11
a=13.154656 b=7.121663	Residuals: min= -0.84 Q1=-0.46 med=-0.19 Q3=0.50 max=1.33



Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Mallotus philippensis*
Local name: Sindhure, Rohini
FRA database code: 6419
Model = Wykoff
Equation: $h(d) = bh + exp(a + b/(d + 1))$

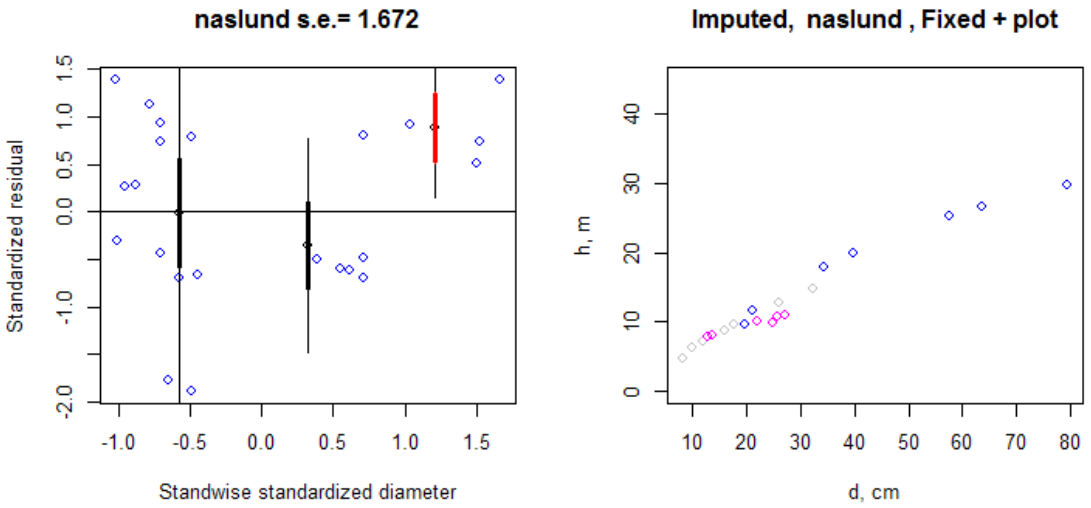
Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.215
bh = breast height (=1.3)	Adj. R^2=0.91 (for mixed model only)
d = diameter at breast height	F-statistic: 750.4 on 1 and 73 DF, p-value: < 2.2e-16
a=2.884112 b=-9.789406	Residuals: min= -2.53 Q1=-0.51 med= -0.04 Q3=0.45 max= 1.93

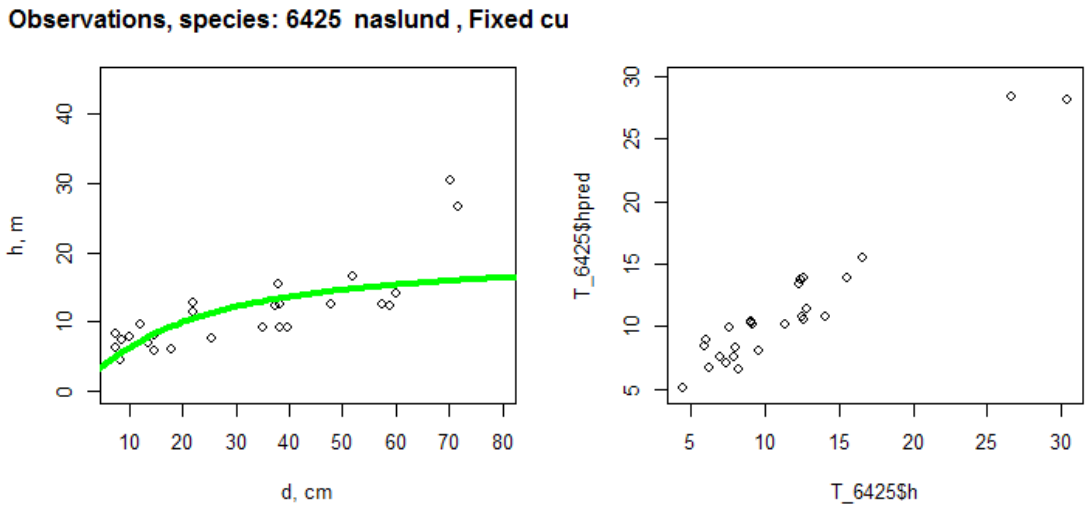


Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Mangifera indica*
Local name: Aanp
FRA database code: 6425
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.672
bh = breast height (=1.3)	Adj. R^2=0.92 (for mixed model only)
d = diameter at breast height	F-statistic: 282.1 on 1 and 24 DF, p-value: 9.018e-15
a=2.1494220 b=0.2307096	Residuals: -min=-1.89 Q1= -0.61 med=-0.25 Q3=0.78 max=1.39

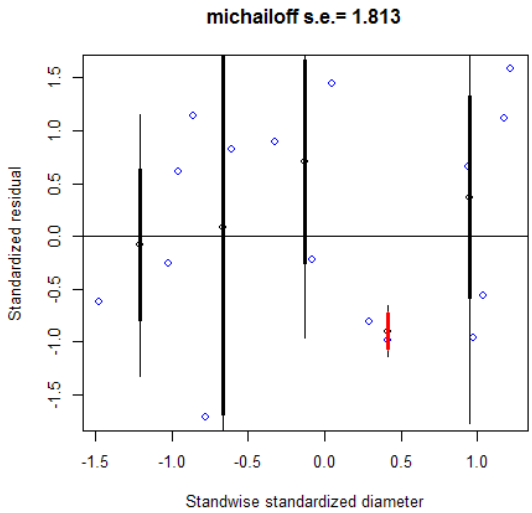


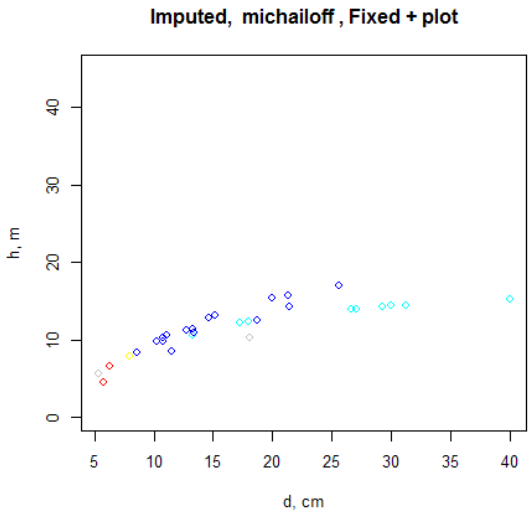


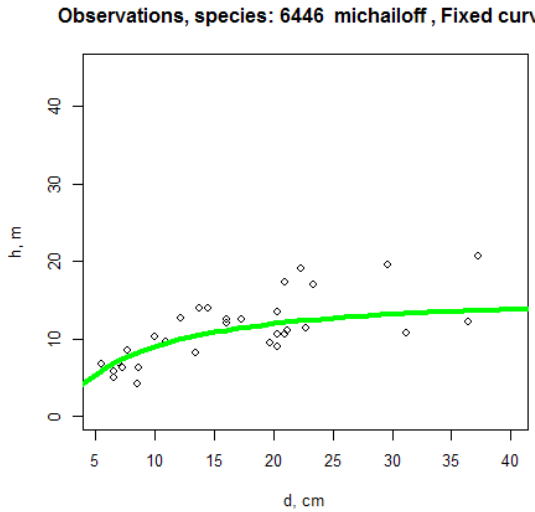
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

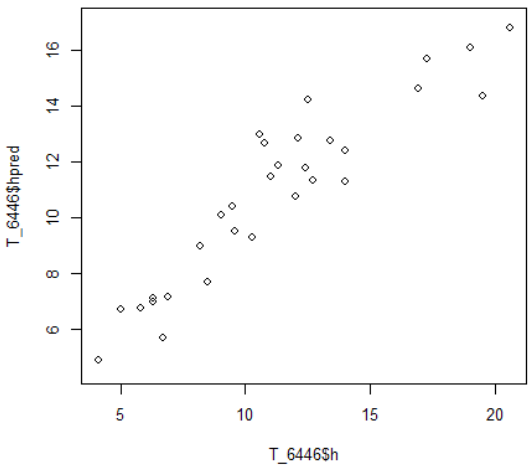
Species: *Miliusa velutina*
Local name: Karyauta, Kalikath
FRA database code: 6446
Model = Michailoff
Equation: *h(d) = bh + a e^(-b d^(-1))*

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=1.813
bh = breast height (=1.3)	Adj. R^2=0.85 (for mixed model only)
d = diameter at breast height	F-statistic: 166.3 on 1 and 29 DF, p-value: 1.549e-13
a=14.672072 b=6.421498	Residuals: min= -1.71 Q1=-0.59 med=-0.19 Q3=0.75 max=1.58





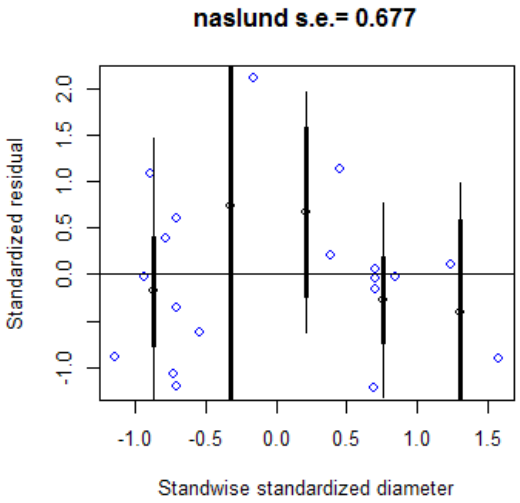


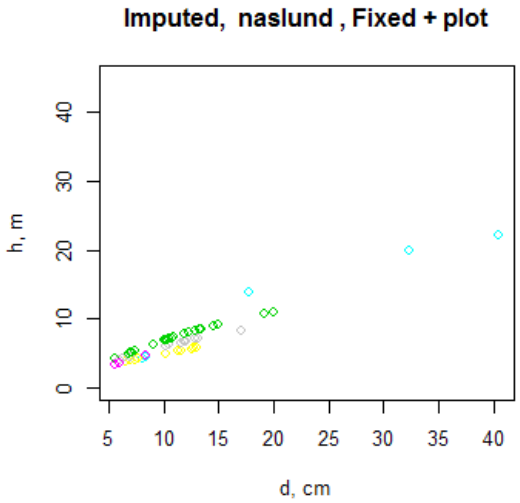


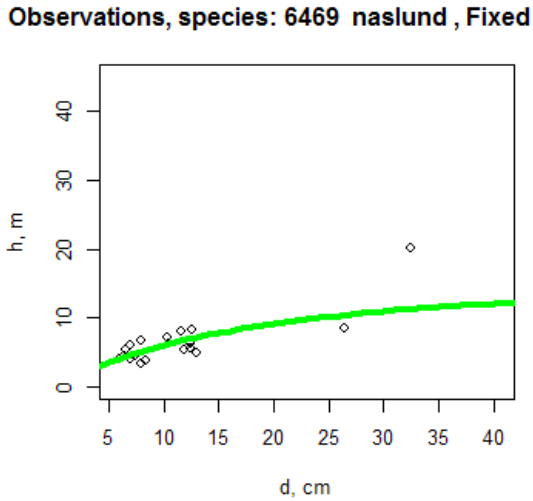
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

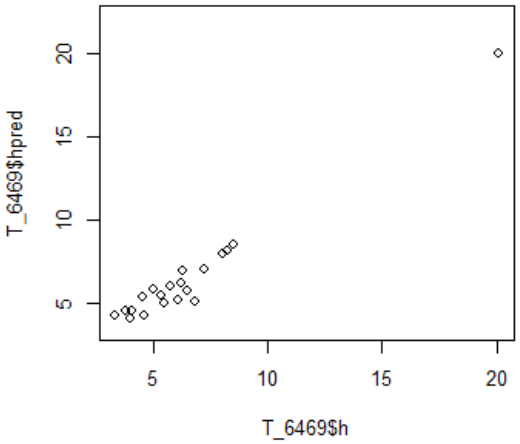
Species: *Nyctanthes arbor-tristis*
Local name: Parijat, Ratgamki, Kurri, Harsingar, Harsingar, Harsingha,Budilo
FRA database code: 6469
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd'	s.e.=0.677
bh = breast height (=1.3)	Adj. R^2=0.96 (for mixed model only)
d = diameter at breast height	F-statistic: 472.7 on 1 and 18 DF, p-value: 2.269e-14
a=2.0507084 b= 0.2531544	Residuals: -min=-1.22 Q1= -0.69 med=-0.026 Q3=0.25 max=2.11





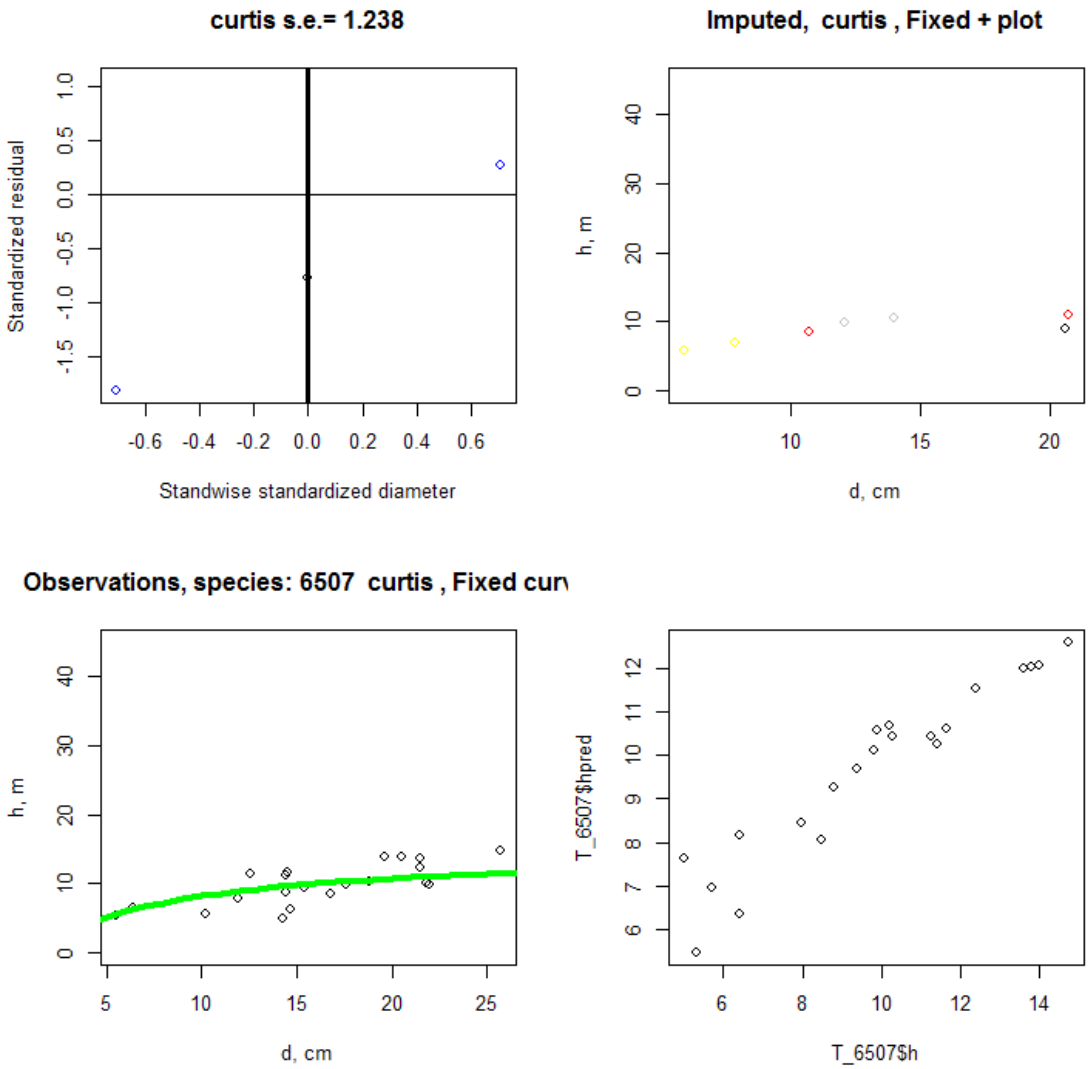




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Phyllanthus emblica*
Local name: Amala, Yabara, Aaura
FRA database code: 6507
Model = Curtis
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

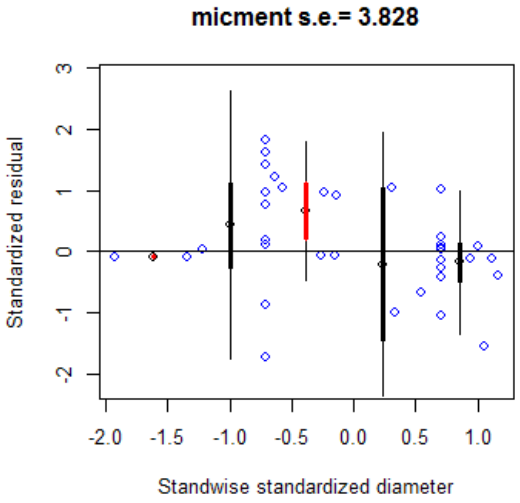
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=13.063752 b=6.647723	s.e.=1.238 Adj. R^2=0.89 (for mixed model only) F-statistic: 179.3 on 1 and 19 DF, p-value: 3.977e-11 Residuals: min= -1.81 Q1=-0.31 med= -0.87 Q3=0.70 max=1.05

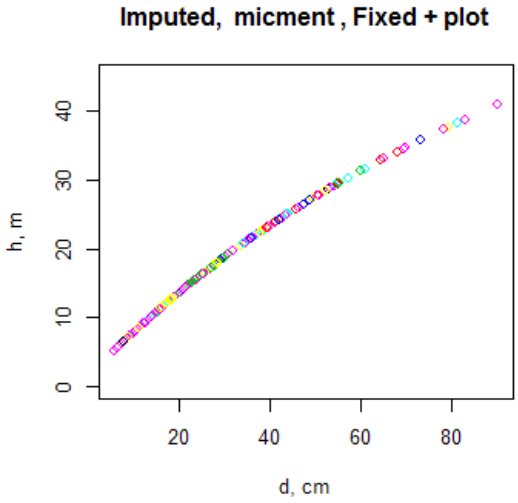


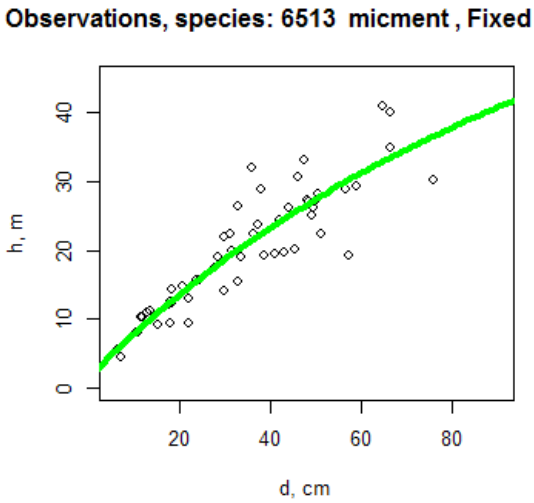
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

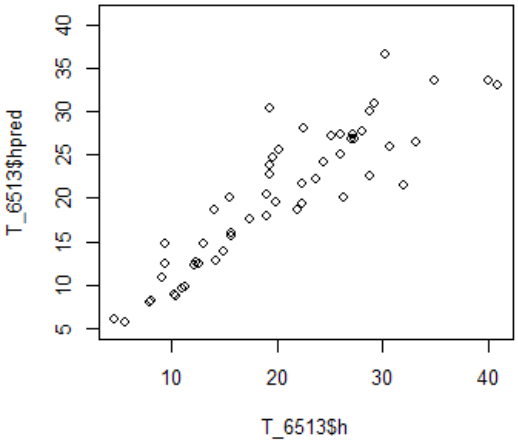
Species: *Pinus roxburghii*
Local name: Rani Salla, Khote Salla, Salla, Aule Salla
FRA database code: 6513
Model = Micment
Equation: $h(d) = bh + a\,d/(b + d)$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=108.5695 b=157.1189	s.e.=3.828 Adj. R^2=0.81 (for mixed model only) F-statistic: 219.1 on 1 and 52 DF, p-value: < 2.2e-16 Residuals: min= -2.21 Q1=-0.60 med= -0.0006 Q3=0.69 max=2.86





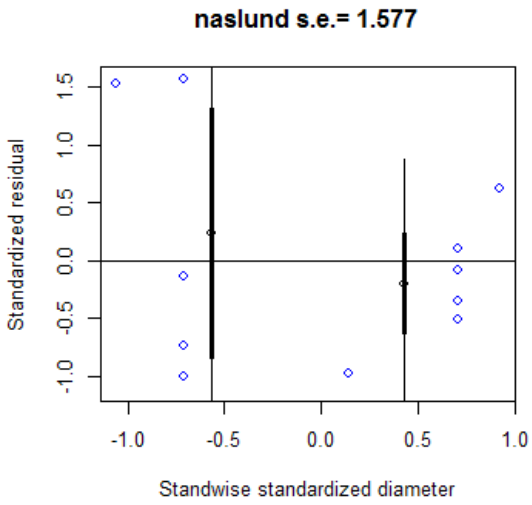


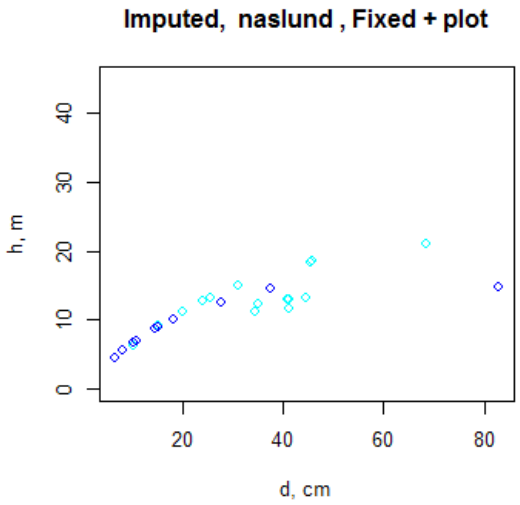


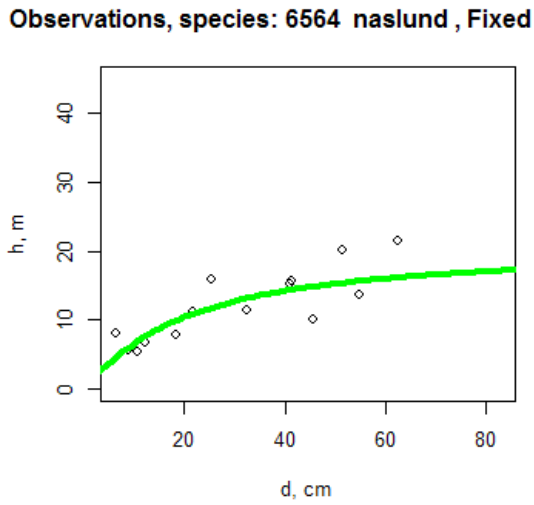
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

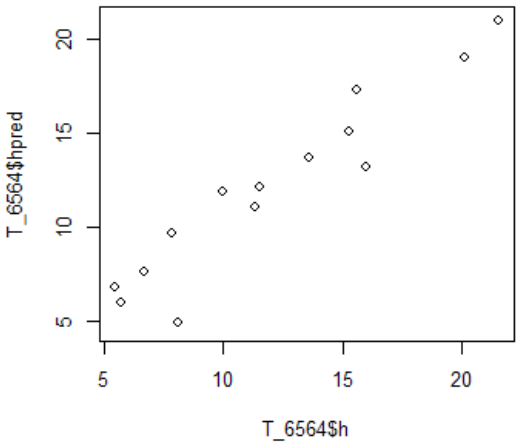
Species: *Quercus lanata*
Local name: Banjh, Phalant, Thulo Banjh, Banga, Sano Phalat
FRA database code: 6564
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.0690330 b=0.2262233	s.e.=1.577 Adj. R^2=0.90 (for mixed model only) F-statistic: 117.6 on 1 and 12 DF, p-value: 1.482e-07 Residuals: -min=-1.11 Q1= -0.68 med=-0.11 Q3=0.28 max=1.57





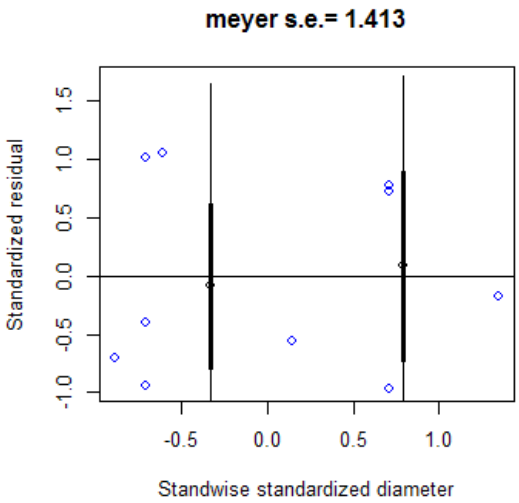


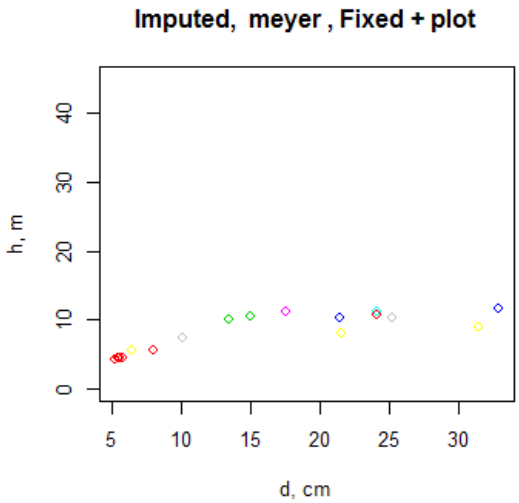


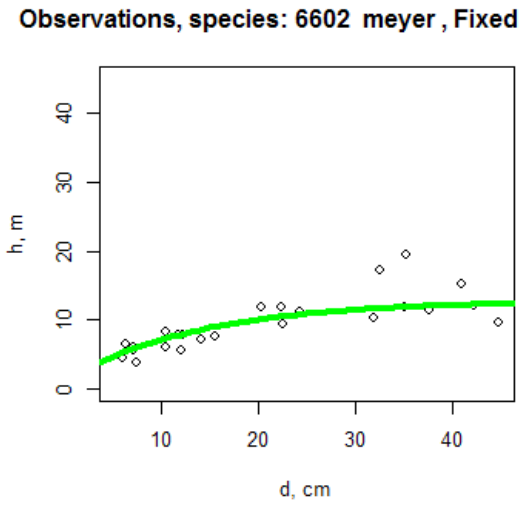
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

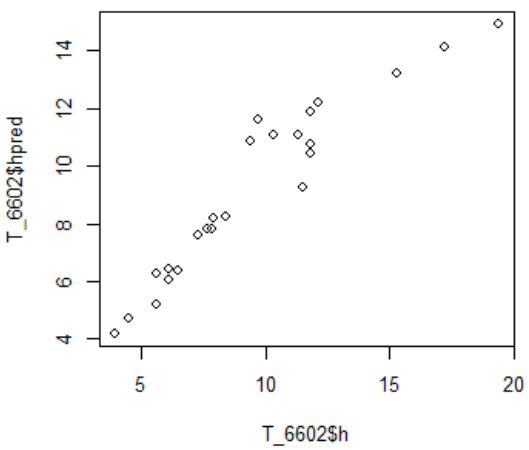
Species: *Sapium insigne*
Local name: Ban Peepal, Khirro, Kherra
FRA database code: 6602
Model = Meyer
Equation: $h(d) = bh + a\,(1-\exp(-b\,d))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a= 11.53033492 b= 0.07158401	s.e.=1.413 Adj. R^2=0.90 (for mixed model only) F-statistic: 201.6 on 1 and 22 DF, p-value: 1.477e-12 Residuals: -min=-0.97 Q1= -0.43 med=-0.015 Q3=0.67 max=1.69





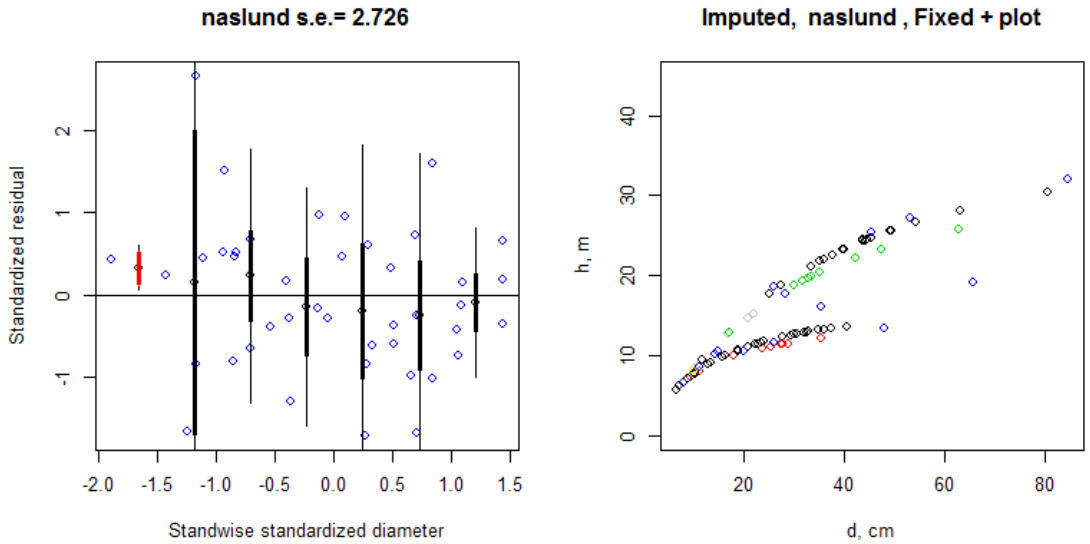


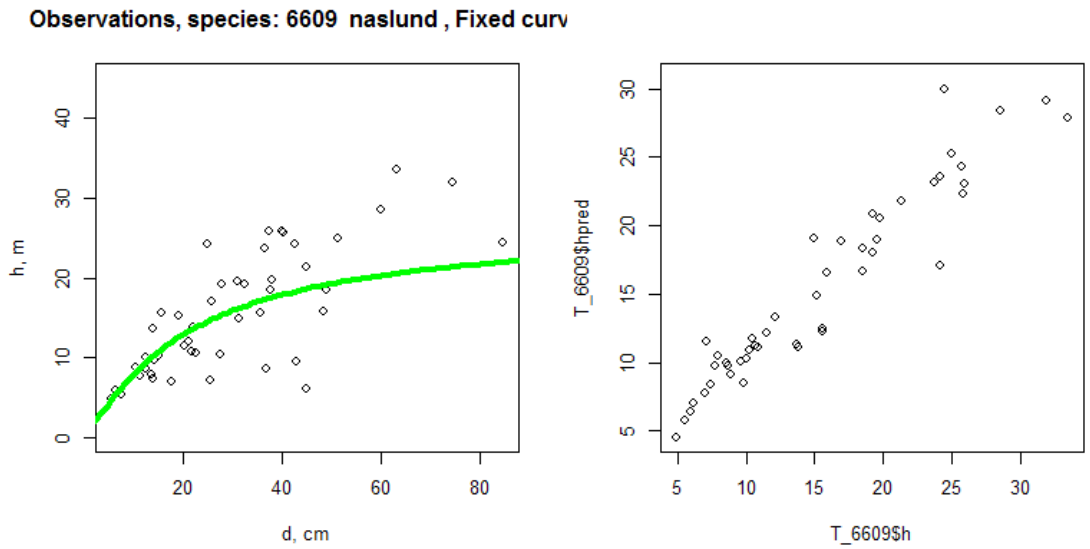


Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Schima wallichii*
Local name: Chilaune, Aule Chilaune, Goichasi, Sule Chilaune
FRA database code: 6609
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.9243638 b=0.1973034	s.e.=2.726 Adj. R^2=0.91 (for mixed model only) F-statistic: 459.2 on 1 and 45 DF, p-value: < 2.2e-16 Residuals: min= -1.72 Q1=-0.64 med= -0.17 Q3=0.46 max=2.67

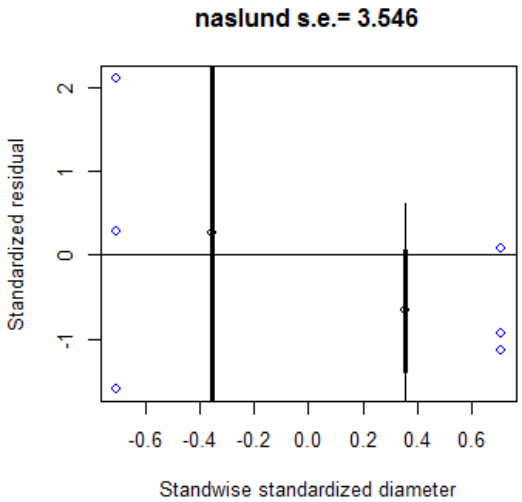


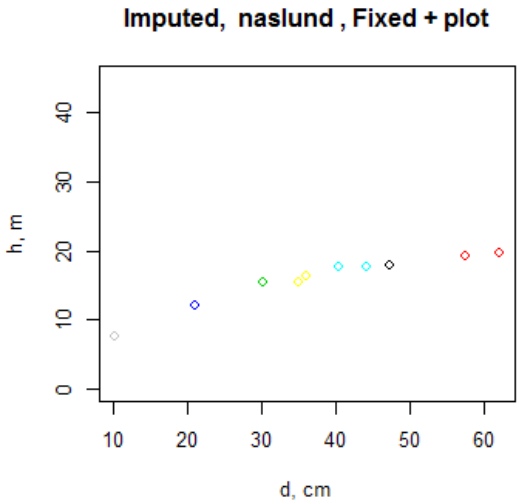


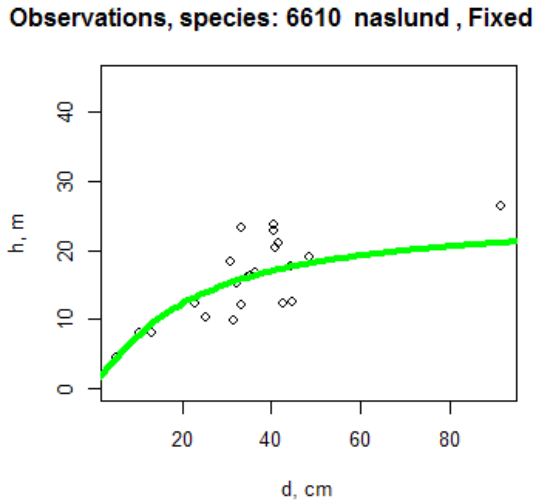
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

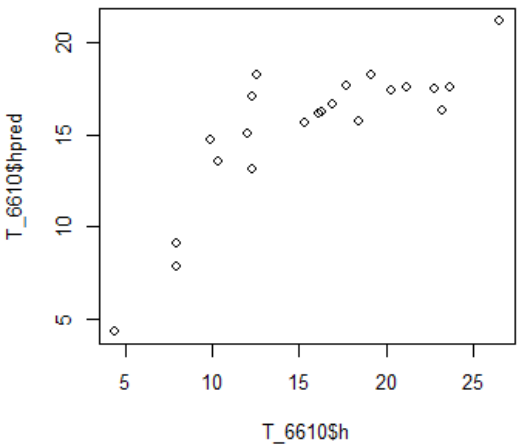
Species: *Schleichera oleosa*
Local name: Kusum, Gosum
FRA database code: 6610
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.9563081 b=0.2032857	s.e.=3.546 Adj. R^2=0.64 (for mixed model only) F-statistic: 38.03 on 1 and 20 DF, p-value: 5.028e-06 Residuals: min= -1.60 Q1=-0.81 med= 0.042 Q3=0.61 max= 2.11





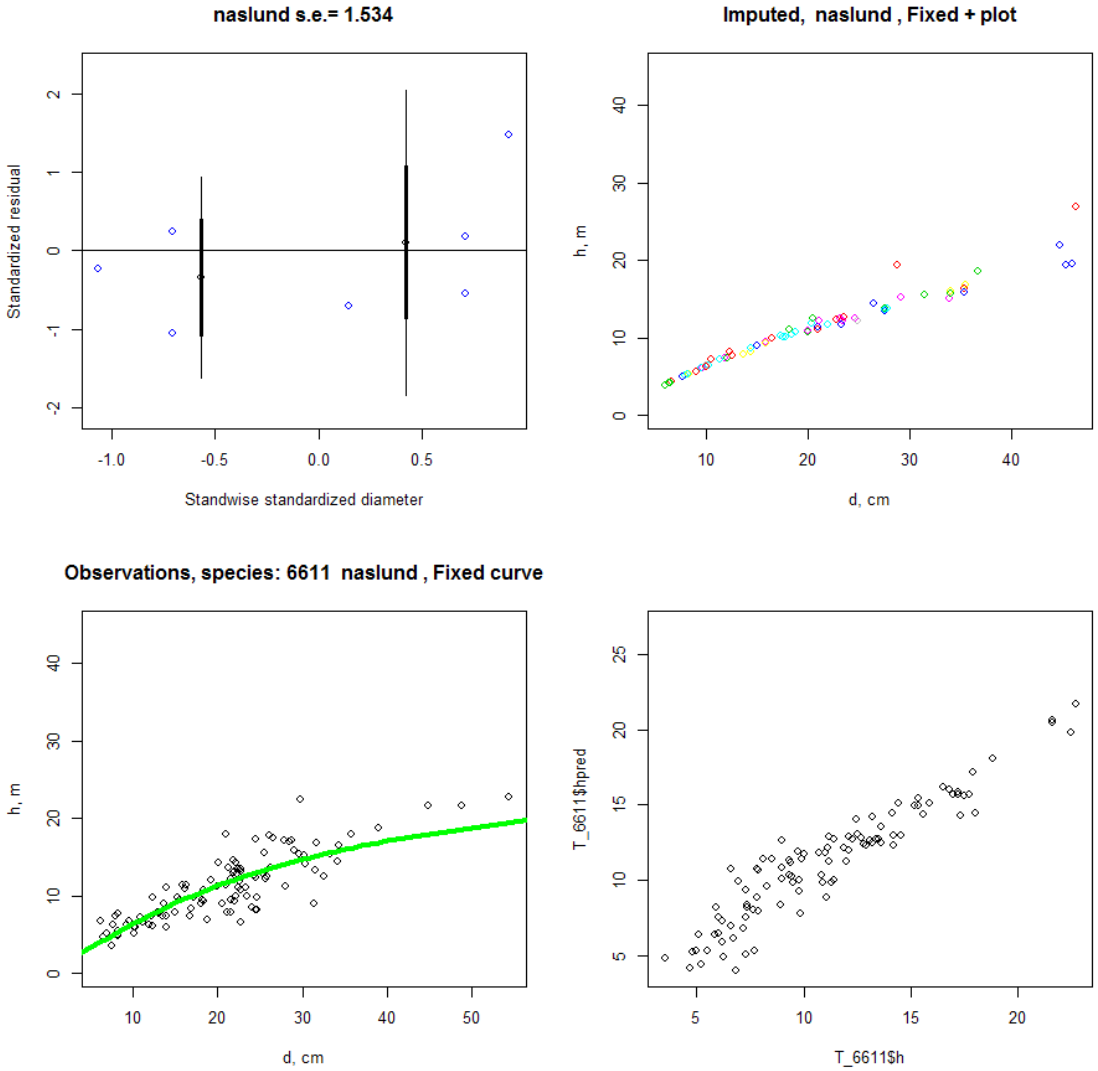




Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Species: *Semecarpus anacardium*
Local name: Bhalayo, Bhela, Kumbha, Kage Bhalayo
FRA database code: 6611
Model = Naslund
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

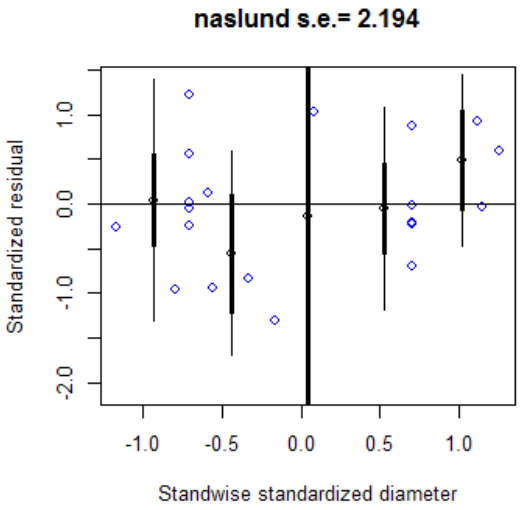
Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.574769 b=0.187479	s.e.=1.534 Adj. R^2=0.87 (for mixed model only) F-statistic: 727.8 on 1 and 102 DF, p-value: < 2.2e-16 Residuals: min= -2.09 Q1=-0.65 med=- 0.040 Q3=0.39 max= 2.35

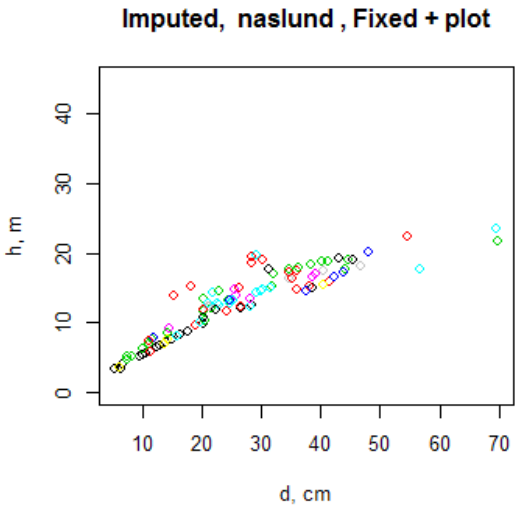


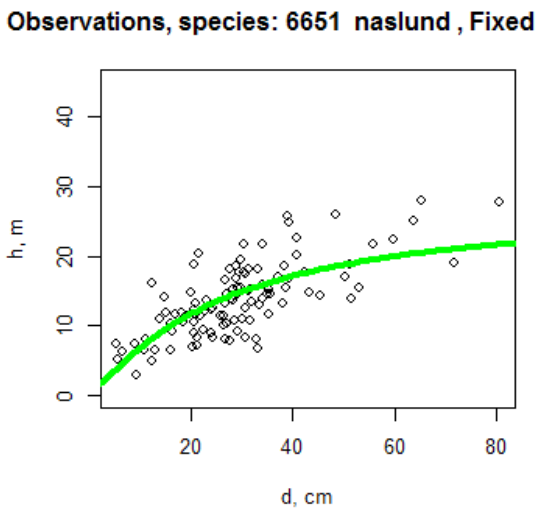
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

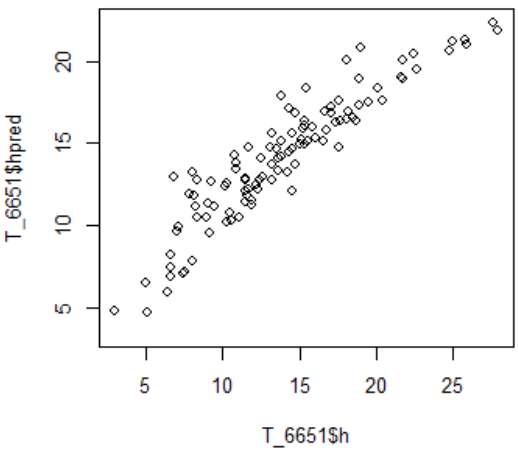
Species: *Syzygium cumini*
Local name: Jamun, Jamuno
FRA database code: 6651
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.3078842 b=0.1929505	s.e.=2.194 Adj. R^2=0.85 (for mixed model only) F-statistic: 629.2 on 1 and 106 DF, p-value: < 2.2e-16 Residuals: min= -2.11 Q1=-0.65 med= -0.063 Q3=0.38 max= 1.39





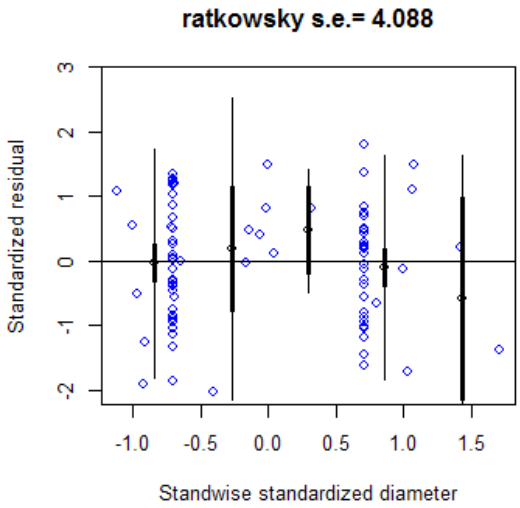


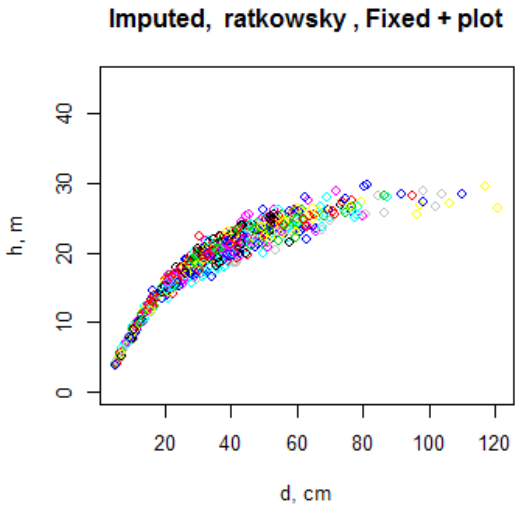


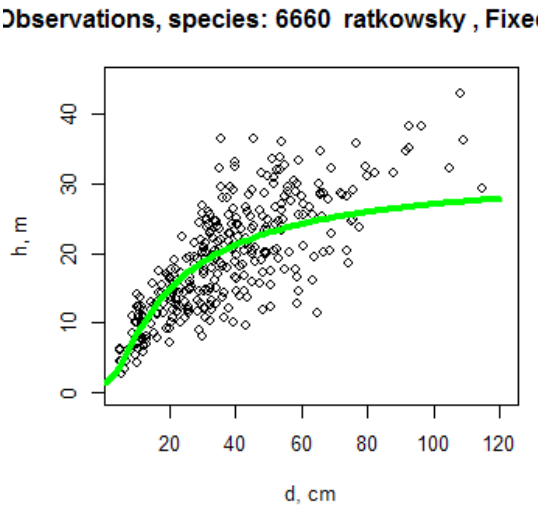
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

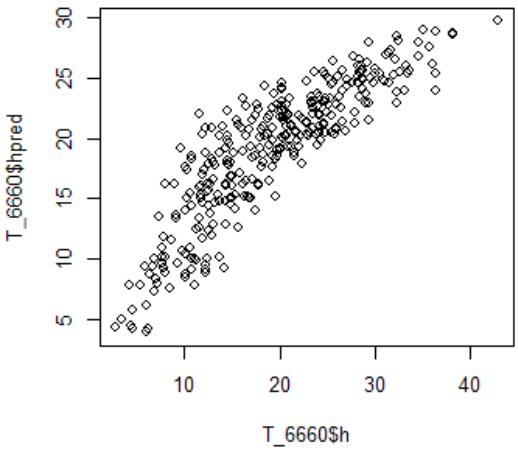
Species: *Terminalia alata*
Local name: Asna, Saaj, Yasal
FRA database code: 6660
Model = Ratkowsky
Equation: $h(d) = bh + a\ exp(-b/(d + c))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=30.935154 b= 18.678794 c= 2.535259	s.e.=4.088 Adj. R^2=0.76 (for mixed model only) F-statistic: 1033 on 1 and 319 DF, p-value: < 2.2e-16 Residuals: min= -2.04 Q1=-0.66 med=0.06 Q3=0.63 max=2.81





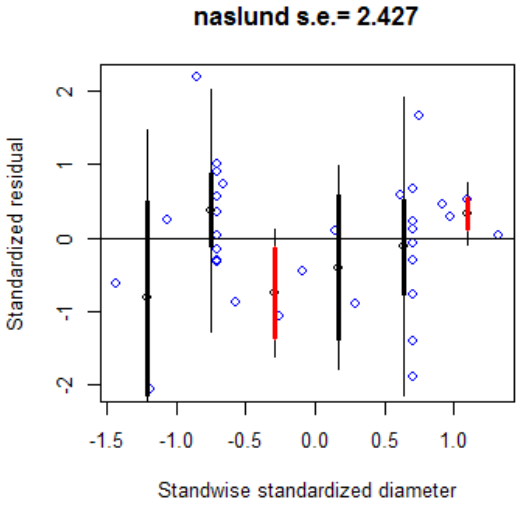


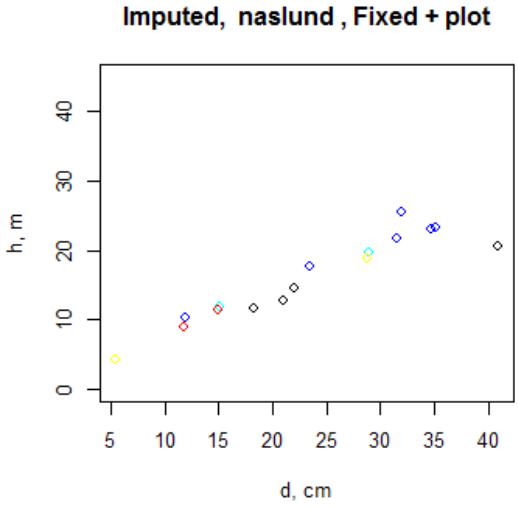


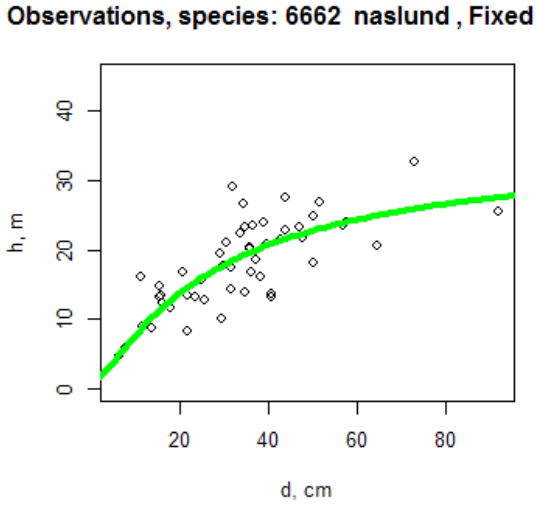
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

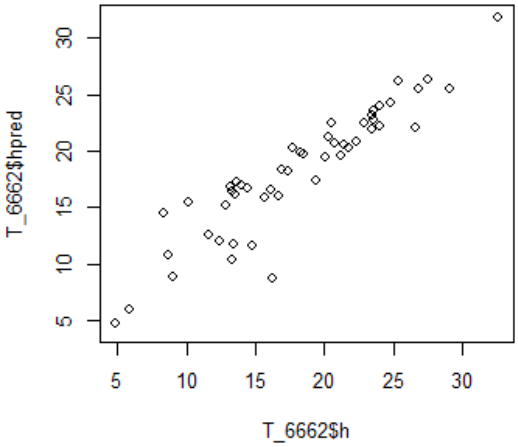
Species: *Terminalia bellirica*
Local name: Barro, Barai, Bahera
FRA database code: 6662
Model = Naslund
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a= 2.2322669 b= 0.1709499	s.e.=2.427 Adj. R^2=0.85 (for mixed model only) F-statistic: 270.4 on 1 and 48 DF, p-value: < 2.2e-16 Residuals: min= -2.06 Q1=-0.60 med=0.03 Q3=0.49 max=2.19





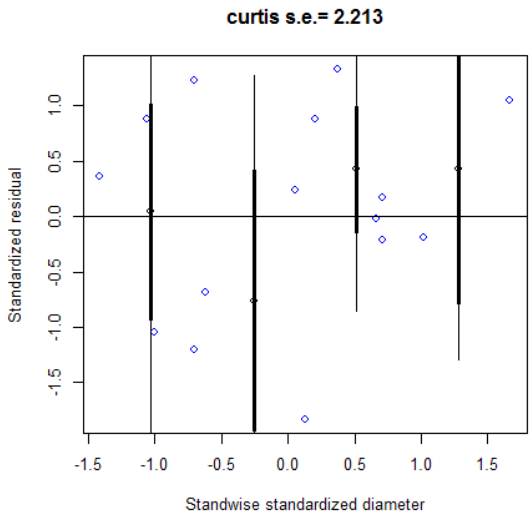


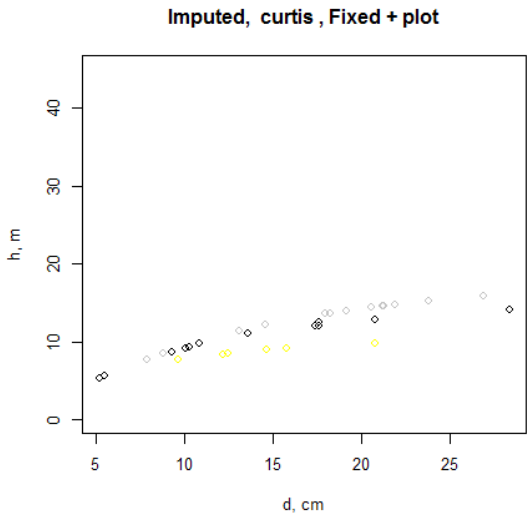


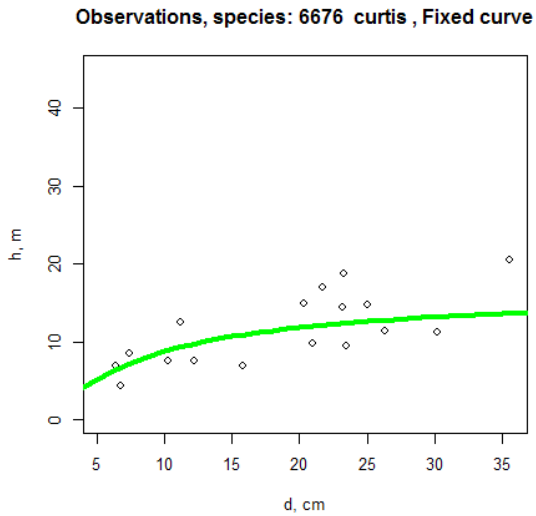
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

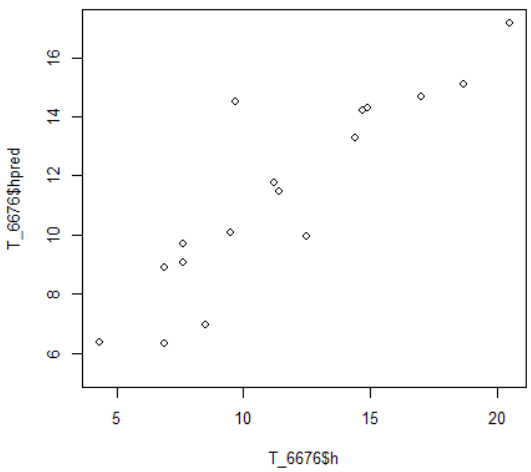
Species: *Trewia nudiflora*
Local name: Bhelor, Gutel, Pitha, Ramrittha
FRA database code: 6676
Model = Curtis
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=15.133094 b=7.442621	s.e.=2.213 Adj. R^2=0.78 (for mixed model only) F-statistic: 57.48 on 1 and 15 DF, p-value: 1.657e-06 Residuals: min= -1.83 Q1=-0.68 med=0.17 Q3=0.87 max=1.33









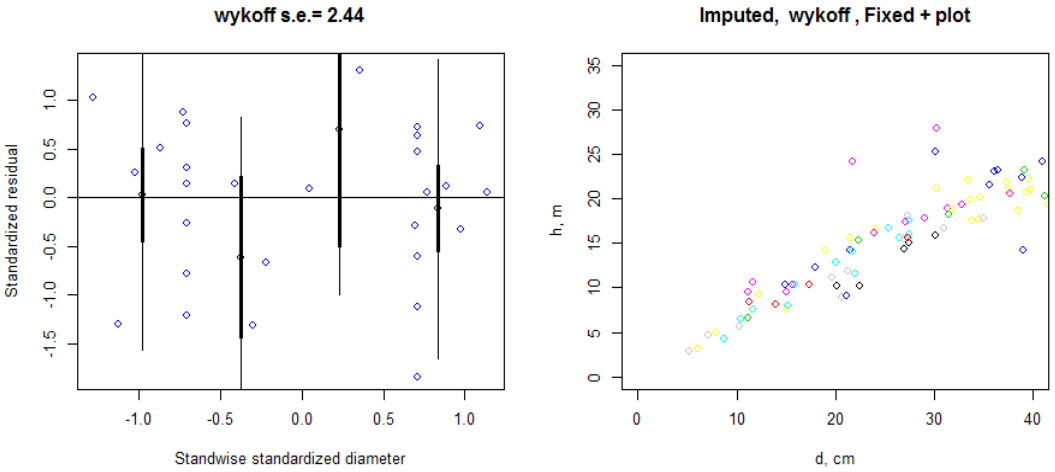
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

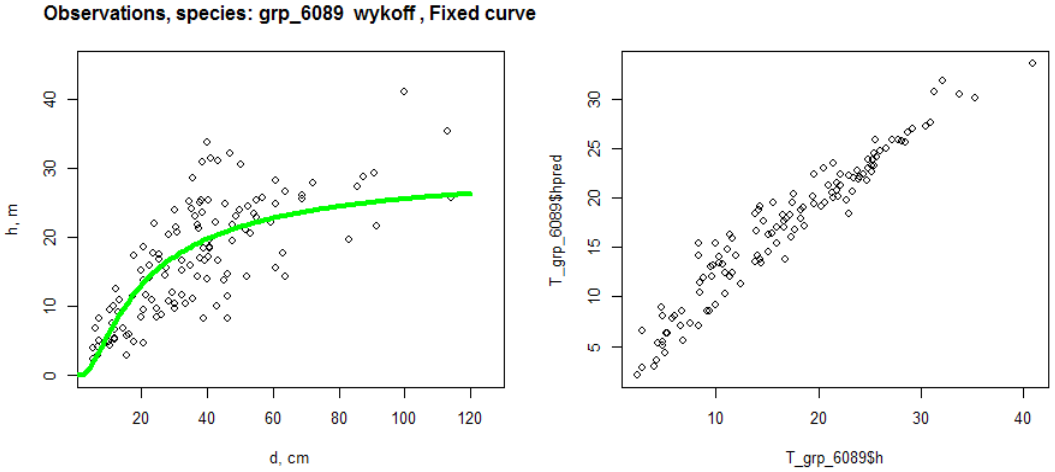
Group 1

Scientific name	Local name	code
Anthocephalus chinensis	Kadam	6114
Aporusa octandra	Hade	6115
Alnus nepalensis	Uttis	6106
Diospyros malabarica	Allo, KaloTendu, Teju	6256
Ficus religiosa	Pipal, Pipar	6323
Ficus racemosa	Pakar, Dumri, Dumari	6322
Ficus lacor	Kabhro, Pakadi	6316
Ficus benjamina	Sami, Swami	6308

Model = Wykoff (grp_6089)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.413974 b=-17.683269	s.e.=2.44 Adj. R^2=0.93 (for mixed model only) F-statistic: 1583 on 1 and 121 DF, p- value: < 2.2e-16 Residuals: min= -1.84 Q1=-0.59 med= 0.07 Q3=0.41 max=1.36





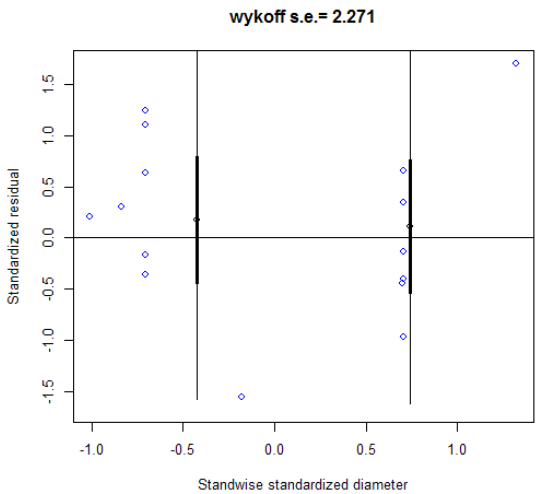
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

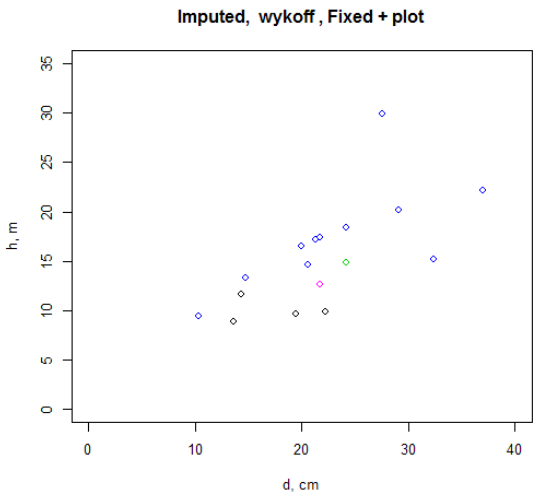
Group 2

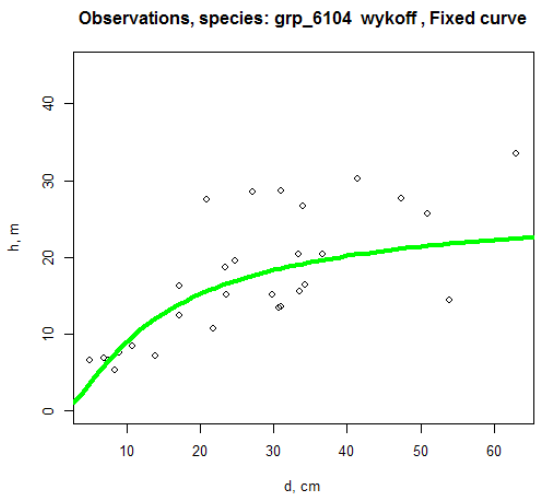
Scientific name	Local name	code
Albizia odoratissima	Karkur, Sirish, Siran, Padke, KarkureSiris	6103
Albizia procera	Seto Siris	6104
Albizia lebbeck	Kalo Siris	6105
Grevillea robusta	Kagiyo, KagiyoRukh	6339
Albizia chinensis	Kalo Siris	6098

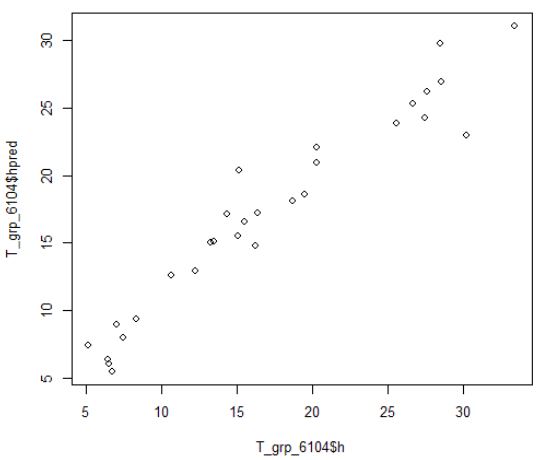
Model = Wykoff (grp_6104)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.30016 b=-12.17665	s.e.=2.271 Adj. R^2=0.93 (for mixed model only) F-statistic: 384.5 on 1 and 27 DF, p-value: < 2.2e-16 Residuals: min= -1.67 Q1=-0.47 med= -0.17 Q3=0.39 max=1.70









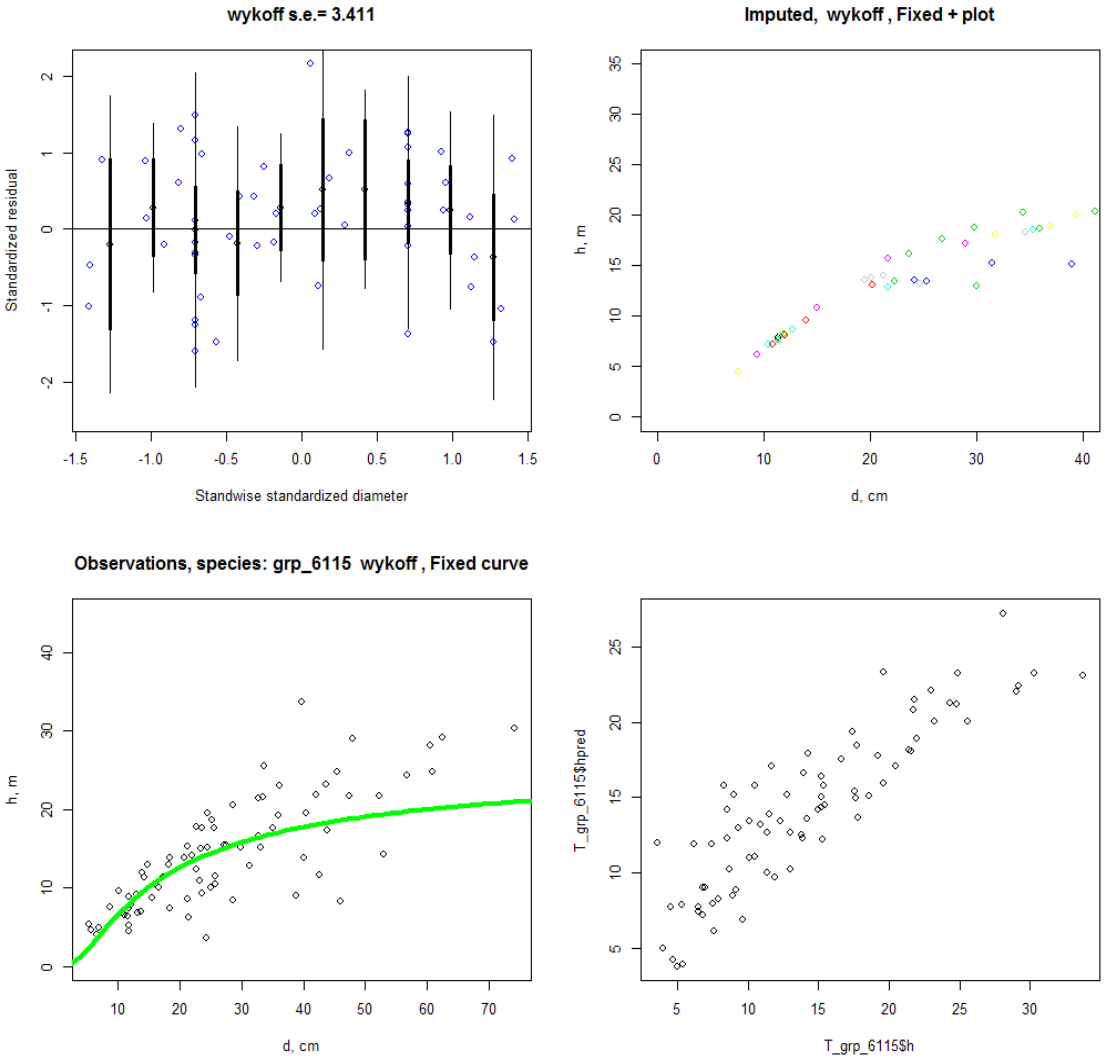
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

Group 3

Scientific name	Local name	code
Madhuca latifolia	Latimauwa, Mahuwa	6411
Duabanga grandiflora	Lampate, Odhane	6263
Erythrina stricta	Parijat, Phaledo	6287
Alstonia scholaris	Chalamain, Chativan	6109

Model = Wykoff (grp_6115)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.23742 b=-14.69093	s.e.=3.411 Adj. R^2=0.78 (for mixed model only) F-statistic: 287.2 on 1 and 77 DF, p-value: < 2.2e-16 Residuals: min= -2.46 Q1=-0.63 med= 0.11 Q3=0.64 max=2.16



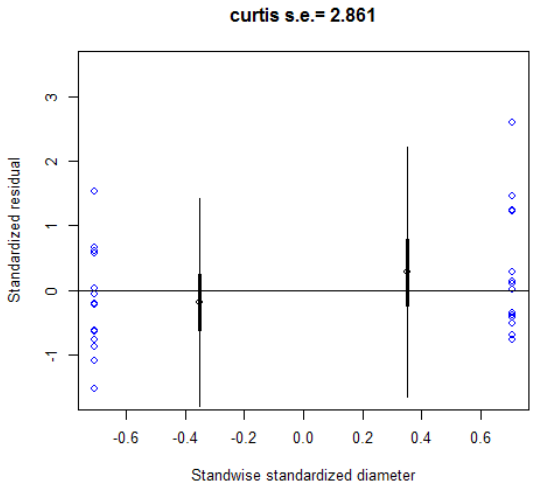
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

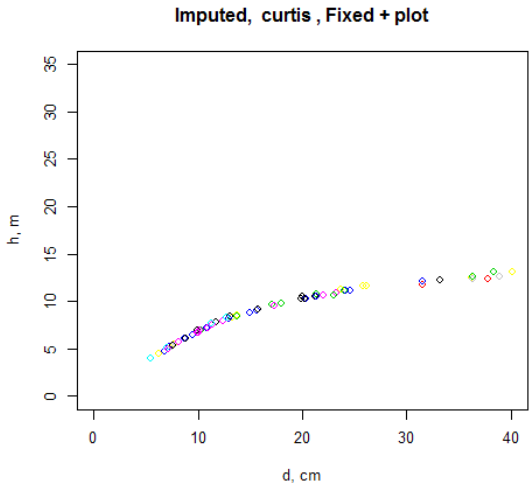
Group 4

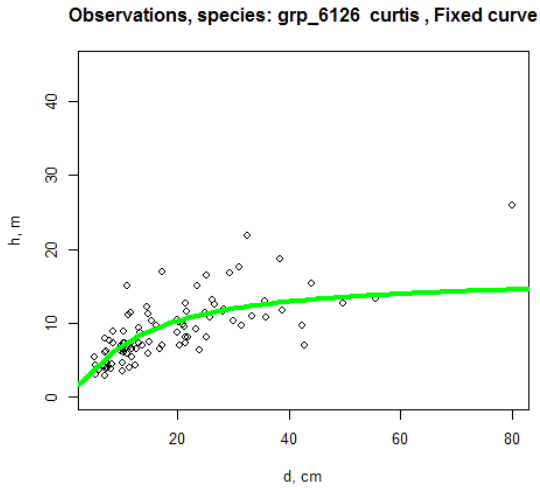
Scientific name	Local name	code
Bauhinia variegata	Koiralo, SetoKoiralo	6131
Mitragyna parviflora	Tikul, Sano Haldu	6448
Bauhinia purpurea	Tanki, RatoKoiralo	6127
Myrica esculenta	Kaphal, Kawasi	6456
Cornus oblonga	Latikath	6221
Aegle marmelos	Bel, Belpatra	6090
Phoebe lanceolata	Jhakri, Jhakri Kath	6499

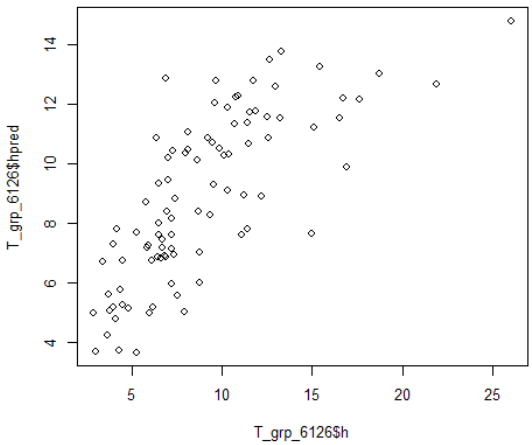
Model = Curtis (grp_6126)
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=15.05745 b= 10.59044	s.e.=2.861 Adj. R^2=0.55 (for mixed model only) F-statistic: 114.5 on 1 and 90 DF, p-value: < 2.2e-16 Residuals: min= -1.64 Q1=-0.64 med= -0.199 Q3=0.48 max=3.50









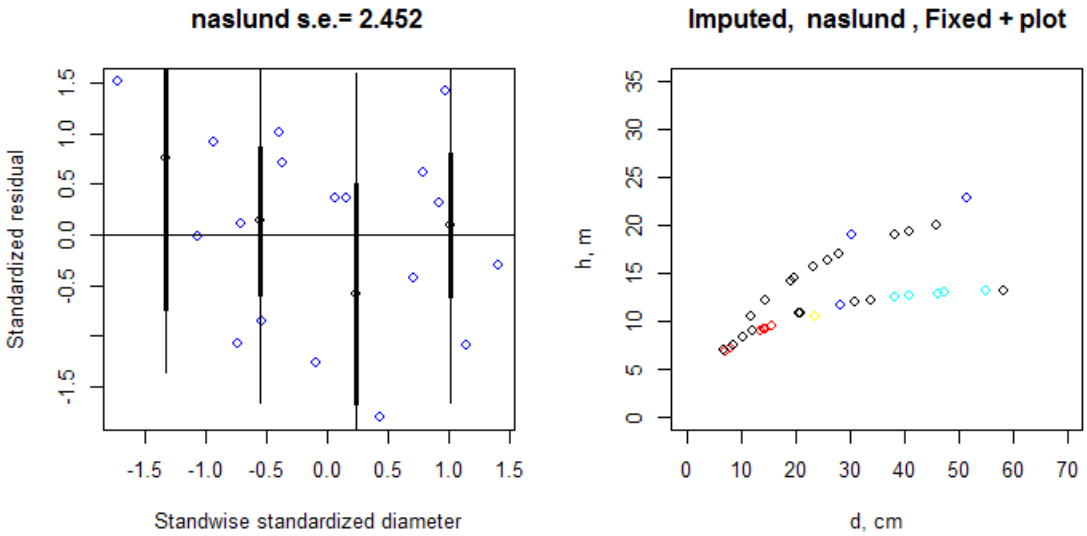
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

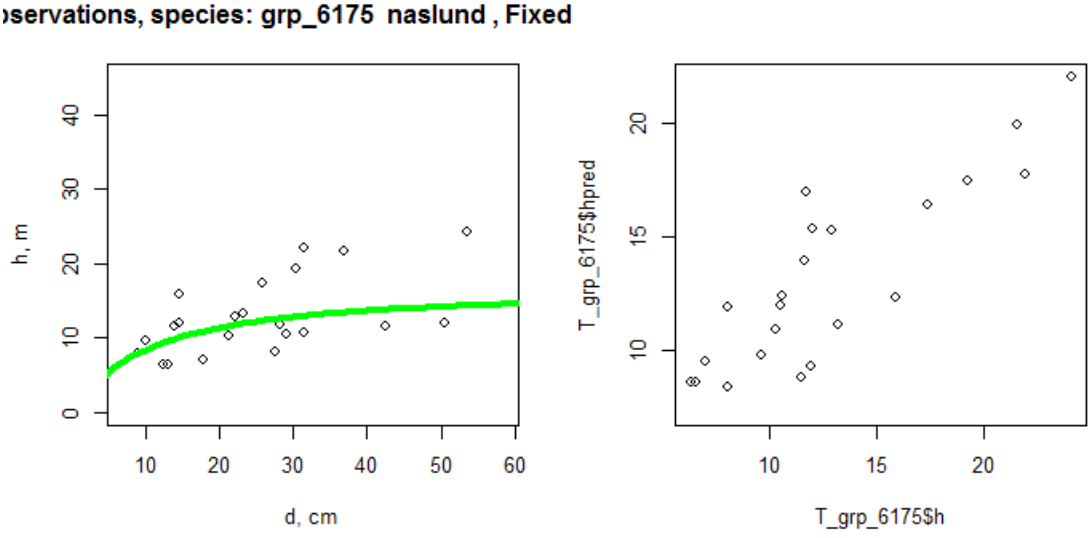
Group 5

Scientific name	Local name	code
Castanopsis lancifolia	AauleKatus, PatleKatus	6176
Saraca asoca	Ashok, Asau	6603

Model = Naslund (grp_6175)
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.2008685 b=0.2547602	s.e.=2.452 Adj. R^2=0.73 (for mixed model only) F-statistic: 58.3 on 1 and 20 DF, p-value: 2.379e-07 Residuals: min= -1.80 Q1= -0.75 med= -0.16 Q3=0.55 max=1.51





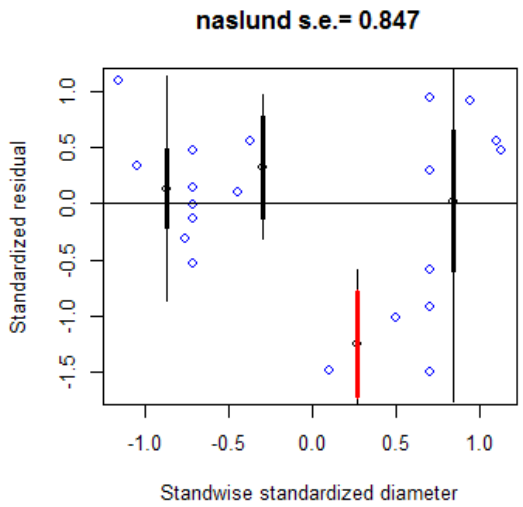
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

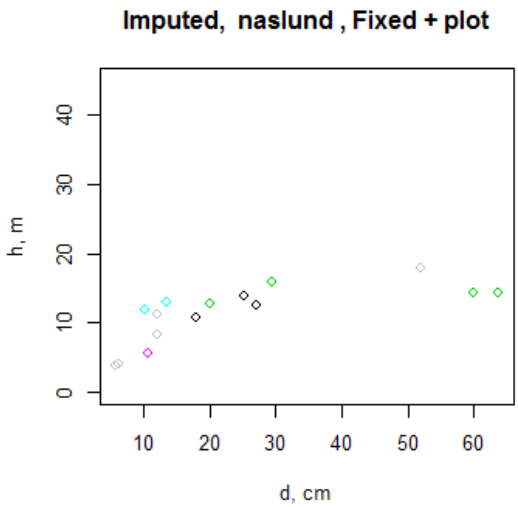
Group 6

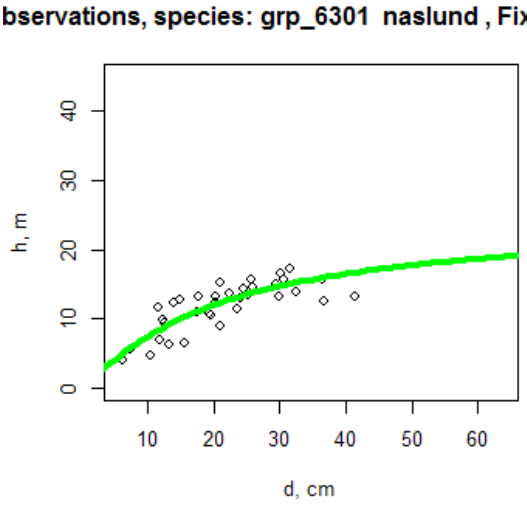
Scientific name	Local name	code
Feronia limonia	AmiloBel, Kaitho	6301
Bridelia retusa	Gayo, Kaja	6144
Xylosma longifolium	Chirauda, Dade kanda	6698
Leucaena leucocephala	Ipillpil	5447
Stereospermum chelonoides	KuberKach, Pandari	6638

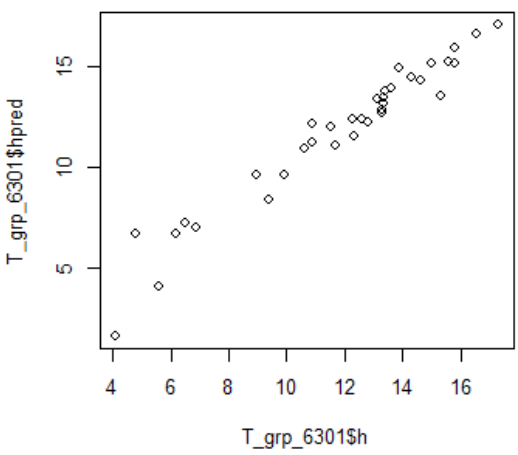
Model = Naslund (grp_6301)
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.9498989 b=0.2075037	s.e.=0.847 Adj. R^2=0.94 (for mixed model only) F-statistic: 579.4 on 1 and 33 DF, p-value: < 2.2e-16 Residuals: min= -1.68 Q1=-0.54 med= 0.096 Q3=0.44 max=1.10









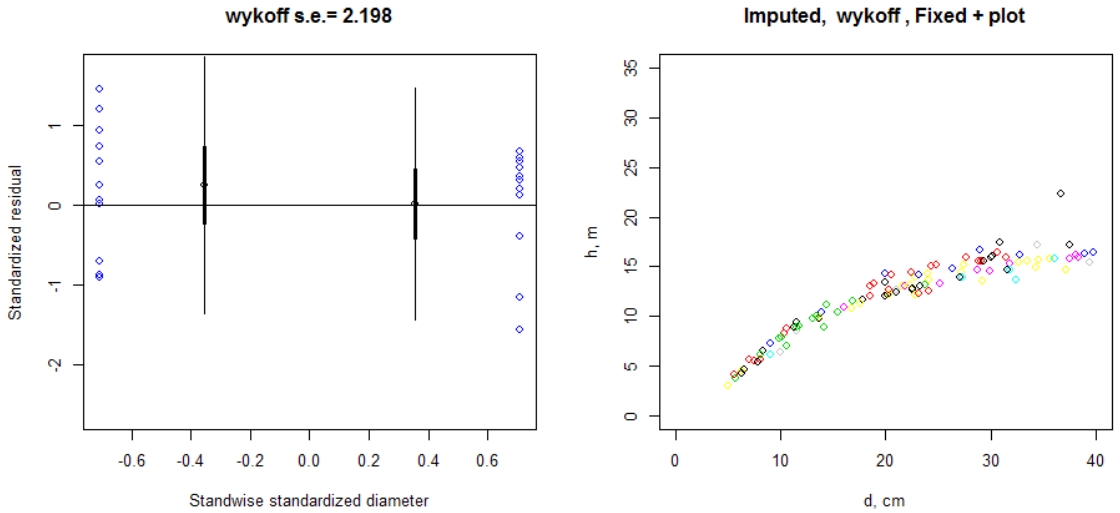
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

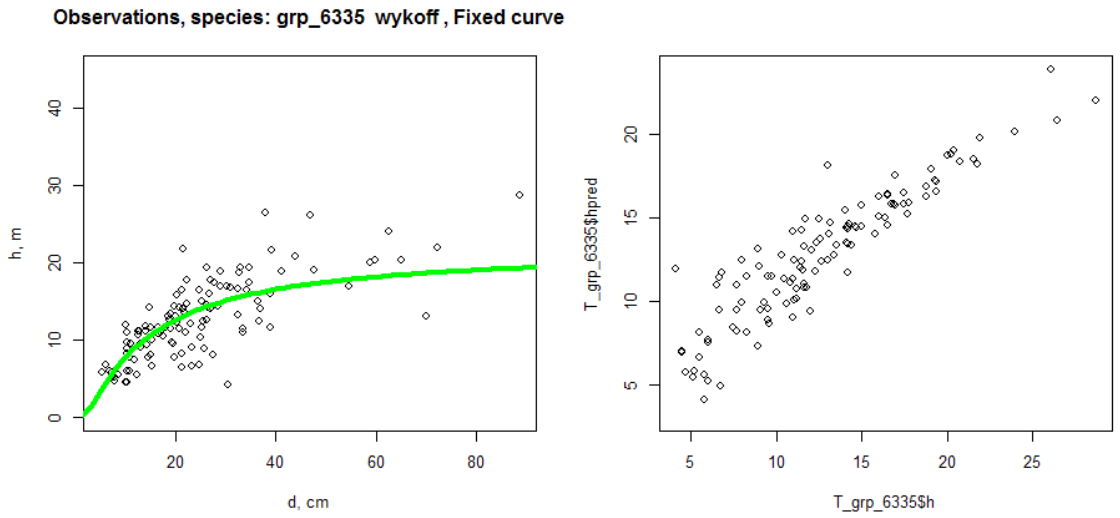
Group 7

Scientific name	Local name	code
Aesandra butyracea	Chiuri, Mahuwa	6091
Pyrus pashia	Mayal, Pana	6556
Bischofia javanica	Kainjal, Adhikrini	6137
Xeromphis spinosa	Main Phal, Maidal	6695
Stereospermum personatum	Padari, KuberKacha	6639
Saurauia napaulensis	Gogan, Ratendu	6605
Tamarindus indica	Imili, Titri	6655

Model = Wykoff (grp_6335)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.088643 b=-11.584409	s.e.=2.198 Adj. R^2=0.84 (for mixed model only) F-statistic: 618.3 on 1 and 115 DF, p-value: < 2.2e-16 Residuals: min= -2.64 Q1=-0.51 med=0.06 Q3=0.49 max=1.72





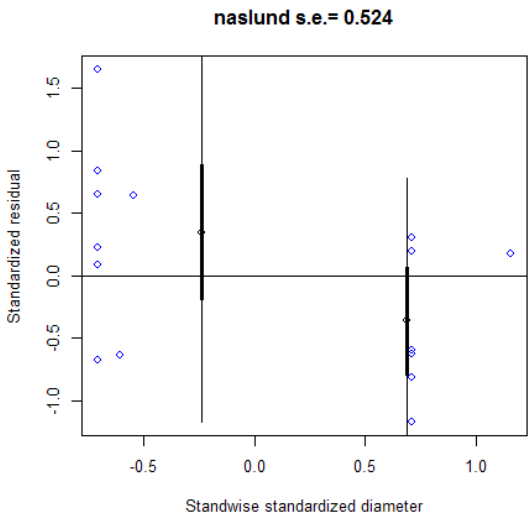
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

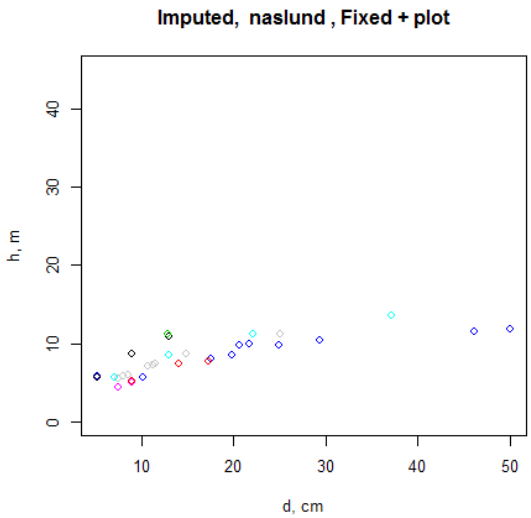
Group 8

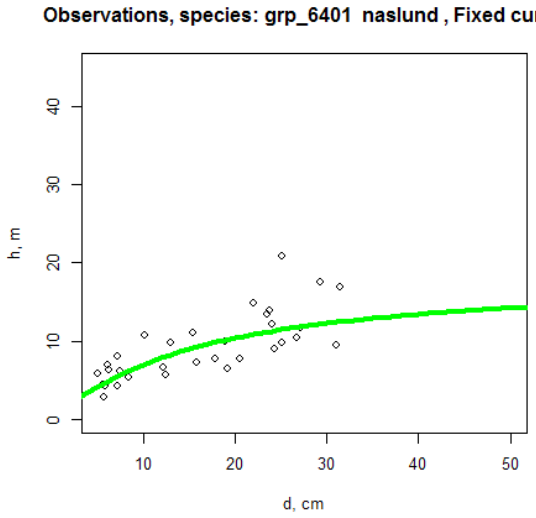
Scientific name	Local name	code
Trichilia connaroides	Chaichunge, Aankhataruwa	6677
Spondias pinnata	Amaro, Yamar	6632
Terminalia chebula	Harro	6664
Lyonia ovalifolia	Angeri	6405
Castanopsis tribuloides	Musure katus	6177

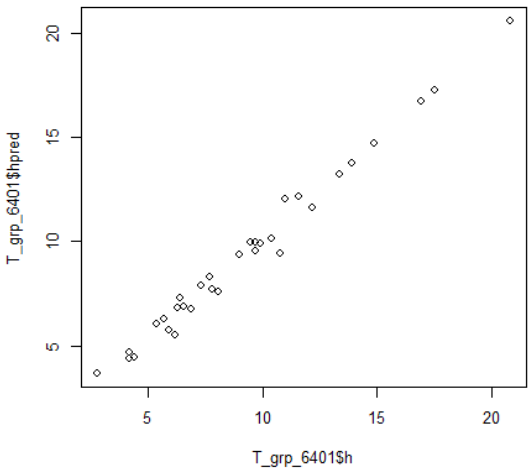
Model = Naslund (grp_6401)
Equation: $h(d) = bh + d^2/(a + b\,d)^2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.7673866 b=0.2431112	s.e.=0.524 Adj. R^2=0.98 (for mixed model only) F-statistic: 2083 on 1 and 30 DF, p-value: < 2.2e-16 Residuals: min= -1.17 Q1=-0.60 med=-0.04 Q3=0.22 max=1.65









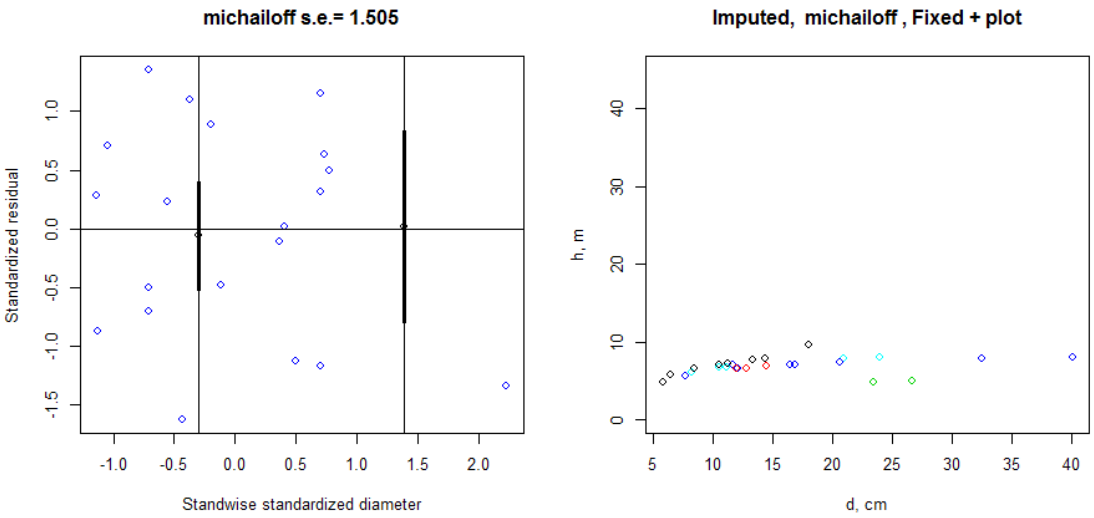
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

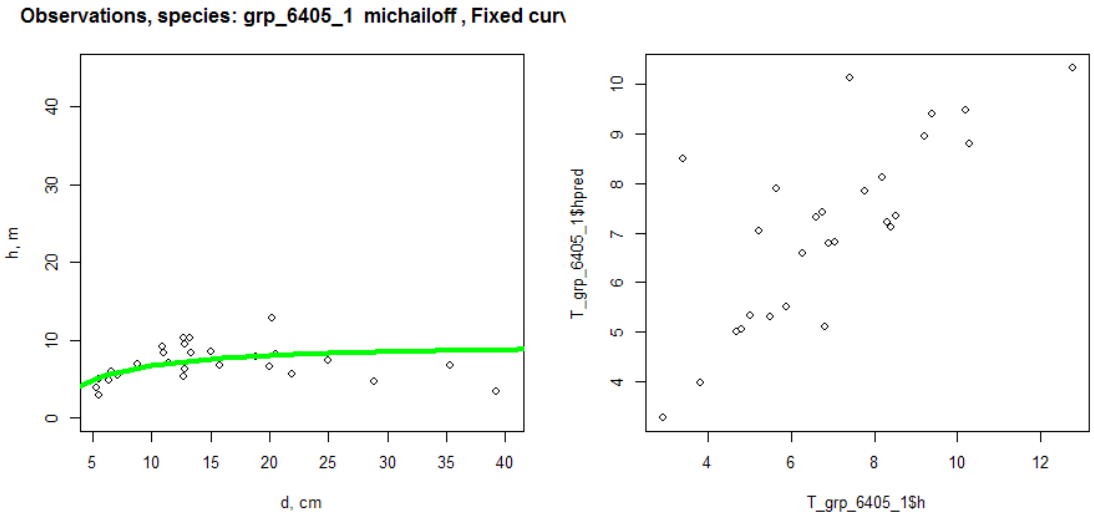
Group 9

Scientific name	Local name	code
Psidium guajava	Amba, belauti	6548
Prunus persica	Aaru, Aadu, Khale	6541
Wendlandia puberula	Kainyu, Ban Kanyau	6694
Boehmeria rugulosa	Daar, Getha	4951
Ficus auriculata	Nibharo, Nimaro	6306
Ehretia macrophylla	Lodo	6270

Model = Michailoff (grp_6405_1)
Equation: $h(d) = bh + a\, e^{(-b\, d^{(-1)})}$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a= 8.255740 b= 4.238689	s.e.=1.505 Adj. R^2=0.55 (for mixed model only) F-statistic: 33.17 on 1 and 25 DF, p-value: 5.301e-06 Residuals: min= -1.62 Q1=-0.49 med=0.014 Q3=0.57 max=1.35





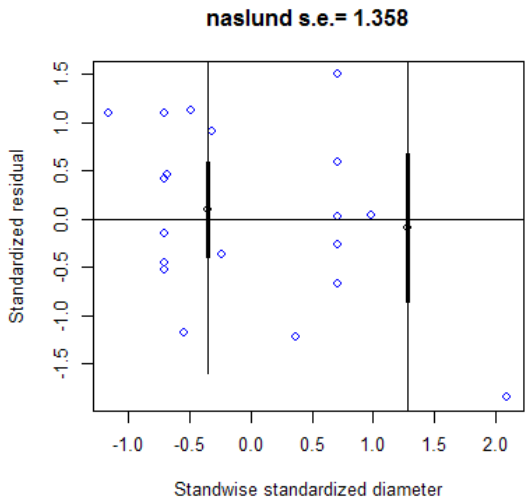
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

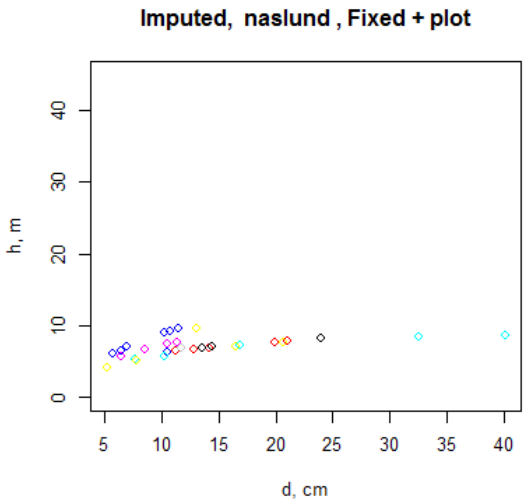
Group 10

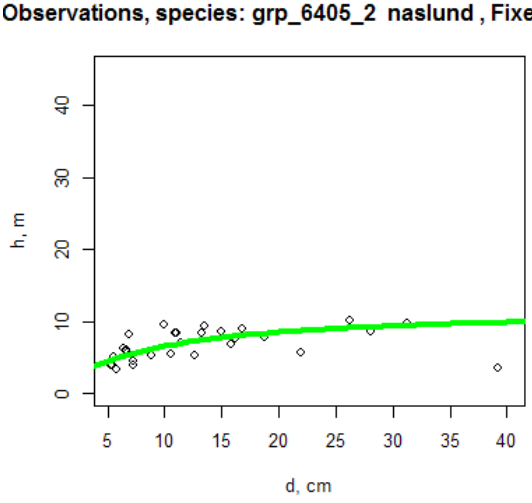
Scientific name	Local name	code
Woodfordia fruticosa	Dhaiyaro, Dhayaro	6039
Rhododendron arboreurn	LaliGuras, Guras	6573
Zizyphus mauritiana	Bayar, Bayari	6701
Zizyphus rugosa	Kanta Bayar, RukhBayari, Phander	6702
Moringa oleifera	Shovanjan, Sahijan	6455

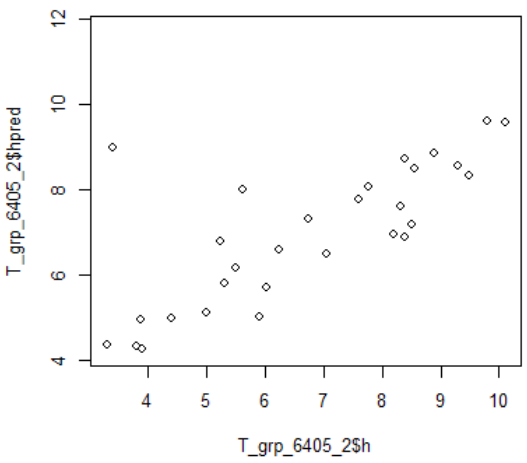
Model = Naslund (grp_6405_2)
Equation: $h(d) = bh + d\text{^}2/(a + b\,d)\text{^}2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.2544455 b=0.3105645	s.e.=1.358 Adj. R^2=0.56 (for mixed model only) F-statistic: 37.27 on 1 and 27 DF, p-value: 1.607e-06 Residuals: min= -1.85 Q1=-0.59 med=-0.15 Q3=0.46 max=1.50









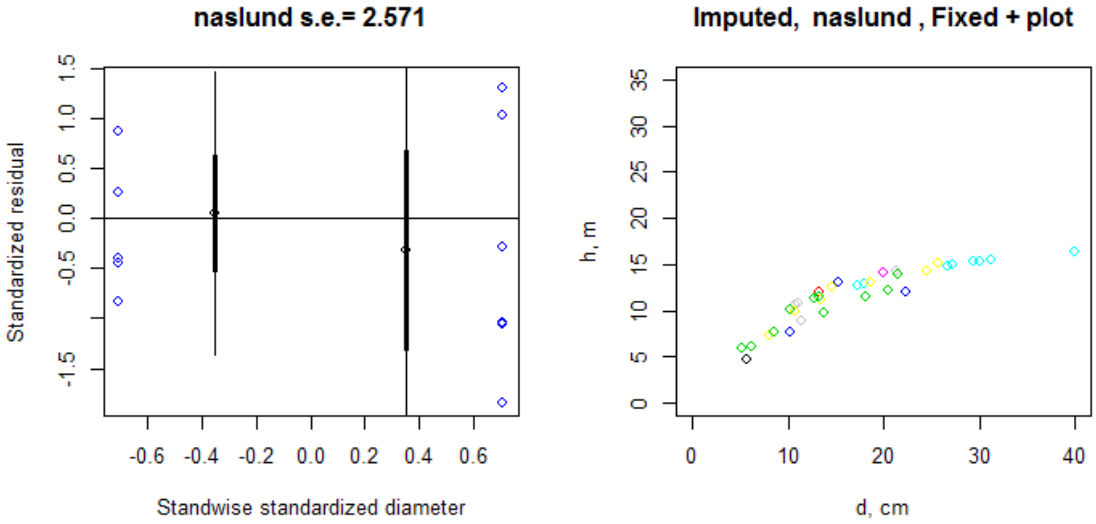
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

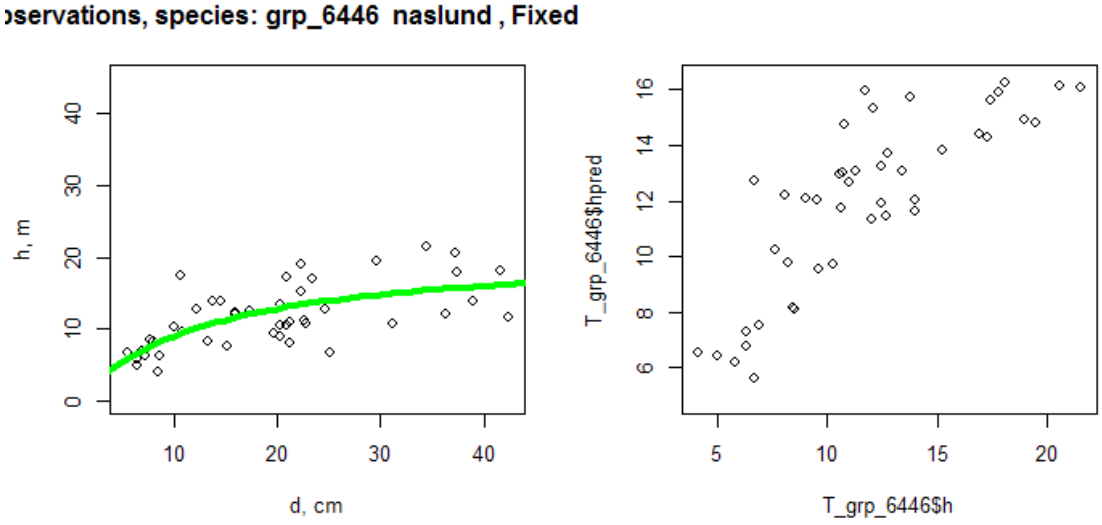
Group 11

Scientific name	Local name	code
Gmelina arborea	Khamari, Gamhari	6337
Ehretia laevis	Datrung, Datingal	6269
Sapindus mukorossi	Rittha	6599
Ehretia acuminata	Dhatrung, Nalsuna	6267

Model = Naslund (grp_6446)
Equation: $h(d) = bh + d\text{^}2/(a + b\,d)\text{^}2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a= 1.3207310 b= 0.2278702	s.e.=2.571 Adj. R^2=0.67 (for mixed model only) F-statistic: 89.39 on 1 and 42 DF, p-value: 5.824e-12 Residuals: min= -1.85 Q1=-0.75 med=-0.29 Q3=0.49 max=1.39





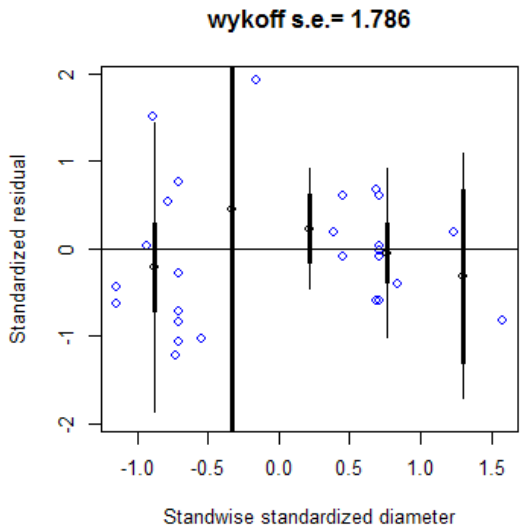
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

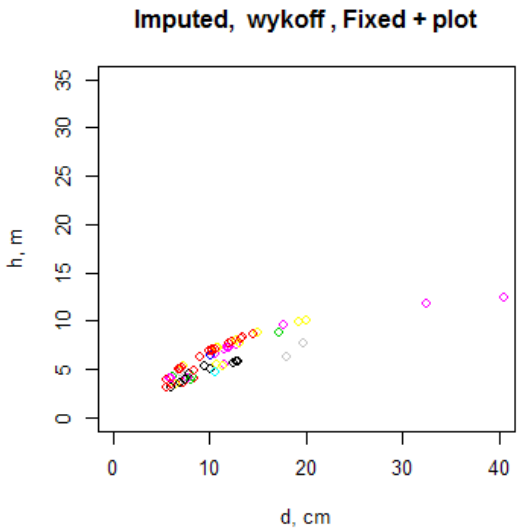
Group 12

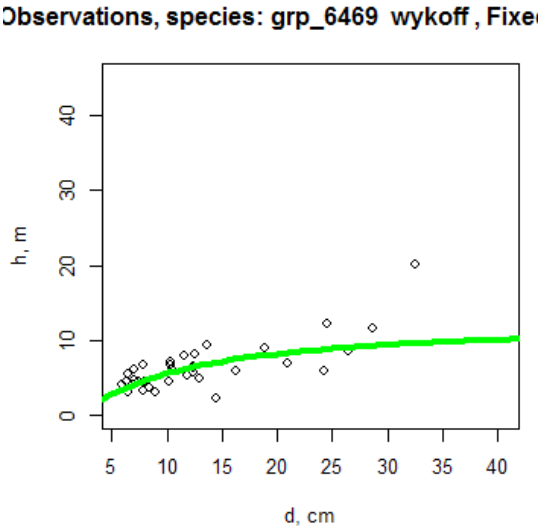
Scientific name	Local name	code
Ficus hispida	Kharseto, Thotne	6315
Ehretia acuminata	Dhatarunga, SetoLoro	6266
Symplocos racemosa	SetiBiraunli	6645
Melia dubia		6429

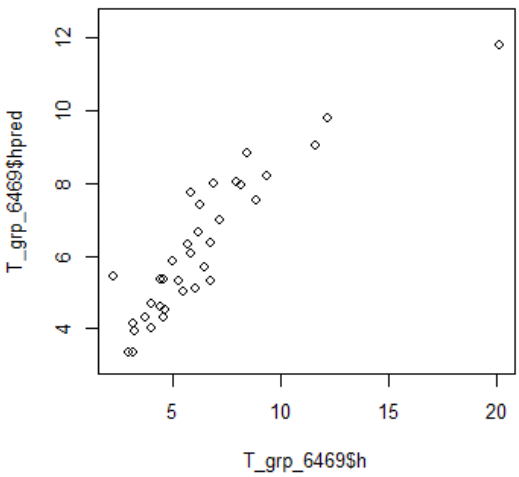
Model = Wykoff (grp_6469)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.524882 b=-8.738399	s.e.=1.786 Adj. R^2=0.79 (for mixed model only) F-statistic: 132.7 on 1 and 33 DF, p-value: 4.173e-13 Residuals: min= -1.93 Q1=-0.60 med=-0.091 Q3=0.57 max=1.93









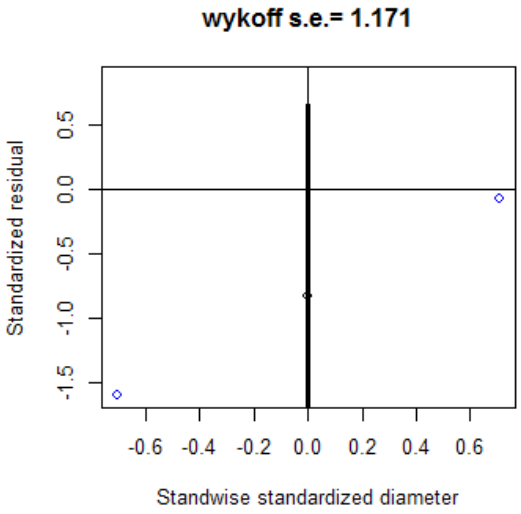
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

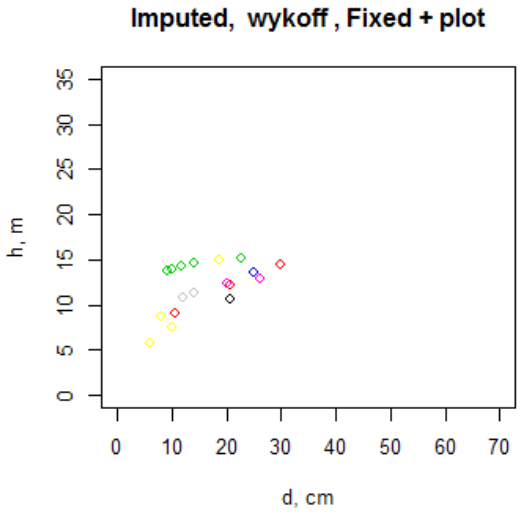
Group 13

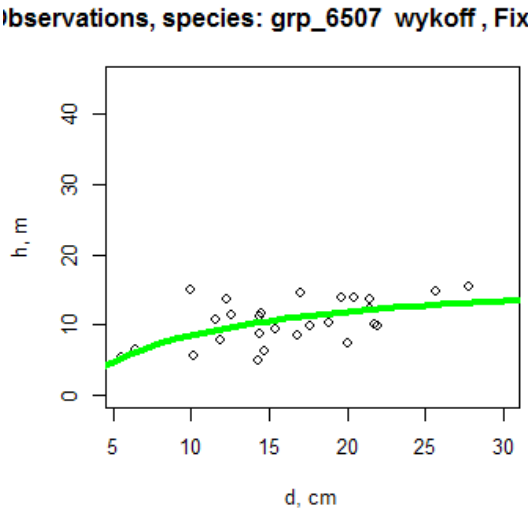
Scientific name	Local name	code
Dalbergia stipulacea	Tantebiri	6240
Neolitsea umbrosa	Putali, Khapate	6465
Streblus asper	Bedula, Kakshi	6641
Cipadessabaccifera	Masgede	5051

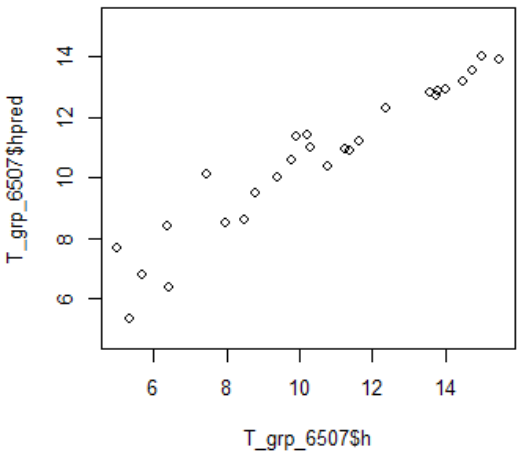
Model = Wykoff (grp_6507)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.837542 b=-7.571907	s.e.=1.171 Adj. R^2=0.90 (for mixed model only) F-statistic: 261.4 on 1 and 25 DF, p-value: 9.521e-15 Residuals: min= -1.59 Q1=-0.43 med=0.041 Q3=0.48 max=0.86









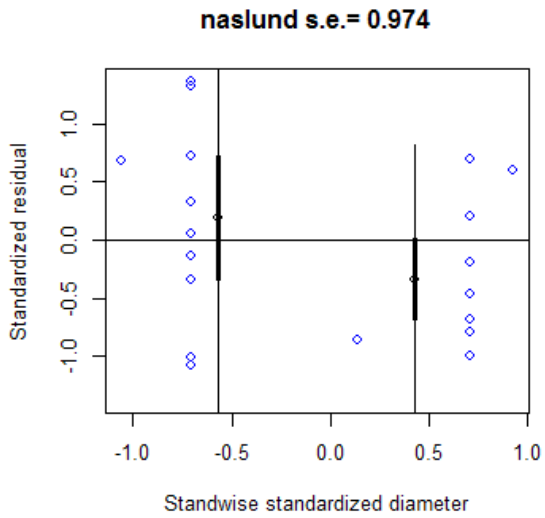
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

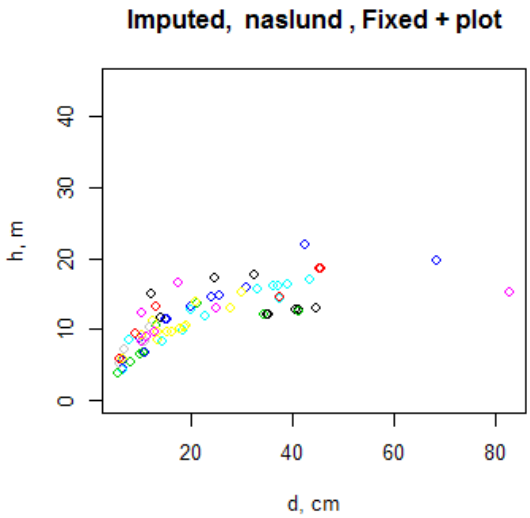
Group 14

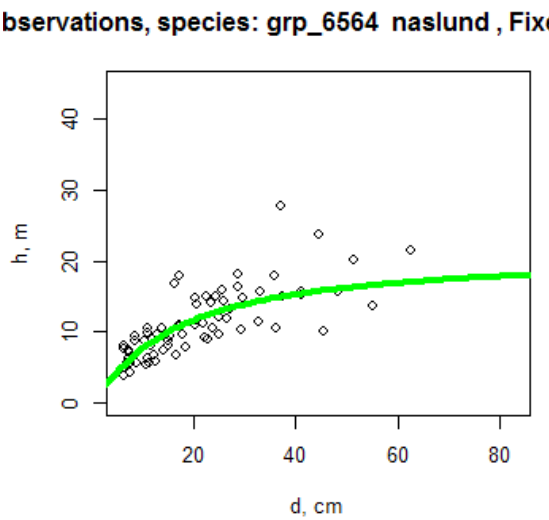
Scientific name	Local name	code
Toona ciliata	Tooni, Tuni	6669
Persea gamblei	Kathe Kaulo	5654

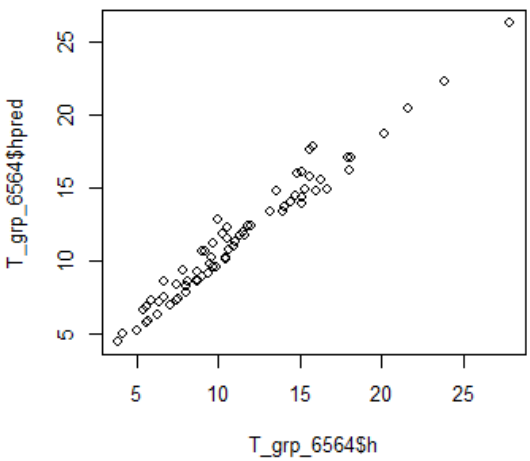
Model = Naslund (grp_6564)
Equation: *h(d) = bh + d^2/(a + b d)^2*

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=1.6812116 b=0.2250429	s.e.=0.974 Adj. R^2=0.96 (for mixed model only) F-statistic: 1797 on 1 and 69 DF, p-value: < 2.2e-16 Residuals: min= -1.38 Q1=-0.66 med=-0.074 Q3=0.29 max=1.37









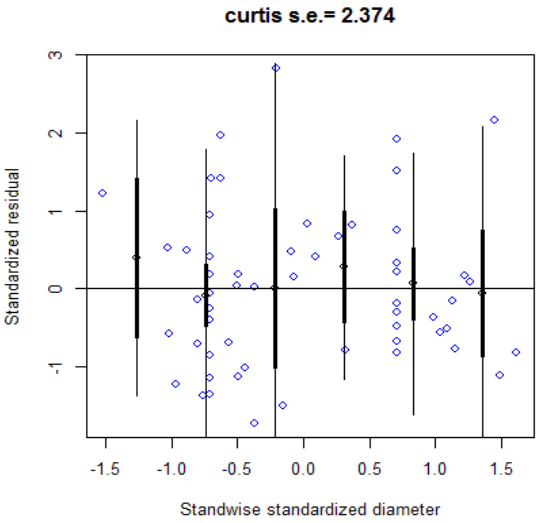
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

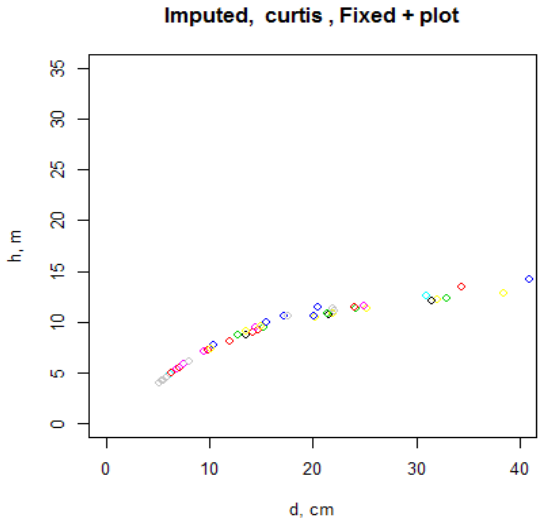
Group 15

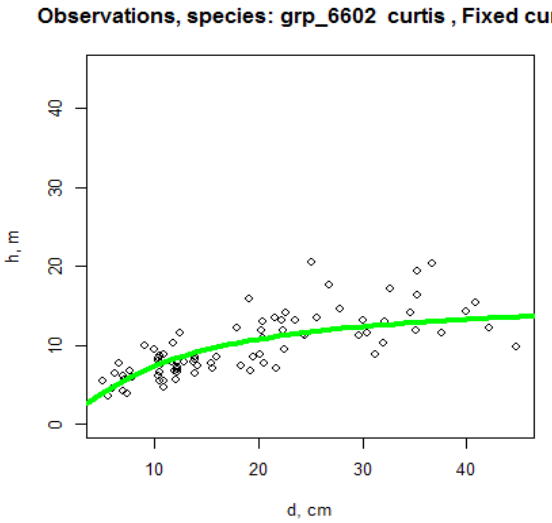
Scientific name	Local name	code	Scientific name	Local name	code
Cassia fistula	Rajbrikshya, Amaltas	6172	*Cinnamomum glanduliferum*	Mareche Malawi	6189
Dalbergia latifolia	Satisal	6235	*Cinnamomum tamala*	Tejpat	6193
Symplocos theifolia	Ghoge, Hakulal	6649	*Betula alnoides*	Saur, Lekh Saur	6134
Acer oblongum	Firfire, PutaliPhool	6075	*Persea duthiei*	Kaulo, MahiloKaulo	6491
Symplocos ramosissima	Kharane, Dabdabe	6646	*Dysoxylum binectariferum*	BauriPhal, Dhamina	6264
Persea odoratissima	Setikaulo	6493	*Holoptelea integrifolia*	Khamari, MethePhal	6345

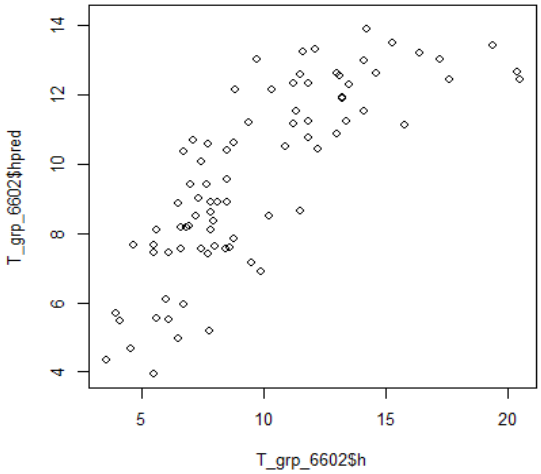
Model = Curtis (grp_6602)
Equation: $h(d) = bh + a\,(d/(1 + d))^{\wedge}b$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=15.221887 b=9.761137	s.e.=2.374 Adj. R^2=0.63 (for mixed model only) F-statistic: 141 on 1 and 80 DF, p-value: < 2.2e-16 Residuals: min= -1.73 Q1=-0.74 med=-0.09 Q3=0.52 max=2.82









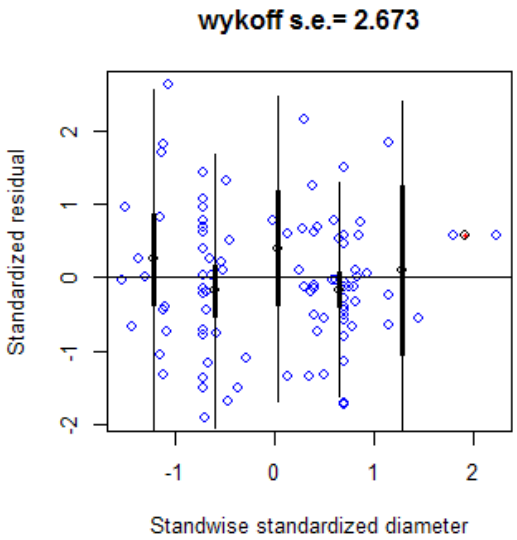
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

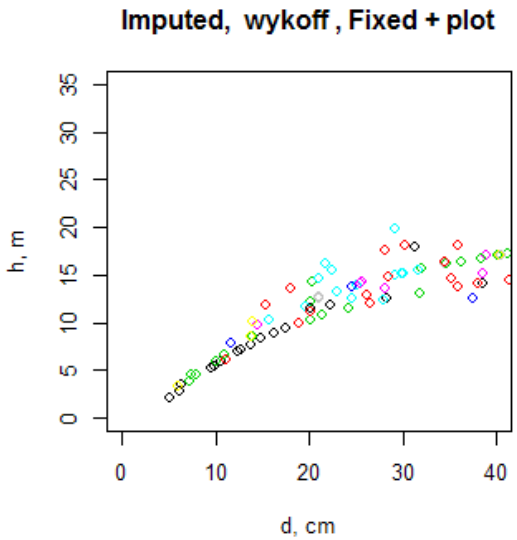
Group 16

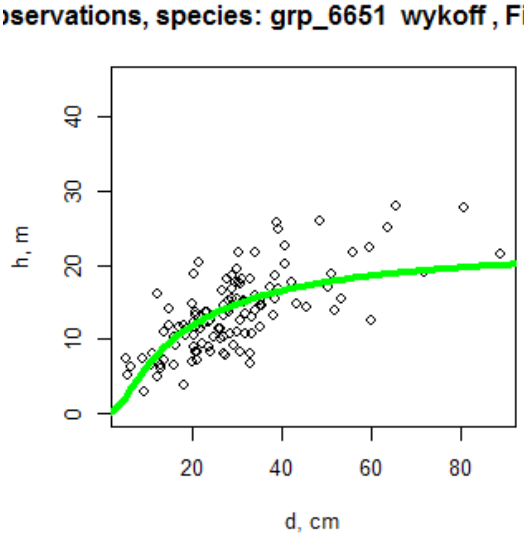
Scientific name	Local name	code
Artocarpus heterophyllus	Katahar	6120
Pterocarpus marsupium	Bijaya Sal	6549
Artocarpus lakoocha	Badahar	6122

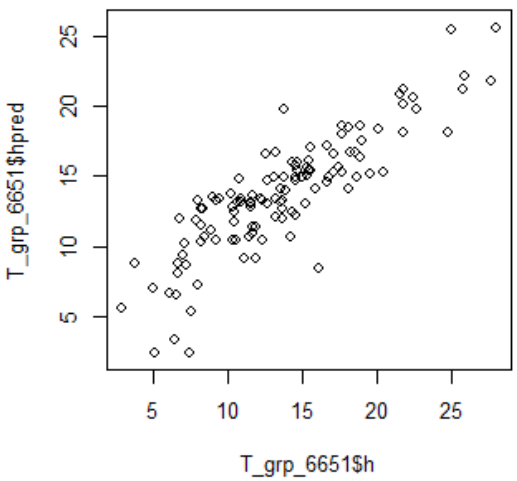
Model = Wykoff (grp_6651)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.153628 b=-14.159027	s.e.=2.673 Adj. R^2=0.74 (for mixed model only) F-statistic: 337.1 on 1 and 115 DF, p-value: < 2.2e-16 Residuals: min= -1.91 Q1=-0.66 med=0.046 Q3=0.58 max=2.63









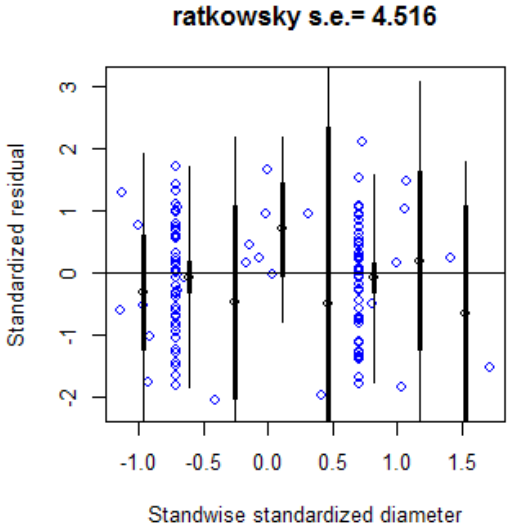
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

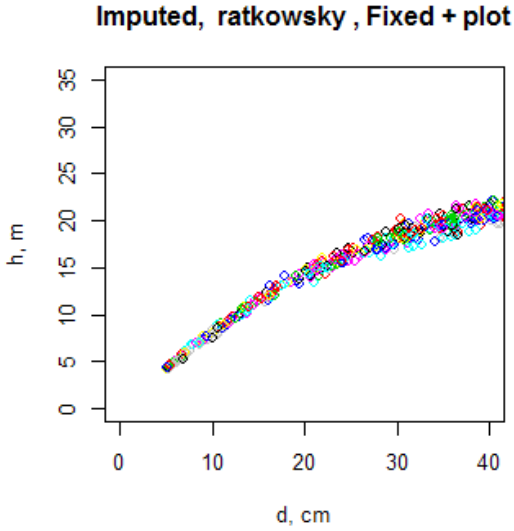
Group 17

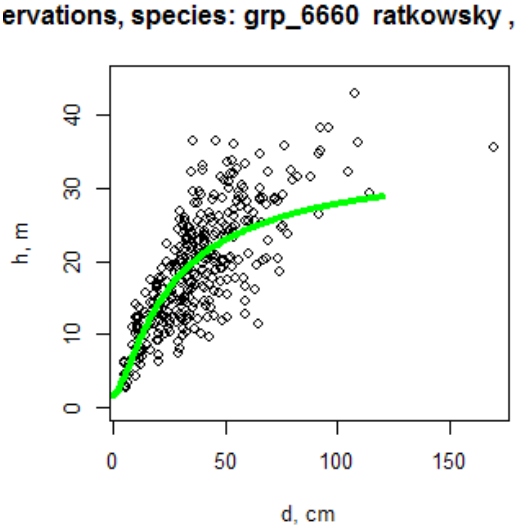
Scientific name	Local name	code
Michelia champaca	Chanp	6437
Mesua ferrea	Nageswar	6435
Pterospermum acerifolium	Hatti Pailo	6551
Michelia excelsa	Seto Chanp	6439

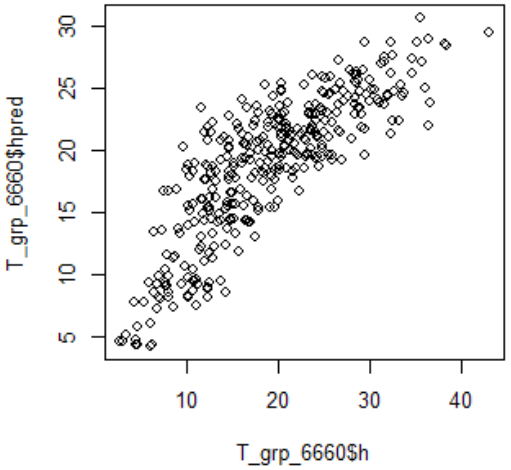
Model = Ratkowsky (grp_6660)
Equation: $h(d) = bh + a\ exp(-b/(d + c))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=33.288628 b=23.452442 c=4.684739	s.e.=4.516 Adj. R^2=0.69 (for mixed model only) F-statistic: 780.5 on 1 and 347 DF, p-value: < 2.2e-16 Residuals: min= -2.19 Q1=-0.72 med=0.044 Q3=0.67 max=3.10









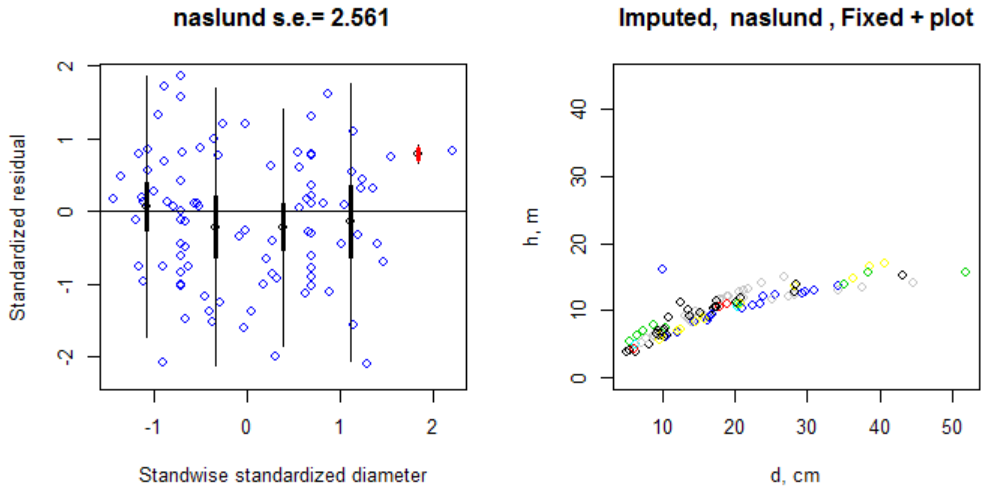
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

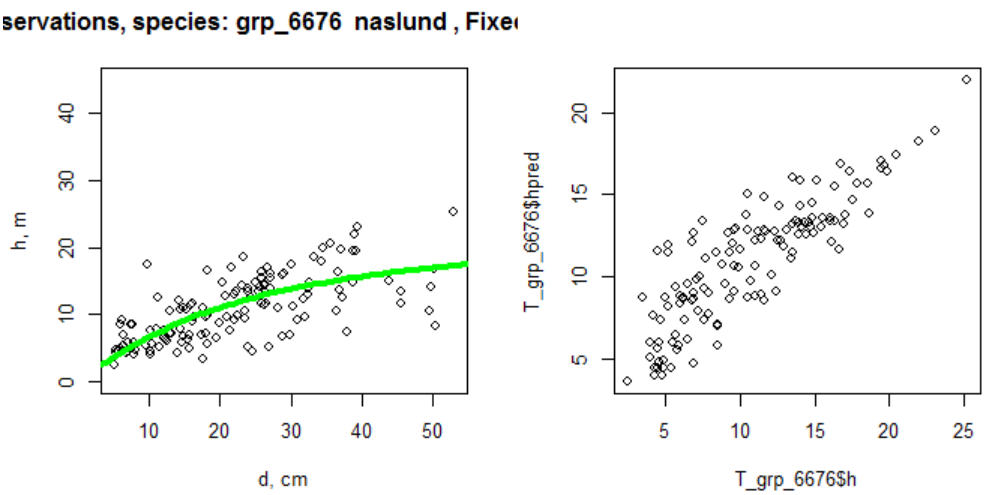
Group 18

Scientific name	Local name	code	Scientific name	Local name	code
Kydia calycina	Kubhinde	6367	*Eurya acuminata*	Jhigane	6296
Ficus semicordata	Khanya	6325	*Ficus neriifolia*	Dudhilo	6317
Sterculia villosa	Odal	6637	*Careya herbacea*	Kumbhi	6160
Cochlospermum religiosum	Kumbhi	6211	*Lagerstroemia reginae*	Asare phool	5421
Cascabela thevetia	Kanail	6167			
Litsea lancifolia		5458	*Ficus glaberrima*		6314

Model = Naslund (grp_6676)
Equation: $h(d) = bh + d\text{^}2/(a + b\ d)\text{^}2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.230720 b=0.207879	s.e.=2.561 Adj. R^2=0.73 (for mixed model only) F-statistic: 355.2 on 1 and 128 DF, p-value: < 2.2e-16 Residuals: min= -2.29 Q1=-0.75 med=0.053 Q3=0.61 max=1.86





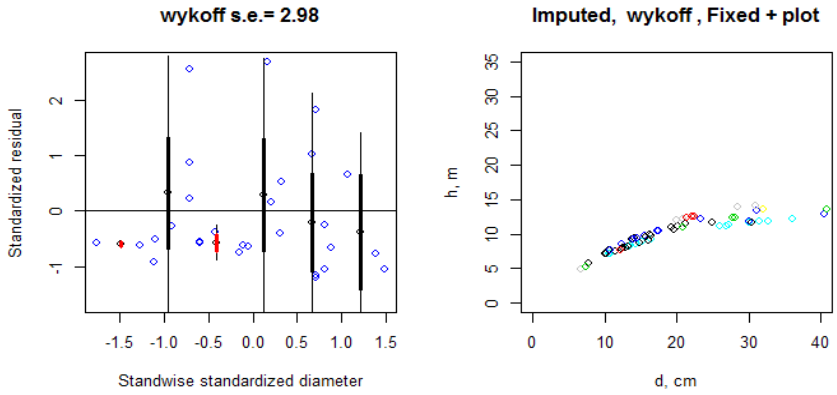
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

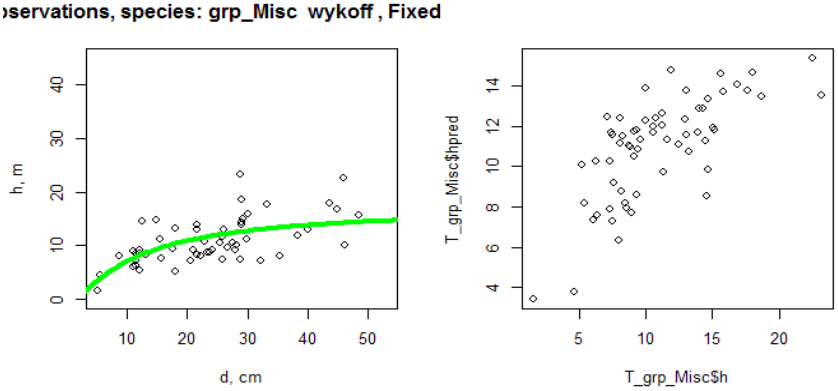
Group 19

Scientific name	Local name	code	Scientific name	Local name	code
Sesbania bispinosa	Kada Dhaicha	6612	*Brassaiopsis polyacantha*	Dangdinge, Kalo Chuletro	6143
Rhododendron arboreum	Lali Guras	6570	*Indigofera pulchella*	Mirmire	5386
Dysoxylum gobara	Dhamina	6265	*Ficus benghalensis*	Bar	6307
Leea aequata		5425	*Elaeagnus infundibularis*		5200
Rhus javanica	Bhakimlo	6586	*Melia azedarach*	Bakaino,	6428
Calotropis gigantea	Aank	4983	*Solanum torvum*	Thulo Bihi	5890
Wendlandia coriacea		6028	*Celtis australis*	Khari, Khadko	6181
Vitex peduncularis		6025	*Buddleja asiatica*	Bhimsen Pate	6148
Ardisia solanacea	Damai phal,	4848	*Reinwardtia indica*	Pyauli	5717
Macaranga denticulata	Mallato	6407	*Schoenoplectus tabernaemontani*		4791

Model = Wykoff (grp_Misc)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.870500 b=-9.951618	s.e.=2.98 Adj. R^2=0.50 (for mixed model only) F-statistic: 58.55 on 1 and 61 DF, p-value: 1.75e-10 Residuals: min= -1.66 Q1=-0.65 med=-0.25 Q3=0.54 max=2.69





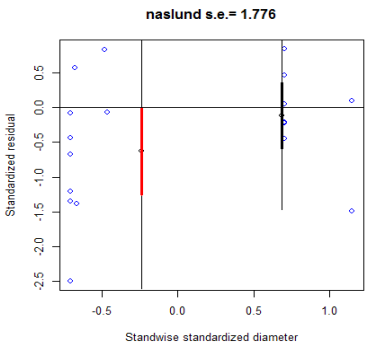
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

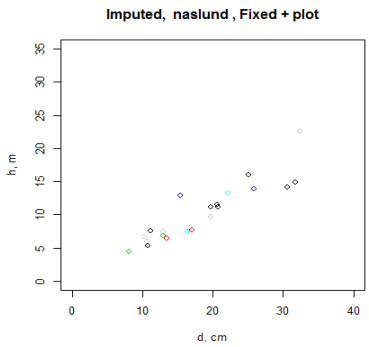
Group 20

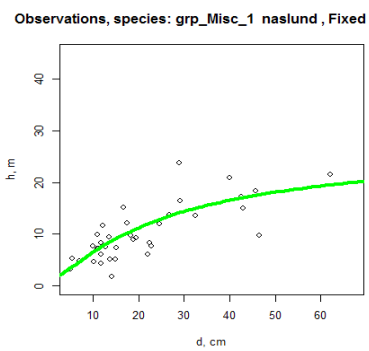
Scientific name	Local name	Code	Scientific name	Local name	code
Murdannia japonica	Nigalo gava	5563	*Naregamia alata*	Pitta Papada	6462
Solanum angum	Bihi, Bhut Kataiya	5883	*Artocarpus chaplasha*	Later	6119
Cassia floribunda	Chhinchhine Bish	5020	*Viburnum colebrookianum*		6006
Thuja orientalis	Mayur Pankhi	6668	*Cinnamomum bejolghota*	Sinkauli, Bara Singoli	6187
Lyonia villosa	Angeri	6406	*Excoecaria acerifolia*	Godasilo, Uttus	6300
Celastrus paniculatus	Malkagunu	5037	*Vallaris solanacea*	Saphed Bel	6691
Hydrangea anomala	Bahuni Kath, Landun	5351	*Mitrasacme pygmaea*		6451
Phoenix acaulis	Khajur, Thakal, Khajuriya	6501	*Litsea salicifolia*	Paheli	6402
Lindera pulcherrima	Syalphusre	6381	*Terminalia myriocarpa*	Pani Saj	6665
Mangifera sylvatica	Chhuchi Aanp, Ban Aanp	6426	*Populus jacquemontiana*	Pipal lagara	6526
Sambucus canadensis	Kanike Phool	5859	*Ceiba pentandra*	Kapok	6180
Jatropha curcas	Sajiwa, nirguni	5405	*Symplocos racemosa*	Lodh, Kholme	6644
Homalium napaulense	Phalame Kande, Aaluya	5348	*Acacia pennata*	Aradi,Arare	4813
Sesbania grandiflora	Agasti	6613	*Tectona grandis*	Teak, Sagawan	6659

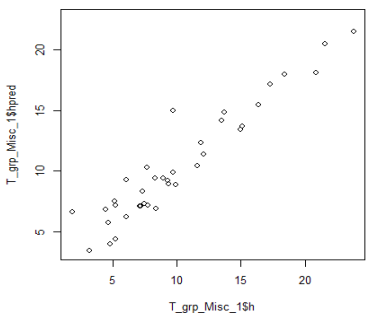
Model = Naslund (grp_Misc_1)
Equation: $h(d) = bh + d\text{^}2/(a + b\ d)\text{^}2$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=2.441760 b=0.194992	s.e.=1.776 Adj. R^2=0.89 (for mixed model only) F-statistic: 313.7 on 1 and 35 DF, p-value: < 2.2e-16 Residuals: min= -2.49 Q1=-0.44 med=0.021 Q3=0.35 max=0.84









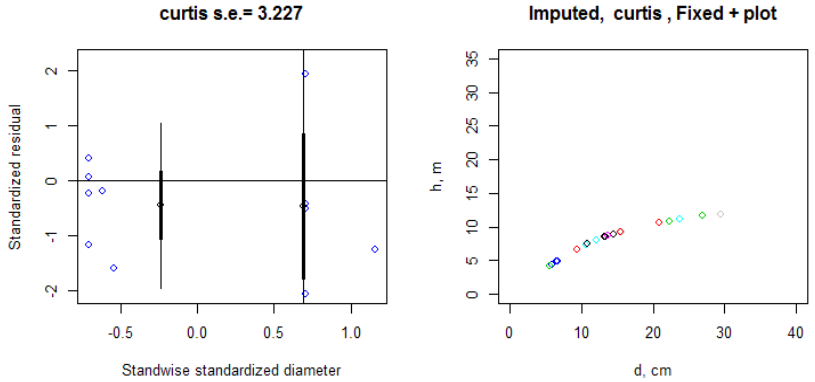
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

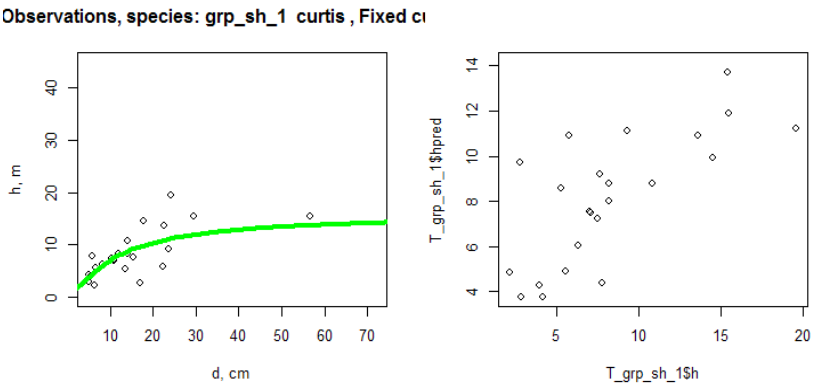
Group 21

Scientific name	Local name	code	Scientific name	Local name	code
Annona squamata	Sitaphal, Sarifa	6112	*Flacourtia indica*	Kandail	5282
Saurauia tristyla		6607	*Punica granatum*	Anar, Darim	5706
Myricaria rosea	Orima	6458	*Indigofera atropurpurea*	Neer, Sakhinu	5376
Citrus medica	Bimiro	6203	*Maesa chisia*	Bilaune	5498
Carissa carandas	Paner	6163	*Holarrhena pubescens*	Madise Khirro	5347
Alstonia neriifolia		6108	*Antidesma acidum*	Archale	4842
Murraya koenigii	Asare, Mitho nim	5569	*Phoenix humilis*	Thakal	6503
Pyrularia edulis	Amphi	6552	*Desmos chinensis*		6247
Symplocos sumuntia	Hakulal	6648	*Mussaenda frondosa*	Asare, Dhobini	5573
Premna interrupta	Ginneri, Gideri	5688	*Xeromphis uliginosa*	Pindar, Maidal	6696
			Jasminum mesneyi	Dabal Jai	5404

Model = Curtis (grp_sh_1)
Equation: $h(d) = bh + a\,(d/(1+d))^{\wedge}b$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=14.770759 b=9.869299	s.e.=1.776 Adj. R^2=0.50 (for mixed model only) F-statistic: 22.62 on 1 and 21 DF, p-value: 0.0001068 Residuals: min= -2.07 Q1=-0.47 med=0.075 Q3=0.53 max=2.22





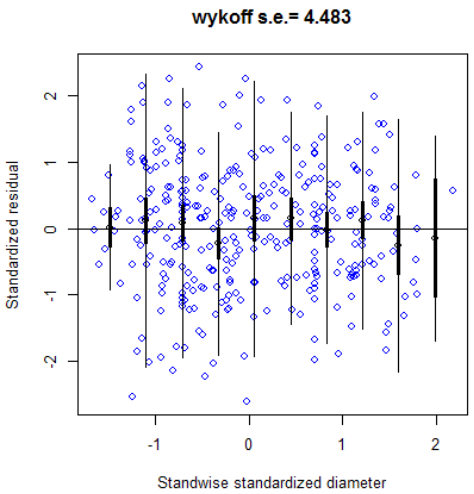
Annex 1. Diameter-Height model/curve for Siwalik physiographic zone of Nepal

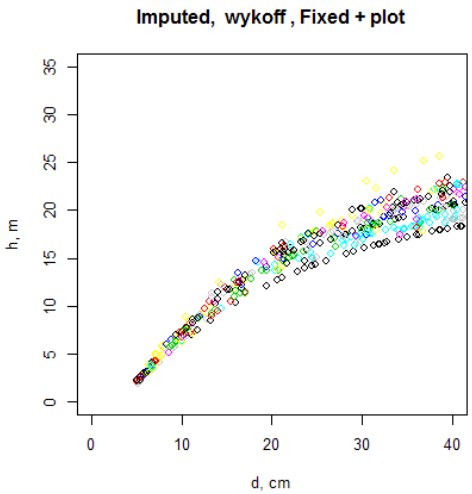
Group 22

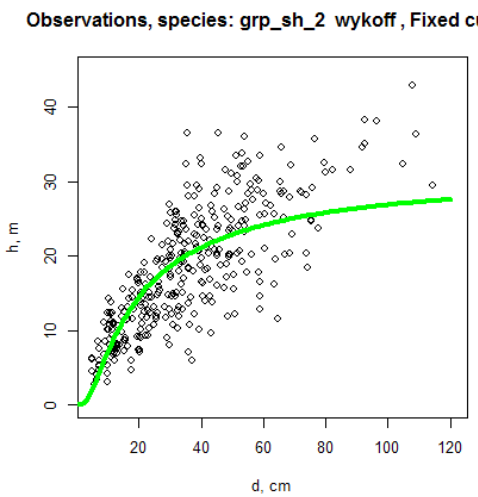
Scientific name	Local name	code	Scientific name	Local name	code
Citrus maxima	Bhogate	6202	*Wendlandia proxima*		6031
Debregeasia salicifolia	Dar Tusare	5160	*Grewia optiva*	Bhimal	5326
Randia tetrasperma	Hakukeda, Kanda	5712	*Toddalia asiatica*	Mainkara	5975
Carica papaya	Mewa	6162	*Pavetta indica*	Takali	5636
Colebrookea oppositifolia	Dhursule, Sitroma	5080	*Premna barbata*	Ginneri	5681
Cleyera japonica	Baklopati	6208	*Dalbergia pinnata*	Damar	6237
Oroxylum indicum	Tatelo, karam	5598	*Erythrina suberosa*	Phullidha	5226

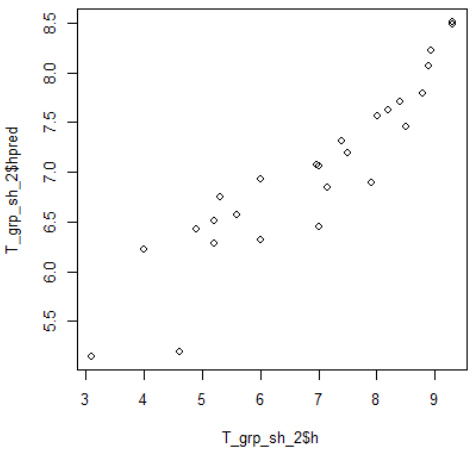
Model = Wykoff (grp_sh_2)
Equation: $h(d) = bh + exp(a + b/(d + 1))$

Parameter	Validity
h(d) = predicted height for dbh 'd' bh = breast height (=1.3) d = diameter at breast height a=3.453517 b=-16.433297	s.e.=4.483 Adj. R^2=0.84 (for mixed model only) F-statistic: 137.5 on 1 and 24 DF, p-value: 2.008e-11 Residuals: min= -2.61 Q1=-0.69 med=0.073 Q3=0.63 max=2.44









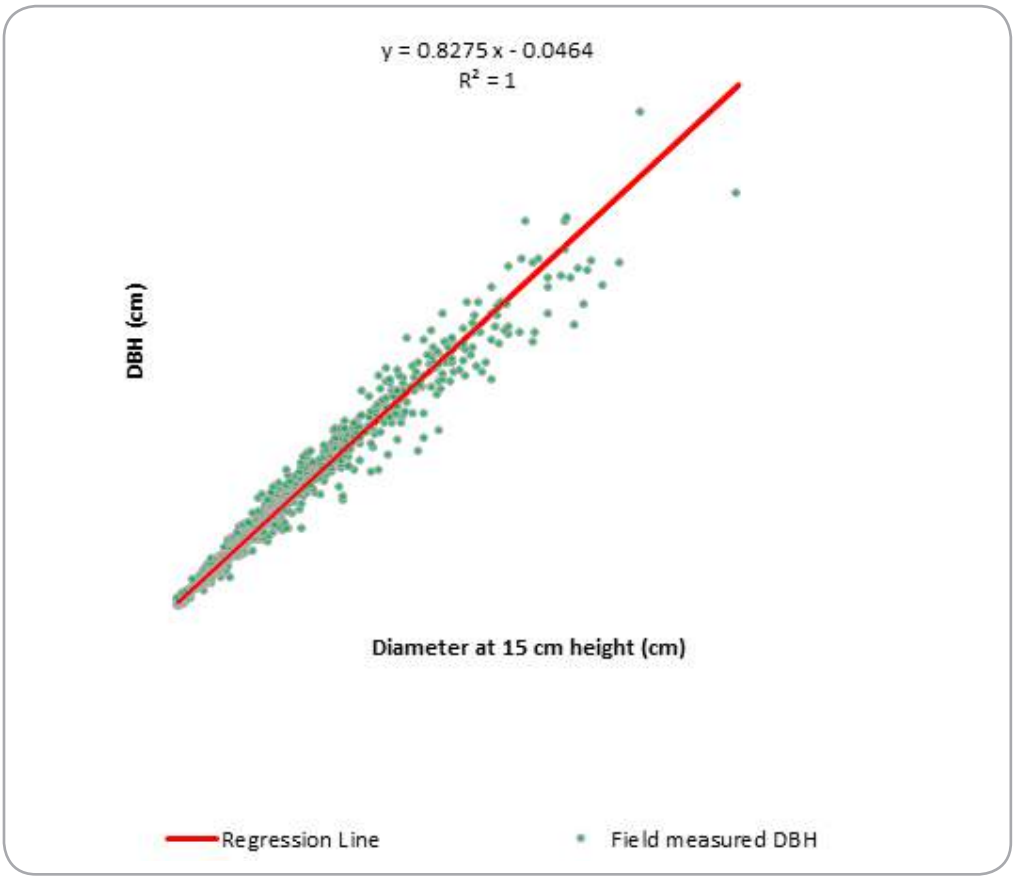
Annex 2: Equation for Predicting Tree DBH from Diameter at 15 cm Height (stump)

Equation: Ln Dbh = a+b Ln(d_15)

Where,

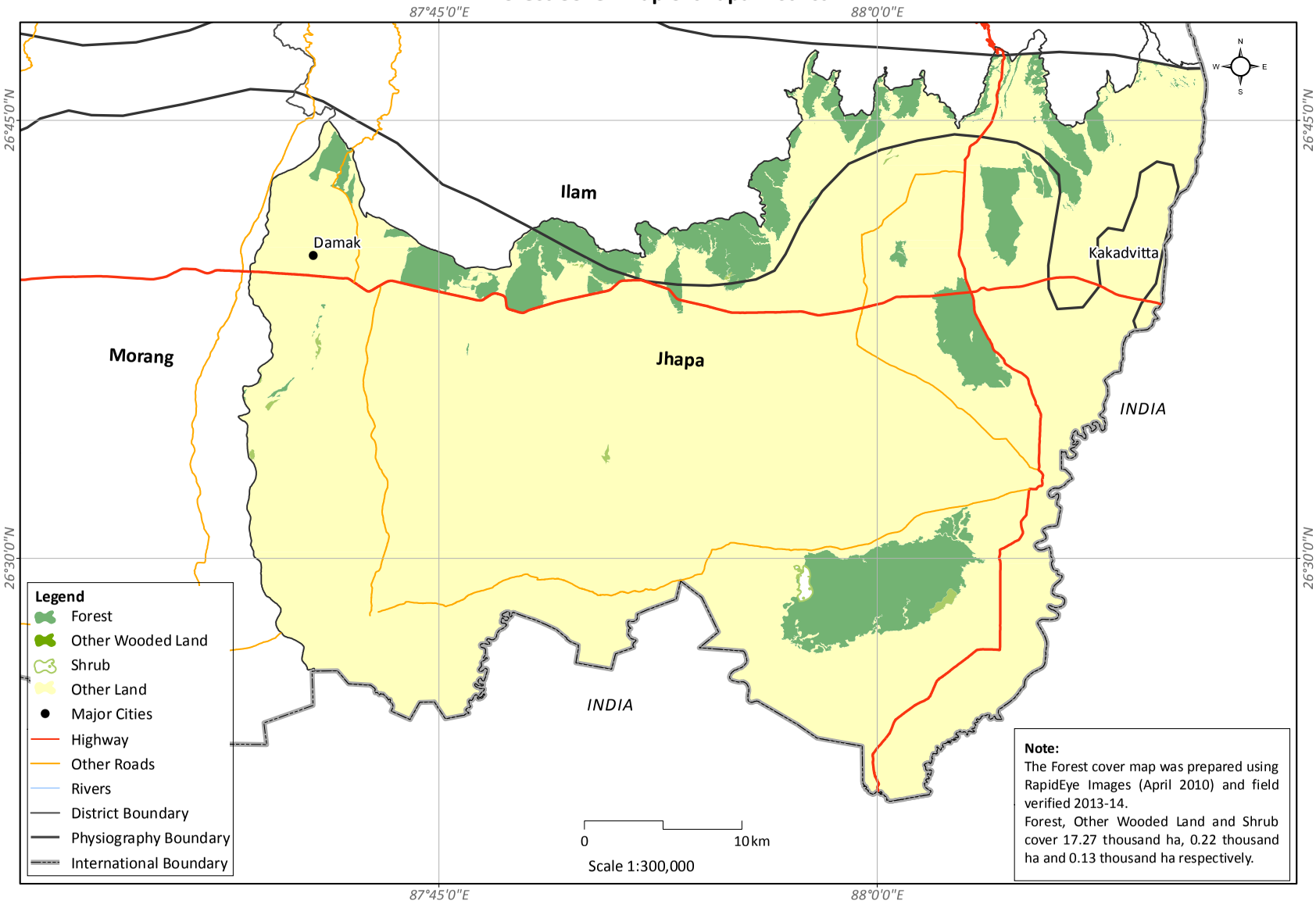
- Ln = Natural logarithm
- Dbh = Diameter at breast height
- d_15 = Diameter of stumps measured at 15 cm from ground level.
- a and b = Constant

Estimate	SE	Residual SE	Adjusted R-Square	F-statistic	DF	p_value
a = -0.200345	0.018477	0.09609	0.9756	3.597e+04 on 1	898	< 2.2e-16
b = 1.002703	0.005287					



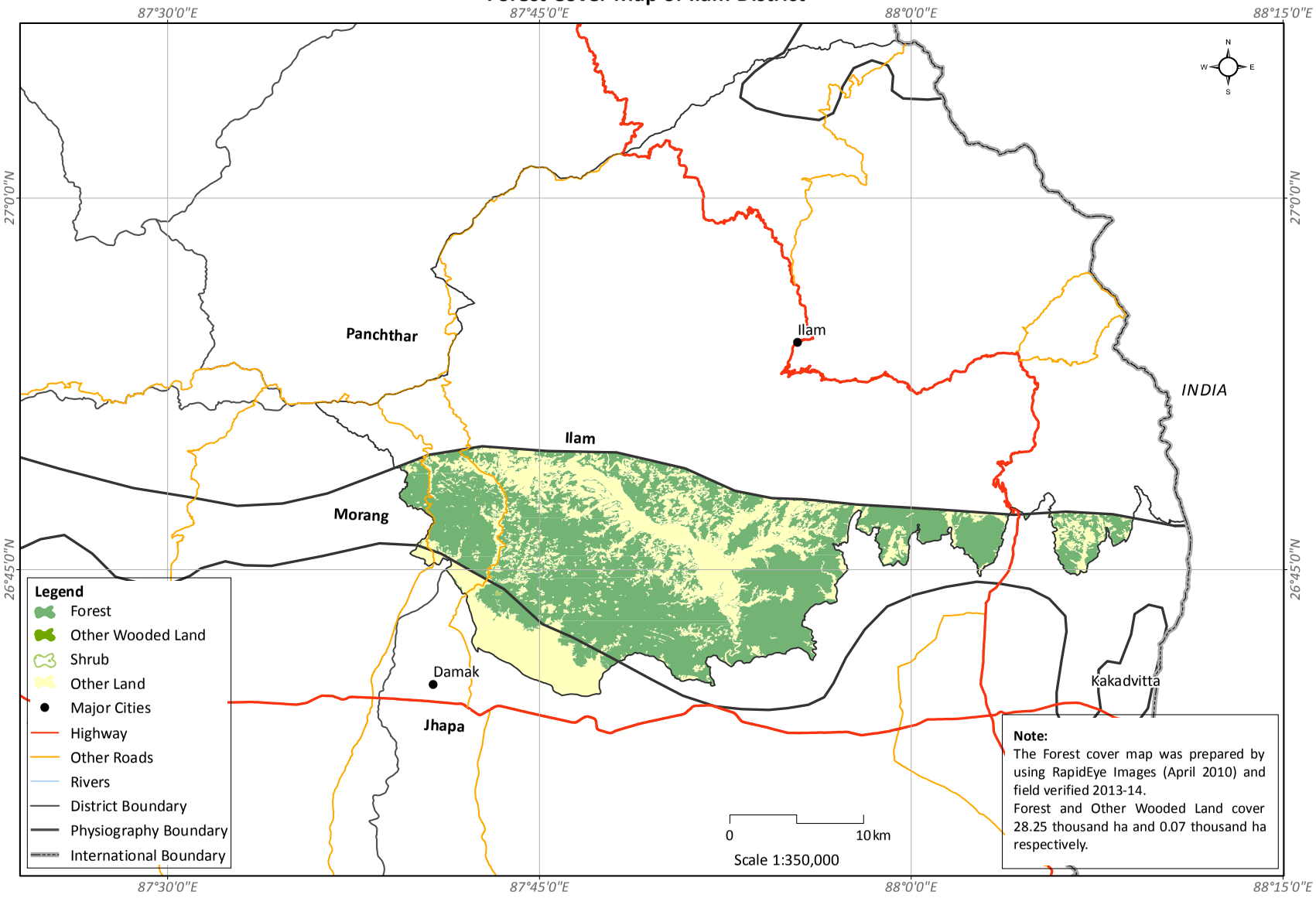
Annex 3. District Forest-cover Maps

Forest Cover Map of Jhapa District



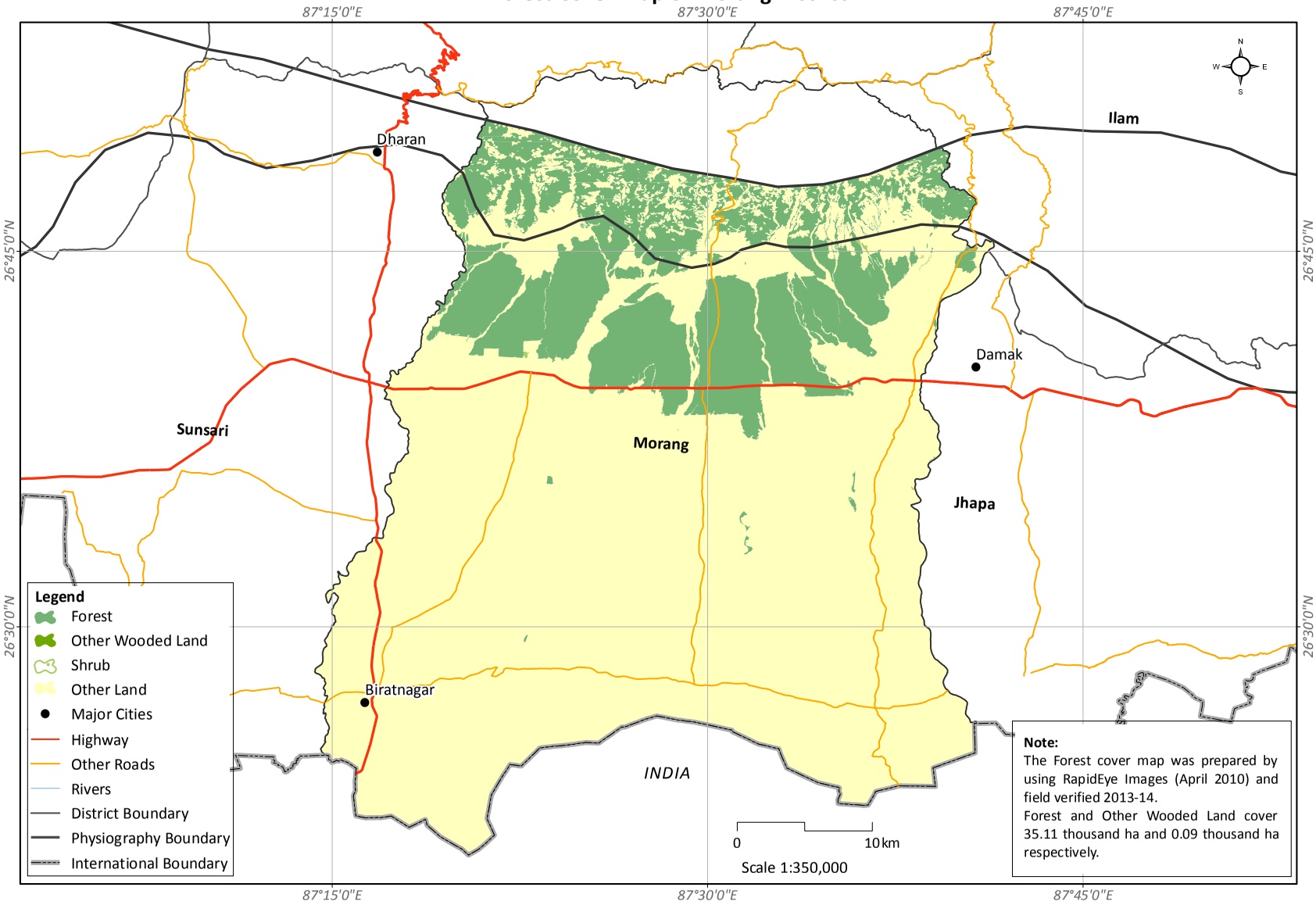
Annex 3. District Forest-cover Maps

Forest Cover Map of Ilam District



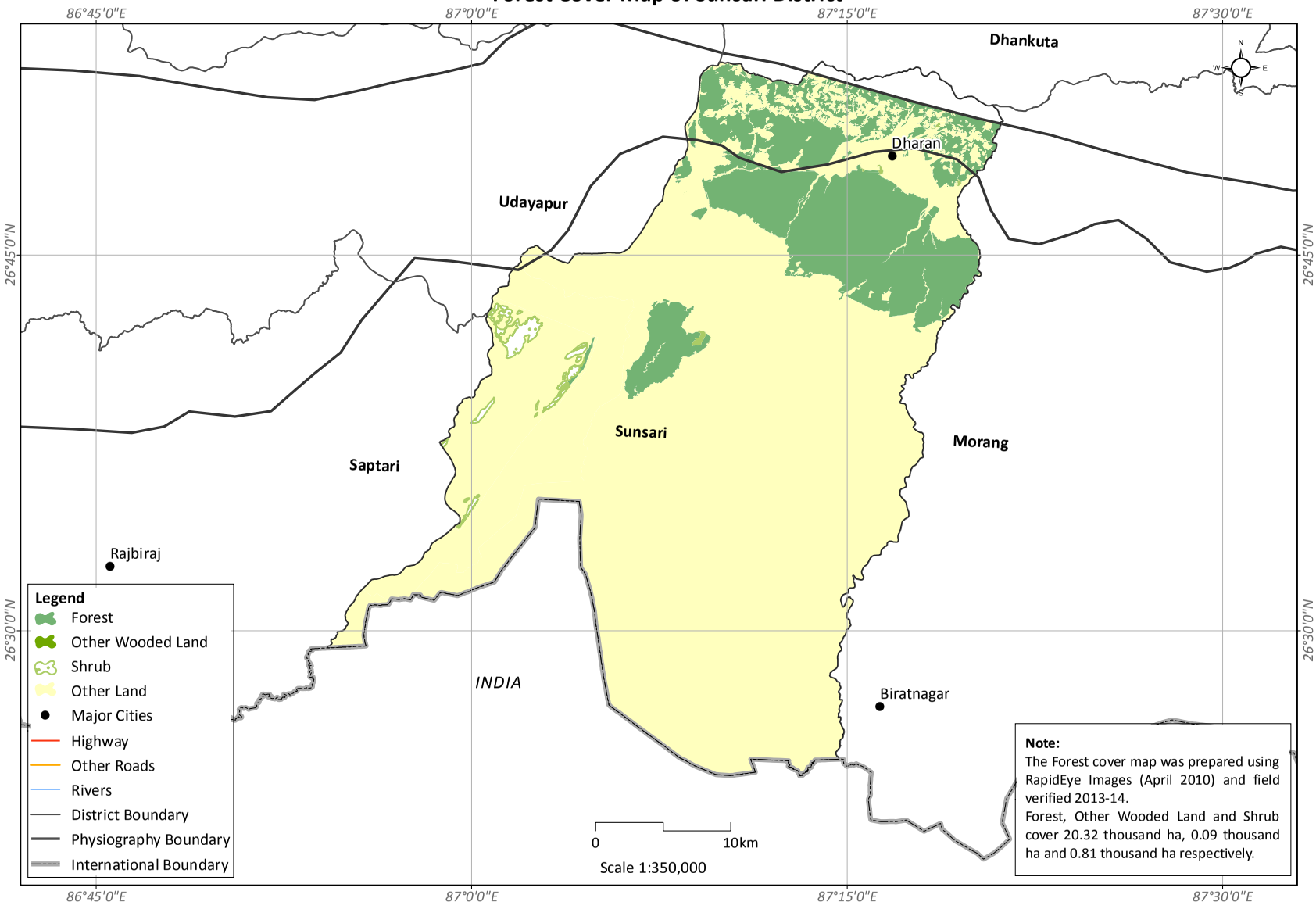
Annex 3. District Forest-cover Maps

Forest Cover Map of Morang District



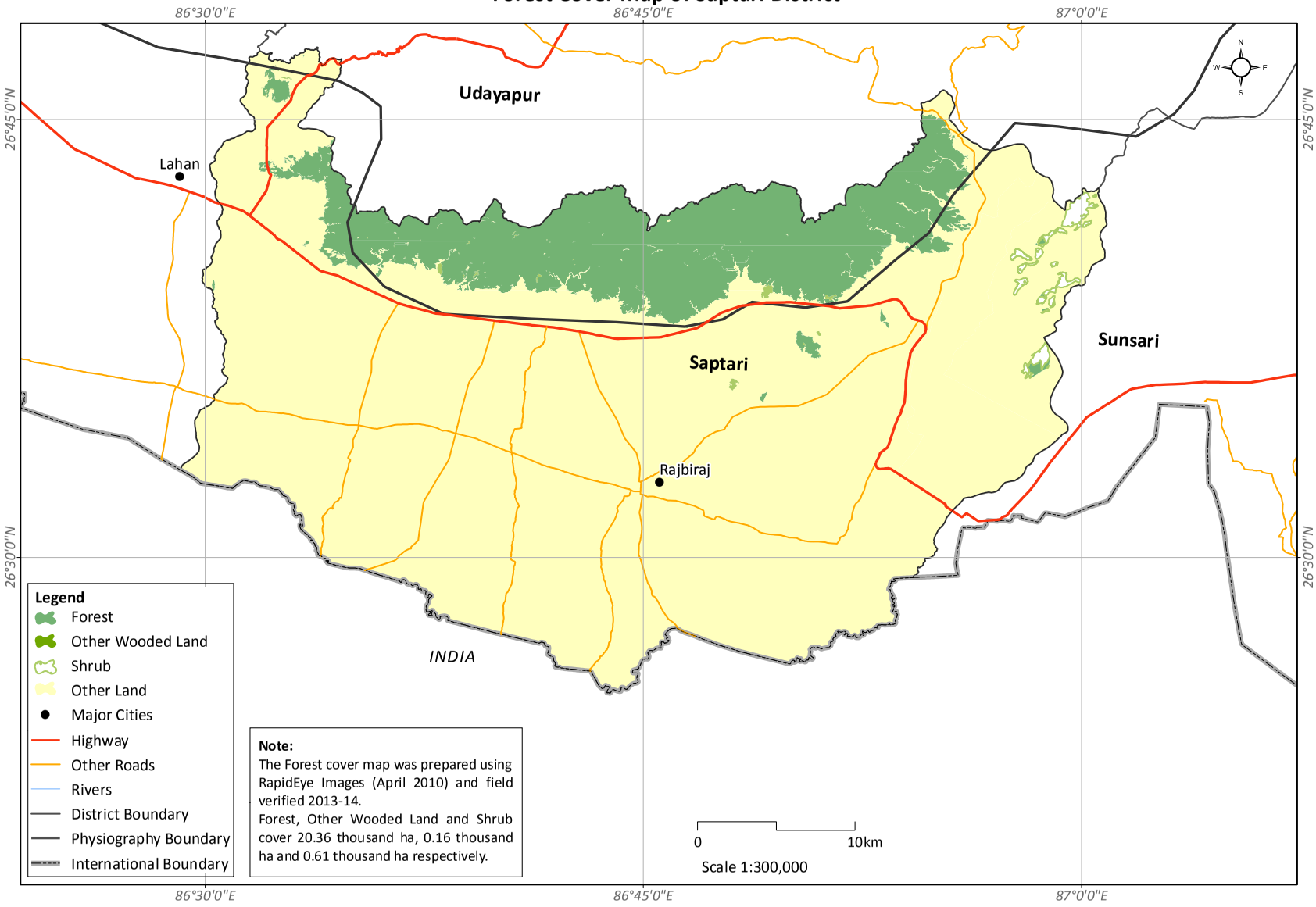
Annex 3. District Forest-cover Maps

Forest Cover Map of Sunsari District



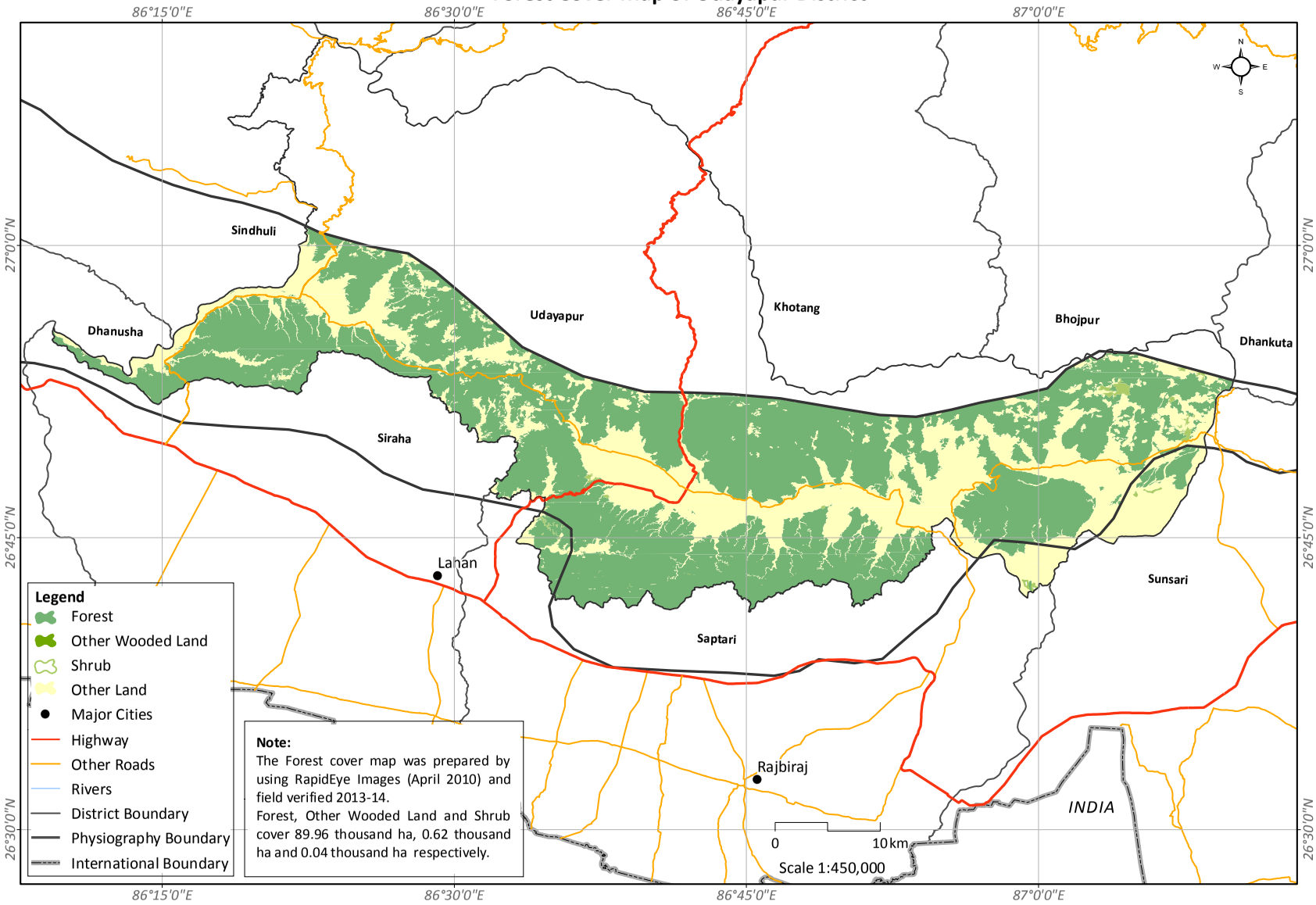
Annex 3. District Forest-cover Maps

Forest Cover Map of Saptari District



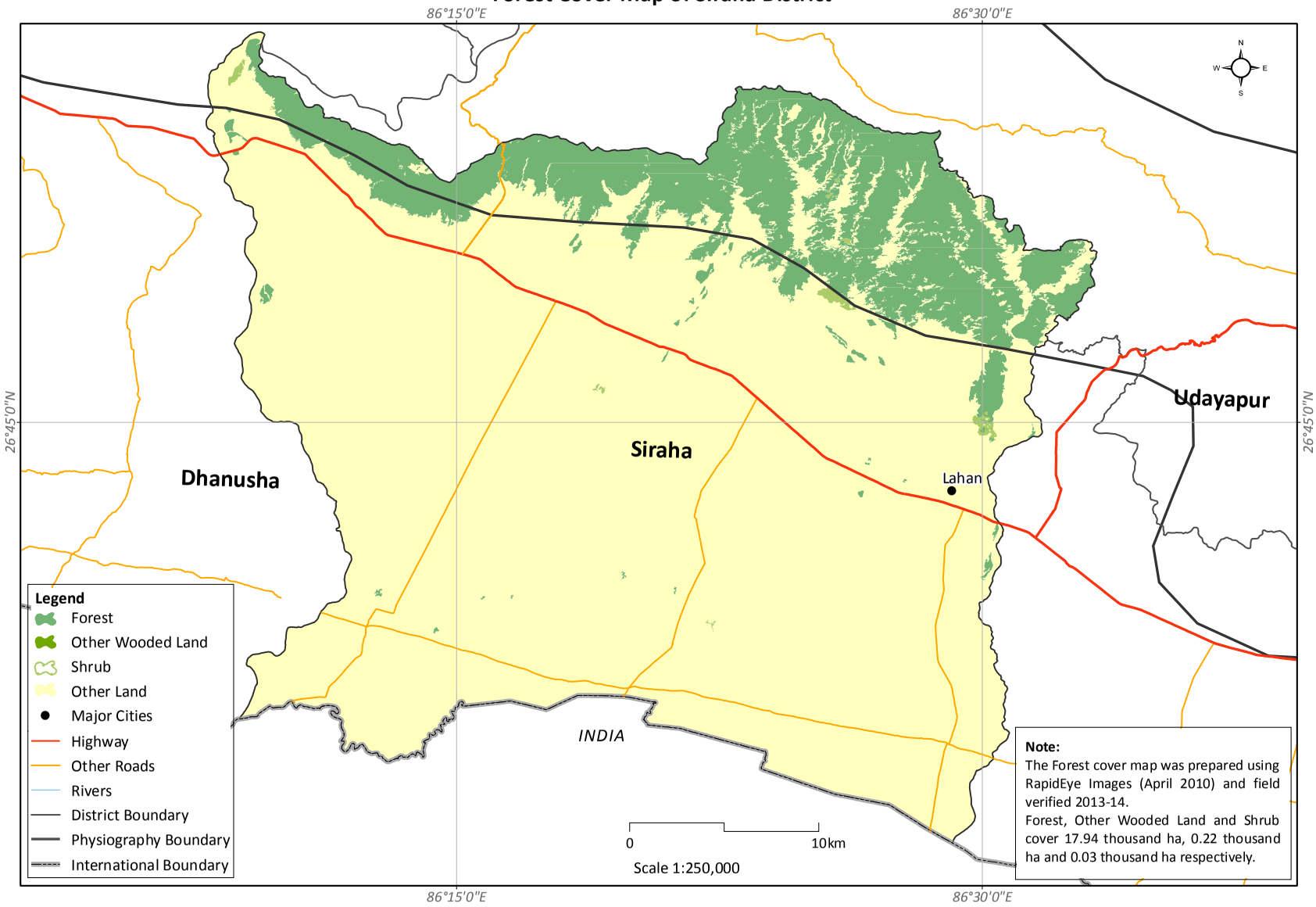
Annex 3. District Forest-cover Maps

Forest Cover Map of Udayapur District



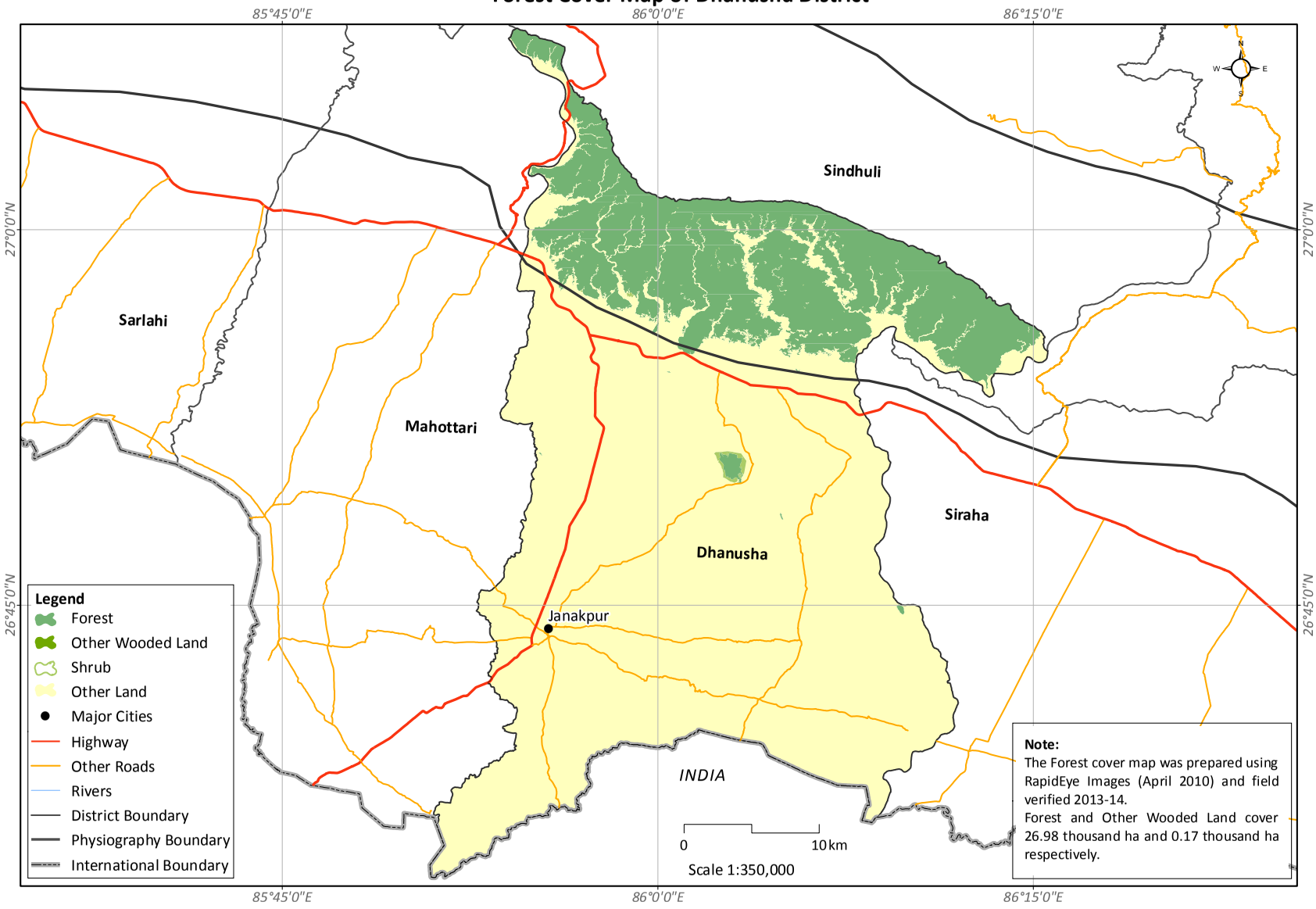
Annex 3. District Forest-cover Maps

Forest Cover Map of Siraha District



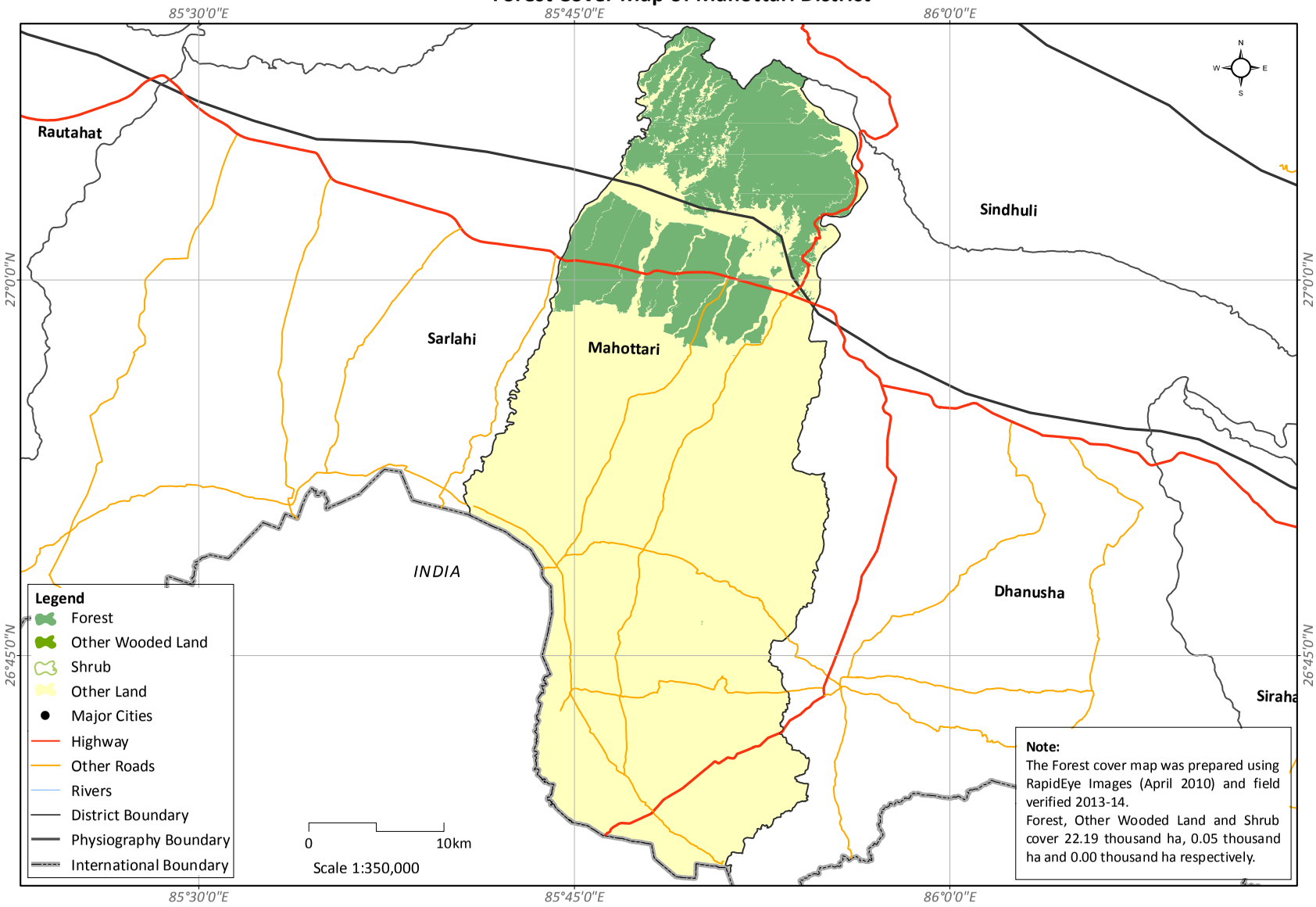
Annex 3. District Forest-cover Maps

Forest Cover Map of Dhanusha District



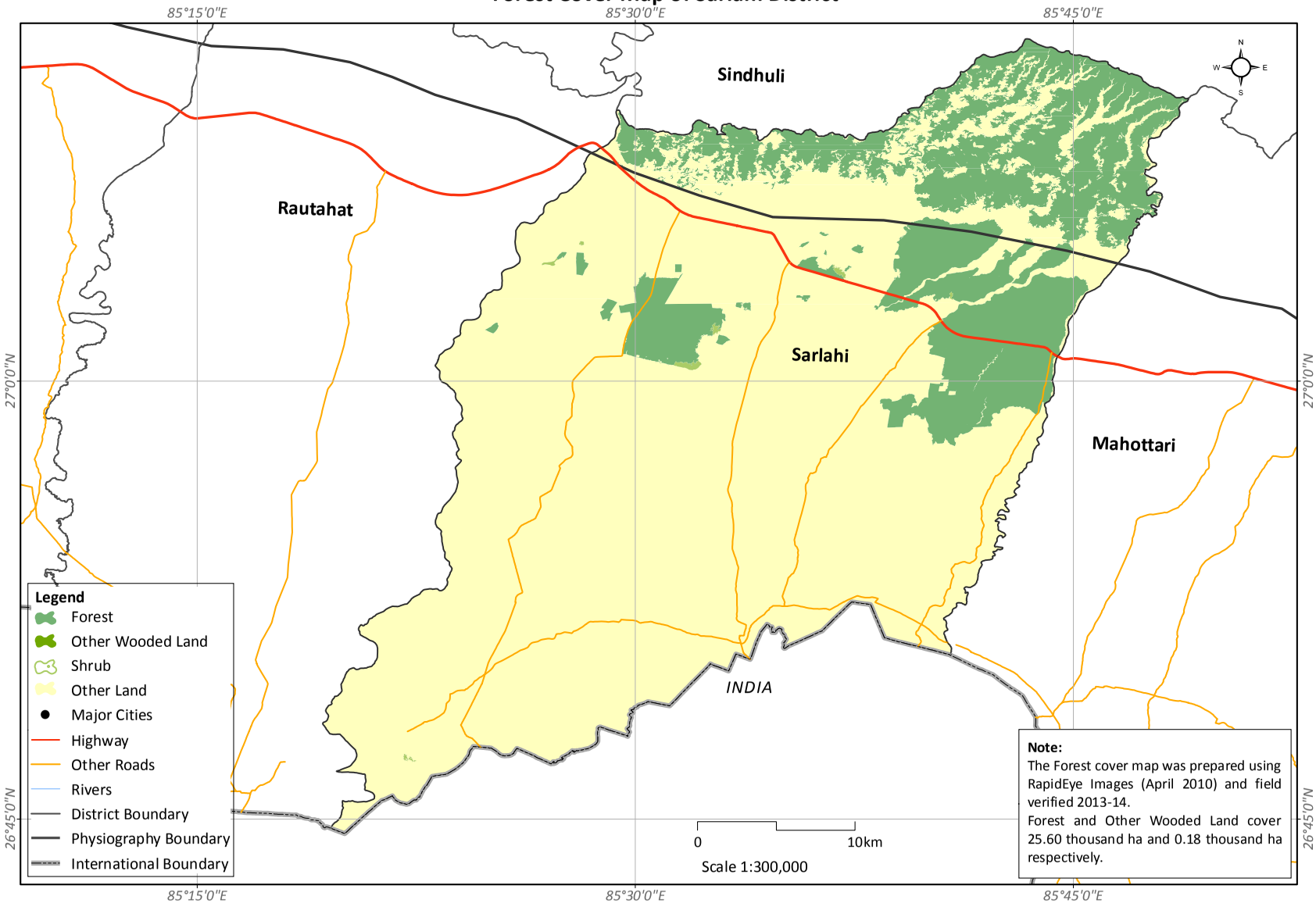
Annex 3. District Forest-cover Maps

Forest Cover Map of Mahottari District



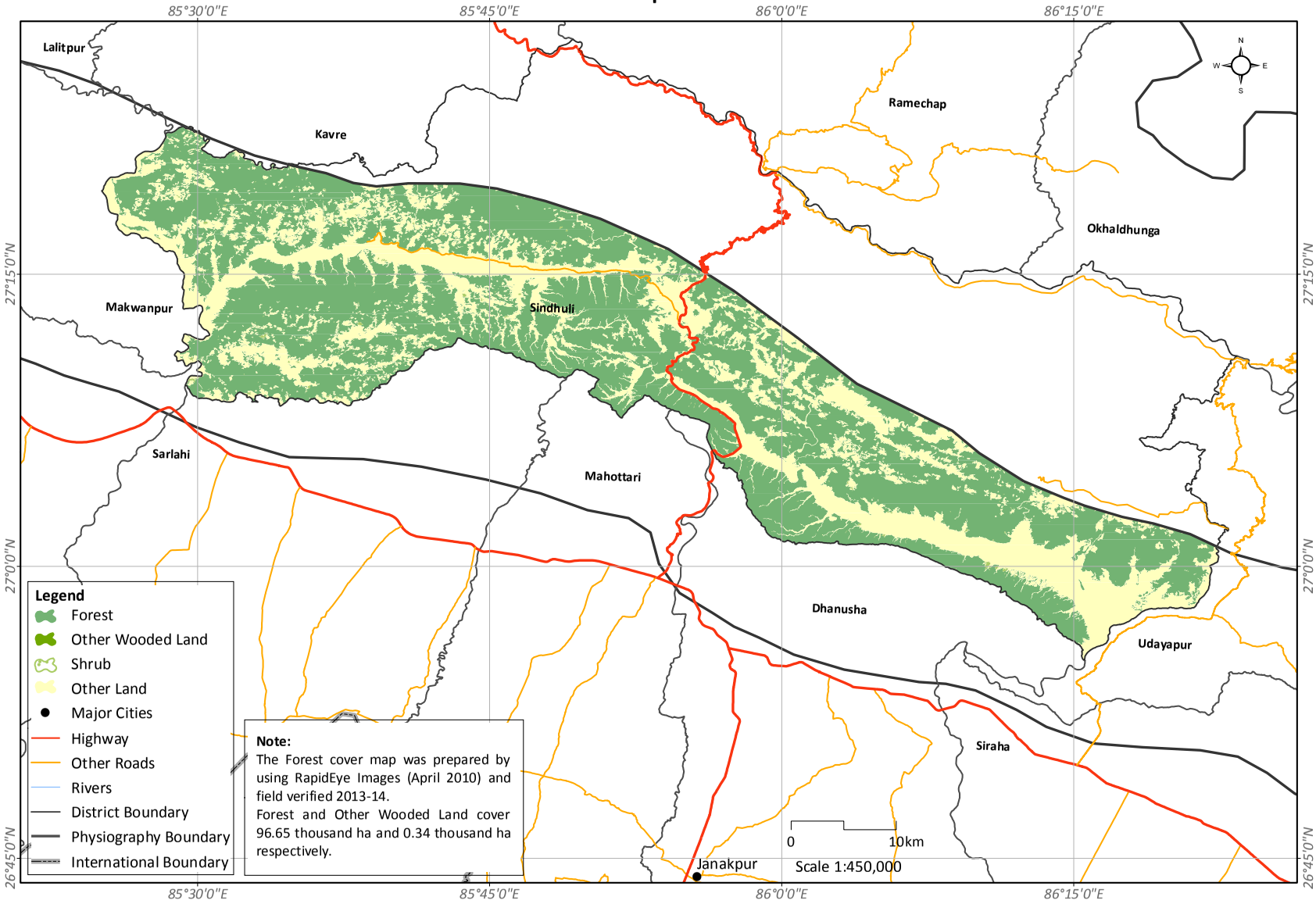
Annex 3. District Forest-cover Maps

Forest Cover Map of Sarlahi District



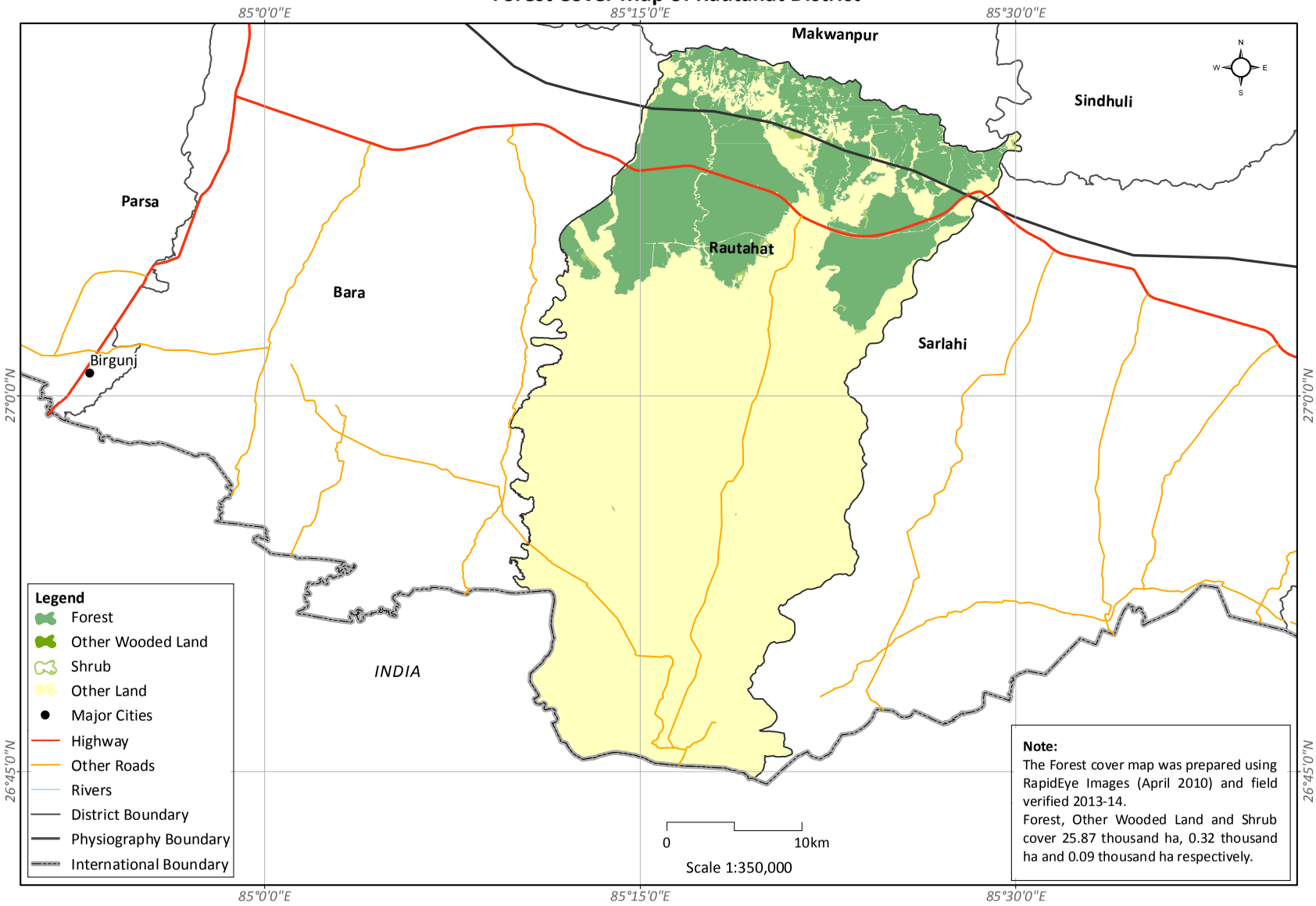
Annex 3. District Forest-cover Maps

Forest Cover Map of Sindhuli District



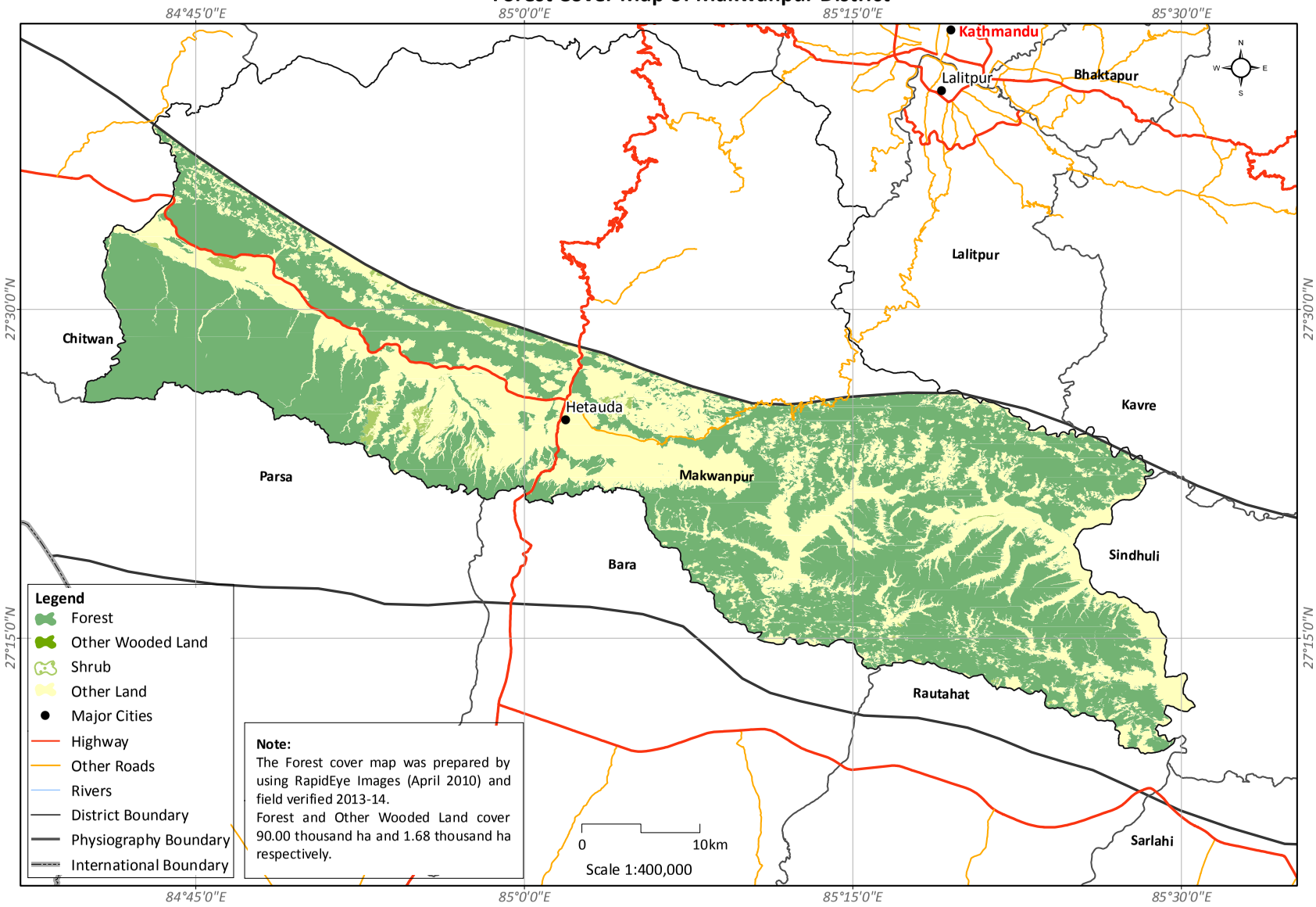
Annex 3. District Forest-cover Maps

Forest Cover Map of Rautahat District



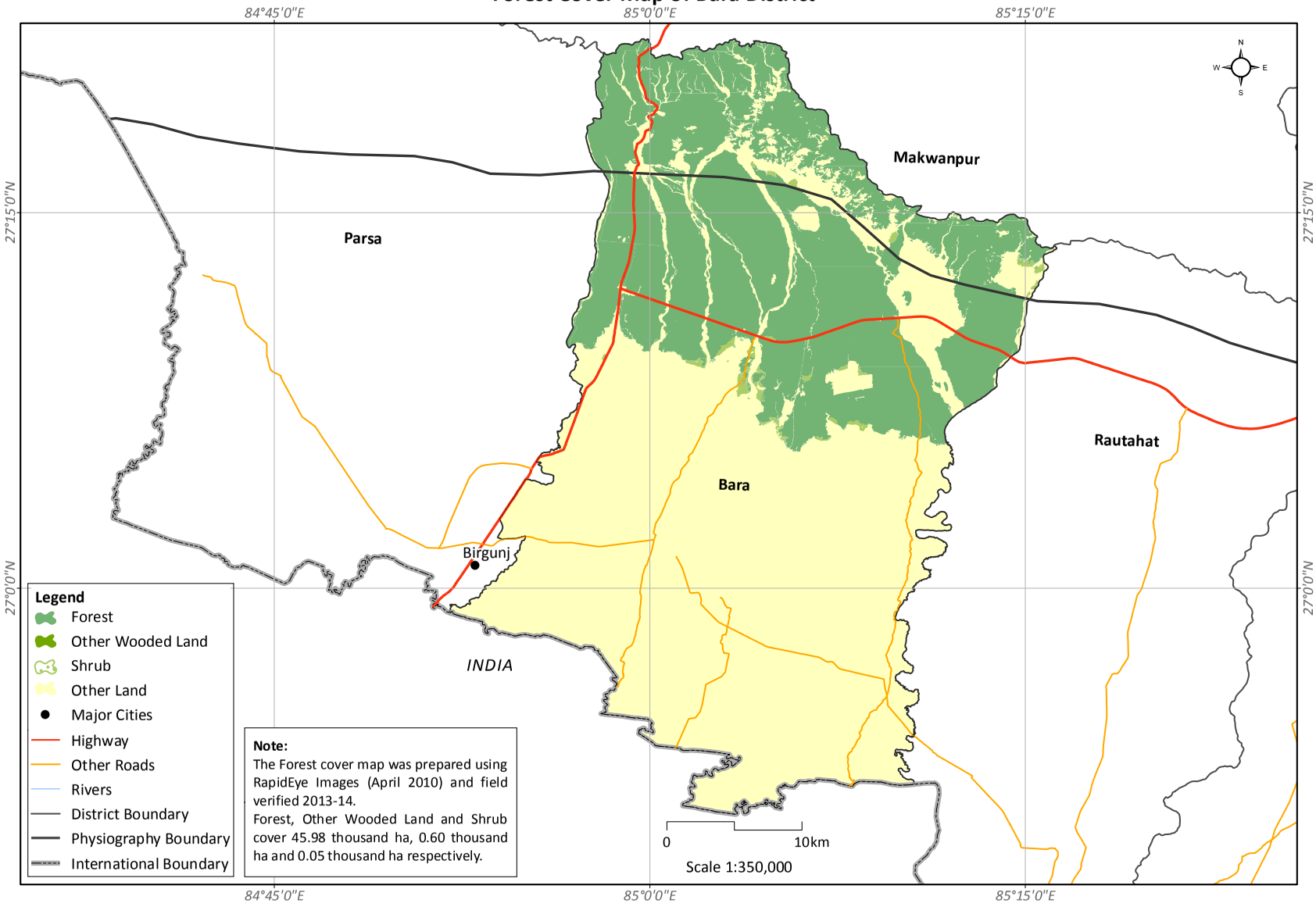
Annex 3. District Forest-cover Maps

Forest Cover Map of Makwanpur District



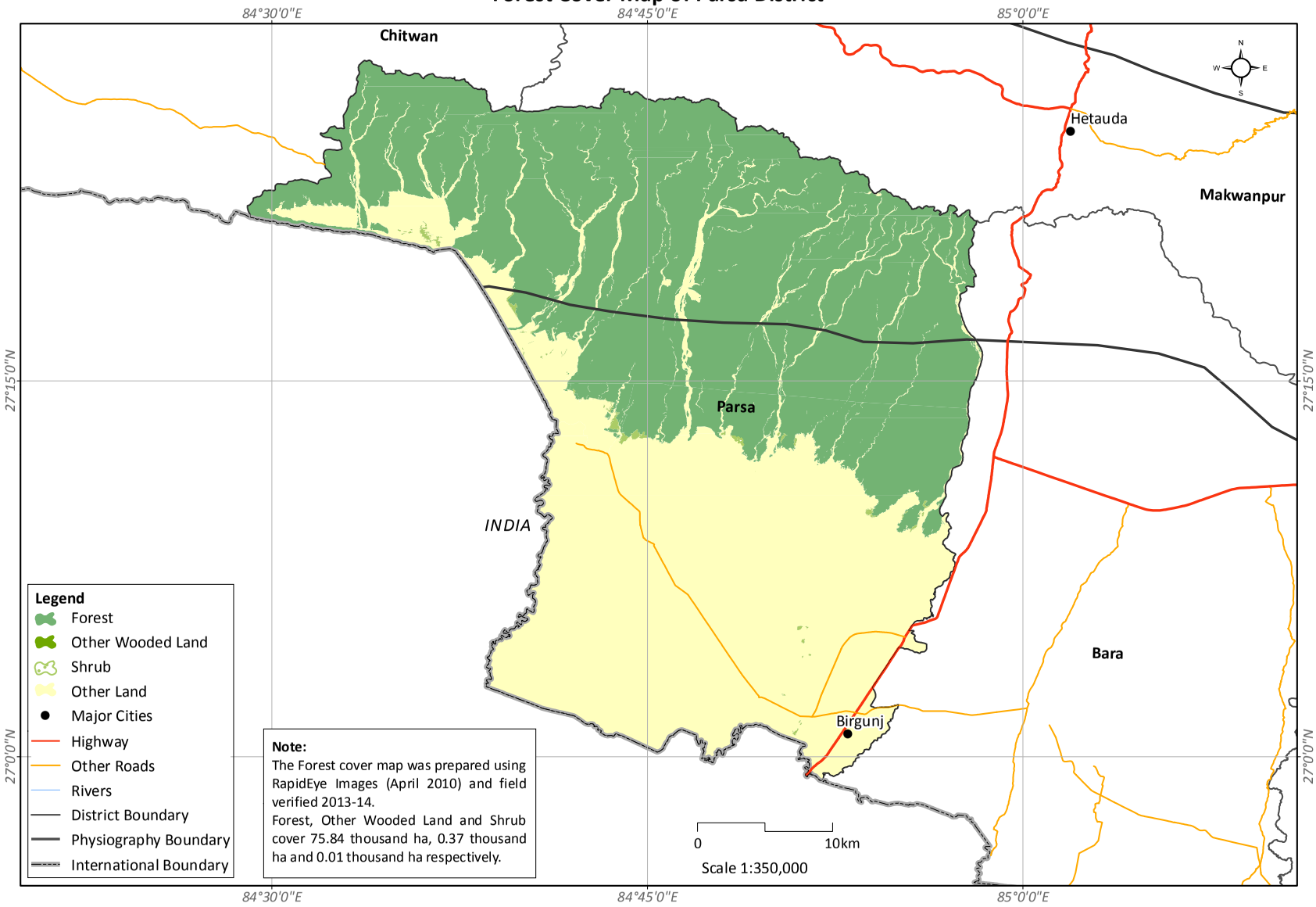
Annex 3. District Forest-cover Maps

Forest Cover Map of Bara District



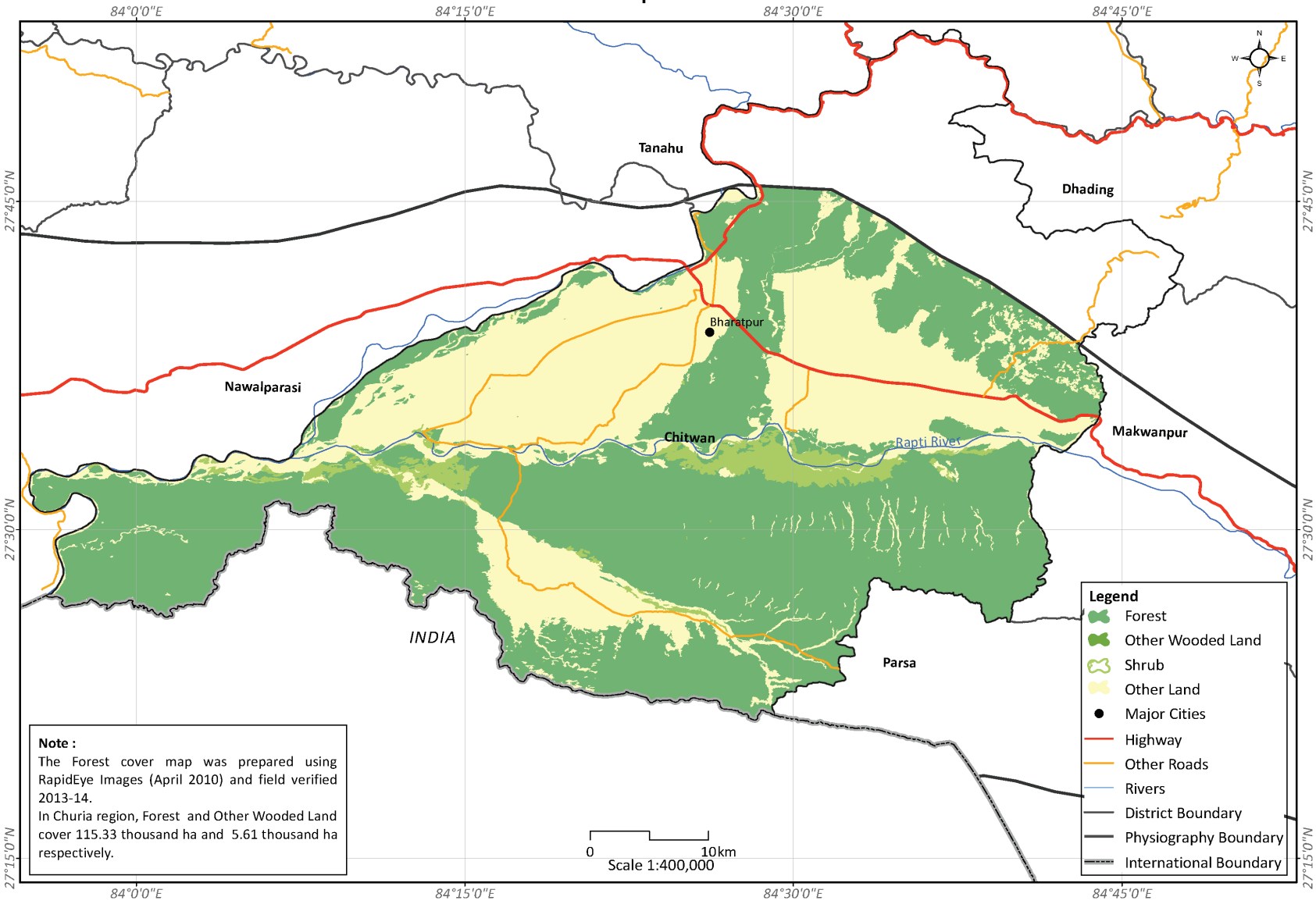
Annex 3. District Forest-cover Maps

Forest Cover Map of Parsa District



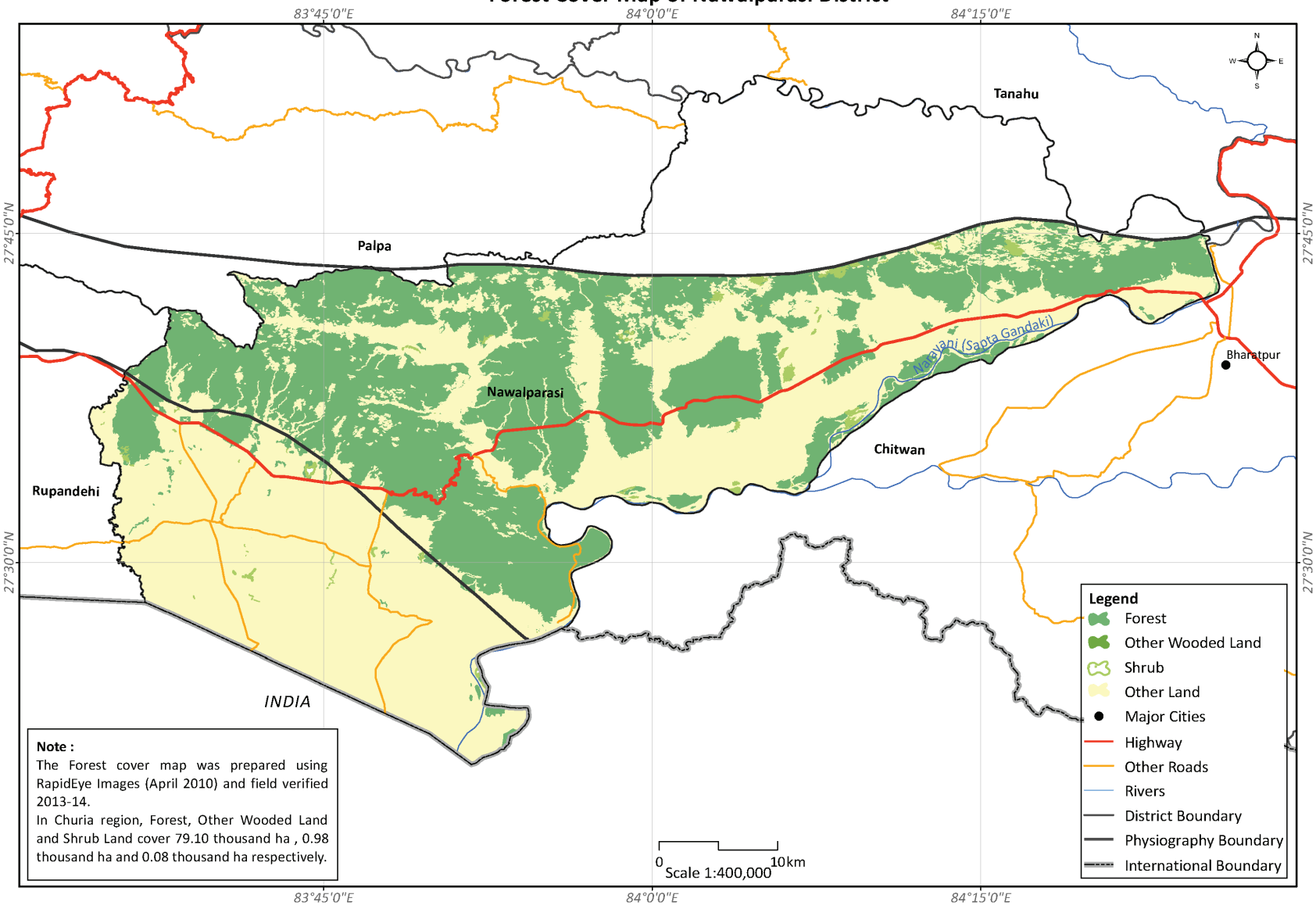
Annex 3. District Forest-cover Maps

Forest Cover Map of Chitwan District



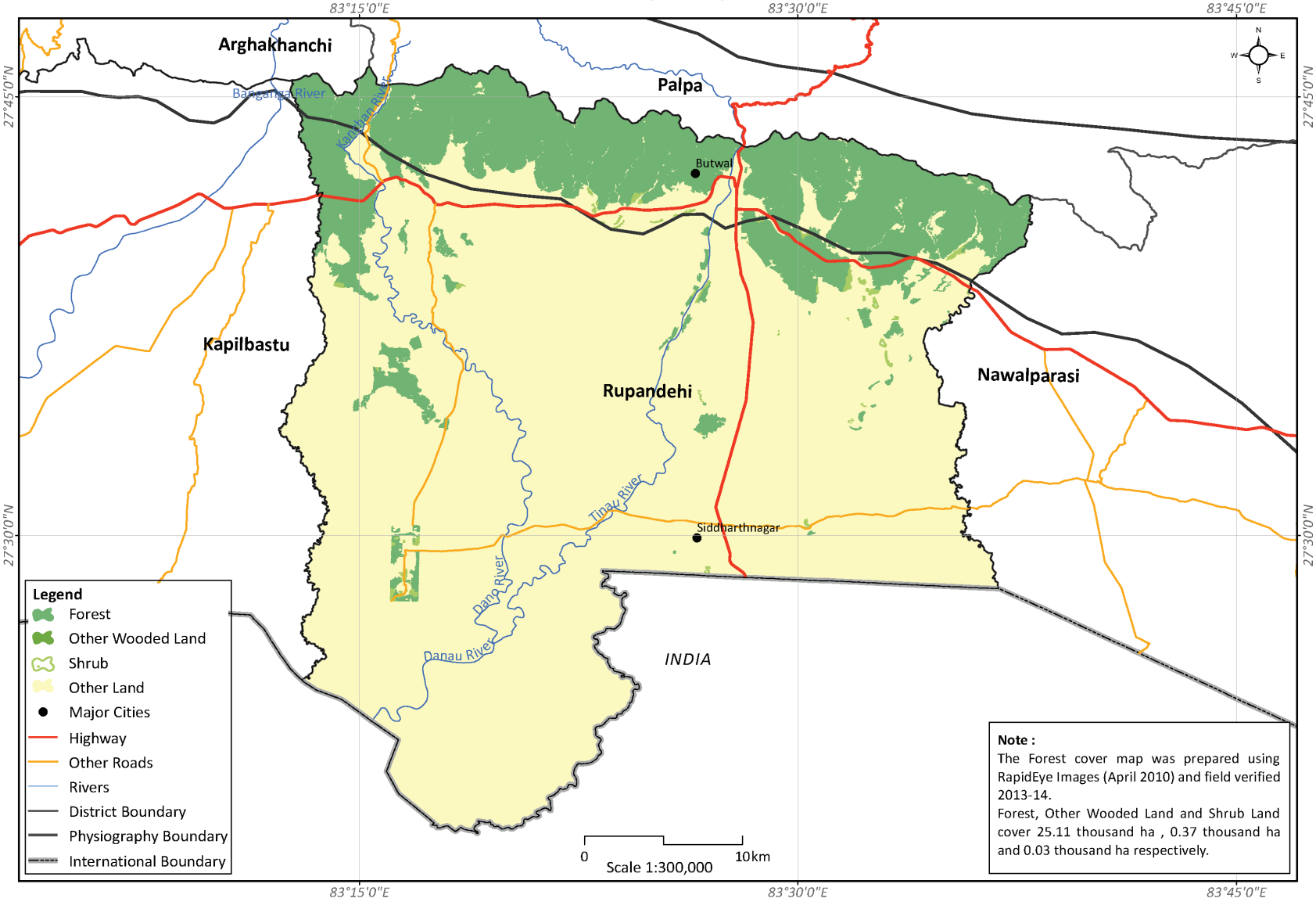
Annex 3. District Forest-cover Maps

Forest Cover Map of Nawalparasi District



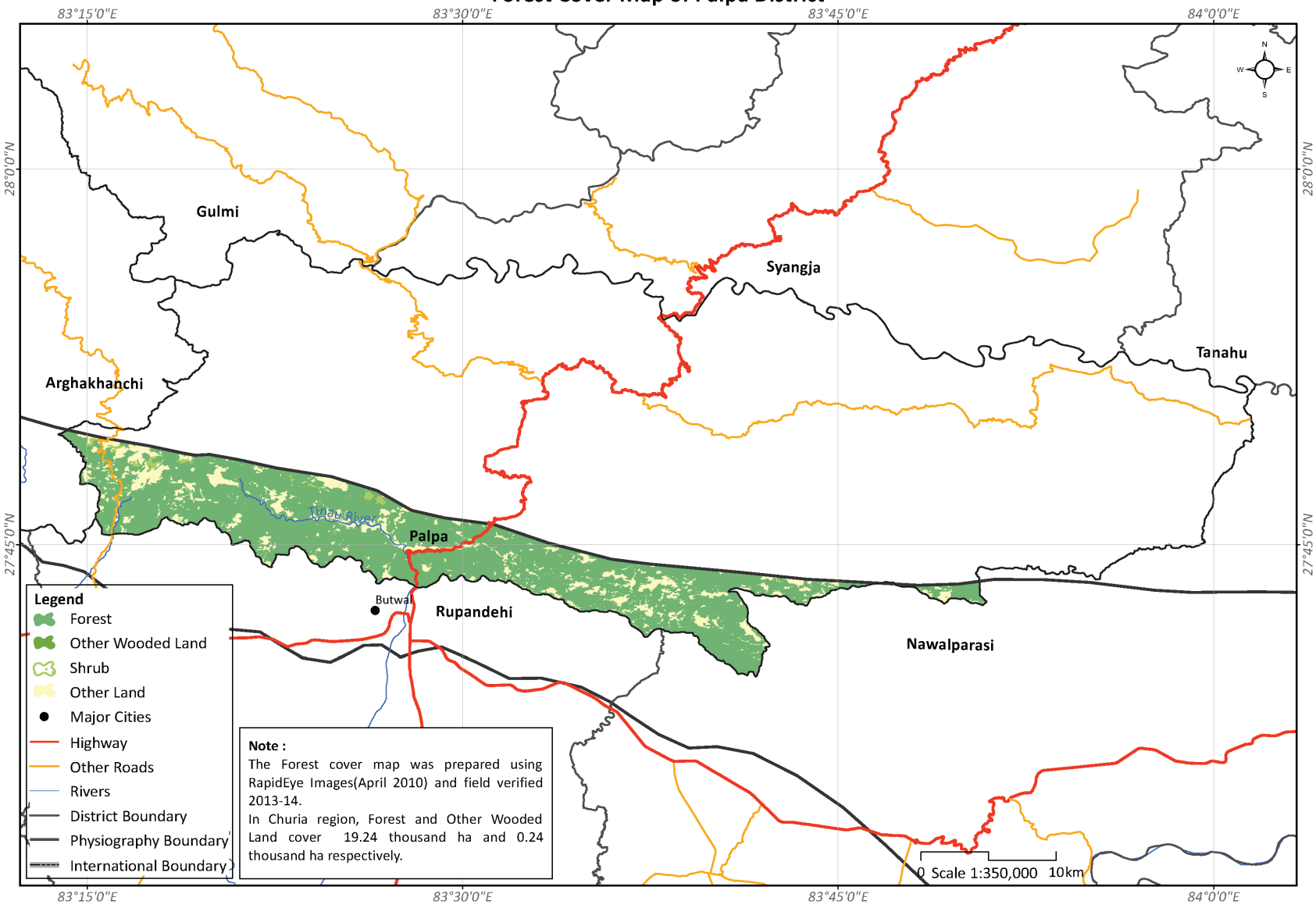
Annex 3. District Forest-cover Maps

Forest Cover Map of Rupandehi District



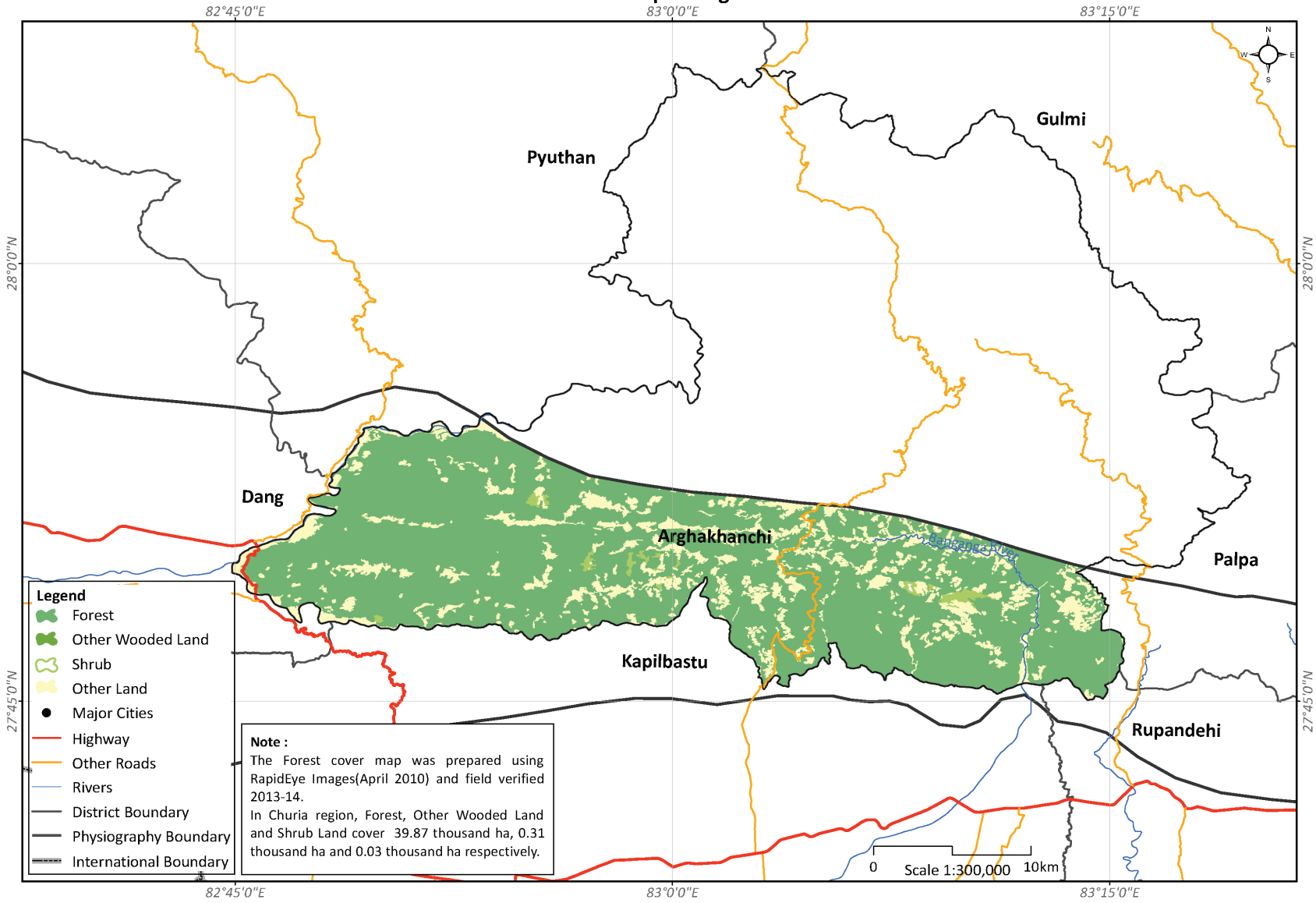
Annex 3. District Forest-cover Maps

Forest Cover Map of Palpa District



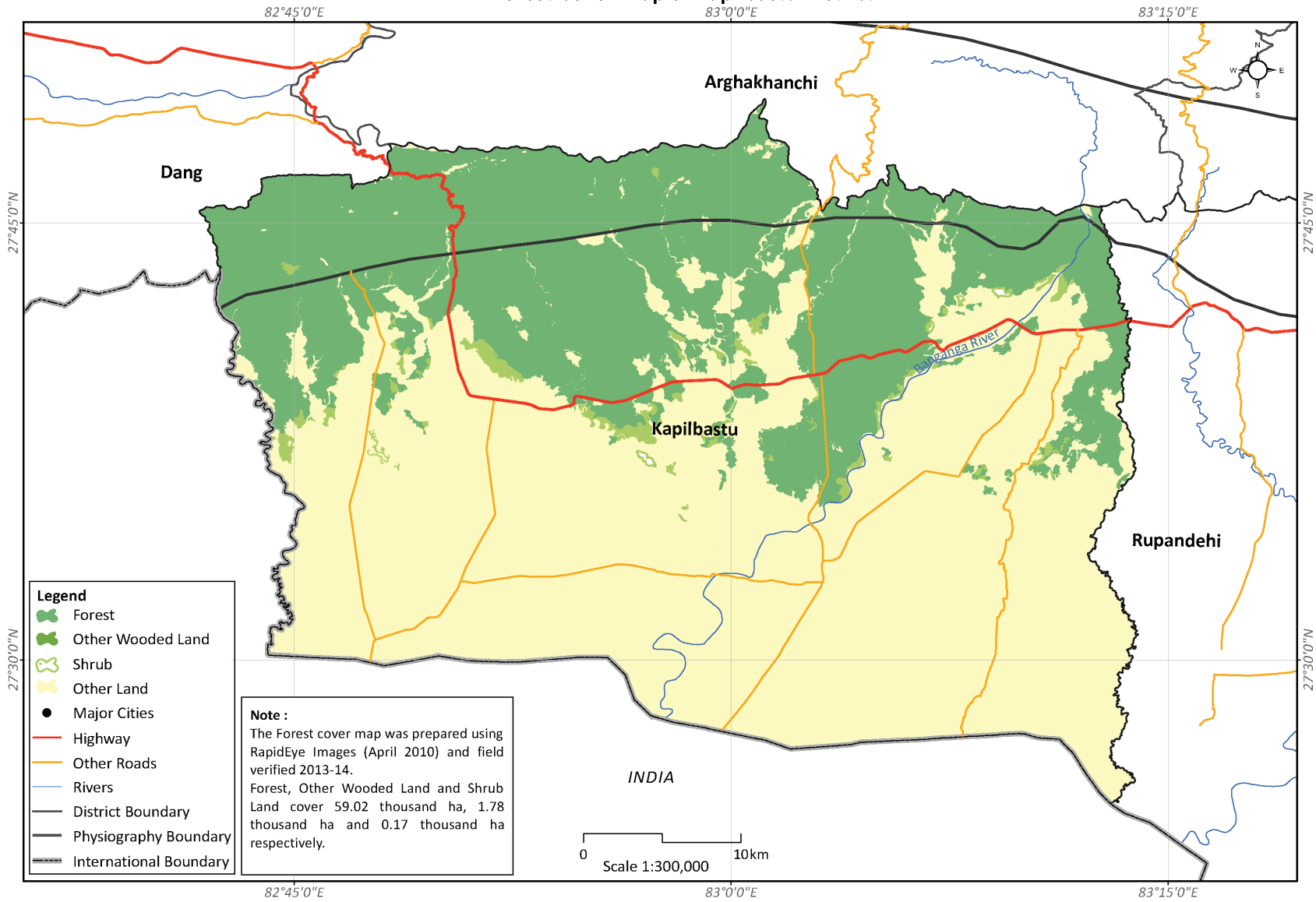
Annex 3. District Forest-cover Maps

Forest Cover Map of Arghakhanchi District



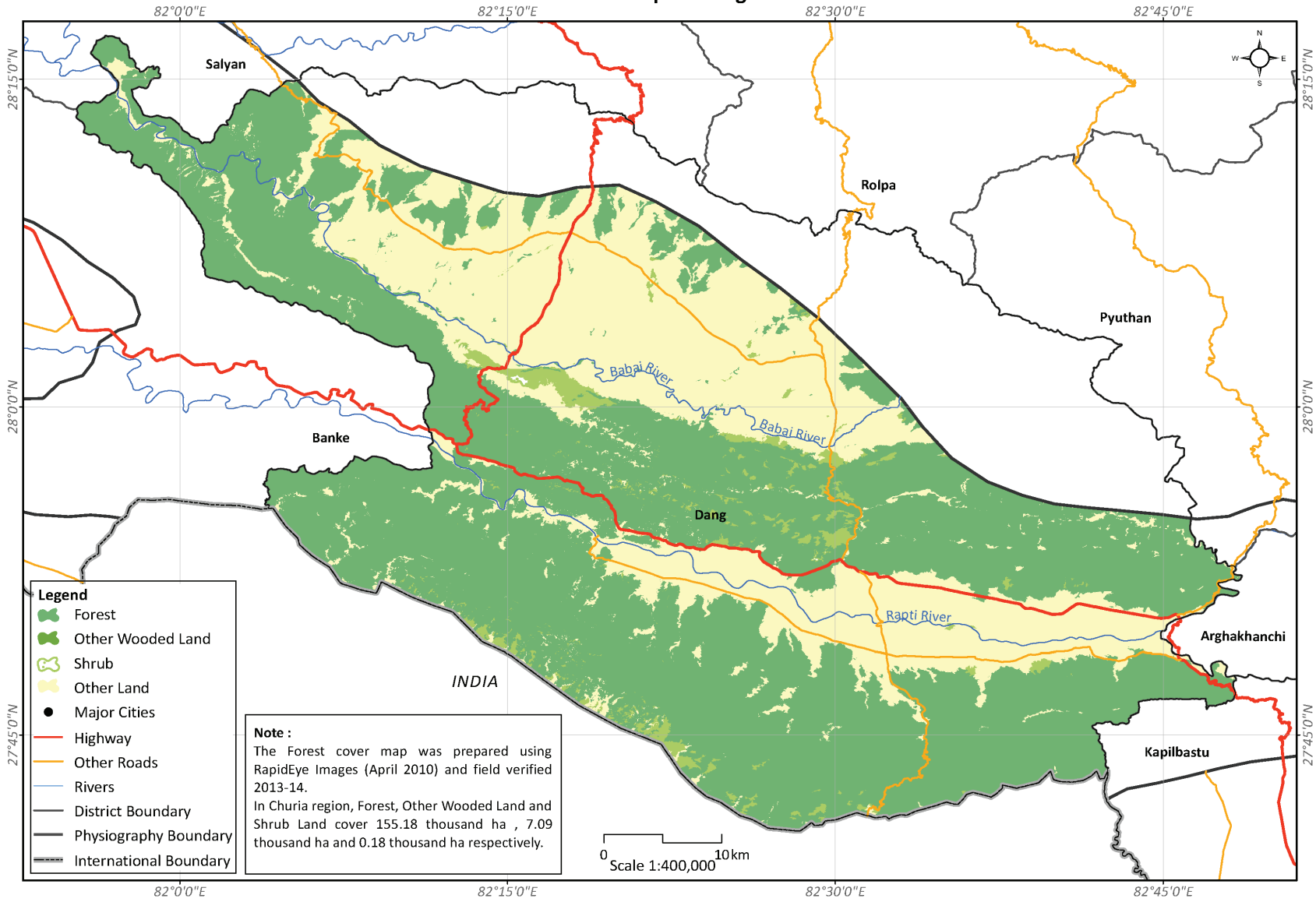
Annex 3. District Forest-cover Maps

Forest Cover Map of Kapilbastu District



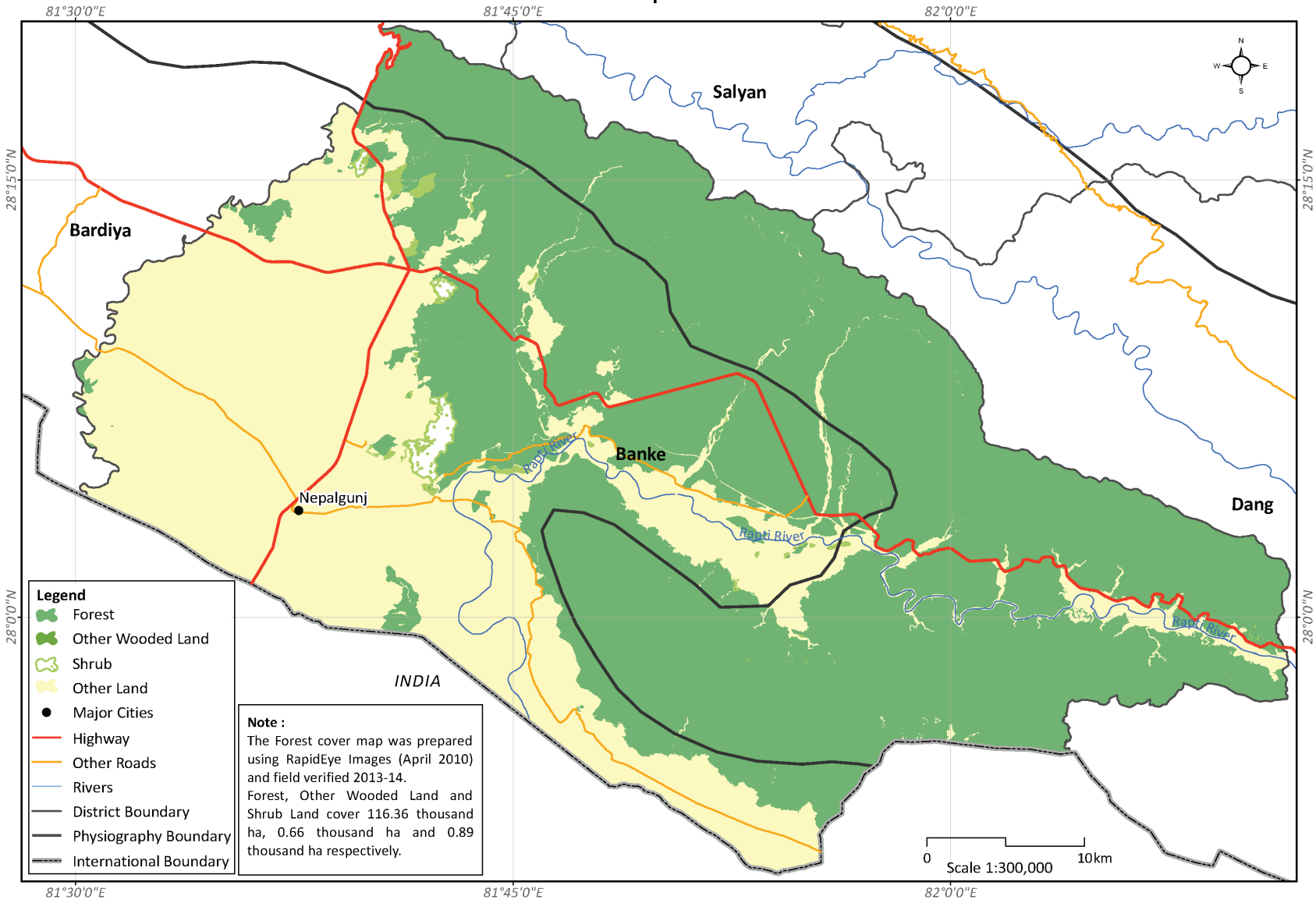
Annex 3. District Forest-cover Maps

Forest Cover Map of Dang District



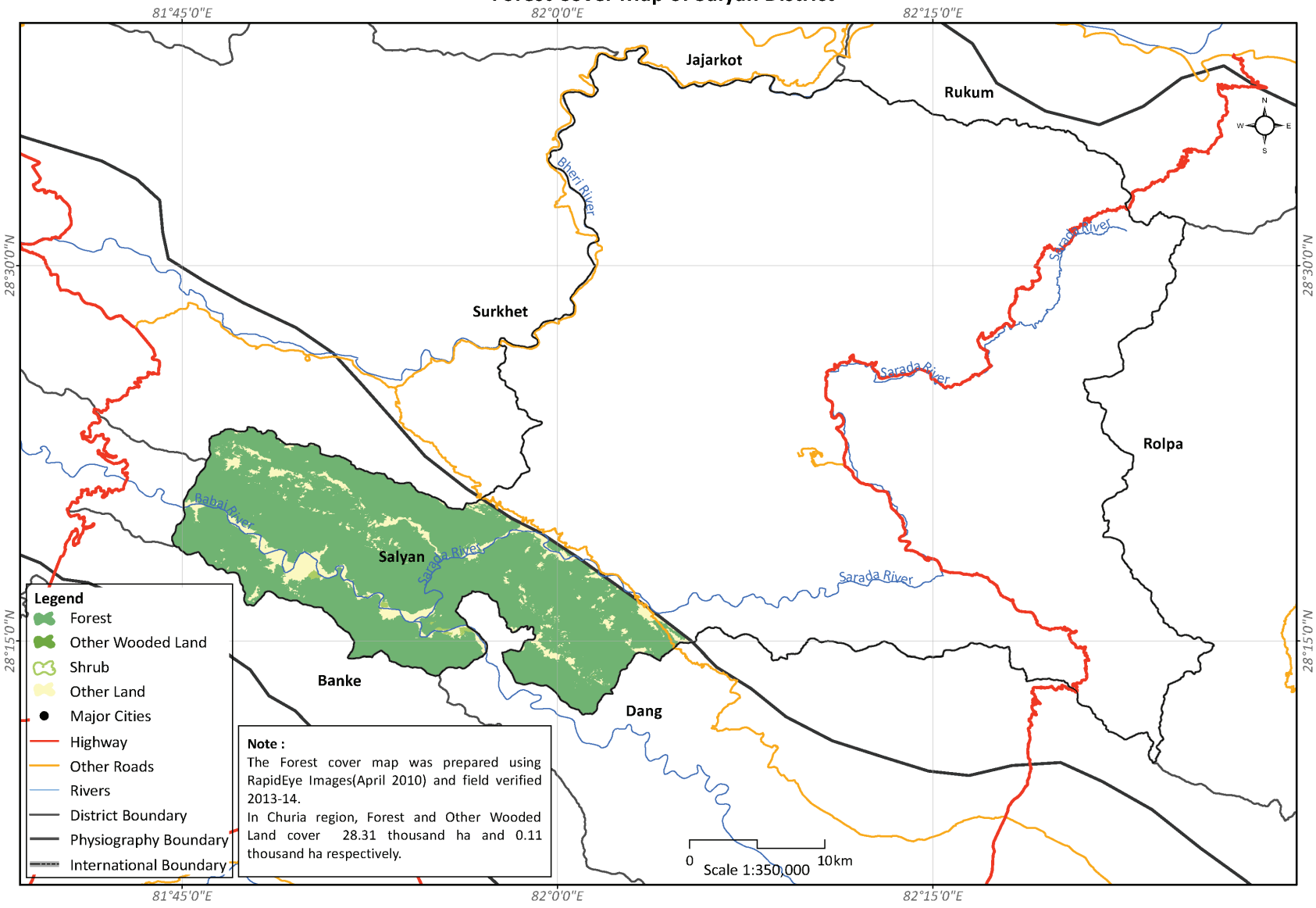
Annex 3. District Forest-cover Maps

Forest Cover Map of Banke District



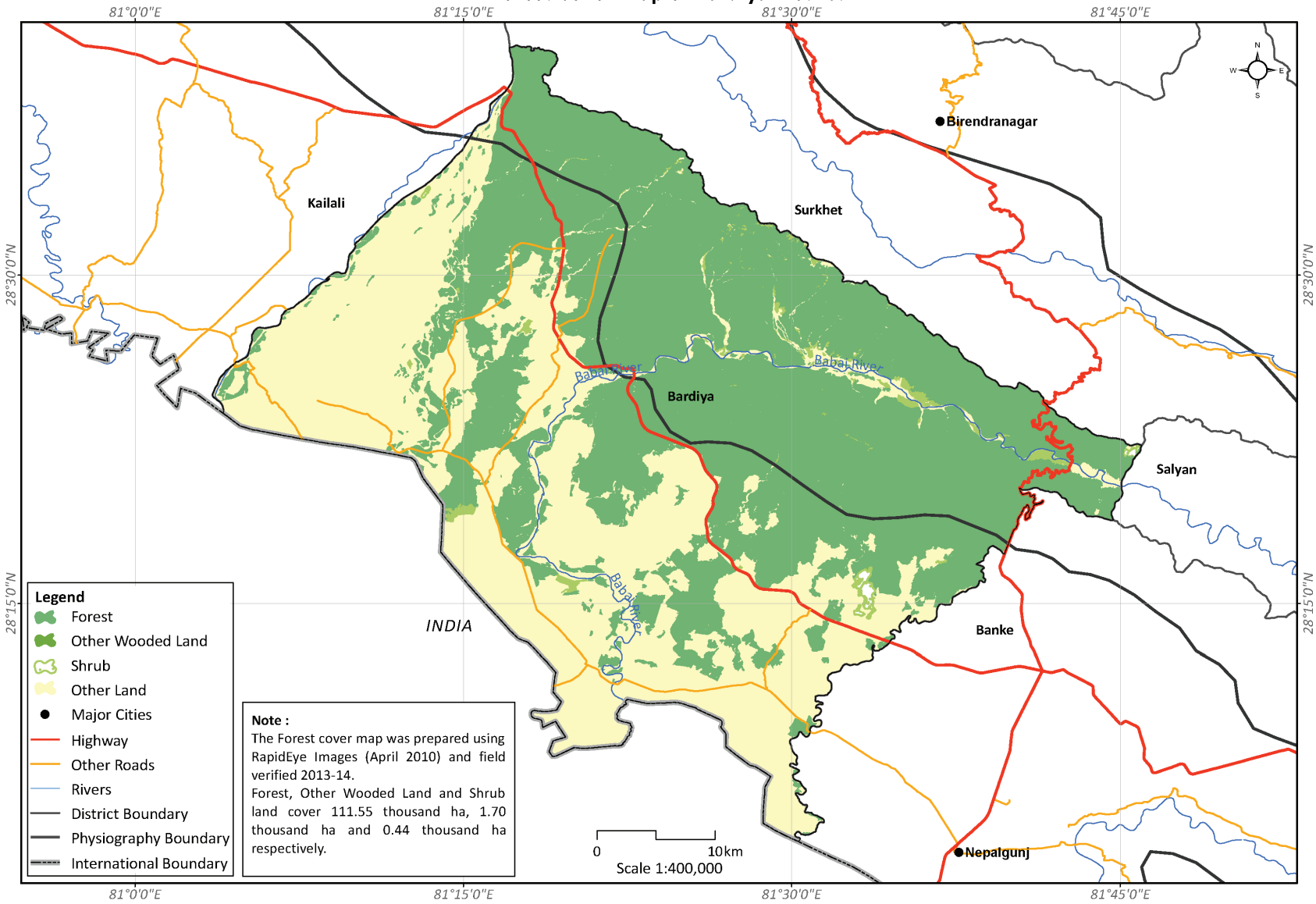
Annex 3. District Forest-cover Maps

Forest Cover Map of Salyan District



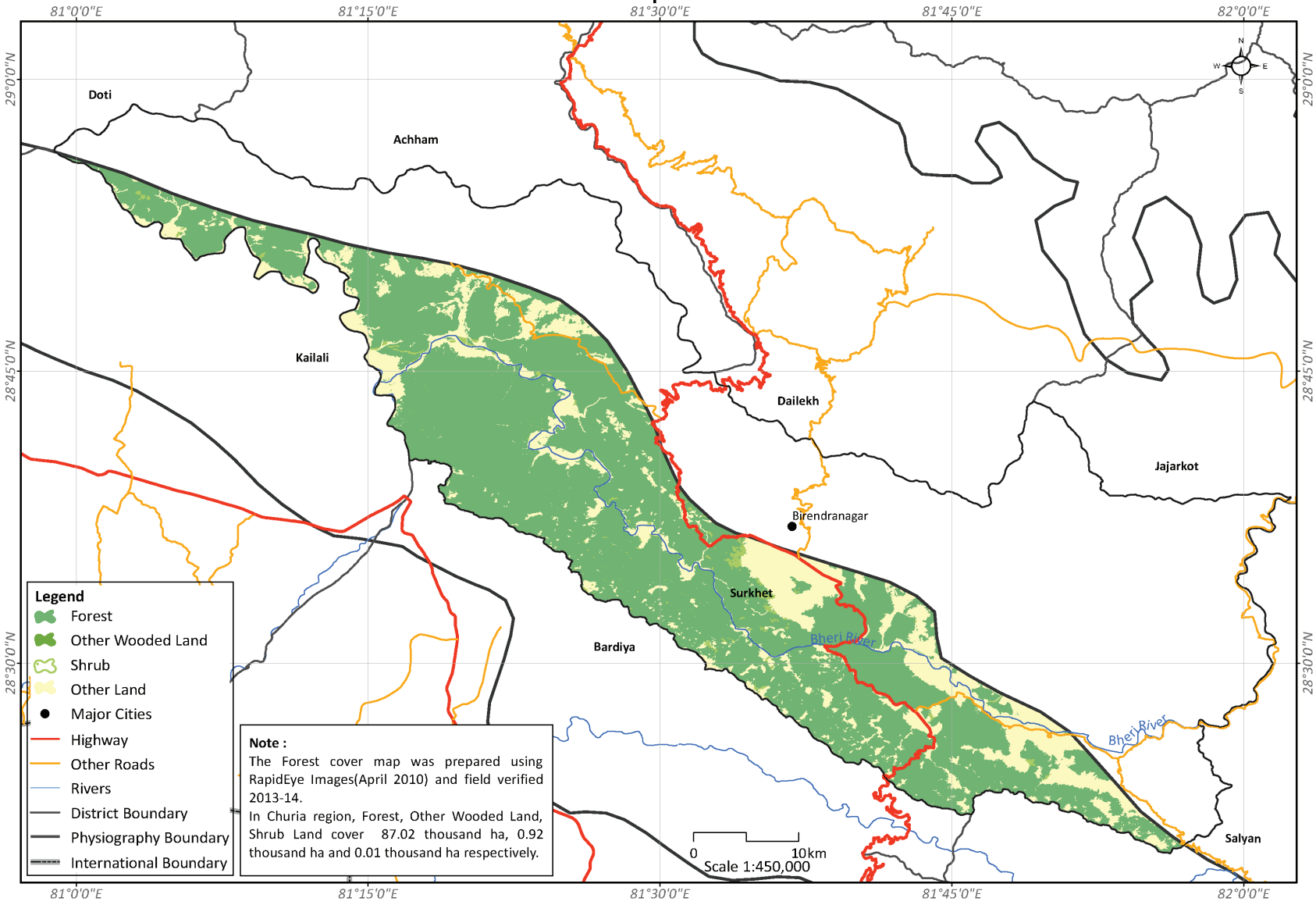
Annex 3. District Forest-cover Maps

Forest Cover Map of Bardiya District



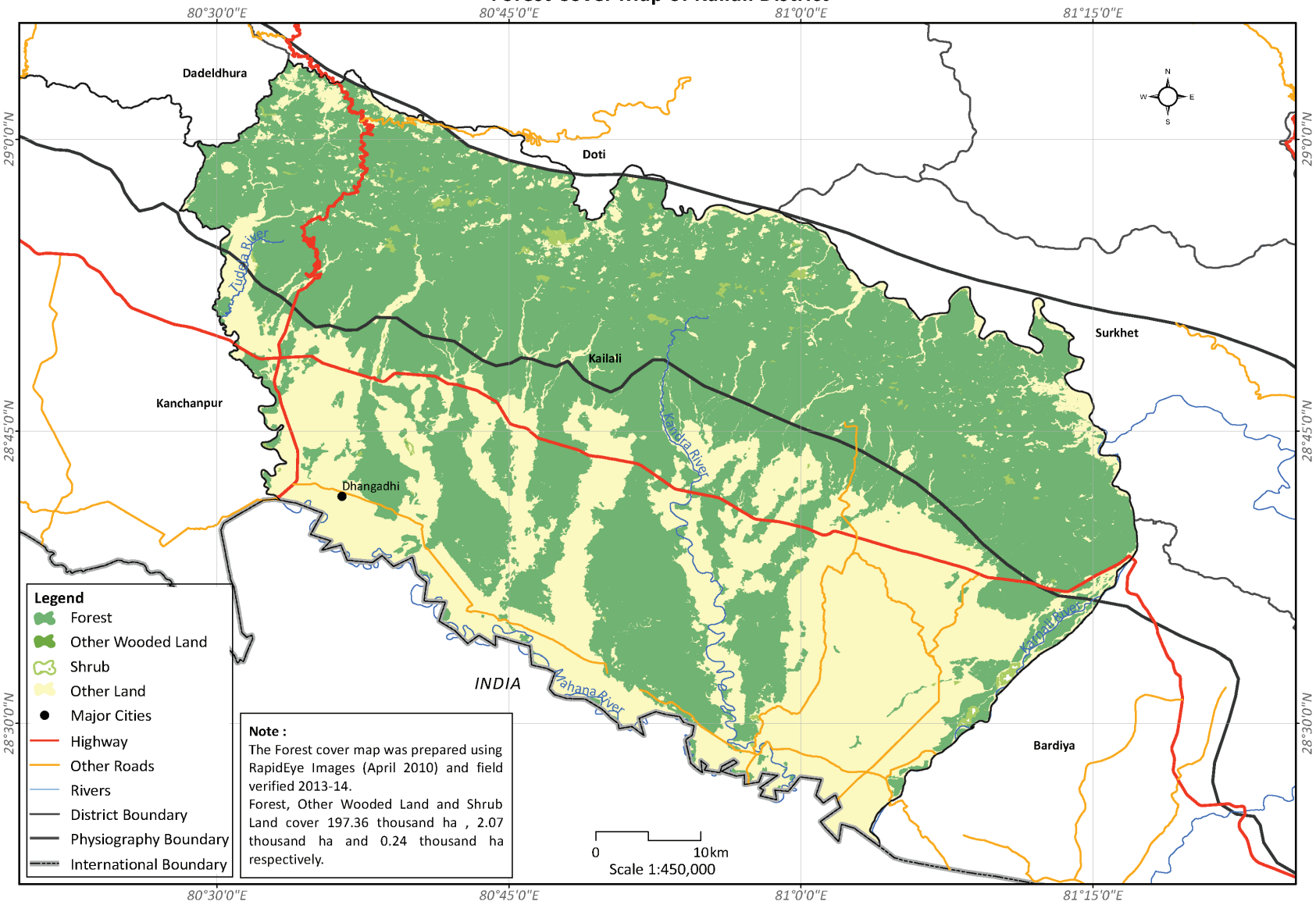
Annex 3. District Forest-cover Maps

Forest Cover Map of Surkhet District



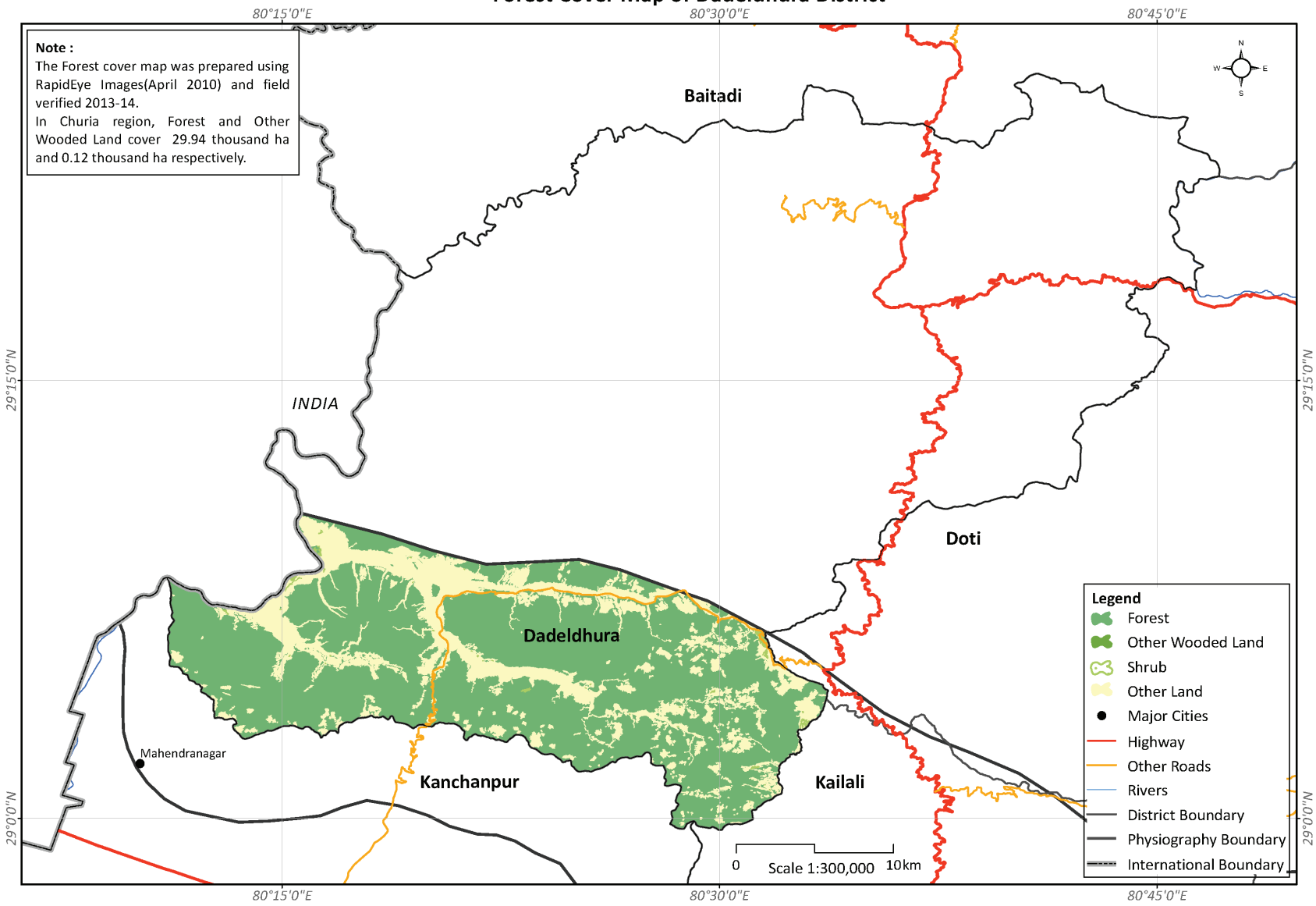
Annex 3. District Forest-cover Maps

Forest Cover Map of Kailali District



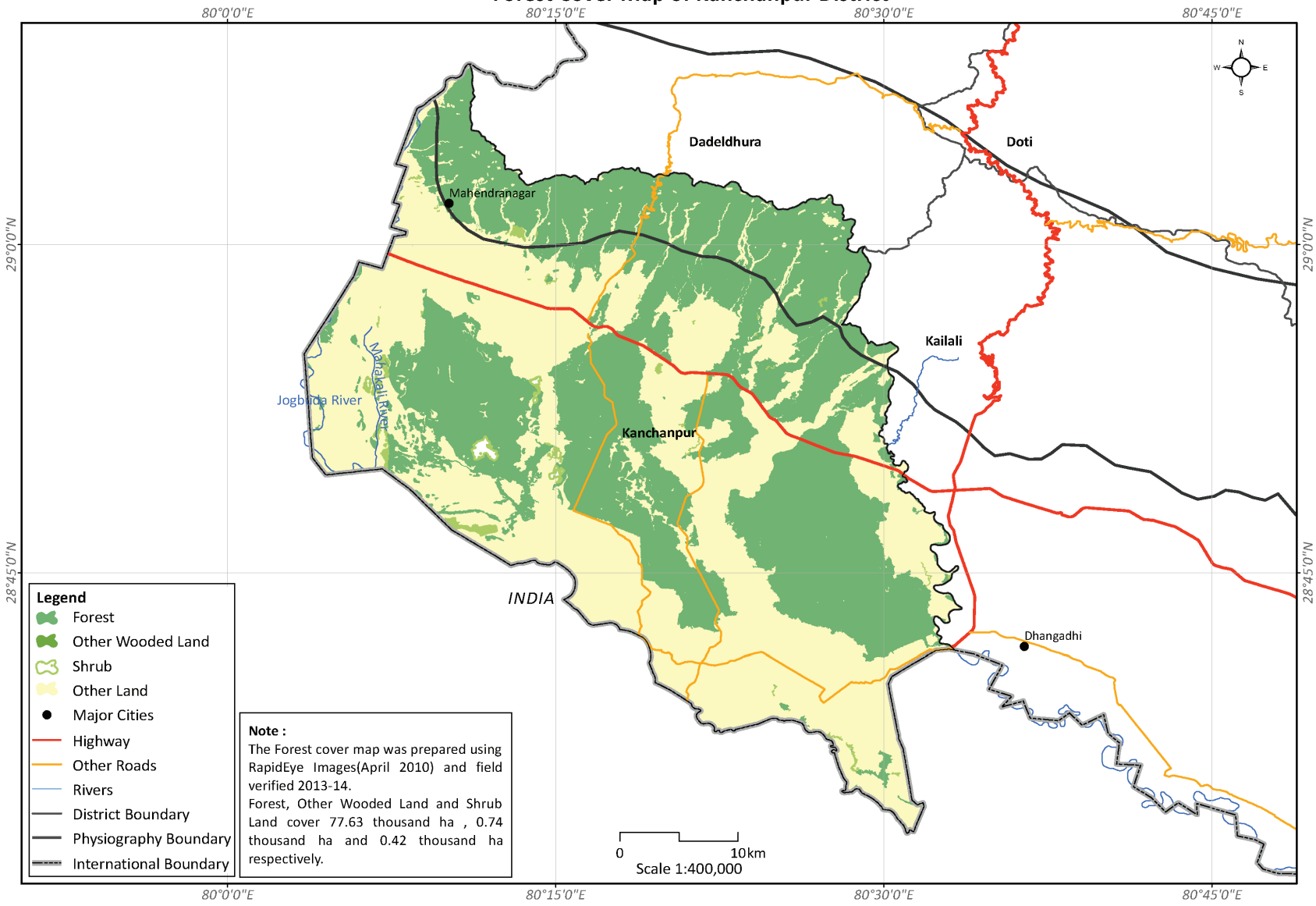
Annex 3. District Forest-cover Maps

Forest Cover Map of Dadeldhura District



Annex 3. District Forest-cover Maps

Forest Cover Map of Kanchanpur District



Annex 4. Annual rate of forest cover change in 18 districts of Churia

Annual rate of forest cover change for selected 18 districts of Churia region was presented over the period 1991-2010 and over the period 2001-2010. This is because of lack of classified historical forest cover map data for the remaining 18 districts. The forest area in these 18 districts of which there is historical data, declined by 10,215 ha over the period 1991–2010 and by 6417 ha over the period 2001–2010. The annual rate of change of forest cover in these districts was about -.09% per year over the both period 1991–2010 and -0.12% over the period 2001–2010.

Districts	DOF 1991	DOF 2001	Forest 2010	Change in area (ha)		Annual Rate of Change	
				1991-2010	2001-2010	1991-2010	2001-2010
Arghakhanchi							
Banke	74,122	73,343	77,368	3246	4,025	0.23	0.60
Bara	16,782	16,738	15,177	-1605	-1561	-0.53	-1.08
Bardiya	63,472	63,380	64,924	1452	1,544	0.12	0.27
Bhojpur							
Chitwan							
Dadeldhura							
Dang							
Dhankuta							
Dhanusha	28,266	27,549	26,685	-1581	-864	-0.30	-0.35
Doti							
Ilam							
Jhapa	7,635	7,291	6,288	-1347	-1003	-1.02	-1.63
Kailali	130,126	131,479	126,203	-3923	-5276	-0.16	-0.45
Kanchanpur	21,499	18,855	21,471	-28	2616	-0.01	1.45
Kapilbastu	21,282	21,367	21,550	268	183	0.07	0.09
Kavre							
Lalitpur							
Mahottari	13,933	14,056	12,772	-1161	-1284	-0.46	-1.06
Makwanpur							
Morang	10,864	10,236	11,652	788	1,416	0.37	1.45
Nawalparasi	74,864	76,724	75,877	1013	-847	0.07	-0.12
Palpa							-100.00
Parsa	52,622	52,085	51,282	-1340	-803	-0.14	-0.17
Pyuthan							
Rautahat	9,068	9,079	7,234	-1834	-1845	-1.18	-2.49
Rupandehi	19,522	18,948	18,593	-929	-355	-0.26	-0.21
Salyan							
Saptari	18,714	18,408	18,327	-387	-81	-0.11	-0.05
Sarlahi	16,574	16,445	14,090	-2484	-2355	-0.85	-1.70
Sindhuli							
Siraha	16,788	16,378	15,793	-995	-585	-0.32	-0.40
Sunsari	5,526	5,500	6,158	632	658	0.57	1.26
Surkhet							
Tanahu							
Udayapur							
Total	**601,659**	**597,861**	**591,444**	**-10,215**	**-6,417**	**-0.09**	**-0.12**

Source: DoF 2005 and FRA Nepal 2010

Annex 5. Forest Fragment in the Churia Physiographic Region

Table 1. Region-wise minimum and maximum cluster sizes

Region	Mean	Maximum	Minimum
Central	305.01	50,445.40	0.01
Eastern	323.32	42,052.61	0.26
Far-Western	643.48	125,205.52	0.00
Mid-Western	726.51	74,042.48	0.00
Western	548.89	39,755.56	0.25

Table 2. Proportion of fragments according to size classes

Size Class	Far-Western	Mid-Western	Western	Central	Eastern	Total
< 2	44.00%	41.44%	47.00%	43.74%	41.42%	43.29%
2-10	34.91%	32.62%	33.67%	37.89%	36.38%	35.81%
10-20	9.45%	7.75%	6.33%	6.90%	5.60%	6.97%
20-50	4.73%	5.61%	4.67%	4.21%	4.85%	4.70%
50-100	2.55%	2.67%	2.67%	2.57%	2.43%	2.56%
100-500	1.82%	4.28%	1.00%	1.87%	4.66%	2.78%
500-1000	1.45%	2.41%	0.67%	0.58%	1.31%	1.15%
1000 and over	1.09%	3.21%	4.00%	2.22%	3.36%	2.74%

Figure 1. Proportion of area and segments

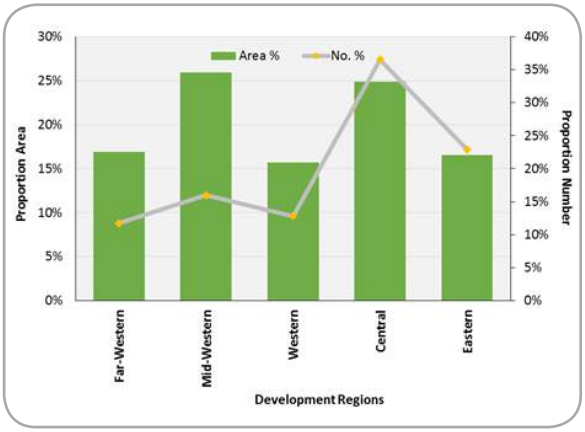


Table 3. Forest fragments in Churia according to the size classes

Forest Size Class (Ha)	Far-Western		Mid-Western		Western		Central		Eastern		Total	
	No.	Area (Ha)	No.	Area (Ha)	No.	Area (Ha)	No.	Area (Ha)	No.	Area (Ha)	No.	Area (Ha)
2-10	96	388.62	122	554.18	101	439.39	324	1,424.48	195	825.76	838	3,632.45
10-20	26	348.12	29	422.46	19	271.94	59	842.32	30	428.23	163	2,313.08
20-50	13	406.08	21	656.29	14	422.34	36	1,049.63	26	827.89	110	3,362.23
50-100	7	485.09	10	683.93	8	582.19	22	1,567.09	13	826.52	60	4,144.82
100-500	5	1,438.62	16	3,245.22	3	796.63	16	3,003.48	25	5,816.97	65	14,300.91
500-1000	4	3,351.38	9	6,070.22	2	1,312.27	5	3,371.04	7	5,678.32	27	19,783.23
1000 and over	3	170,412.27	12	259,916.44	12	160,699.73	19	249,127.16	18	158,665.17	64	998,820.76
Total	275	176,957.35	374	271,713.60	300	164,668.33	855	260,782.34	536	173,298.50	2,340	1,047,420.12

Annex 5. Forest Fragment in the Churia Physiographic Region

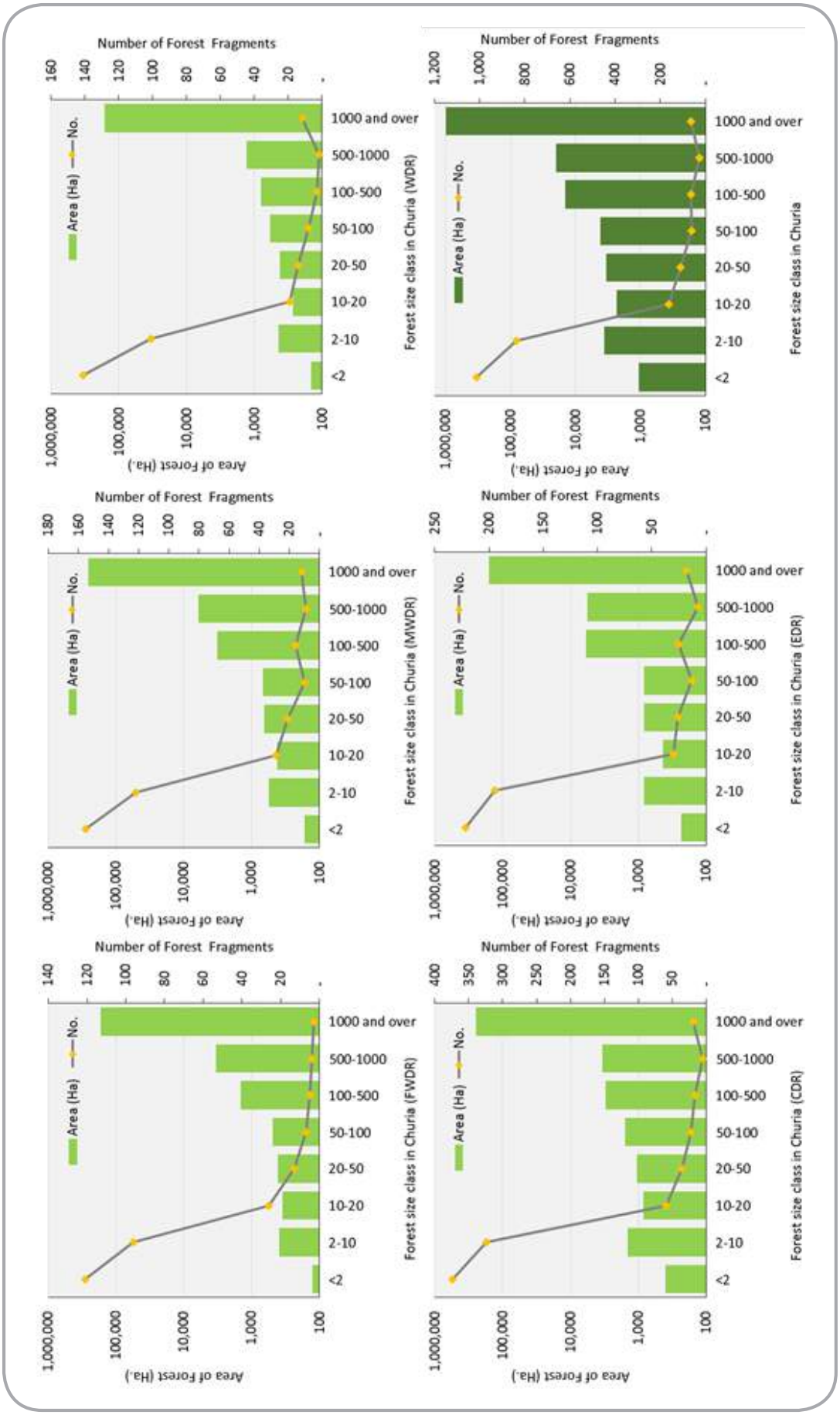


Figure 2 Forest fragment sizes in Churia

Annex 6: Quality Assurance Report

Plot No.	Plot ID	Quality Enumerated Trees	Quality No. of Trees/ha	Quality Basal Area (m2/ha)	Enumerated Trees	No. of Trees/ ha	Basal Area (m2/ ha)	Difference in Enumerated Trees	Difference in No. of trees/ha	Difference in Basal Area (m2/ ha)
1	15-77-1	11	183	11	11	184	11	0	0	-1
2	15-77-4	41	1546	37	42	1411	37	1	-135	0
3	30-69-1	31	648	28	32	627	29	1	-21	1
4	34-72-2	19	218	23	16	182	20	-3	-36	-3
5	34-72-5	4	115	5	5	165	5	1	50	0
6	46-59-3	11	326	17	11	327	17	0	0	0
7	46-59-6	12	120	12	11	106	12	-1	-14	-1
8	50-53-3	9	245	6	8	195	6	-1	-50	0
9	50-53-6	9	394	8	7	181	5	-2	-213	-3
10	54-51-1	5	547	3	7	348	5	2	-199	1
11	54-51-4	9	1158	5	8	959	5	-1	-199	0
12	59-48-2	6	144	7	6	108	6	0	-36	-1
13	59-48-5	14	894	10	14	894	10	0	0	0
14	66-46-1	9	639	7	9	639	8	0	0	0
15	66-46-4	2	249	1	2	249	1	0	0	0
16	76-43-2	6	48	23	6	48	25	0	0	2
17	76-43-5	11	88	9	11	88	9	0	0	0
18	91-39-3	24	1410	19	24	1410	20	0	0	1
19	91-39-6	22	1269	15	20	871	14	-2	-398	-1
20	101-40-1	32	3024	34	32	2791	45	0	-233	11
21	101-40-4	30	2196	24	30	2196	24	0	0	0
22	112-41-2	13	355	26	12	198	21	-1	-157	-5
23	112-41-5	20	727	27	20	578	27	0	-149	0
24	114-37-3	20	303	20	18	281	19	-2	-22	-2
25	114-37-6	12	120	16	12	120	15	0	0	-1
26	118-34-1	7	68	6	8	76	6	1	8	1
27	118-34-2	19	1106	26	18	920	24	-1	-187	-3
28	126-33-2	25	385	21	25	385	21	0	0	0
29	135-30-1	21	269	25	22	277	26	1	8	0
30	135-30-3	5	52	5	5	58	6	0	6	0
31	144-28-4	32	1098	30	32	1098	30	0	0	0
32	146-23-4	25	1078	22	25	1078	22	0	0	0
33	153-23-2	19	554	16	21	611	17	2	58	1
34	153-23-5	21	706	18	21	706	19	0	0	1
35	169-18-3	25	338	22	26	543	23	1	205	0
36	169-18-6	17	560	19	17	709	19	0	149	0
								-4	-1565	2
	Total	**598**	**23179**	**604**	**594**	**21614**	**605**	**-4**	**-1565**	**2**
	Mean	**17**	**644**	**17**	**17**	**600**	**17**	**0**	**-43**	**0**
	Maximum	41	3024	37	42	2791	45	2	205	11
	Minimum	2	48	1	2	48	1	-3	-398	-5
	Standard Deviation	10	647	9	10	609	10	1	113	2
	St. Error	2	108	2	2	101	2	0	19	0
	Upper Limit at 95 %	20	855	20	20	799	20	0	-7	1
	Lower Limit at 95 %	13	433	14	13	402	14	0	-80	-1
	Percentage of Error	**10**	**17**	**9**	**10**	**17**	**10**	**-159**	**-43**	**906**

Annex 7. Annotated Checklist of Tree

Sp.ID	Family	*Botanical Name*	Local Name
6075	Aceraceae	*Acer oblongum* Wall. ex DC.	Firfire, Putali Phool
6093	Agavaceae	*Agave angustifolia* Haw.	
6632	Anacardiaceae	*Spondias pinnata* (L.f.) Kurz	Amaro, Yamar
6611	Anacardiaceae	*Semecarpus anacardium* L.f	Bhalayo, Bhela, Kumbha, Kage Bhalayo
6591	Anacardiaceae	*Rhus wallichii* Hook.f.	Thulo Bhalayo,Bhalayo, Chosi, Dotiyal
6586	Anacardiaceae	*Rhus javanica* L.	Bhakimlo, Dudhe, Dudhe Bhalayo, Bhalayo, Bhagma Illi, Bhakmula
6426	Anacardiaceae	*Mangifera sylvatica* Roxb.	Chhuchi Aanp, Ban Aanp
6425	Anacardiaceae	*Mangifera indica* Linn.	Aanp, Amchur, Yam, Aam, Aamba Kyungba
6370	Anacardiaceae	*Lannea coromandelica* (Houtt.) Merr.	Dabdabe, Chainchuinge, hallaure, Dabdabi, bara, Jhigada, Jhigan, Jhigini, Jhighat
6184	Anacardiaceae	*Choerospondias axillaris* (Roxb.) B.L. Burtt&A.W. Hill	Lapsi, Amali, Laalang, Kalang
6147	Anacardiaceae	*Buchanania latifolia* Roxb.	Piyari, Kaja, Gayo, Char, Achar,Chiraunji, Piyal, Kath Bilawa
6446	Annonaceae	*Miliusa velutina* (Dunal) Hook. f.& Thoms.	Karyauta, Kalikath
6247	Annonaceae	*Desmos chinensis* Lour.	
6112	Annonaceae	*Annona squamata* L.	Sitaphal, Sarifa, Shariphal
6111	Annonaceae	*Annona reticulata* L.	Anti, Ramphal, Sriram Phal
6302	Apiaceae	*Ferula asafoetida* L.	
6691	Apocynaceae	*Vallaris solanacea* (Roth) Kuntze	Saphed Bel, Dudhe bel
6167	Apocynaceae	*Thevetia peruviana = Cascabela thevetia* (L.) Lippold	Pahelo Karabir, Kandel, Kanail
6164	Apocynaceae	*Carissa spinarum* L.	Karauna
6163	Apocynaceae	*Carissa carandas* L.	Paner, Karonda, Karauna
6109	Apocynaceae	*Alstonia scholaris* (L.) R. Br.	Chalamain, Chativan
6108	Apocynaceae	*Alstonia neriifolia* D. Don	
6040	Apocynaceae	*Wrightia arborea* (Dennst.) Mabberly	Ban Kera, Thulo Bankera, Thulo Kuro, Kiringi, Kaling
5347	Apocynaceae	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don	Indra Jau, Kurchi, Kebat, Madise Khirro, Dudh Khirro, Dudh Kira, Bhate Khirro
6355	Aquifoliaceae	*Ilex godajam* Colebr. ex Hook.f.	Gurbe
6608	Araliaceae	*Schefflera venulosa* (Wight & Arn.) Harms	Khursimlo, Kusmero, Kursimlo
6143	Araliaceae	*Brassaiopsis polyacantha* (Wall.) R. N. Banerjee	Dangdinge, Kalo Chuletro
6675	Arecaceae	*Trachycarpus takil* Becc.	
6504	Arecaceae	*Phoenix sylvestris* Roxb.	Khajur, Kandel, Tadi
6503	Arecaceae	*Phoenix humilis* Royle ex Becc. & Hook. f.	Khajur, Thakal
6501	Arecaceae	*Phoenix acaulis* Roxb.	Khajur, Thakal, Khajuriya, Khajuri, Takul
6212	Arecaceae	*Cocos nucifera* L.	Nariwal
6117	Arecaceae	*Areca catechu* (L. f.) Willd.	Supari
6125	Basellaceae	*Basella alba L.*	Poisag, Pawai
6134	Betulaceae	*Betula alnoides* Buch.-Ham. ex D. Don	Saur, Painyu, Lekh Saur
6107	Betulaceae	*Alnus nitida* (Spach) Endl.	Uttis
6106	Betulaceae	*Alnus nepalensis* D.Don	Uttis
6639	Bignoniaceae	*Stereospermum personatum* (Hassk.) Chatterjee	Padari, Parari, padari, Kunda, Kuber Kacha, Kuber Bacha

Annex 7. Annotated Checklist of Tree

Sp.ID	Family	*Botanical Name*	Local Name
6638	Bignoniaceae	*Stereospermum chelonoides* (L.f.) DC.	Kuber Kach, Pandari
6361	Bignoniaceae	*Jacaranda mimosifolia* D. Don	Nilo Phool, Birendra Phool
5598	Bignoniaceae	*Oroxylum indicum* (L.) Kurz	Tatelo, Karam Kanda, Sauna, Sontat, Totilla, Laamendho
6139	Bombacaceae	*Bombax ceiba* L.	Simal, Simar
6335	Burseraceae	*Garuga pinnata* Roxb.	Dabdabe, Ramsin, Aule Dabdabe, Kharpat
6224	Capparaceae	*Crateva unilocularis* Buch.-Ham.	Siplikan, Khaichola
6162	Caricaceae	*Carica papaya* Linn.	Mewa
6435	Clusiaceae	*Mesua ferrea* L.	Nageswar, Phalame, Ruk kesar, Potal, Narisal, Nag Keshar, Nageswar Champa, Nageswari
6333	Clusiaceae	*Garcinia xanthochymus* Hook. f. ex J. Anderson	Chuyal, Chunyal, Chunel
6211	Cochiospermaceae	*Cochlospermum religiosum* (L.) Alston	Kumbhi, Rukh Kumbhi
6665	Combretaceae	*Terminalia myriocarpa* Van Heurck & Mull. Arg.	Pani Saj
6664	Combretaceae	*Terminalia chebula* Retz.	Harro, Harai, Thulo Harro, Jangali Harro, Jange Harro
6662	Combretaceae	*Terminalia bellirica* (Gaertn.) Roxb.	Barro, Barai, Bahera
6661	Combretaceae	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Arjun, Kahulo, Kahu
6660	Combretaceae	*Terminalia alata* Heyne ex Roth	Asna, Saj, Yasal, Sajha, Asan
6113	Combretaceae	*Anogeissus latifolius* (Roxb. ex DC.) Bedd.	Banjhi, Bad dhaera, Vakli, Dhavadan
6270	Cordiaceae	*Ehretia macrophylla* Wall.	Lodo
6269	Cordiaceae	*Ehretia laevis* Roxb.	Loro, Pan, Datrung, Datingal, Chamror
6267	Cordiaceae	*Ehretia acuminata* R. Br. var. seruata (Roxb.) I.M. Johnston	Seto Loro, Dhatrunga, Chille, Nalsuna
6221	Cornaceae	*Cornus oblonga* (Wall.) Sojak	Latikath, Latikath
6668	Cupressaceae	*Thuja orientalis* L.	Mayur Pankhi
6228	Cycadaceae	*Cycas pectinata* Griff.	Kalbal, Thakal, Dheduwako Puchhar, Khajurati, Banarak Lathi
6244	Daphniphyllaceae	*Daphniphyllum himalense* (Benth.) Mull.-Arg.	Rakcha, Rakta Chandan
6250	Dilleniaceae	*Dillenia pentagyna* Roxb.	Tantari, Agai, Chalta
6615	Dipterocarpaceae	*Shorea robusta* Gaertn.	Sal, Sakhuwa, Agrakh, Chimar, Sakhu
6259	Ebenaceae	*Diospyros tomentosa* Roxb.	Abinas,Bidi Pat, Tendu
6256	Ebenaceae	*Diospyros malabarica* (Desr.) Kostel.	Allo, Kalo Tendu, Khallu, Teju, Halabed
6573	Ericaceae	*Rhododendron arboreurn* Smith var. *arboretum*	Lali Guras, Tango, Bhorans, Dotiyal, Ghoras, Guras, Taggu, Pada Mendo
6405	Ericaceae	*Lyonia ovalifolia* (Wall.) Drude	Angeri, Angir, Chele, Jaggu Chal, Gobre, Tissi
6676	Euphorbiaceae	*Trewia nudiflora* Linn.	Gutel, Vellor, Ramrittha, Aule Kapasi, Gamari, Velthar, Gurel,Pitha
6602	Euphorbiaceae	*Sapium insigne* (Royle) benth. Ex Hook.f.	Ban Peepal, Khirro, Kherra
6601	Euphorbiaceae	*Sapium eugeniaefolium* Buch.-Ham. ex Hook.f.	
6507	Euphorbiaceae	*Phyllanthus emblica* Linn.	Amala, Yabara, Aaura
6506	Euphorbiaceae	*Phyllanthus acidus* (L.) Skeels	Pate Amala, Kathe Amala, Hari Phal

Annex 7. Annotated Checklist of Tree

Sp.ID	Family	*Botanical Name*	Local Name
6419	Euphorbiaceae	*Mallotus philippensis* (Lam.) Mull.-Arg.	Rohini, Ruina, Sindur, Sindure
6409	Euphorbiaceae	*Macaranga pustulata* King ex Hook.f.	Mallito
6408	Euphorbiaceae	*Macaranga indica* Wight.	Papri, Maledo, Malata
6407	Euphorbiaceae	*Macaranga denticulata* (Blume) Mull-Arg.	Mallato
6144	Euphorbiaceae	*Bridelia retusa* (L.) Spreng.	Gayo, Kaja
6115	Euphorbiaceae	*Aporusa octandra* (Buch.- Ham. ex D. Don) A. R. Vickery	Hade
5405	Euphorbiaceae	*Jatropha curcas* L.	Sajiwan, Nirguni, Sajiwa, Ratanjot, Saruwa, Sajiyon, Hatti Kane, Batti Bal, Baghandi, Arin
4842	Euphorbiaceae	*Antidesma acidum* Retz.	Archale, Himalcheri, Amari, Amar, Imili, Kali Katai
6655	Fabaceae	*Tamarindus indica* L.	imili, Titri, Tetor, Tale Amilo, Amili
6614	Fabaceae	*Sesbania sesban* (L.) Merr.	
6613	Fabaceae	*Sesbania grandiflora* (L.) Poir.	Agasti, Agast
6612	Fabaceae	*Sesbania bispinosa* (Jacq.) W. Wight	Kande Dhaicha
6603	Fabaceae	*Saraca asoca* (Roxb.) De Wilde	Ashok, Asau
6549	Fabaceae	*Pterocarpus marsupium* Roxb.	Bijaya Sal, Bijaya Sar, Bandhuk Puspa
6516	Fabaceae	*Pithecellobium bigeminum* (L.) Benth.	
6287	Fabaceae	*Erythrina stricta* Roxb.	Mandar, Panjir, Parijat, Phaledo
6286	Fabaceae	*Erythrina arborescens* Roxb.	Phaledo, Roding, Theki Kath
6246	Fabaceae	*Desmodium oojenense* (Roxb.) Ohashi	Sadan, Pandan, Tinkire, Sandan pipli, Sadhan, Panjan, Panan
6245	Fabaceae	*Delonix regia* (Bojer. ex Hook.f.) Rafin	Gulmohar
6240	Fabaceae	*Dalbergia stipulacea* Roxb.	Tantebiri, Tate vari
6239	Fabaceae	*Dalbergia sissoo* Roxb. ex DC.	Sisam, Sissoo, Sisawa
6237	Fabaceae	*Dalbergia pinnata* (Lour.) Prain	Damar
6172	Fabaceae	*Cassia fistula* L.	Rajbrikshya, Bandar lathi, Amaltas, banarak lathi, Kirala, Sinara
6153	Fabaceae	*Butea monosperma* (Lam.) Kuntze	Palas, Dhak, Tesu, Hastakarni, palas, Bulyatra
6131	Fabaceae	*Bauhinia variegata* L.	Koiralo, Kanabu, Seto Koiralo,Koirar, kachnar, Aanbu
6129	Fabaceae	*Bauhinia scandens* L.	
6127	Fabaceae	*Bauhinia purpurea* L.	Tanki, Rato Koiralo, Koiralo, Kachnar
6126	Fabaceae	*Bauhinia malabarica* Roxb.	Tanki,, Amil Tanki, Asoti, Khatta Jhinjhora, Jhinjhora, Khatuwa
6105	Fabaceae	*Albizia lebbeck* (L.) Benth.	Kalo Siris
6103	Fabaceae	*Albizia odoratissima* (L. f.) Benth.	Karkur, Sirish, Siran, Padke, Karkure Siris
6101	Fabaceae	*Albizia julibrissin* Durazz.	Lakhe, Padke Sirish, Rato Sirish, Thanaka
6066	Fabaceae	*Acacia rugata* (Lam.) Voigt	Rasula, Sikakai
6064	Fabaceae	*Acacia nilotica* (L.) Willd. ex Del. subsp. *indica* (Benth.) Brenan	Babul, Kikar
6063	Fabaceae	*Acacia catechu* (L. f.) Willd.	Khayar
6235	Fabaceae	*Dalbergia latifolia* Roxb.	Satisal
6104	Fabaceae	*Albizia procera* (Roxb.) Benth.	Seto Siris
6098	Fabaceae	*Albizia chinensis* (Osbeck) Merr.	Kalo Siris

Annex 7. Annotated Checklist of Tree

Sp.ID	Family	*Botanical Name*	Local Name
6565	Fagaceae	*Quercus leucotrichophora* A.Camus	Tikhe Banjh, Tikhe Ghas, Banjh, Sano Banjh
6564	Fagaceae	*Quercus lanata* Sm.	Banjh, Phalant, Thulo Banjh, Banga, Sano Phalat
6563	Fagaceae	*Quercus lamellosa* Sm.	ThulovPhalant, Gogane, Pharat- Singhali, Shalsi, bansi, Banga, Phalant, Bongshet, Pharat
6560	Fagaceae	*Quercus glauca* Thunb. var. *glauca*	Sano Phalant, Phalant
6177	Fagaceae	*Castanopsis tribuloides* (Sm.) A. DC.	Musure Katus, Singara
6176	Fagaceae	*Castanopsis lancifolia* (Kurz) Hickel & A. Camus	Aaule Katus, Patle Katus
6175	Fagaceae	*Castanopsis indica* (Roxb.) Miq.	Dhale katus, Katus, Dhalne Katus, Banjh Katus, Chyakpal
6173	Fagaceae	*Castanopsis echinocarpa* Miq.	
6698	Flacourtiaceae	*Xylosma longifolium* Clos	Chirauda, Sallu, Dade kanda, Dhare kanda, Siyalu, Katari, Phalam, Kandhara
6329	Flacourtiaceae	*Flacourtia jangomas* (Lour.) Raeusch.	
6170	Flacourtiaceae	*Casearia graveolens* Dalzell	Badkaule, Pipane
6168	Flacourtiaceae	*Casearia elliptica* Willd.	Thulo Deri, Sano Bethe, Chilla, Deri, Beri
5282	Flacourtiaceae	*Flacourtia indica* (Burm. f.) Merr.	Kandail
6299	Hamamelidaceae	*Exbucklandia populnea* (R. Br. ex Griff.) R. W. Br.	Piple, Pipli
6362	Juglandaceae	*Juglans regia* L.	Okhar, Hade Okhar, Akhrot
6280	Juglandaceae	*Engelhardia spicata* Lesch. ex *Blume var. colebrookeana* Lesch. ex Blume	Mahuwa
6499	Lauraceae	*Phoebe lanceolata* (Nees) Nees	Jhakri, Syaula, Jhakri Kath
6498	Lauraceae	*Phoebe cathia* (Buch.-Ham. ex D.Don) Kosterm.	
6495	Lauraceae	*Persea villosa* (Roxb.) Kosterm.	
6493	Lauraceae	*Persea odoratissima* (Nees) Kosterm.	Seto Kaulo, Kaulo, Roro
6491	Lauraceae	*Persea duthiei* (kingex Hook.f.) Kosterm	Kaulo, Mahilo Kaulo
6465	Lauraceae	*Neolitsea umbrosa* (Nees) Gamble	Putali, Khapate, Phephe, Potele
6402	Lauraceae	*Litsea salicifolia* (Roxb. ex Nees) Hook.f.	Paheli
6401	Lauraceae	*Litsea monopetala* (Roxb.) pers.	Kutmero, Ghante Phool, Ratmate, Kadmero, Putmero
6395	Lauraceae	*Litsea doshia* (Buch.-Ham. ex D.Don) Kosterm.	Jhakre Seula, Paheli, Padke Kath
6394	Lauraceae	*Litsea cubeba* (Lour.) Pers.	Siltimbur
6381	Lauraceae	*Lindera pulcherrima* (Nees) Benth. ex Hook. f.	Syalphusre
6194	Lauraceae	*Cinnamomum zeylanicum* Breyn.	Dalchini
6193	Lauraceae	*Cinnamomum tamala* (Buch.-Ham.) Nees & Eberm.	Tejpat, Shisi
6192	Lauraceae	*Cinnamomum parthenoxylon* (Jack) Meisn.	
6191	Lauraceae	*Cinnamomum impressinervium* Meisn.	

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6188	Lauraceae	*Cinnamomum camphora* (L.) J. Presl	
6187	Lauraceae	*Cinnamomum bejolghota* (Buch.-Ham.) Sweet	Sinkauli, Bara Singoli
6133	Lauraceae	*Beilschmiedia roxburghiana* Nees.	
5654	Lauraceae	*Persea gamblei* (King ex Hook. f.) Kosterm.	Kathe Kaulo
6160	Lecythidaceae	*Careya herbacea* Roxb.	Kumbhi, Kuma, Bodar
5425	Leeaceae	*Leea aequata* L.	Kak Nasika, Kag Jangha, Kag Chchche
5226	Leguminosae	*Erythrina suberosa* Roxb.	Phullidha, Burumarer, Mader, Dhauldhak, Madar, Phaledo
4813	Leguminosae	*Acacia pennata* (L.) Willd.	Aradi, Arare, Arphu, Ghante Arphu, Agaiya Bel, Agla Alle, Pan
6451	Loganiaceae	*Mitrasacme pygmaea* R. Br.	
6151	Loganiaceae	*Buddleja macrostachya* Benth.	Bhimsen pati
6148	Loganiaceae	*Buddleja asiatica* Lour.	Sina Swan, Bhimsen Pate, Narayan Pati, Cheule
6373	Lythraceae	*Lawsonia inermis* Linn.	Meharee
6369	Lythraceae	*Lagerstroemia parviflora* Roxb.	Bot Dhaiyaro, Asare, Sidda, Hade
6368	Lythraceae	*Lagerstroemia indica* L.	Asare Phool
5421	Lythraceae	*Lagerstroemia reginae* Roxb.	Asare Phool, Thulo Asare Phool
6439	Magnoliaceae	*Michelia excelsa* Blume.	Seto Chanp
6437	Magnoliaceae	*Michelia champaca* L.	Chanp, Aule Chanp, Champa, Sun Chanp, Phul Chanp
6418	Magnoliaceae	*Magnolia pterocarpa* Roxb.	Patpate
6413	Magnoliaceae	*Magnolia campbellii* Hook.f. & Thoms.	Chanp, Purbeli
6367	Malvaceae	*Kydia calycina* Roxb.	Kubhinde, Bori, Pali, Pala, Pulu, Puli
6180	Malvaceae	*Ceiba pentandra* (L.) Gaertn.	
6677	Meliaceae	*Trichilia connaroides* (Wight & Arn) Benfvelzen	Chaichunge, Singmur, Aankha taruwa, Ankha Tare, Komal Siuli
6669	Meliaceae	*Toona ciliata* M. Roem.	Tooni, Tuna, Tuni
6462	Meliaceae	*Naregamia alata* W. & A.	Pitta Papada
6429	Meliaceae	*Melia dubia* Cav.	
6428	Meliaceae	*Melia azedarach* Linn.	Bakenu, Bakaino, Khaibasi, Bakain
6265	Meliaceae	*Dysoxylum gobara* (Buch.-Ham.) Merr.	Lasune, Thulo Dhamina, Dhamina
6264	Meliaceae	*Dysoxylum binectariferum* (Roxb.) Hook. f. ex Bedd.	Bauri Phal, Dhamina, Sano Dhamina
6123	Meliaceae	*Azadirachta indica* A. Juss.	Nim
6641	Moraceae	*Streblus asper* Lour.	Bedula,Kakshi
6325	Moraceae	*Ficus semicordata* Buch.-Ham. ex Sm.	Khaniyo, Khurhuri
6324	Moraceae	*Ficus rumphii* Blume	Pakar, Pakhar, Sammi
6323	Moraceae	*Ficus religiosa* L.	Pipal, Pipar
6322	Moraceae	*Ficus racemosa* L.	Pakar, Dumri, Gullar, Dumari
6320	Moraceae	*Ficus neriifolia* Sm. var. *neriifolia*	Dudhilo, Dudh Karaiya, Magoo(Tam.)
6316	Moraceae	*Ficus lacor* Buch.-Ham.	Kabhro, Pakadi, Palaksa, Pilkhan
6315	Moraceae	*Ficus hispida* L.f.	Kharseto, Kharawa, Kharseto, Thotne, Tote
6314	Moraceae	*Ficus glaberrima* Blume	Pakhuri
6311	Moraceae	*Ficus carica* L.	Anjir, Bhote Dakhh, Nebharo

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Sp.ID	Family	*Botanical Name*	Local Name
6309	Moraceae	*Ficus benjamina* L. var. *benjamina*	Sami, Swami, Chonkar
6307	Moraceae	*Ficus benghalensis* Linn.	Bar
6306	Moraceae	*Ficus auriculata* Lour.	Nibharo, Timilo, Bhemala, Nimaro, Timile, Khamare, Anjir
6304	Moraceae	*Ficus arnottiana* Miq.	
6122	Moraceae	*Artocarpus lakoocha* Wall. ex Roxb.	Badahar
6121	Moraceae	*Artocarpus integra* (Thunb.) Merr.	Rukh Katahar
6120	Moraceae	*Artocarpus heterophyllus* Lam.	Katahar
6119	Moraceae	*Artocarpus chaplasha* Roxb.	Later
6455	Moringaceae	*Moringa oleifera* Lam.	Shovanjan, Sahijan
6456	Myricaceae	*Myrica esculenta* Buch.-Ham. ex D.Don	Kaphal, Kawasi, Kapsi
6651	Myrtaceae	*Syzygium cumini* (L.) Skeels = *Eugenia jambolana*	Jamuna, Jambu, Phadir, Kalo Jamun, Karki Jamun, Jam, Jambu
6650	Myrtaceae	*Syzigium aromaticum* (L.) Merr. & Perry	Lwang
6548	Myrtaceae	*Psidium guajava* Linn.	Amba, belauti, Ambak, Runi, Latam, Amarud
6290	Myrtaceae	*Eucalyptus camaldulensis* Dehn.	Masala
6289	Myrtaceae	*Eucalyptus amygdalina* Labill.	
6288	Myrtaceae	*Eucalyptus alba* Reinw. ex Blume	Masala, Gorharki Gachha
6207	Myrtaceae	*Cleistocalyx operculatus* (Roxb.) Meer. & Perry	Kyamuna, Phulepa, Phandir
6470	Ochnaceae	*Ochna obtusata* DC.	
6477	Oleaceae	*Osmanthus fragrans* Lour.	Silinge, Siringe
6469	Oleaceae	*Nyctanthes arbor-tristis* Linn.	Parijat, Ratgamki, Kurri, Harsingar, Harsingar, Harsingha,Budilo
6330	Oleaceae	*Fraxinus floribunda* Wall.	Lankuri
6140	Palmae	*Borassus flabellifer* L.	Tad, Tadi, Tal, Dariwal
6513	Pinaceae	*Pinus roxburghii* Sarg.	Rani Salla, Khote Salla, Salla, Aule Salla
6339	Proteaceae	*Grevillea robusta* A.Cunn. ex R. Br.	Kagiyo, Kagiyo Rukh
5706	Punicaceae	*Punica granatum* L.	Anar, Darim
6702	Rhamnaceae	*Zizyphus rugosa* Lam.	Kanta Bayar, Harra Bayar, Ban Bagero, Rukh Bayari, Phander, Kath Ber
6701	Rhamnaceae	*Zizyphus mauritiana* Lam.	Bayar, Bayari, Pewandi, Pemdi Ber
6700	Rhamnaceae	*Zizyphus incurva* Roxb.	Hade Bayar, Damlashi
6556	Rosaceae	*Pyrus pashia* Buch.- Ham. ex D.Don	Mayal, Pana
6555	Rosaceae	*Pyrus malus* L.	
6553	Rosaceae	*Pyrus communis* L.	
6545	Rosaceae	*Prunus saliciana* Lindl.	
6541	Rosaceae	*Prunus persica* (L.) Batsch	Aaru, Aadu, Khale
6530	Rosaceae	*Prunus amygdalus* Batsch	Kagaji Badam
6696	Rubiaceae	*Xeromphis uliginosa* (Retz.) Maheshwari	Pindar, Pirar, Maidal
6695	Rubiaceae	*Xeromphis spinosa* (Thunb) Keay	Main kanda, Main Phal, Maidal, Madan Phal, Amuki
6694	Rubiaceae	*Wendlandia puberula* DC.	Kainyu, Ban Kanyau
6448	Rubiaceae	*Mitragyna parviflora* (Roxb.) Korth.	Tikul, Sano Haldu, Phaldu, Kaim
6350	Rubiaceae	*Hymenodictyon flaccidum* Wall.	Karam
6349	Rubiaceae	*Hymenodictyon excelsum* (Roxb.) Wall.	Lati Karam, Seti Kath, Bhurkul,Bhudkul

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Sp.ID	Family	*Botanical Name*	Local Name
6213	Rubiaceae	*Coffea arabica* L.	Coffee
6114	Rubiaceae	*Anthocephalus chinensis* (Lam.) A. Rich. ex Walp.	Kadam
6089	Rubiaceae	*Adina cordifolia* (Willd. ex Roxb.) Benth. & Hook. f. ex Brandis	Karam, Haldu, Karma
6031	Rubiaceae	*Wendlandia proxima* (D. Don) DC.	---
6029	Rubiaceae	*Wendlandia exserta* (Roxb.) DC.	Rato Kaiyo, Ban Kaiyo, Badhuwa, Chaulai, Tilko, Tiluko
5636	Rubiaceae	*Pavetta indica* L.	Kagiyo Phool, Takali
6301	Rutaceae	*Feronia limonia* (L.) Swingle	Amilo Bel, Kaitho,Karanda,Karanta, Kentho
6206	Rutaceae	*Citrus sinensis* Osbek	Suntala
6205	Rutaceae	*Citrus reticulata* Blanco	Suntola
6203	Rutaceae	*Citrus medica* Linn.	
6202	Rutaceae	*Citrus maxima* (Burm. ex Rumph.) Merr.	Bhogate
6201	Rutaceae	*Citrus limon* (L.) Burm.f.	Nibuwa, Lembakyumba
6198	Rutaceae	*Citrus junos* Tanaka	
6197	Rutaceae	*Citrus jambhiri* Lush.	
6196	Rutaceae	*Citrus aurantium* Linn.	
6195	Rutaceae	*Citrus aurantifolia* (Christ.) Swingle	Kagati
6090	Rutaceae	*Aegle marmelos* (L.) Correa	Bel, Bel patra
6047	Rutaceae	*Zanthoxylum armatum* DC.	
5975	Rutaceae	*Toddalia asiatica* (L.) Lam.	Mainkara, Mainkangra
5569	Rutaceae	*Murraya koenigii* (L.) Spreng.	Asare, Mitho Nim, Khole Jamun, Machimer, Mechiya Sag
6593	Salicaceae	*Salix babylonica* L.	Bains, Tissi
6526	Salicaceae	*Populus jacquemontiana* Dode	Pipal Lahara
6525	Salicaceae	*Populus ciliata* Wall. ex Royle	Bhote Pipla Bange Kath, Lekh Pipla
6598	Santalaceae	*Santalum album* L.	Shree Kanda, Chandan
6610	Sapindaceae	*Schleichera oleosa* (Lour.) Oken	Kusum, Gosum, Gausam
6599	Sapindaceae	*Sapindus mukorossi* Gaertn.	Rittha
6385	Sapindaceae	*Litchi chinensis* Sonner	
6412	Sapotaceae	*Madhuca longifolia* (Koeing) Macbride	Mahuwa, Chiuri
6411	Sapotaceae	*Madhuca latifolia* (Roxb.) Macbride	Latimauwa, Mahuwa
6261	Sapotaceae	*Diploknema butyracea* (Roxb.) H.J. Lam = *Aesandra butyracea* (Roxb.) Baehni	
6607	Saurauiaceae	*Saurauia tristyla* DC.	
6605	Saurauiaceae	*Saurauia napaulensis* DC.	Gogan. Gogane, Tonsi, Ratendu, Gogina, Tingir
5883	Solanaceae	*Solanum angum* Lam.	Bihi, Nilo Bihi, Thulo Bihi, Bhut Kataiya, Kalchauda Kanda
6263	Sonneratiaceae	*Duabanga grandiflora* (Roxb. ex DC.) Walp.	Lampate, Odhane, Lampatiya
6137	Staphyleaceae	*Bischofia javanica* Blume	Kainjal, Adhikrini, Ken
6637	Sterculiaceae	*Sterculia villosa* Roxb.	Odal, Odane, Andal
6635	Sterculiaceae	*Sterculia foetida* L.	Kaju
6634	Sterculiaceae	*Sterculia balanghas* L. var. *angustifolia* (Roxb. ex G. Don) Mast.	

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Sp.ID	Family	*Botanical Name*	Local Name
6551	Sterculiaceae	*Pterospermum acerifolium* (L.) Willd.	Hatti Pailo, Golaicho, Mayang, kanak Champa, Kathe Chanp, Mushkanda
6327	Sterculiaceae	*Firmiana colorata* (Roxb.) R. Br.	
6649	Symplocaceae	*Symplocos theifolia = S. lucida =S. phyllocalyx*	Ghoge, Hakulal, Ghole, Bakalpati
6648	Symplocaceae	*Symplocos sumuntia* Buch.-Ham. ex D. Don	Hakulal
6646	Symplocaceae	*Symplocos ramosissima* Wall. ex G. Don	Kharane, Dabdabe
6645	Symplocaceae	*Symplocos racemosa* Roxb. var. *racemosa*	Lodh, Kholme, Seti Biraunli
6644	Symplocaceae	*Symplocos racemosa* Roxb.	Lodh, Kholme, Seti Biraunli, Chamlane, Chamalyo
6643	Symplocaceae	*Symplocos pyrifolia* Wall. ex G. Don	Kholme, Seti Kath
6458	Tamaricaceae	*Myricaria rosea* W. W. Sm.	Orima
6226	Taxodiaceae	*Cryptomeria japonica* (L.f.) D.Don	Katle salla, Dhupi salla
6667	Tetramelaceae	*Tetrameles nudiflora* R. Br.	
6609	Theaceae	*Schima wallichii* (DC.) Korth.	Chilaune, Aule Chilaune, Goichasi, Sule Chilaune
6296	Theaceae	*Eurya acuminata* DC.	Jhigane, Jhyanu, Pate, Tegar, Sano jhigni, Jhikune Pate, Tinger, Thyasu, Pajan
6209	Theaceae	*Cleyera japonica* Thunb. var. *wallichiana* (DC.) Sealy	Baklopati, Kalo Baklepate
6341	Tiliaceae	*Grewia subinaequalis* DC.	Falsa, Fussi, Syal Phusro, Phosro, Harsa-Pharsa, Phalsa
5326	Tiliaceae	*Grewia optiva Drumm.* ex Bturet	Bhimal, Bhebul, Bheol, Syal Phusre
6345	Ulmaceae	*Holoptelea integrifolia* (Roxb.) Planch.	Khamari, kanju, papari, Methe Phal, Sano Pangre, Papri
6181	Ulmaceae	*Celtis australis* L.	Khari, Khadko
5160	Urticaceae	*Debregeasia salicifolia* (D. Don) Rendle	Dar, Tusare
4951	Urticaceae	*Boehmeria rugulosa* Wedd.	Daar, Getha, Jenthi, Jenti
6659	Verbenaceae	*Tectona grandis* L.f.	Teak, Sagawan, Saguan
6337	Verbenaceae	*Gmelina arborea* Roxb.	Khamari, Gambari, Gamhari, Khamar
6156	Verbenaceae	*Callicarpa arborea* Roxb.	Gaulo, Mas Gede,Thulo Daikamala
6025	Verbenaceae	*Vitex peduncularis* Wall. ex Schauer	---

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
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Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
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120_36.1													2																1	4																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
141_25.5																									1														3																		1														
141_25.6						1																			2												1		2		2																												
142_26.1																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
16_79.2																																																																											
16_79.3																									1																				3																																								
16_79.4																																												1	1																																								
162_14.1													1																								1																																																				
162_14.2																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
23_73.6																																					1																																			
24_76.1																																																																															
24_76.2																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
43_59.4																															1																																														
43_59.6																		

Annex 8. Tree species Abundance in Sampling Sub-plots

| Plot ID | 4791 | 4813 | 4842 | 4951 | 5160 | 5226 | 5282 | 5326 | 5347 | 5405 | 5421 | 5425 | 5569 | 5598 | 5636 | 5654 | 5706 | 5883 | 5975 | 6025 | 6029 | 6031 | 6040 | 6063 | 6075 | 6089 | 6090 | 6091 | 6098 | 6103 | 6104 | 6105 | 6106 | 6108 | 6109 | 6112 | 6113 | 6114 | 6115 | 6119 | 6126 | 6127 | 6131 | 6134 | 6137 | 6139 | 6143 | 6144 | 6147 | 6148 | 6160 | 6163 | 6167 | 6168 | 6170 | 6172 | 6175 | 6176 | 6177 | 6180 | 6181 | 6187 | 6189 |
|---|---|---

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	4791	4813	4842	4951	5160	5226	5282	5326	5347	5405	5421	5425	5569	5598	5636	5654	5706	5883	5975	6025	6029	6031	6040	6063	6075	6089	6090	6091	6098	6103	6104	6105	6106	6108	6109	6112	6113	6114	6115	6119	6126	6127	6131	6134	6137	6139	6143	6144	6147	6148	6160	6163	6167	6168	6170	6172	6175	6176	6177	6180	6181	6187	6189
88_42.5				1																																																					2						
88_42.6																				1																																						7		1				
9_79.1													2																																													2						
9_79.2																				7																																													
9_79.3																																				4																	3														
9_79.4																																																																				
9_79.6																																				1																	1														
91_39.1																																																																				
91_39.2																																				5																	6														
91_39.3																																				1																	5														
91_39.4																																				1				1																										
91_39.5																										2										6																	1														
91_39.6																																				4																	4														
95_38.4																																																																				
96_39.1																																																																				
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97_40.3																				5																																																
97_40.4																																																																				
97_40.5																				1																																															
97_40.6																																																																			
98_41.3																																																																			

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
101_40.1																																									1																											
101_40.2																																										2																											
101_40.3																																																																							
101_40.4																																																																							
101_40.5																																																																							
101_40.6																																																																							
103_40.1									4								1																																																							
103_40.2									1								5																																																							
103_40.3									2																																																																	
103_40.4									1												1																																																				
103_40.5									5										2																																																						
103_40.6									2										2																																																					
105_36.1		3											2																															1																											2			
105_36.2		1											1																															2																											2			
105_36.3		2									1																																	1																														
105_36.4													1																															4			3										2									2			
105_36.5																																													1																					3			
105_36.6																																											3	1																					5			
107_33.1											6																														1		2																												
107_33.3											1					1																										2	1	2	2																					1			
107_33.4																																												1																												
107_33.5																																																																						
107_33.6											2																	1																																											
108_36.1													1			6									1																				1															1												
108_36.2																																				3		2					3														1								1				
108_36.3																									1													2																																
108_36.4		1					1				4		1																									1																																
108_36.5							1				5														1													2																											5			
108_36.6											6																								1																																
11_78.1											1																																																										
11_78.2											1																																																										
11_78.3																																										2																												
11_78.4											1																																3																												
11_78.5					1						1										2																							3	6														1												
11_78.6											1																																5																												
110_33.1											3		1																															1																												
110_33.2											2												2																					1			1																			2			
110_33.3											2																1																1													1											
110_33.4											4																																	4														1										
110_33.5																																													4													2							2			
112_41.1		1																																								2																												
112_41.2																																										3																												
112_41.3													1																														2																												
112_41.4		1				1														1																						2																												
112_41.5																																																																		
112_41.6													1																														8																												
113_40.1		2				2																																				1															2											
113_40.2																		3																																							3											
113_40.3													1																														2																												
113_40.4													1					1																											1															5											
113_40.5		1				1							1																														1																												
113_40.6																		1																											1																1										
114_37.1											3		1												1																1				5														4										
114_37.2													2												2																			8														1										
114_37.3		1									1		3												2																			6																												1
114_37.4											2		1																															3																												
114_37.5											1		2																															4																												
114_37.6											2														1																1			2			1											1										
116_35.1											1																																				1																						
116_35.6											4		1																							1		1		1																												
118_34.1																																																																		
118_34.2																																												1														4										
118_34.6											2																										1				1														7										

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
119_35.1		2																																																																		
12_80.1																																				2																1																								
12_80.4																																																																																
12_80.5							3																													1																2				1			1																		
120_36.1																2																				1																2					1																								
120_36.2													1																														2												4																														
120_36.4						3																																				1																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
141_25.5																																										1	1										1															
141_25.6																																1											2																											
142_26.1		1														1																																																											
142_26.3																																																																																	
142_26.4																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
16_79.2																																																																					
16_79.3																																																			1	1																							
16_79.4																																																			4																							
162_14.1																																											1	3																																			
162_14.2	1																																										1	4																																			
162_14.3																																											1	1																																			
162_14.4																																																																																	
162_14.5																																				1					1				3																																								
162_14.6																																																																																					
163_16.1																																												1																																											
163_16.4																							1																			1																																											
163_16.5																																											2																																												
163_16.6													1																															3																																												
165_14.3																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
23_73.6											5																							1							1																												
24_76.1																																			1																	2																
24_76.2																																			1				2												4																
24_76.3					1																														2																	1																
24_76.4																																									2											1																
24_76.5																														2					1	1															1																
24_76.6					1																														2						2	1										7																
27_74.1																																			1					1		4										5																
29_68.1																																			2							1										3																
29_68.2																																			2							3																												
29_68.3																																										2																												
29_68.4																																										1																												
29_68.5															1																				1	1	1							1																												
29_68.6																																			1																																		
30_69.1											1																																																														
30_69.2											2																																																														
30_69.3											2																																																														
30_69.5											2			6																						1																																								
30_69.6		3									4																																																																							
31_70.1											4																																																																							
32_71.6																																			3				1			1																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
43_59.4		1									1																																									1																	
43_59.6					1						1																																									1																	
45_50.1																																											2																													
45_50.2																					1																																																									
45_50.3																																																																																	
45_50.4															1																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
58_48.1											2																													3																															
58_48.2																																									3		1																													
58_48.3											3			1																											2																													
58_48.4											1																														2																													
58_48.5											1																														1																													
58_48.6											2																														3			1																											
59_48.1											2																									1			1																													
59_48.2																											1																																									
59_48.3															5																																																							
59_48.4											1																																																											
59_48.5																									1																		1																													
59_48.6																																										1																													
60_52.3																																																																								
60_52.4																																																																								
60_52.5																																																																								
62_43.1																																									1		3																													
62_43.2																																									1														1										2					
62_43.3																																										5																													
62_43.4																																										1	1													4															
62_43.5											1																																2																													
62_43.6																																																																		1				
65_42.1																																										5														2											3				
65_42.4																																												6																													
65_42.5							1																		1																		1	2													1															
65_42.6																																											1																													
66_46.1														2																													4																													
66_46.3																																										3	1																													
66_46.4																																																																							
66_46.5																																										4																													
66_46.6																																										6	3																													
68_43.1																																										5																													
68_43.2																																																																							
68_43.3																																																																							
68_43.4																	1																											4																													
68_43.5											1																																																														
69_46.2																																																																							
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69_46.4																																																																							
69_46.5																																																																							
69_46.6																																																																							
7_80.1																																																																							
7_80.2											1																				1																																								
7_80.3											2																																																															
7_80.4											3																																																															
7_80.5											3																																																															
7_80.6											5																																																															
73_45.1		1																																																																									
73_45.3																																																																									
73_45.5											1																																																															
73_45.6											1															1																																																	
76_43.2																																																																								
76_43.3																							3																																																			
76_43.4																																										1	1																													
76_43.5																																											1																													
78_45.2											2																															1																													
78_45.3																																		1								1																													
78_45.4												1																														1																													
78_45.5											2																																																														
82_43.2																																																																								
82_43.3																																																																								
82_43.4																																																																								
82_43.5											1																																2																													
88_42.1																																																																								
88_42.3																																																																								

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6193	6207	6208	6209	6211	6221	6235	6237	6239	6240	6246	6247	6250	6256	6259	6263	6264	6265	6266	6267	6269	6270	6287	6296	6301	6306	6307	6308	6315	6316	6317	6322	6323	6324	6325	6335	6337	6339	6341	6345	6349	6367	6369	6370	6381	6401	6402	6405	6406	6407	6411	6419	6425	6426	6429	6435	6437	6439	6446	6448	6451	6455	6456	6458
88_42.5																																																																					
88_42.6																																																	3																								
9_79.1																																										3																								
9_79.2											8																																																															
9_79.3											3																																																															
9_79.4											2																																1																															
9_79.6											4																																3	2																															
91_39.1													2																														1	6																															
91_39.2																																																																											
91_39.3																																4											1																															2					
91_39.4																																										2	2																																			
91_39.5																																																																																	
91_39.6																																										1	1																																										
95_38.4		1			1																																					6																																										
96_39.1																																																																																							
96_39.2													1																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
101_40.1																1											30																													0
101_40.2																											15																													
101_40.3																											10																													
101_40.4																											37																													
101_40.5																											14																													
101_40.6																											14																													
103_40.1																																					12									1	7										
103_40.2																																			1		3									1										
103_40.3																																					11										2										
103_40.4																																					2										1										
103_40.5																								1													2										2										
103_40.6																																					4										7										
105_36.1																											16																3															
105_36.2																											13																													
105_36.3																											18			1												2															
105_36.4																									2		1														3	2															
105_36.5																											12																													
105_36.6																									1		14																													
107_33.1						5																			1		12																													
107_33.3																									1		8														1															
107_33.4						1																			2		20											2																	
107_33.5						1			1																2		15											2														3			
107_33.6					4	4																					4											1			4														
108_36.1																											5																													
108_36.2																											9	2																													
108_36.3																											9														1															
108_36.4																											10														1															
108_36.5																									2		7	1																													
108_36.6																								1			11														1															
11_78.1																											13														5															
11_78.2																											11														5															
11_78.3									1																		19											1			3															
11_78.4																											7														6															
11_78.5																											1														3															
11_78.6																											6														2															
110_33.1								1																			32														1															
110_33.2																											11		1													1					2								
110_33.3																									2		9														4		1													
110_33.4																											11											1			1															
110_33.5																											1											2			1							3							
112_41.1																							1		1		6														1	1	2													
112_41.2																							1		2		6											1			1	2													
112_41.3																							1		1		13														1													
112_41.4																									2		16														6	2	1													
112_41.5																							1		5		11											1			1	1													
112_41.6																							1		1		13														1	1													
113_40.1																									3		8											1			2														
113_40.2																									1		7											1			2														
113_40.3																								1	1		15														2														
113_40.4																									1		6														2														
113_40.5																				2					1		17														3	1													
113_40.6																																					1																			
114_37.1																											5															1	1													
114_37.2																											5															2													
114_37.3														1													5															1													
114_37.4																											5															1													
114_37.5																											4														3	2													
114_37.6																											3																											
116_35.1						6																					7	2																				6								
116_35.6									1												1						18		1									1			1														
118_34.1																											2	2													4															
118_34.2																											8	1													6															
118_34.6																									2		11	2													1	1													

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
119_35.1																												8																														
12_80.1																																									2																		
12_80.4																																								5																		
12_80.5																				2																				3																		
120_36.1																							1					3																														
120_36.2																				1			4		1														2																		
120_36.4																									1			17										1			1		2														
120_36.5																									2			25																														
120_36.6																							6		1			13										2			1																
122_32.1																							1		1			6										2																		
122_32.6									1														1	1	1			9										3																		
124_32.1																							5					25	1									2																		
124_32.2									1	6															1			24																														
124_32.4																							2					20																												2		
124_32.6																												36																										1				
126_33.1																												22							2																						
126_33.2																							1		2			18																														
126_33.3																									1			9																														
126_33.4																												26																														
126_33.5																												23																														
126_33.6																									1			21																														
128_31.2																												5														7																		
128_31.3																												17															1																
128_31.5																												20														2																
128_31.6																												14														2	1															
130_33.1																												8																														
130_33.2																									3			3														7	1															
130_33.3																									1			13														1	1	1														
130_33.4																												6																														
131_33.1																												4														9	1															
131_33.2																												33												6		13																
131_33.3																									2			6														7																
131_33.4																																										7															1		
131_33.5																																										1	1													1			
132_33.1														1									5					10												3		5																
132_33.2																							4					14												5		7	4	2														
132_33.3																						1	10					16												6																
132_33.4																							3					11												2				1												
132_33.5														4									6					11												2		1														
132_33.6														2									11					5												2																
134_28.1																				1					1			20												1			1													
134_28.2																									2			15												1																
135_30.1																												17														1																
135_30.2																												20																														
135_30.3																												1														1																
135_30.4																									2			6												3		7													1			
135_30.5																												15														6																
135_30.6																												1												1		2				1										
138_28.5																												7														2	1															
138_28.6																																										2																
139_30.1																												11														7																
139_30.2																											1	8														4				1										
139_30.3																												13														4																
139_30.4																												2														3	1															
14_76.1																									3			9														3																
14_76.2																								1	2			16														3																
14_76.3																									2			9														2													1			
14_76.4																								2																		7				1									1			
14_76.5																												8														1																
14_76.6																									1																		1																
141_25.1																																																										
141_25.2																																										2																
141_25.3									1															1																		1																
141_25.4																																																									

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
141_25.5																																																									
141_25.6																																																									
142_26.1																										1		18												1			1	1	1												
142_26.3																												17																														
142_26.4																												5											1																				
142_26.5									1											1								4													2																	
142_26.6																												6																														
143_27.1																							1					1																														
143_27.2																												3																														
143_27.3																									3			14													1																	
143_27.5																												16													2																	
144_28.1																							1																																				
144_28.2																							1					2													6																	
144_28.4																							1		3			26													2																	
144_28.5																							5					14													1																	
144_28.6																							1					2																													
146_23.1									1																												1				1																	
146_23.2																									1								1																								
146_23.3																				1								6													1										5						
146_23.4									3																1			8													2										3						
146_23.6																				1								2													2																	
147_23.1																												14													1	2																
147_23.2																												10																														
147_23.3									2																			11											1		3																	
147_23.4									1																			13											1		1																	
147_23.5																				1				1				7													6																	
147_23.6																												7											2																		
148_23.1																												16																														
148_23.4																												8											1		1			1														
148_23.5																												17											1			1	2														
148_23.6																							2					13											1		2																
149_25.1																							3					10											2		1																
149_25.2																												3																														
149_25.3																							2					1											1		3																
149_25.4																							8					1																												1			
149_25.5																							11					13													1																	
15_77.1										3					6		1																																										
15_77.2										5					3																																										
15_77.3										7					3	1																																									
15_77.4														10	11	9																																									
15_77.5				1						1				7		2																																									
15_77.6										12																																															
151_24.1																																									4																		
151_24.2																												7													6																	
153_23.2																								1				22																													
153_23.3																												14																														
153_23.4																												3													4	1																
153_23.5																												22																														
153_24.6																																																										
156_19.1																									7			2													6																	
156_19.2																																									5																	
156_19.3																									1			2																													
156_19.5																												1																							1						
156_19.6																																							1																	
158_18.2																				7																																						
158_18.3																				1																									1														
158_18.4																				1								1																													
158_18.5																																									1																	
159_21.1																												27													1	1																
159_21.2																												13													4																	
159_21.3																												6													3																	
159_21.4																									1			22						1							1																
159_21.6																												26													2																	
16_79.1										9																		17											2																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
16_79.2										4																		9																													
16_79.3			1							2			1																				1																									
16_79.4										5																							1					1											1								
162_14.1																																																											
162_14.2																				2																																										
162_14.3																									1										1										1					1								
162_14.4			5																						4			4													1																		
162_14.5			1																																					3																		
162_14.6																																																											
163_16.1																																																											
163_16.4																								1	1																																					
163_16.5																									1			4													1																		
163_16.6									1																			7													1										10						
165_14.3																												8											2																		
165_14.6																												1													3																		
165_17.6																												9																														
166_17.1																									1			18													1																		
166_17.2																									1			8													1			1														
166_17.3																									3			19													2																		
166_17.4																									1			23																														
166_17.5																									1			6													2																		
166_17.6																												17																														
167_19.1																												14													2	1																	
167_19.2																							2					9													1		1								1			1			
167_19.3				1																			3					29													2	1															
167_19.4																							3					9											1																		
167_19.5																		1					7		1			4													2		2																
167_19.6																							1																																				
169_18.1																									1			6													1																		
169_18.2																									1			14											1																		
169_18.3																									1			21											1																		
169_18.4																												7													1	1																
169_18.5																									1			8													1																		
169_18.6																												4																														
172_17.1																												10													4																		
172_17.2									2																			16													2	1							9									
172_17.3																												14													2								1									
172_17.4																									3			15													3		1														
172_17.5																									2		1	15											1			2		1														
172_17.6																												13													4																		
174_19.3																				3																																								
18_76.1			1							6				1		3																																		3									
18_76.2										4			1								1																			1																		
18_76.4										11																																																	
18_76.5										11																		7													1																		
18_76.6										5																		6													1																		
182_18.2																							1																				1										1						
182_18.4																				2																								1										1			1			
194_16.3																							1																																				
194_16.5																												4														1																		
197_17.1																												7													2	1	1																
197_17.4																																																											
20_73.2																												17				1									1																		
20_73.3																												13													5	1																	
20_73.4																								2																	2																		
20_73.5																												11													3																		
20_73.6																												15													7																		
21_76.1										20					5																									1																		
21_76.3										16					6																																											
21_76.4										40					3																									1																		
21_76.5										11					3	1																																										
23_73.2																												2													2										1						
23_73.4																												4													8																		
23_73.5																																										18																		

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
23_73.6																												17										1			9					1										
24_76.1																												16										3			2															
24_76.2																												5													4								1							
24_76.3																												9										1			6															
24_76.4					3																							13										4			5															
24_76.5					3																							2																													
24_76.6																			1									19																													
27_74.1																												2													3															
29_68.1																								1	1			12													2															
29_68.2																									4			12																													
29_68.3																												18																													
29_68.4																									3			11													1		1														
29_68.5																									2			13																													
29_68.6																									1			8													2															
30_69.1																									1			21											2			9		1													
30_69.2																									2			13														7															
30_69.3																																									2															
30_69.5					1																							1															1							1						
30_69.6																												20										1			2												1			
31_70.1																								1	1			8													2															
32_71.6																												3										1																		
33_69.2										6																		18													1															
34_64.1																												9		2											4															
34_64.2									1																			5										1			5															
34_64.3																												10										1	1		4															
34_64.4																												7											1		7															
34_64.5							1																					21										2			4															
34_64.6																									1			11													1															
34_72.1																												6													1															
34_72.2																												15													1															
34_72.4																									4			23													1															
34_72.5																																									2															
34_72.6																												1													4															
35_69.2																																																								
35_69.6			4																																					1																	
36_65.1																																							18		1	3															
36_65.2		1																		1								3												9			5												2			
36_65.3										2				3										1				2												7			4		3	1										
36_65.4																				1								3												1			11															
36_65.5										1															2			14												3			16															
36_65.6										2																		19												1			10															
37_63.1																									3			13														10															
37_63.2																												15														4															
37_63.3									1																																																	
37_63.4																												12												1			2															
37_63.5																												7														4															
37_63.6																												31														5															
38_61.1																												7															1														
38_61.2			3																																							1														4	
38_61.3			3																									2														1															
38_61.5																								2				11												1			3															
40_60.1																												2												3			1															
40_60.2																												1												2			2	3															
40_60.3					1																							2												2																	
40_60.6																												11												1			2												1			
41_61.2																																										3															
41_61.3																																										1															
41_61.4																								2																		4		1									2			1			
41_61.5																				2								1														3															
41_61.6																				1																						1									4						
42_61.1																												12												2			2															
42_61.3																												2														10															
42_61.5																												9														1															
42_61.6									1																			6														3															

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
43_59.4																												1											1																	
43_59.6																								1	1			10											2			2														
45_50.1																												7														2															
45_50.2																								2				8											2																
45_50.3																												12														2	2														
45_50.4									2																			5														1														
45_50.5																												1														4														
45_50.6																												4																												
46_59.1																												5																												
46_59.3																												1											1			6														
46_59.5																												1														5														
46_59.6																												1														7		1													
47_55.2			3																	1								1		3											1														
47_55.3			3								1																			2											5														
47_55.5			7																	3																																						
48_52.1			1																									10														1		1													
48_52.2																												7					2									4														
48_52.3									1																			3														1	1													
48_52.4																												14														2														
48_52.5			1							1																		14														1														
48_52.6																												11														4														
49_56.1																												3														8														
49_56.2																												3														7														
49_56.3										1															1			4											1			4														
49_56.4																									2			13														2														
49_56.5										4																		6																												1
49_56.6																																																								
5_79.2																												2																												
5_79.3																																																							
5_79.6																								1																																		
50_53.1										1																		1														4														
50_53.2																									3																		4														
50_53.3										1																		1														1														
50_53.4																																												10														
50_53.5																																											3														
50_53.6										2																		2																												
51_51.1																																											2														
51_51.2									1																																	1														
51_51.3																																																							
51_51.4																																																							
51_51.5																																																							
51_51.6																														1																										
52_51.1																																											3														
52_51.3																								1	1							2										7														
52_51.4																									1			6														2														
52_51.5																								1				3														3														
52_51.6																																											2														
53_54.2																												3																												
53_54.3																												6																												
53_54.4																												9																												
53_54.5																												11													1																
53_54.6																												14													1																
54_51.1																																																							
54_51.2																												14																												
54_51.3																																																							
54_51.4																												2														2														
54_51.5																																																							
54_51.6																												5																												
55_54.2																												25																												
55_54.3																												46													1														
57_48.2																												4																												
57_48.3																																																							
57_48.4																																											3														
57_48.5																																									1			2														

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
58_48.1			3																									6													1															
58_48.2			2																																							1															
58_48.3			1																																							1															1
58_48.4			8																																							2															
58_48.5			2																																							3															2
58_48.6			2																																							1															
59_48.1									1																2			6											1			1														
59_48.2										1																																																	
59_48.3																												1																														
59_48.4																												5													1															
59_48.5																									1																	1															
59_48.6																												2												2		4														
60_52.3																												21																												
60_52.4																												13																												
60_52.5																												23																												
62_43.1									1																3			7													5														
62_43.2																																									2															
62_43.3			11																					1																	4	1														
62_43.4												1																																												
62_43.5																				1								3													2													3		
62_43.6			16																					2																	1													1		
65_42.1																																									2														1	
65_42.4																																									2															
65_42.5																																									5														1	
65_42.6																												16														1															
66_46.1																																																								
66_46.3																												1																												
66_46.4																																																							
66_46.5																												7												1															
66_46.6																																																							
68_43.1																																									6															
68_43.2																									1			20														1												1		
68_43.3																												7														6										1				
68_43.4																									1			7														2														
68_43.5																												8																									1		
69_46.2																									2			6												1		2														
69_46.3																												8														3												2		
69_46.4																												1																												
69_46.5																												10												1		1														
69_46.6										1																		7														1		1												
7_80.1																												23														4		1												
7_80.2																												26												1		10		2												
7_80.3																												11												1		2														
7_80.4																												22												1		5		1												
7_80.5									1																			21														7		3												
7_80.6																												12														10														
73_45.1										2															1			16												1															
73_45.3					1															1								7												1		2														
73_45.5																												4												1		2														
73_45.6																					1							10												2		7		1												
76_43.2																												5														1														
76_43.3																												3														3														
76_43.4																												1																												
76_43.5																																									1															
78_45.2																												15												1		8														
78_45.3																									2			17														6														
78_45.4																									1			19														6														
78_45.5																												23	1													6														
82_43.2																												3	1											1		2														
82_43.3							1																					4	1													1														
82_43.4																					2				1			7	1											1		5						1								
82_43.5									1																			5														6		1												
88_42.1							1																1					12																												
88_42.3													1							1																						2															

Annex 8. Tree species Abundance in Sampling Sub-plots

Plot ID	6462	6465	6469	6491	6493	6499	6501	6503	6507	6513	6526	6551	6556	6559	6564	6570	6573	6586	6599	6602	6605	6607	6609	6610	6611	6612	6613	6615	6632	6637	6638	6639	6641	6644	6645	6646	6648	6649	6651	6655	6659	6660	6662	6664	6665	6668	6669	6676	6677	6691	6694	6695	6696	6698	6701	6702
88_42.5																							5																1																			
88_42.6																							6					2											2																			
9_79.1																												1																														
9_79.2																												1														5																	
9_79.3																												17														3																	
9_79.4																																										11																	
9_79.6																												4														11																	
91_39.1																								2	1			1														5																	
91_39.2																									1			12														4																	
91_39.3																									1			2											1			7																	
91_39.4																									1			4														1																	
91_39.5																					2							1														10																	
91_39.6																									3			3														3																	
95_38.4																									2			10																														
96_39.1																1									1			9														1																	
96_39.2																									1			11														1	1	1															
96_39.3																												17														1									1								
96_39.4																												5														1	1																
96_39.5																												10														1	1																
96_39.6																									1			14														1																	
97_40.1	2																								2			18											1									1								
97_40.2																												12																						1								
97_40.3																												17																														
97_40.4																									1			8															1																
97_40.5																									2			8															1																
97_40.6																												15																														
98_41.3																												10																														
98_41.4																												11																														
98_41.5																												2														2																	

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
192_16.2	329	87.80225347370	26.73220242750	N/A	N/A	Ilam
192_16.3	323	87.80226297370	26.73355663460	N/A	N/A	Ilam
192_16.4	274	87.80526025810	26.73083112920	N/A	N/A	Ilam
192_16.5	300	87.80526979310	26.73218533560	N/A	N/A	Ilam
192_16.6	332	87.80527932870	26.73353954180	N/A	N/A	Ilam
192_16.1	303	87.80224397450	26.73084822000	Chulidanda	Mahamai	Ilam
197_17.1	258	88.00451532090	26.76129759390	Hatchumasa CF	Khudunabari	Jhapa
197_17.3	238	88.00453914140	26.76400584550	N/A	Khudunabari	Jhapa
197_17.2	246	88.00452723070	26.76265171990	N/A	Khudunabari	Jhapa
197_17.5	246	88.00754418480	26.76263030460	N/A	Khudunabari	Jhapa
197_17.6	240	88.00755613120	26.76398442900	N/A	Khudunabari	Jhapa
197_17.4	257	88.00753223920	26.76127618000	Biram	Khudunabari	Jhapa
188_18.4	699	87.64680816530	26.80734098240	Chillaepakha	Ramitaekhola	Morang
188_18.6	639	87.64682353450	26.81004946110	Chillaepakha	Ramitaekhola	Morang
188_18.1	481	87.64378975400	26.80735474030	Chillepakho	Ramitae Khola	Morang
188_18.2	492	87.64379740250	26.80870898060	Chillaepakho	Ramitaekhola	Morang
188_18.3	615	87.64380505140	26.81006322060	Chillaepakha	Ramitaekhola	Morang
188_18.5	639	87.64681584960	26.80869522190	Chillaepakha	Ramitaekhola	Morang
182_18.1	733	87.40239975890	26.81348409930	Chanaute	Yangshila	Morang
182_18.2	638	87.40240454090	26.81483839070	Mayapani	Yangshila	Morang
182_18.4	619	87.40541844960	26.81347548590	Chanaute pakho	Yangshila	Morang
182_18.5	505	87.40542326740	26.81482977690	NR	Yangshila	Morang
182_18.3	544	87.40240932320	26.81619268190	Mayapani	Yangshila	Morang
112_41.6	556	84.59277130440	27.68729489440	Dharapani CF	Shaktikhor-8	Chitwan
112_41.5	622	84.59280099150	27.68594193820	Kalika CF	Shaktikhor-9	Chitwan
112_41.1	646	84.58979100610	27.68453609900	KALIKA CF, KUPRIKOT	Shaktikhor	Chitwan
112_41.2	593	84.58976128360	27.68588905250	KALIKA CF	Shaktikhor-9	Chitwan
112_41.3	566	84.58973155910	27.68724200570	kalika cf	Shaktikhor-9	Chitwan
108_36.5	398	84.42997510820	27.50610491500	SOUTH EAST FROM DUMRIYA POST	CNP	Chitwan
108_36.6	365	84.42994365540	27.50745773850	CHURE	CNP	Chitwan
114_37.5	249	84.67301027730	27.54123425110	CNP	Piple	Chitwan
114_37.6	234	84.67298175450	27.54258731410	CNP	Piple	Chitwan
105_36.2	170	84.30554477480	27.50636604570	Chitwan NP	CNP	Chitwan
105_36.3	188	84.30551179990	27.50771873350	Chitwan NP	Chitwan Natioal Park	Chitwan
105_36.4	192	84.30861179680	27.50507212410	Chitwan NP	CNP	Chitwan
105_36.5	155	84.30857886120	27.50642481550	CNP(BANKATTA)	CNP	Chitwan
105_36.6	196	84.30854592330	27.50777750670	Chitwan NP	CNP	Chitwan
105_36.1	181	84.30557774740	27.50501335760	Chitwan NP	Chitwan NP	Chitwan
108_36.1	320	84.42697222140	27.50469597280	Chure	CNP	Chitwan
108_36.2	341	84.42694073370	27.50604879330	South east from Dumariya Post	CNP	Chitwan
108_36.3	366	84.42690924390	27.50740161350	Chure	CNP	Chitwan
108_36.4	379	84.43000655880	27.50475209130	South east from Dumriya Post	CNP	Chitwan
114_37.1	245	84.67000294290	27.53983031030	CNP	Piple	Chitwan
114_37.2	241	84.66997438500	27.54118337070	CNP	Piple	Chitwan
114_37.3	242	84.66994582510	27.54253643090	CNP	Piple	Chitwan
114_37.4	243	84.67303879800	27.53988118770	CNP	Piple	Chitwan
59_48.3	485	82.43646191870	27.93249989710	Pandeshowri CF	Dharna	Dang
59_48.4	542	82.43947435820	27.92976070310	Pandewor CF	Dharna	Dang
59_48.5	534	82.43949229790	27.93111438230	Pandeshowri CF	Dharna	Dang
59_48.6	483	82.43951023890	27.93246806130	Pandeswori	Dharna	Dang
59_48.1	521	82.43642611400	27.92979253530	pandaveshwori	dharma	Dang

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
59_48.2	526	82.43644401570	27.93114621630	Pandshwor CF	Dharma-1	Dang
62_43.3	372	82.56071913880	27.75330600680	Bhatti Danda Ban	Gadhawa	Dang
62_43.4	320	82.56372359700	27.75056435000	Bhatti Danda	Ganga paraspur	Dang
62_43.5	310	82.56374293800	27.75191798720	Bhatti Danda	Ganga Pasaspur	Dang
62_43.6	390	82.56376228020	27.75327162400	Bhatti Danda ban	Ganga Paraspur	Dang
62_43.1	366	82.56068053080	27.75059872890	Bhatti Danda Ban	Godhawa	Dang
62_43.2	324	82.56069983410	27.75195236790	Bhatti Danda Ban	Godhawa	Dang
63_45.1	239	82.60035045560	27.82320139770	Agriculture Land	Ganga Paraspur	Dang
63_45.2	239	82.60037031040	27.82455499660	N/A	Ganga Paraspur	Dang
63_45.3	236	82.60039016640	27.82590859530	N/A	Gnga Paraspur	Dang
63_45.4	243	82.60339548530	27.82316606160	Khadkapur Plantation	Ganga Paraspur	Dang
63_45.5	245	82.60341537780	27.82451965850	N/A	Ganga Paraspur	Dang
63_45.6	238	82.60343527160	27.82587325510	N/A	Ganga Paraspur	Dang
65_42.2	227	82.68285043540	27.71704634190	Pahad Ban	Goberdiha	Dang
65_42.3	234	82.68287121990	27.71839990550	Pahad Ban	Goberdiha	Dang
65_42.4	214	82.68587156460	27.71565575460	Baghasoti khola ban	Gobardiha	Dang
65_42.5	230	82.68589238510	27.71700931640	Pahad	Goberdiha	Dang
65_42.6	267	82.68591320710	27.71836287790	PAHAD BAN	GOBERBINA	Dang
65_42.1	184	82.68282965240	27.71569277810	Sohili Naka Ban	Gobardiha	Dang
162_14.1	159	86.59419430210	26.68651448950	Pariyar bathan	Panshera	Saptari
162_14.2	190	86.59418950610	26.68786880460	Pariyar Bathan	Pansera	Saptari
162_14.3	202	86.59418470980	26.68922311940	Khudimathi CF	Pansera	Saptari
162_14.4	230	86.59720964090	26.68652307340	Kadimathi	Pansera	Saptari
162_14.6	196	86.59720011990	26.68923170440	Khodimathi CF	Pnsera	Saptari
162_14.5	208	86.59720488050	26.68787738900	Khudi mathi CF	Pansera	Saptari
101_40.6	185	84.14687475800	27.65234279260	Rajratna Madhyabaarti Cf	Pithauli-4	Nawalparasi
101_40.1	178	84.14390740320	27.64957524540	Santi Madyabarti CF	Pithaul-4	Nawalparasi
101_40.2	188	84.14387223840	27.65092771950	santimadhyabarti cf	pithouli-4	Nawalparasi
101_40.3	182	84.14383707120	27.65228019340	Santi Madhyabarti CF	Pithauli-4	Nawalparasi
101_40.4	178	84.14694501540	27.64963783740	Santi Madhyabarti CF	Pithauli-4	Nawalparasi
101_40.5	183	84.14690988790	27.65099031520	Santi Madhyabarti CF	Pithauli-4	Nawalparasi
194_16.1	184	87.88264028640	26.72862500660	N/A	Danabari -1	Ilam
194_16.3	174	87.88266118740	26.73133336590	Saraswati	Danabari	Ilam
194_16.2	205	87.88265073650	26.72997918640	N/A	Danabari	Ilam
194_16.4	160	87.88565644880	26.72860620780	Sarashwati	Danabari	Ilam
194_16.5	213	87.88566693460	26.72996038650	Shivapokhari	Danabari	Ilam
194_16.6	238	87.88567742120	26.73131456490	NA	Danabari	Ilam
165_14.5	227	86.71779206560	26.68554941180	Kurtia danda	Khoksar Parbaha	Saptari
165_14.1	230	86.71478008460	26.68418905540	Kurtia danda	Khoksar Parbaha	Saptari
165_14.6	240	86.71778873050	26.68690374470	Kurtia danda	Khoksar prabaha	Saptari
165_14.2	240	86.71477671410	26.68554338820	Kurtia danda	Khoksar Parbaha	Saptari
165_14.3	222	86.71477334340	26.68689772080	Kurtia danda	Khoksar Parbaha	Saptari
165_14.4	170	86.71779540050	26.68419507860	Kurtia Danda	Khoksar Parbaha	Saptari
158_18.4	234	86.43960249210	26.83389634080	Laligurans CF	Bisnupur-Katti	Siraha
158_18.5	221	86.43959582670	26.83525059680	Laligurans CF	Bishnupur-Katti	Siraha
158_18.3	259	86.43656992800	26.83659286020	Laigurans CF	Bishnupur Katti-3	Siraha
158_18.2	239	86.43657662980	26.83523860510	Laligurans CF	Bishnupur Katti-3	Siraha
158_18.1	233	86.43658333110	26.83388434980	Khattikhola	Bishnupurkatti	Siraha
158_18.6	230	86.43958916090	26.83660485250	Mahajawi settlement	Bishnupur-Katti	Siraha
103_40.5	155	84.22793778630	27.65089096480	Chitwan NP	Rajahar	Nawalparasi
103_40.6	124	84.22790365340	27.65224353660	Chitwan NP (Kharkatta)	Rajahar	Nawalparasi
103_40.1	141	84.22493409520	27.64947757610	CNP (Karkatta)	Rajhar	Nawalparasi
103_40.2	154	84.22489992740	27.65083014470	CNP	RAJHAR	Nawalparasi
103_40.3	146	84.22486575730	27.65218271310	CNP (Kharkatta)	Rajhar	Nawalparasi

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
103_40.4	152	84.22797191680	27.64953839270	Chitwan NP	Rajhar	Nawalparasi
156_19.2	599	86.35684801410	26.87274761830	Jhakri talla	Chandra udaypur	Siraha
156_19.3	600	86.35684035160	26.87410184620	Jhakri talla	Chandra Udaypur	Siraha
156_19.4	489	86.35987578840	26.87140710000	Jhanki Toll	Chandra Udaypur	Siraha
156_19.5	512	86.35986816240	26.87276132900	Jhankri tala	Chandra udayapur	Siraha
156_19.6	504	86.35986053590	26.87411555770	Jhankitalae	Chandra Udayapur	Siraha
156_19.1	591	86.35685567610	26.87139339010	Jhakri Talla	Chandra Udayapur	Siraha
44_57.1	820	81.82039280320	28.24661485000	N/R	Mahadevpuri	Banke
44_57.4	780	81.82345066060	28.24659646500	NA	Mahadevpuri	Banke
44_57.5	810	81.82346106110	28.24795037040	NA	Mahadevuri	Banke
44_57.6	796	81.82347146230	28.24930427550	NA	Mahadevpuri	Banke
44_57.2	779	81.82040316510	28.24796875640	N/A	Mahadevpuri	Banke
44_57.3	765	81.82041352770	28.24932266250	N/A	Mahadevpuri	Banke
55_54.1	647	82.27049967730	28.14449357270	Chukile Khola	Tulsipur M.-8	Dang
55_54.1	647	82.27049967730	28.14449357270	Chukile Khola	Tulsipur M.-8	Dang
55_54.6	652	82.27358622220	28.14717267500	Agriculture land	Tulsipur M P -8	Dang
55_54.5	653	82.27357020500	28.14581894510	Agriculture land	Tulsipur M P-8	Dang
55_54.4	665	82.27355418890	28.14446521500	Agriculture Land	Tulsipur M P-8	Dang
55_54.3	662	82.27053163380	28.14720103590	Ashwara CF	Tulsipur M.- 11	Dang
55_54.2	658	82.27051565500	28.14584730440	Ashwar CF, Chukile	Tulsipur M.-8	Dang
55_54.2	658	82.27051565500	28.14584730440	Ashwar CF, Chukile	Tulsipur M.-8	Dang
45_50.2	195	81.86603533550	27.99589013980	Sajawa / Jalaan	Baijapur	Banke
45_50.4	213	81.86907518990	27.99451695240	jalaan	baijapur	Banke
45_50.5	225	81.86908605120	27.99587089160	NA	Baijapur	Banke
45_50.6	214	81.86909691320	27.99722483050	jalaan/malaiyan	baijapur	Banke
45_50.1	215	81.86602451240	27.99453619960	Jalaan	Baijapur	Banke
45_50.3	186	81.86604615950	27.99724407980	Jalan	Baijapur	Banke
47_55.4	547	81.94708367820	28.17622432880	Bharayang	Kanchanpur	Banke
47_55.2	647	81.94403981480	28.17759930610	NA	Kachanapur	Banke
47_55.3	620	81.94405170390	28.17895318090	NA	Kachanapur	Banke
47_55.5	591	81.94709560490	28.17757820280	Khairi/Bharyang	Kachanapur	Banke
47_55.6	629	81.94710753240	28.17893207650	BHARYANG	KACHANAPUR	Banke
47_55.1	650	81.94402792660	28.17624543090	Bharyang/Khairi	Kachanapur	Banke
48_52.4	246	81.98978207340	28.06851006900	Laile Damar	Kachanapur	Banke
48_52.5	243	81.98979448160	28.06986394710	Laile Damar	Kusum	Banke
48_52.6	244	81.98980689060	28.07121782500	Laile Damar	Kachanapur	Banke
48_52.1	229	81.98672941310	28.06853204680	Laile Damar	Kachanapur	Banke
48_52.2	228	81.98674178300	28.06988592620	laile damar	Kachanapur	Banke
48_52.3	211	81.98675415380	28.07123980530	Laile Damar	Kachanapur	Banke
51_51.1	253	82.10943744040	28.03411857700	Bairiha Khola Ban	Khaskhu suma	Banke
51_51.2	261	82.10945132840	28.03547240990	Bairiha Khola Ban	Khaskusma	Banke
51_51.3	299	82.10946521730	28.03682624250	Bairiha Khola Ban	Khoskusma	Banke
51_51.4	277	82.11248900870	28.03409389830	Khairbhatti	Khaskusma	Banke
51_51.5	298	82.11250293490	28.03544772980	Khairbhatti	Khaskusma	Banke
51_51.6	301	82.11251686200	28.03680156100	Khairbhatti	Khaskusma	Banke
52_51.3	533	82.15015088560	28.03736427800	Banke NP	Khaskusum	Banke
52_51.4	511	82.15317363010	28.03463106800	Banke NP	Khaskusum	Banke
52_51.5	554	82.15318806580	28.03598488030	Banke NP	Khuskusum	Banke
52_51.1	528	82.15012208950	28.03465665080	Banke NP	Khaskusma	Banke
52_51.6	596	82.15320250250	28.03733869230	Banke NP	Khaskhusma	Banke
52_51.6	596	82.15320250250	28.03733869230	Banke NP	Khaskhusma	Banke
52_51.2	519	82.15013648710	28.03601046450	BankeNP	Khaskusum	Banke
126_33.4	511	85.15739139900	27.39231531530	Bansagopal	Harnamadi	Makwanpur

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
126_33.5	543	85.15736895410	27.39366882550	Ratomataedanda Bansgopal CF	Harnamadi	Makwanpur
126_33.6	567	85.15734650760	27.39502233540	Bans Gopal	Harnamadi	Makwanpur
126_33.1	525	85.15435864630	27.39227521530	Bans Gopal	Harnamadi-2	Makwanpur
126_33.2	557	85.15433616440	27.39362872320	Bansagopal	Harnamadi	Makwanpur
126_33.3	571	85.15431368100	27.39498223080	Patranje	Harnamadi	Makwanpur
118_34.4	521	84.83416715410	27.43073714060	PWR	Hadikhola	Makwanpur
119_35.5	329	84.87487542590	27.46793233040	Rapti river	Manhari	Makwanpur
119_35.6	324	84.87484945750	27.46928559380	Rapti river bed	Hodikhola	Makwanpur
118_34.1	509	84.83113395390	27.43068995450	PWR[KOTRA KHOLA]	Hadikhola	Makwanpur
118_34.2	510	84.83110749320	27.43204318630	Gabuwa kholsi	Hadi khola	Makwanpur
118_34.3	492	84.83108103070	27.43339641770	PWR	Hadikhola	Makwanpur
118_34.5	512	84.83414073030	27.43209037510	PWR	HADIKHOLA	Makwanpur
119_35.2	344	84.87184112700	27.46788597250	Runchedaanda	Hadikhola-8	Makwanpur
119_35.2	344	84.87184112700	27.46788597250	Runchedaanda	Hadikhola-8	Makwanpur
119_35.1	378	84.87186713060	27.46653271140	Churiamai	Hadikhola	Makwanpur
119_35.3	331	84.87181512150	27.46923923320	Dardara village	Hadikhola	Makwanpur
118_34.6	510	84.83411430480	27.43344360920	PWR	Hadikhola	Makwanpur
115_35.4	542	84.71305971140	27.46750399940	Chitwan NP	manahari	Makwanpur
115_35.5	475	84.71303176720	27.46885711510	Chitwan NP	Manahari	Makwanpur
115_35.6	540	84.71300382090	27.47021023040	Chitwan NP	manahari	Makwanpur
116_35.4	464	84.75351906690	27.46729043440	PWR-MAYAKHOLA	MANOHARI	Makwanpur
119_35.4	328	84.87490139260	27.46657906670	Rptiriver bed/Rajaiya	Manahari	Makwanpur
115_35.1	507	84.71002575600	27.46745411670	Chitwan NP	Manahari	Makwanpur
115_35.2	541	84.70999777470	27.46880722950	Chitwan NP	Manahari	Makwanpur
115_35.3	470	84.70996979150	27.47016034200	Chitwan NP	Manahari	Makwanpur
116_35.1	512	84.75048503210	27.46724143350	PWR	Manahari	Makwanpur
116_35.2	556	84.75045754520	27.46859458440	PWR	Manahari	Makwanpur
116_35.3	532	84.75043005630	27.46994773490	PWR	MANOHARI	Makwanpur
116_35.5	524	84.75349161700	27.46864358810	PWR-MAYAKHOLA FOREST	MANOHARI	Makwanpur
116_35.6	485	84.75346416520	27.46999674150	PWR	Manohari	Makwanpur
147_23.4	433	86.00013661450	27.02157894800	Sano Khirkhire Sir	Ranibans	Dhanusha
146_23.5	340	85.95981024400	27.02351376510	Sundari khola	Tulsi	Dhanusha
146_23.2	389	85.95678638640	27.02349139170	Jhinge danda	TULSI	Dhanusha
146_23.3	380	85.95677387690	27.02484545090	Dwangdwange	Tulsi VDC	Dhanusha
146_23.4	351	85.95982271650	27.02215970430	Sundari dovan	Tulsi	Dhanusha
146_23.6	375	85.95979777070	27.02486782570	Sundari CF	Tulsi VDC	Dhanusha
146_23.1	365	85.95679889510	27.02213733220	Sundari CF	Tulsi	Dhanusha
12_80.3	990	80.48941308390	29.05307686160	Panchwali	Alitaal	Dadeldhura
12_80.1	916	80.48942641880	29.05036919980	Sidhabhagwati	Jogbuda	Dadeldhura
12_80.2	937	80.48941975160	29.05172303080	Panchwale	Alitaal	Dadeldhura
12_80.4	863	80.49250787630	29.05038088100	Kesharigoth (Panchwali CF)	Alitaal-6(Balauchu)	Dadeldhura
12_80.5	930	80.49250124930	29.05173471270	CANCHAWALI CF	aLITAAL-6	Dadeldhura
12_80.6	968	80.49249462180	29.05308854420	Panchawali CF	alitaal-6	Dadeldhura
153_23.5	310	86.24200956650	27.01920592400	Ranithan	Sirthauli	Sindhuli
153_23.6	330	86.24200047860	27.02056009040	Ranithan	Sirthauli	Sindhuli
151_24.3	680	86.15905320290	27.05793614940	Tamarnikhop	Sirthauli	Sindhuli
151_24.4	630	86.16209828330	27.05524593410	Tamarnikhop	Sirthauli	Sindhuli
151_24.5	600	86.16208822180	27.05660006720	Shivshakti	Sirthauli	Sindhuli
153_23.1	280	86.23899471250	27.01783544770	Ranithan	Sirthauli	Sindhuli
153_23.2	300	86.23898558900	27.01918961350	Ranithan	Sirthauli	Sindhuli
153_23.3	320	86.23897646490	27.02054377900	Ranithan	Sirthauli	Sindhuli
153_23.4	290	86.24201865380	27.01785175720	Ranithan	Sirthauli	Sindhuli

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
151_24.2	650	86.15906330140	27.05658201750	Tamarnekhop	Sirthauli	Sindhuli
151_24.6	670	86.16207815960	27.05795420010	Tamarnikhop	Sirthauli	Sindhuli
151_24.1	600	86.15907339920	27.05522788550	Jordaha	Sirthauli	Sindhuli
71_44.3	784	82.92554104410	27.79264771150	N/A	SIDDHARA	Arghakhanchi
71_44.4	879	82.92853690320	27.78989851620	N/A	SIDDHARA	Arghakhanchi
71_44.5	820	82.92856079450	27.79125188190	N/A	SIDDHARA	Arghakhanchi
71_44.6	749	82.92858468750	27.79260524720	N/A	SIDDHARA	Arghakhanchi
71_44.1	911	82.92549333510	27.78994097580	N/A	Siddhara	Arghakhanchi
73_45.1	1022	83.00634335330	27.82662235210	Lawadip Pakha	Siddhara	Arghakhanchi
73_45.2	1060	83.00636824670	27.82797564710	N/A	Siddhara	Arghakhanchi
73_45.3	1047	83.00639314190	27.82932894190	Lamadip	Siddhara	Arghakhanchi
73_45.4	858	83.00938779570	27.82657805830	Nahkhola	Siddhara	Arghakhanchi
73_45.5	1018	83.00941272680	27.82793135080	Lamadip	Siddhara	Arghakhanchi
73_45.6	1091	83.00943765970	27.82928464310	Lamadip	Siddhara	Arghakhanchi
71_44.2	829	82.92551718880	27.79129434380	N/A	Siddhara	Arghakhanchi
69_46.3	532	82.84362649790	27.86419813350	Kapraghat	Siddhara-8	Arghakhanchi
69_46.1	582	82.84358067950	27.86149129800	Gurung Danda	Siddhara-8	Arghakhanchi
69_46.5	610	82.84664933400	27.86280396240	Gurung Danda	Siddhara-8	Arghakhanchi
69_46.2	566	82.84360358790	27.86284471590	Gurug danda	Siddhara-8	Arghakhanchi
69_46.4	644	82.84662638790	27.86145054670	Gurug Danda	Siddhara-8	Arghakhanchi
69_46.6	590	82.84667228180	27.86415737770	Vitrikholi	SiDDHARA -8	Arghakhanchi
147_23.1	398	85.99711277050	27.02155744200	Dhobire	Naktaghii	Dhanusha
147_23.2	413	85.99710074550	27.02291151870	Dhobibire	Nactaji	Dhanusha
124_32.1	526	85.07312896020	27.35683172590	Jarung	Hattiya	Bara
124_32.2	564	85.07310552470	27.35818517720	Dharapakha	Hatiya	Bara
124_32.3	527	85.07308208760	27.35953862830	JARUNG	HATTYA	Bara
124_32.4	487	85.07616060480	27.35687354190	CHISAPANI CF	HATTYA	Bara
124_32.5	482	85.07613720620	27.35822699560	JURUNG CF	HATIYA	Bara
124_32.6	565	85.07611380590	27.35958044900	JARUNGSAKTI CF	Hatiya	Bara
169_18.2	299	86.87928785680	26.82670688530	Sitapaila Danda	Beltar	Udayapur
169_18.3	290	86.87928642150	26.82806120470	Banspane Dhappar	Beltar	Udayapur
169_18.4	221	86.88230836610	26.82535510860	Basanta Panchami CF	Beltar	Udayapur
169_18.6	260	86.88230556730	26.82806374800	Basanta panchami CF	Beltar	Udayapur
169_18.5	232	86.88230696680	26.82670942840	Basanta panchami CF	Beltar	Udayapur
169_18.1	257	86.87928929210	26.82535256560	Sitapaila Danda	Beltar	Udayapur
166_17.2	255	86.75765741490	26.79306500940	Baherwa CF	Trijunga municipality-6	Udayapur
166_17.3	268	86.75765453750	26.79441932610	Baredawa CF	Trijunga Municipality	Udayapur
166_17.4	248	86.76067845500	26.79171582430	Baharba c f	Trijuga Municipality	Udayapur
166_17.5	322	86.76067561370	26.79307014160	Jhandidanda	Trijuga Municipality	Udayapur
166_17.6	336	86.76067277210	26.79442445860	Beharwa CF	TRIJUNGA municipality	Udayapur
163_16.5	311	86.63911687070	26.75932677990	Shivashakti CF	Trijunga-8	Udayapur
163_16.6	283	86.63911259220	26.76068108820	Shivashakti CF	trijula municipality - 8	Udayapur
163_16.2	262	86.63609959780	26.75931906630	Shivashakti-CF	Trijula-8	Udayapur
163_16.3	305	86.63609528350	26.76067337420	Shivshakti CF	Trijuga municipality	Udayapur
163_16.4	297	86.63912114900	26.75797247130	Ambika CF	Trijuga Municipality-9	Udayapur
166_17.1	242	86.75766029210	26.79171069250	Hodhodiyadanda	Trijuga municipality	Udayapur
163_16.1	230	86.63610391180	26.75796475810	Ambica CF	Trijuga-9	Udayapur
174_19.3	564	87.08150010820	26.85982923120	N/A	N/A	Udayapur
174_19.2	540	87.08149913780	26.85847491620	N/A	N/A	Udayapur
174_19.5	603	87.08451909370	26.85847314330	N/A	N/A	Udayapur
174_19.6	603	87.08452010010	26.85982745820	N/A	N/A	Udayapur
174_19.1	530	87.08149816740	26.85712060100	N/A	N/A	Udayapur

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
174_19.4	655	87.08451808750	26.85711882820	N/A	N/A	Udayapur
159_21.5	509	86.48226980020	26.94285086820	SikharCF	Panchawati	Udayapur
159_21.6	488	86.48226361320	26.94420511280	Sikhar CF	Panchawati	Udayapur
159_21.1	426	86.47925394330	26.94148550200	Bataschuli CF	Panchawati-6	Udayapur
159_21.2	410	86.47924772060	26.94283974620	Bataschuli CF	Panchawati-6	Udayapur
159_21.4	521	86.48227598670	26.94149662330	SikharCF Bhaludhunga	Panchwati	Udayapur
159_21.3	409	86.47924149750	26.94419399020	Sikhar CF	Risku	Udayapur
172_17.5	157	87.00206261840	26.78803476470	Belaka jungle	Thokshila	Udayapur
172_17.6	180	87.00206264290	26.78938909450	Jaldevi	Thoksila	Udayapur
172_17.2	159	86.99904452600	26.78803477650	JALDEVI CF	RAMPUR	Udayapur
172_17.1	167	86.99904453730	26.78668044640	Jaldevi CF	RAMPUR	Udayapur
172_17.3	176	86.99904451460	26.78938910630	BELKA BAN/JALDEVI CF	Rampur	Udayapur
172_17.4	173	87.00206259390	26.78668043460	Jaldevi	Rampur thokshila	Udayapur
120_36.4	646	84.91566204060	27.50241038220	Mantolingh	Sarikhet	Makwanpur
120_36.5	625	84.91563653300	27.50376367450	Mendoling CF	Sarikhet	Makwanpur
120_36.1	535	84.91262671680	27.50236486060	Mindulung	Sarikhet	Makwanpur
120_36.2	529	84.91260117210	27.50371815030	Mendoling CF	Sarikhet	Makwanpur
120_36.3	557	84.91257562550	27.50507143960	Mendalunj	Sarikhet-9	Makwanpur
120_36.6	541	84.91561102350	27.50511696650	Mandoling	Sarikhet	Makwanpur
130_33.4	523	85.31915257940	27.39086806180	Deutakhola	Shikharpur	Makwanpur
130_33.5	497	85.31913210550	27.39222169030	CHISAPANI	SHIKHARPUR	Makwanpur
130_33.5	497	85.31913210550	27.39222169030	CHISAPANI	SHIKHARPUR	Makwanpur
130_33.1	539	85.31611960140	27.39083148000	Deutakhola	Shikharpur	Makwanpur
130_33.2	540	85.31609909060	27.39218510640	DEUTAKHOLA CF	SHIKHARPUR	Makwanpur
130_33.3	562	85.31607857840	27.39353873250	Deutakhola	Shikharpur	Makwanpur
130_33.6	526	85.31911163020	27.39357531860	CHISAPANI	SHIKHARPUR	Makwanpur
131_33.5	647	85.35957391250	27.39183054790	Baikuntha	Phabarbari	Makwanpur
132_33.4	819	85.40003556630	27.39007397880	Dharmasala	Beitini	Makwanpur
132_33.5	835	85.40001607800	27.39142766240	Dharamshala	Betini	Makwanpur
132_33.6	855	85.39999658840	27.39278134570	Dharmashala	Betini-5	Makwanpur
132_33.1	802	85.39700248670	27.39003915610	Dharmashala	Betini	Makwanpur
131_33.4	519	85.35959389350	27.39047689150	Baikuntha	Phapapbari	Makwanpur
132_33.2	843	85.39698296150	27.39139283780	Dharmashala	Betini	Makwanpur
132_33.3	880	85.39696343500	27.39274651910	Dharmashala	Betini-5	Makwanpur
131_33.6	692	85.35955393000	27.39318420400	Kaleshwor CF	Betani	Makwanpur
131_33.1	733	85.35656086380	27.39044118920	Baikuntha	Phapharbari	Makwanpur
131_33.3	706	85.35652082650	27.39314849770	Kaleshwor CF	Betani	Makwanpur
131_33.2	714	85.35654084580	27.39179484360	Baikuntha	Phaparbari	Makwanpur
134_28.4	235	85.47849497180	27.20873216800	Ballepakha	Raigaun	Makwanpur
134_28.5	244	85.47847658220	27.21008593750	Thulo Ballekhola	Raigaun-5	Makwanpur
134_28.6	243	85.47845819130	27.21143970670	Ballae Pakha	Raigaun	Makwanpur
134_28.1	282	85.47546670300	27.20869925270	Balekholaban	Raigaun-5	Makwanpur
134_28.2	311	85.47544827690	27.21005302020	Dhandevi	Raigaun	Makwanpur
134_28.3	268	85.47542984940	27.21140678750	Thulo ballepakha	Raigaun	Makwanpur
128_31.6	361	85.23741675680	27.32212796280	Ghum Kholsi Pakha	Chhatiwan	Makwanpur
129_32.6	292	85.27825106190	27.35785709980	NA	Chattiwan	Makwanpur
128_31.1	312	85.23442866300	27.31938252920	Sunachouri khola	Sripur Chhatiwan	Makwanpur
128_31.2	342	85.23440722310	27.32073611110	Hatticharan	Sripur Chhatiwan-4	Makwanpur
128_31.5	354	85.23743816150	27.32077437900	Ghum Kholsi Pakha	Sripur Chhatiwan	Makwanpur
128_31.5	354	85.23743816150	27.32077437900	Ghum Kholsi Pakha	Sripur Chhatiwan	Makwanpur
128_31.3	363	85.23438578160	27.32208969270	Hatticharan CF	Sripur Chhatiwan	Makwanpur
128_31.3	363	85.23438578160	27.32208969270	Hatticharan CF	Sripur Chhatiwan	Makwanpur
128_31.3	363	85.23438578160	27.32208969270	Hatticharan CF	Sripur Chhatiwan	Makwanpur

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
129_32.1	319	85.27526100240	27.35511246160	Bhoktini	Chhattiwan - 1, Bhogteni	Makwanpur
129_32.2	308	85.27524002620	27.35646606610	NA	Chattiwan-1Bhegteni	Makwanpur
129_32.3	291	85.27521904840	27.35781967030	NA	Chattiwan-1 Jaljale	Makwanpur
129_32.4	319	85.27829294230	27.35514988670	Bhokteni	CHATTIWAN-1	Makwanpur
128_31.4	324	85.23745956470	27.31942079490	Sundarikhola	Sripur Chhatiwan	Makwanpur
129_32.5	295	85.27827200280	27.35650349340	Bhoktini	Chattiwan	Makwanpur
141_25.2	329	85.75636787840	27.09842455700	Gangatae Kholsi	Parwanipur-9	Sarlahi
141_25.3	396	85.75635291780	27.09977850690	Thulobhir	Parwanipur-9	Sarlahi
141_25.4	281	85.75940845770	27.09709735080	Tintallae forest	Parwanipur-9	Sarlahi
141_25.4	281	85.75940845770	27.09709735080	Tintallae forest	Parwanipur-9	Sarlahi
141_25.5	298	85.75939353450	27.09845130250	Thulokholsi	Parwanipur-9	Sarlahi
141_25.6	339	85.75937861020	27.09980525390	Thulokhop	Parwanipur-9	Sarlahi
141_25.1	387	85.75638283800	27.09707060690	Tintalle	Parwanipur-9	Sarlahi
149_25.2	580	86.07908897110	27.09392756500	Samal dndaa	Hatpaate	Sindhuli
149_25.2	580	86.07908897110	27.09392756500	Samal dndaa	Hatpaate	Sindhuli
149_25.3	620	86.07907789450	27.09528166040	Basigothala Dando	Hatpatae	Sindhuli
149_25.4	610	86.08212586860	27.09259326240	Dudhidaha	Hatpatae	Sindhuli
149_25.5	600	86.08211482910	27.09394735920	Chirlimbas Danda	Hatpatae	Sindhuli
149_25.6	600	86.08210378890	27.09530145580	Bhaisigotha Danda	Hatpatae	Sindhuli
149_25.1	615	86.07910004700	27.09257346930	SAMALDANDA	Hatpate	Sindhuli
138_28.1	335	85.63697660880	27.20687249860	Mahaboudha CF	Kalpabriksha	Sindhuli
138_28.2	202	85.63696013560	27.20822636310	NA	Kalpabriksha	Sindhuli
138_28.4	290	85.64000504400	27.20690192230	NA	Kalpabriksha	Sindhuli
138_28.5	675	85.63998860740	27.20825578850	Ajinagar	Kalpabriksha	Sindhuli
138_28.6	650	85.63997216960	27.20960965440	Ajingar	Kalpabriksha	Sindhuli
138_28.3	355	85.63694366130	27.20958022740	NA	Kalpabriksha	Sindhuli
143_27.3	660	85.83823808860	27.17093137220	Kamaladijanmasthan CF	Kamalamai municipality	Sindhuli
143_27.2	610	85.83825210720	27.16957739530	Kamalaji Janmasthan	Kamalamai	Sindhuli
143_27.4	625	85.84129375130	27.16824845950	Kamala Janmasthan	Kamalamai	Sindhuli
143_27.5	679	85.84127977030	27.16960243820	Kamlamaijanmsthan CF	Kamlamai municipality	Sindhuli
143_27.6	630	85.84126578830	27.17095641660	Panikhahare	Kamalamai	Sindhuli
143_27.1	600	85.83826612470	27.16822341800	KAMALAJI JANMSTHAN	KAMALAMAI	Sindhuli
144_28.3	557	85.87921965610	27.20649084600	Dakshinkali CF	Kamlamai	Sindhuli
144_28.4	625	85.88227537470	27.20380705290	Dakshinkali CF	Kamlamai	Sindhuli
144_28.6	574	85.88224835930	27.20651503490	Dakshinkali CF	Kamlamai municipality	Sindhuli
144_28.2	570	85.87923320080	27.20513685650	Dashinkali CF	Kamlamai	Sindhuli
144_28.1	600	85.87924674460	27.20378286680	Daxinkali	Kamlamai	Sindhuli
144_28.5	630	85.88226186750	27.20516104410	Aapgairi	Kamlamai	Sindhuli
136_31.3	1136	85.55771741780	27.31881993710	N/A	N/A	Sindhuli
136_31.2	1163	85.55773493120	27.31746614000	N/A	N/A	Sindhuli
136_31.1	1062	85.55775244340	27.31611234270	N/A	N/A	Sindhuli
135_30.4	710	85.51986905420	27.28049367270	JARAYODADA	PIPALMADI	Sindhuli
135_30.6	720	85.51983316360	27.28320123510	Jarayodanda	Pipalmadi	Sindhuli
135_30.2	320	85.51682080320	27.28181535310	Kanyadanda	Pipalmadi	Sindhuli
135_30.5	715	85.51985110950	27.28184745400	Jarayodada	Pipalmadi	Sindhuli
135_30.1	295	85.51683878460	27.28046157370	Kanyadanda CF	Pipalmadi	Sindhuli
136_31.4	1045	85.56078373660	27.31614359310	N/A	N/A	Sindhuli
136_31.5	1154	85.56076626120	27.31749739220	N/A	N/A	Sindhuli
136_31.6	1115	85.56074878450	27.31885119110	N/A	N/A	Sindhuli
135_30.3	237	85.51680282050	27.28316913230	Kanyadanda	Pipalmadi	Sindhuli

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
147_23.3	412	85.99708871960	27.02426559510	Parvati CF	Ranibas	Sindhuli
147_23.5	419	86.00012462570	27.02293302590	Sanokhirkhirae sir	Ranibas	Sindhuli
147_23.6	418	86.00011263610	27.02428710360	Sanokhirkhiraesir	Ranibas	Sindhuli
148_23.1	421	86.03742662380	27.02096599570	Malhania CF	Ranibas	Sindhuli
148_23.2	423	86.03741508240	27.02232008900	Malhania	Ranibas VDC	Sindhuli
148_23.2	423	86.03741508240	27.02232008900	Malhania	Ranibas VDC	Sindhuli
148_23.3	431	86.03740354020	27.02367418190	N/A	N/A	Sindhuli
148_23.3	431	86.03740354020	27.02367418190	N/A	N/A	Sindhuli
148_23.5	410	86.04043898330	27.02234073000	Malhaniya	Ranibas	Sindhuli
148_23.6	383	86.04042747740	27.02369482420	Malhaniya CF	Ranibas	Sindhuli
148_23.4	411	86.04045048850	27.02098663560	Malhaniya CF	Ranibas	Sindhuli
94_37.3	441	83.85909539700	27.54401551040	TINCHULE	DUMKIBASH	Nawalparasi
94_37.4	297	83.86205992760	27.54124802980	khajina khola	daunedevi	Nawalparasi
94_37.4	297	83.86205992760	27.54124802980	khajina khola	daunedevi	Nawalparasi
94_37.1	239	83.85902531580	27.54131052720	NA	DUMKIBASH	Nawalparasi
94_37.2	325	83.85906035520	27.54266301890	N/A	DUMKIBASH	Nawalparasi
94_37.5	384	83.86209500400	27.54260051800	NA	daunedevi	Nawalparasi
94_37.6	516	83.86213008290	27.54395300590	NA	DAUEDEVI	Nawalparasi
98_41.5	537	84.02537824430	27.68712292780	DHUBA	DEURALI-9	Nawalparasi
98_41.6	517	84.02534156320	27.68847525160	Dhaba	Deurali-9	Nawalparasi
98_41.6	517	84.02534156320	27.68847525160	Dhaba	Deurali-9	Nawalparasi
98_41.1	540	84.02237664110	27.68570527100	N/A	deurali	Nawalparasi
98_41.3	612	84.02230320660	27.68840991140	gaiba khola	deurali	Nawalparasi
98_41.4	480	84.02541492290	27.68577060370	Dhuba	Deurali-9	Nawalparasi
98_41.2	578	84.02233992510	27.68705759140	N/A	deurali	Nawalparasi
92_42.1	988	83.77773968160	27.72159659760	Charghare	Dhurkot	Nawalparasi
92_42.2	1080	83.77777398690	27.72294914910	Charghare	Dhurkot	Nawalparasi
92_42.4	810	83.78077948310	27.72153551030	kHAKARA LOSHE	Dhurkot	Nawalparasi
92_42.5	897	83.78081382590	27.72288805830	Khakara Forest	Dhurkot	Nawalparasi
91_39.1	158	83.73743829150	27.61329755960	Basantahariyali CF	Tilkpur	Nawalparasi
91_39.2	176	83.73747194470	27.61465017820	Bhadrkali CF	Dhurkot	Nawalparasi
91_39.3	236	83.73750560010	27.61600279650	BHDRAKALI CF	DHURKOT	Nawalparasi
91_39.6	196	83.74054258430	27.61594280320	bhadrakali	dhurkot	Nawalparasi
91_39.4	162	83.74047520130	27.61323757310	BSANTA HARIYALI	TILAKPUR	Nawalparasi
91_39.5	195	83.74050889160	27.61459018830	BHADRAKLI	DHURKOT	Nawalparasi
92_42.6	986	83.78084817100	27.72424060600	Khakara Rau Forest	Dhurkot	Nawalparasi
95_38.4	173	83.90250248920	27.57735525770	sirsine-satpatre	dumkibas-8	Nawalparasi
95_38.6	236	83.90257374430	27.58006012320	SATPATRE	DUMKIBAS-8	Nawalparasi
95_38.5	218	83.90253811550	27.57870769060	SATPATRE	DUMKIBAASH-8	Nawalparasi
95_38.2	253	83.89950258190	27.57877115070	satpatre	dumkibsh	Nawalparasi
95_38.3	264	83.89953817350	27.58012358690	satpatre	dumkibash	Nawalparasi
95_38.1	236	83.89946699270	27.57741871420	satpatre	dumkibash	Nawalparasi
82_43.4	669	83.37512422470	27.75645539060	KAMLE TATTARI CF	KACHAL-9	Palpa
82_43.5	614	83.37515360410	27.75780836480	KAMLE TATARI CF	KACHAL-9	Palpa
82_43.6	569	83.37518298550	27.75916133870	Kamletattari CF	Kachal	Palpa
82_43.1	573	83.37208248110	27.75650762750	ag-land	kachal-9	Palpa
82_43.2	578	83.37211182290	27.75786060470	sidha chauhar cf	kachal-9	Palpa
82_43.3	628	83.37214116670	27.75921358150	sidhchuhar cf	kachal-9	Palpa
97_40.6	278	83.98354075570	27.65223226450	Ghangsingh Ghairo	Mainaghat-6	Nawalparasi
97_40.2	323	83.98046671910	27.65094533080	KAPASKHORIYA	MAINAGHAT	Nawalparasi
97_40.4	266	83.98346729010	27.64952762440	(Ghang Singh)Chilaune ghairo	Mainaghat-6	Nawalparasi
97_40.5	242	83.98350402160	27.65087994460	Ghangsingh Gairo	mainaghat	Nawalparasi
97_40.1	296	83.98043002480	27.64959300690	Ghyansingera	Mainaghat	Nawalparasi

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97_40.3	317	83.98050341590	27.65229765440	Khargaira	Mainaghat	Nawalparasi
92_42.3	1115	83.77780829470	27.72430170030	Kalikot	Dhurkot/Jamire Palpa	Palpa
85_43.1	644	83.49376984350	27.75698261680	Khulkhule CF	Dobhan	Palpa
85_43.2	627	83.49380069020	27.75833547130	Khulkhule	Dobhan	Palpa
85_43.6	665	83.49687309520	27.75963340510	Jhumsa Khulkhule CF	Dobhan	Palpa
85_43.3	773	83.49383153910	27.75968832550	Khulkhule CF	Dobhan	Palpa
85_43.4	635	83.49681132450	27.75692770270	Settlement area of Shiva Lal Pandey	Dobhan	Palpa
85_43.5	618	83.49684220880	27.75828055410	Agricultural Land	Dobhan	Palpa
88_42.5	1064	83.61863998210	27.72256473690	Ranathakcha Koal	Gothadi	Palpa
88_42.1	980	83.61556744150	27.72126953230	Encroach AG land+CF 5	Gothadi	Palpa
88_42.1	980	83.61556744150	27.72126953230	Encroach AG land+CF 5	Gothadi	Palpa
88_42.2	945	83.61559974500	27.72262226490	Hathilung CF-5	GOTHADI	Palpa
88_42.3	884	83.61563205070	27.72397499730	Hattilung CF-5	Ghothadi	Palpa
88_42.4	1105	83.61860764120	27.72121200750	AG land of Yam Kumari	Gothadi	Palpa
88_42.6	1018	83.61867232530	27.72391746590	HatilungCF	Gothadi	Palpa
122_32.4	271	84.99531121030	27.35748092720	CHURIYA	AMLEKHGUNJ	Bara
122_32.5	660	84.99528682810	27.35883431500	CHURIYA	AMLEKHGUNJ	Bara
122_32.6	660	84.99526244420	27.36018770260	CHURIYA	AMLEKHGUNJ	Bara
122_32.1	630	84.99227969660	27.35743735520	CHURIYA	AMLEKHGUNJ	Bara
122_32.2	620	84.99225527760	27.35879074050	CHURIYA	AMLEKHGUNJ	Bara
122_32.3	615	84.99223085690	27.36014412550	CHURIYA	AMLEKHGUNJ	Bara
76_43.1	152	83.12868668210	27.75523574170	Koile chour CF	Bhalawad	Kapilbastu
76_43.3	162	83.12873934620	27.75794214990	Khutkhute CF	Bhalawad	Kapilbastu
76_43.4	163	83.13172890070	27.75518886070	Koila Chaur CF	Bhalawad	Kapilbastu
76_43.5	156	83.13175526940	27.75654206230	Koili Chaur CF	Bhalawad	Kapilbastu
76_43.6	158	83.13178164000	27.75789526360	Koili chaur CF	BHALAWAD	Kapilbastu
76_43.2	162	83.12871301320	27.75658894590	Khutkhute CF	Bhalawad	Kapilbastu
68_43.5	826	82.80718822110	27.75418591220	Jogi danda	Shivva ghadi	Kapilbastu
68_43.4	861	82.80716586790	27.75283244550	Khobir Pari	Shiva gadhi	Kapilbastu
68_43.6	793	82.80721057580	27.75553937870	Agriculture land of Brhma	Shibhagadi	Kapilbastu
68_43.1	829	82.80412312020	27.75287218300	Bhakrem Danda	Shivagadhi	Kapilbastu
68_43.2	906	82.80414543580	27.75422565200	Pigalichhada ko danda	Shivaghadi	Kapilbastu
68_43.3	885	82.80416775300	27.75557912070	Aada	Shivagada	Kapilbastu
78_45.2	813	83.20934695580	27.82923745480	Dhawa Cheda	Maidan	Arghakhanchi
78_45.1	778	83.20931954370	27.82788433720	Dhawa Cheda	Maidan	Arghakhanchi
78_45.5	789	83.21239107210	27.82918868070	Dhawa Chheda	Maidan-9	Arghakhanchi
78_45.6	795	83.21241852380	27.83054179520	Dhawa Chida	Maidan -9	Arghakhanchi
78_45.3	829	83.20937436980	27.83059057220	Budichour	Maidan-9	Arghakhanchi
78_45.4	752	83.21236362230	27.82783556590	Dhawa Chheda	Maidan-9	Arghakhanchi
113_40.5	323	84.63313621560	27.64968225160	Kalika CF	Birendranagar	Chitwan
113_40.6	293	84.63310707040	27.65103525480	Dudhkoshi Namuna CF	Birendranagar	Chitwan
113_40.1	303	84.63012660160	27.64827731300	Dudh koshi namuna CF	Birendra nagar	Chitwan
113_40.2	292	84.63009742120	27.64963031350	DUDHKOSHI NAMUNA CF	Birendranagar	Chitwan
113_40.3	326	84.63006823870	27.65098331370	Dudhkoshi Namuna CF	Birendranagar 2	Chitwan
113_40.4	302	84.63316535870	27.64832924820	Kalika community forest	Birendranagar	Chitwan
112_41.4	652	84.59283067660	27.68458898160	Ajingare CF	Chainpur	Chitwan
110_33.2	345	84.50737740750	27.39752419720	Ratamate	Ayodhyapuri-9	Chitwan
110_33.3	346	84.50734704220	27.39887712280	Ratamate danda	Ayoudhyapuri	Chitwan
107_33.1	197	84.38612638710	27.39656713170	Ayodhyapuri	Ayodhyapuri	Chitwan
110_33.4	372	84.51043932860	27.39622543850	Ratamate danda (Dabuwa)	Ayodhyapuri	Chitwan

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110_33.5	325	84.51040900220	27.39757836760	Ratomate danda	Ayoudhayapuri	Chitwan
110_33.6	406	84.51037867380	27.39893129630	Ratamate danda	Ayodhyapuri	Chitwan
110_33.1	384	84.50740777060	27.39617127120	Ratamate	Ayodhyapuri-9	Chitwan
107_33.2	464	84.38609454710	27.39791992930	Ayodhyapuri	Ayodhyapuri	Chitwan
107_33.3	477	84.38606270470	27.39927272670	Ayodhyapuri	Ayodhyapuri	Chitwan
107_33.4	475	84.38915766870	27.39662393510	Ayodhyapuri	Ayodhyapuri	Chitwan
107_33.5	460	84.38912586550	27.39797673610	Jaramuniko Bhir ban	Ayodhyapuri	Chitwan
107_33.6	314	84.38909406000	27.39932953670	Baikunthe BZCF	Ayodhyapuri	Chitwan
66_46.1	289	82.72174145980	27.86044860740	Ghantadev	Lal matiya	Dang
66_46.5	298	82.72480877330	27.86176405360	Ghantadev	Lalmatiya	Dang
66_46.2	289	82.72176285370	27.86180211550	ghantadev	Lal matiya VDC	Dang
66_46.3	306	82.72178424910	27.86315562330	Ghantadev CF	Lal matiya VDC	Dang
66_46.4	306	82.72478734160	27.86041054770	Ghantadev	Lalmatiya	Dang
66_46.6	326	82.72483020650	27.86311755920	Ghantadev	Lalmatiya	Dang
50_53.6	708	82.07057967950	28.10845157410	MALAIJALJALA CF	PANCHAKULE	Dang
50_53.1	667	82.06749915920	28.10576770450	MALAI JALJALE C F	PANHKAULE	Dang
50_53.5	659	82.07056623690	28.10709773810	MALAIJALJALA CF	PANCHAKULE	Dang
50_53.4	613	82.07055279530	28.10574390170	MALAIJALJALA CF	PANCHAKULE	Dang
50_53.3	704	82.06752596670	28.10847537950	MALAIJALJALA CF	PANCHAKAULE	Dang
50_53.2	673	82.06751256250	28.10712154210	MALAIJALJALA CF	PANCHKAUL	Dang
54_51.5	664	82.23455813550	28.03702298780	**Sidhadev Leruwapahad CF**	Phulbari-5	Dang
54_51.4	642	82.23454268070	28.03566921600	**Siddadev Leruwa pahad CF**	Phulbari-5	Dang
54_51.1	636	82.23149120140	28.03569660700	Leruwa pahara cf	phulbari-5	Dang
54_51.6	600	82.23457359140	28.03837675940	SIDDHADEV LERUWA PAHAD CF	PHULBARI-5	Dang
54_51.2	632	82.23150661810	28.03705038040	Leruwa Pahara CF	Phulbari-5	Dang
54_51.3	623	82.23152203580	28.03840415350	Leruwa Pahada Cf	Phulbari-5	Dang
58_48.4	539	82.39883133330	27.92930694360	Jurpani cf	Satbariya	Dang
58_48.5	561	82.39884876620	27.93066064680	Jurpani	Satbariya-6	Dang
58_48.6	603	82.39886620040	27.93201434980	Jurpani CF	Satbaria-8	Dang
58_48.1	593	82.39578304800	27.92933787580	Jurpani CFG	Satbaria-6	Dang
57_48.4	297	82.35818810020	27.92884117230	BAGARBABA cf	SATBARIA-8	Dang
57_48.2	361	82.35515666410	27.93022493270	BAGARBALA CF	SATBARIA-8	Dang
57_48.6	362	82.35822195380	27.93154862500	BAGARBABA CF	SATBARIA-8	Dang
57_48.3	319	82.35517355350	27.93157866060	bgarbaba CF	satbaria-8	Dang
57_48.5	276	82.35820502640	27.93019489880	BAGARBABA CF	SATBARIA-8	Dang
58_48.2	678	82.39580044300	27.93069158070	Jurpani CF	Satbariya-6	Dang
58_48.3	733	82.39581783920	27.93204528540	Jurpani cf	Stariya-6	Dang
57_48.1	359	82.35513977580	27.92887120450	bagar baba CF	satbaria-8	Dang
60_52.2	724	82.47512300670	28.07597743610	Jyamire cf	Tribhuwan nagar-8	Dang
60_52.4	740	82.47815678100	28.07459096350	Jyamire CF	Tribhuwan Nagar M-8	Dang
60_52.1	668	82.47510451070	28.07462380680	Barahchhetra cf	tribhuvan Nagar -8	Dang
60_52.3	776	82.47514150390	28.07733106500	Jyamire cf	Tribhuwan municipality-8	Dang
60_52.6	767	82.47819385070	28.07729821790	Barahkchhetra CF	Ghorahi M P-7	Dang
60_52.5	778	82.47817531520	28.07594459090	Barahakchhetra CF	Ghorahi M P-7	Dang
53_54.1	624	82.18904895490	28.14347932740	Agriculture	Shree Gau-8	Dang
53_54.2	651	82.18906390780	28.14483310080	Shree Gaun CF	Shree gaun-8	Dang
53_54.3	634	82.18907886170	28.14618687390	Shree Gaun CF	ShreeGaun-8	Dang
53_54.4	619	82.19210353150	28.14345278610	Shrigaun CF	Shrigaun	Dang
53_54.6	617	82.19213351510	28.14616032970	Shrigaun CF	Shrigaun-6,7,8,9	Dang

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
53_54.5	637	82.19211852280	28.14480655800	Shrigaun CF	Shrigaun	Dang
34_72.1	369	81.39999777040	28.78119588480	Dangi CF	Babiya chaur	Surkhet
34_72.2	340	81.40000293610	28.78254979080	Mailpani CF	Salkote	Surkhet
34_72.3	336	81.40000810220	28.78390369660	Kalapani	Babuyachaur	Surkhet
34_72.3	336	81.40000810220	28.78390369660	Kalapani	Babuyachaur	Surkhet
34_72.4	352	81.40307132820	28.78118674800	Melpani CF	Salkot	Surkhet
34_72.5	321	81.40307653360	28.78254065360	Lamidamar Dovinalla	Salkot	Surkhet
34_72.6	352	81.40308173940	28.78389455880	Lamidamar Dhik	Salkot	Surkhet
27_74.6	250	81.11437907400	28.85052743780	N/A	SUARKHAL	Surkhet
42_61.1	517	81.73591222470	28.38973159090	N/A	Chhinchu-1	Surkhet
42_61.2	830	81.73592157530	28.39108549610	Ag	Chinnchu	Surkhet
42_61.4	829	81.73897424100	28.38971501920	AG land	Chhinchu	Surkhet
42_61.5	839	81.73898363050	28.39106892350	Oilakhola Forest	Chhinchu	Surkhet
42_61.6	485	81.73899302060	28.39242282750	Newlakainpani CF	Chinnchu	Surkhet
42_61.3	878	81.73593092660	28.39243940110	N/A	Chinnchu	Surkhet
27_74.3	275	81.11130341000	28.85053001110	N/A	Lagam	Surkhet
45_62.1	532	81.85767996040	28.42773180270	Deurali C F	Mehelkuna	Surkhet
45_62.2	474	81.85769087540	28.42908566020	Mulpani C F	Mehalkuna	Surkhet
45_62.6	491	81.86076488710	28.43042018370	NA	Melkuna-2	Surkhet
45_62.4	488	81.86074297850	28.42771247120	NA	melkuna	Surkhet
45_62.3	450	81.85770179110	28.43043951740	Na	Melkuna-2	Surkhet
45_62.5	493	81.86075393240	28.42906632760	Na	NA	Surkhet
33_69.2	757	81.36162922670	28.67350212420	Nava Durga	Taranga	Surkhet
33_69.4	602	81.36469496110	28.67213995520	Nava Durga	Taranga	Surkhet
35_69.3	322	81.44349583470	28.67635800800	Bheri Khola	Taranga	Surkhet
35_69.4	300	81.44655482680	28.67364007650	Bheri River	Taranga	Surkhet
35_69.5	309	81.44656056820	28.67499399590	Kuereni	Taranga	Surkhet
35_69.6	324	81.44656631000	28.67634791510	N/A	Taranga-5	Surkhet
33_69.5	800	81.36469964970	28.67349388860	Nava Durga CF	Taranga	Surkhet
33_69.6	800	81.36470433870	28.67484782190	Navadurga CF	Taranga	Surkhet
35_69.1	317	81.44348443050	28.67365016830	Badi Chour	Taranga-5	Surkhet
35_69.2	327	81.44349013240	28.67500408830	Dubi Chaur	Taranga-5	Surkhet
33_69.1	775	81.36162457750	28.67214819020	Nava Durga	Taranga	Surkhet
33_69.3	707	81.36163387620	28.67485605780	Nava Durga CF	Taranga	Surkhet
31_70.2	358	81.27887624850	28.70804724530	Midale dada	Tatopani 1 Taule	Surkhet
31_70.3	415	81.27887983920	28.70940118310	Valuladne danda	Tatopani-1 taule	Surkhet
31_70.4	463	81.28194407480	28.70668694180	Mandada	Tatopani 1 Taule	Surkhet
31_70.5	465	81.28194770470	28.70804087940	Jyanjne Bhir	Tatopaani-1 tule	Surkhet
31_70.6	473	81.28195133500	28.70939481680	Jhyanjane bhirko dada	Ttopni 1 Taule	Surkhet
31_70.1	406	81.27887265810	28.70669330730	Maihunegade	Tatopani-1,Taule	Surkhet
32_71.3	600	81.31894340180	28.74627982420	Gaganpani	Tatopani-7	Surkhet
32_71.4	520	81.32200766000	28.74356468960	Jamukhare	Tatopani-7	Surkhet
32_71.5	540	81.32201181210	28.74491861490	Jamukhare khola	Tatopani-7	Surkhet
32_71.6	450	81.32201596450	28.74627253990	Goverment forest, Khahare	Tatopani-7	Surkhet
32_71.2	600	81.31893928910	28.74492589880	Gaganpani	Tatopani-7	Surkhet
32_71.1	647	81.31893517660	28.74357197320	Gaganpani	Tatopani-7	Surkhet
43_59.3	522	81.77820007570	28.32088738330	Haukhola cf	Kavrechaur-5	Salyan
43_59.4	382	81.78124029270	28.31816209000	Haukhola Bufferzone	Kavrechaur	Salyan
43_59.5	386	81.78125018960	28.31951599520	N/A	N/A	Salyan
43_59.6	402	81.78126008730	28.32086990020	Haukhola	Kavrechaur	Salyan
43_59.2	490	81.77819021690	28.31953347740	Haukhola cf	Kavrechaur-5	Salyan
43_59.1	369	81.77818035870	28.31817957120	Haukhola cf	kavrechaur-5	Salyan
46_59.5	645	81.90363311840	28.32137857790	Lotidumar	Kalimati, Kalche	Salyan

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
46_59.6	634	81.90364456720	28.32273243980	LOTIDAMAR	kALIMATIKALCHE	Salyan
46_59.2	540	81.90057318860	28.32139880510	Charchare (proposed CF)	Kalchi-3	Salyan
46_59.3	380	81.90058459870	28.32275266810	Charchare (proposed CF)	Kalchi-3	Salyan
46_59.4	705	81.90362167030	28.32002471580	charchare	Kalimati Kalche	Salyan
46_59.1	466	81.90056177930	28.32004494180	Charchare (Proposed CF)	Kalchi-3	Salyan
49_56.3	648	82.02489166810	28.21621164010	Dundure	Purandhara-8	Salyan
49_56.4	620	82.02792255160	28.21348103700	Bhalukhola	Purandhara	Salyan
49_56.5	657	82.02793551640	28.21483487050	BHALUKHOLA CF	PURANDHARA	Salyan
49_56.6	653	82.02794848220	28.21618870380	BHLUKHOLA CF	PURANDHARA	Salyan
49_56.1	523	82.02486581460	28.21350397070	Dundure	Purandhara-8	Salyan
49_56.2	650	82.02487874090	28.21485780550	Dundure	Purandhara-8	Salyan
16_79.5	973	80.65790277060	29.01965572150	Ghattgada	Nigali-1	Kailali
16_79.6	964	80.65789830900	29.02100958850	Pyalekhola	Sajhapur-9	Kailali
16_79.6	964	80.65789830900	29.02100958850	Pyalekhola	Sajhapur-9	Kailali
16_79.4	982	80.65790723190	29.01830185430	SALGHARI	SHJPUR-9	Kailali
24_76.3	769	80.98632106270	28.92014514350	Kapra	Pandaun	Kailali
24_76.4	782	80.98939905980	28.91743759760	Kapra	Pandaun	Kailali
24_76.2	809	80.98632124040	28.91879123200	kapra	Pandaun	Kailali
24_76.5	722	80.98939892210	28.91879150940	Kapra	Pandaun	Kailali
24_76.6	675	80.98939878440	28.92014542090	Kapra	Pandaun	Kailali
24_76.1	855	80.98632141810	28.91743732020	Kapra	Pandaun	Kailali
23_73.4	584	80.95140214650	28.80827441210	Batule gado	Ram Shikhar Jhala	Kailali
23_73.5	625	80.95140151820	28.80962834540	Batule Gado	Ram Shikhar Jhala	Kailali
23_73.6	619	80.95140088990	28.81098227840	Batule Gado	Ram Shikhar Jhala	Kailali
23_73.1	483	80.94832771960	28.80827327030	Male ko Thai	Ram Shikhar Jhala	Kailali
23_73.3	503	80.94832638340	28.81098113640	-9999	Ram Shikhar Jhala	Kailali
23_73.2	523	80.94832705150	28.80962720350	Batule gado	Ram Shikhar Jhala	Kailali
15_77.5	1536	80.61909339340	28.94649268780	Dhura Sallery C.F.	Sahajpur-2	Kailali
15_77.5	1536	80.61909339340	28.94649268780	Dhura Sallery C.F.	Sahajpur-2	Kailali
16_79.3	955	80.65481765730	29.02100170990	TIMLIGARA BNITLA	SAHAJPUR	Kailali
16_79.1	1013	80.65482666060	29.01829397650	Sallaghari	Sahajpur-9	Kailali
15_77.2	1583	80.61601496220	28.94648394000	DHURA SALARY	SAHAJPUR	Kailali
15_77.3	1580	80.61600996940	28.94783781540	DHURA SALLERI	SAHAJPUR 2	Kailali
15_77.1	1632	80.61601995480	28.94513006420	DHURA SALERY	SAHAJPUR	Kailali
15_77.4	1585	80.61909834600	28.94513881160	DHURA SALLERI	Sahajpur	Kailali
16_79.2	994	80.65482215910	29.01964784330	SALGHARI CF	SAHAJPUR-9	Kailali
15_77.6	1513	80.61908844060	28.94784656370	Dhuri Gothri	Khanidanda	Kailali
26_72.1	815	81.07223662020	28.77478742410	Panchuli	Sugarkhal	Kailali
26_72.2	865	81.07223755280	28.77614136350	Panchuli	Sugarkhal	Kailali
30_69.1	854	81.23883824210	28.66980239190	Thakleri	Sugurkhal-9	Kailali
30_69.2	860	81.23884131240	28.67115634160	Thakleri	Sugarkhal-9, Ghatte	Kailali
30_69.3	933	81.23884438290	28.67251029100	Karmelo	Sujurkhal-9	Kailali
30_69.5	760	81.24191170190	28.67115089100	-	Sugarkhal 9	Kailali
30_69.6	827	81.24191481190	28.67250484010	PAIDADA	SUGARKHAL-9	Kailali
30_69.4	775	81.24190859210	28.66979694160	N/A	SUGURKHAL-9	Kailali
26_72.3	890	81.07223848560	28.77749530260	Panchuli	Sugrkhal	Kailali
26_72.4	730	81.07531006350	28.77478574580	Panchuli	Sugarkhal	Kailali
26_72.5	800	81.07531103580	28.77613968510	panchuli	Sugarkhal	Kailali
26_72.6	840	81.07531200820	28.77749362410	Panchuli	Sugarkhal	Kailali
27_74.1	280	81.11130052720	28.84782216490	Barjena	Sugarkham	Kailali
27_74.2	262	81.11130196860	28.84917608810	N/A	Sugarkhal	Kailali
27_74.4	282	81.11437611150	28.84781959190	Berjena	Sugarkhal	Kailali
27_74.5	271	81.11437759270	28.84917351500	N/A	Sugarkhal	Kailali
7_80.2	1012	80.28408138550	29.04642221300	Bhagmati CF	Jogbudha	Kanchanpur

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PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
7_80.1	897	80.28409073190	29.04506843300	Bhagwati CF	Joghbudha	Kanchanpur
7_80.4	897	80.28717191360	29.04508482340	Bhagwati CF	Jogubudha-5	Kanchanpur
7_80.5	958	80.28716260740	29.04643860430	Bhagwati CF	Jobudha-5	Kanchanpur
7_80.6	1050	80.28715330050	29.04779238490	Bhagwati CF	Jobudha	Kanchanpur
7_80.3	1038	80.28407203840	29.04777599280	bhagmati CF	jogbuda	Kanchanpur
11_78.1	557	80.45072521570	28.97715910660	Saaj Basera	Krishnapur	Kanchanpur
11_78.2	557	80.45071806460	28.97851294400	Saajbasera Jungle	KLrishnapur	Kanchanpur
11_78.3	525	80.45071091300	28.97986678100	Saajbasera	JOGBUDA-9 Daduldhora	Kanchanpur
11_78.4	673	80.45380448210	28.97717164720	Sajbasera	Jogbuda-9	Kanchanpur
11_78.6	660	80.45379025970	28.97987932300	Saaj Basera	Krishnapur	Kanchanpur
11_78.5	673	80.45379737110	28.97852548520	Saj Basera	Jogbuda-9	Kanchanpur
5_79.2	243	80.20322397110	29.00813028350	Bajanath CF	Bhimdatta -1	Kanchanpur
5_79.4	313	80.20631434440	29.00679474470	NA	Bhimdutta municipality-1	Kanchanpur
5_79.5	275	80.20630399890	29.00814850810	NA	Bhimdutta municipality	Kanchanpur
5_79.6	267	80.20629365260	29.00950227120	Baijanath CF	Bhimdutta municipality-1	Kanchanpur
5_79.1	247	80.20323435680	29.00677652110	NA	NA	Kanchanpur
5_79.3	275	80.20321358480	29.00948404570	Baijanath CF	Bhimdutta Municipality	Kanchanpur
29_68.5	210	81.20190374870	28.63424870370	Dorjari	Baliya	Kailali
29_68.1	203	81.19883187360	28.63289928110	TRISHAKTI	Baliya-8	Kailali
29_68.2	222	81.19883442570	28.63425324180	Dorjare	Baiya	Kailali
29_68.3	223	81.19883697800	28.63560720230	Jalba	BALIYA-8	Kailali
29_68.4	188	81.20190115720	28.63289474330	DORJARI	Baliya	Kailali
29_68.6	243	81.20190634040	28.63560266390	Dorjari	Baliya	Kailali
14_76.6	865	80.57919567650	28.91076191140	Seti	Godabari-8	Kailali
14_76.5	753	80.57920113970	28.90940803460	seti	godawari	Kailali
14_76.1	727	80.57612932170	28.90804450910	SETI CF	GODAWARI	Kailali
14_76.2	749	80.57612381900	28.90939838560	SETI	GODAWARI	Kailali
14_76.3	794	80.57611831580	28.91075226180	SETI CF	GODAWARI	Kailali
14_76.4	758	80.57920660250	28.90805415760	seti	godawari	Kailali
18_76.5	1408	80.74327026770	28.91331129440	bankhutti	khaerala	Kailali
18_76.6	1440	80.74326693400	28.91466519340	sirshe	khairala	Kailali
18_76.3	1360	80.74018940560	28.91465929170	akalagada	khairala-2	Kailali
18_76.4	1382	80.74327360110	28.91195739510	bankhutti	khairala	Kailali
18_76.2	1370	80.74019277920	28.91330539310	akalegadha	khairala-2	Kailali
18_76.2	1370	80.74019277920	28.91330539310	akalegadha	khairala-2	Kailali
18_76.1	1411	80.74019615260	28.91195149410	banakhutti	khairala-2	Kailali
21_76.6	1379	80.86632938730	28.91746152710	N/A	Mahniyal-2, Palsa	Kailali
20_73.1	385	80.82539120250	28.80555222670	Bhulkepani	Mahniyal-6	Kailali
20_73.2	424	80.82538894520	28.80690615470	Proposed Chure Bansghari CF	Mahaniyal - 6	Kailali
20_73.3	447	80.82538668780	28.80826008240	Chure Bansghari	Mahiniyal-6	Kailali
20_73.4	372	80.82846553670	28.80555616800	CHURE BANSGHARI	MOHANYAL	Kailali
21_76.3	1485	80.86325175340	28.91745843720	Palsa Forest	Mahniyal-2, Palsa	Kailali
20_73.5	440	80.82846331920	28.80691009620	Chure bansghari	Mohaniyal	Kailali
21_76.1	1524	80.86325530510	28.91475062050	Palsa ko Khote ban	Mahniyal-2	Kailali
21_76.5	1452	80.86633112320	28.91610761870	N/A	Mahniyal	Kailali
21_76.5	1452	80.86633112320	28.91610761870	N/A	Mahniyal	Kailali
20_73.6	483	80.82846110150	28.80826402410	Churebansghari	Mohanyal	Kailali
21_76.2	1502	80.86325352930	28.91610452900	N/A	Mahniyan-2, Palsa	Kailali
21_76.4	1490	80.86633285900	28.91475371010	Palsa Ban	Mahniyal-2, Palsa	Kailali

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PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
167_19.2	571	86.79970833180	26.86446694990	Dudhkoshi Namuna CF	Sauna	Udayapur
167_19.4	551	86.80273078130	26.86311688900	Janashakti CF	Saune VDC	Udayapur
167_19.5	479	86.80272843190	26.86447119640	Janashakti cf	Saune	Udayapur
167_19.1	545	86.79971071710	26.86311264280	Dudhkoshi Namuna CF	Saune	Udayapur
167_19.6	475	86.80272608240	26.86582550350	Janashakti C F	Saune	Udayapur
167_19.3	537	86.79970594630	26.86582125680	Dudhkoshi Namuna CF	SAUNE	Udayapur
142_26.5	439	85.80032367500	27.13403250600	Sukekhola	Khairmara	Mahottari
142_26.2	410	85.79729701540	27.13400661040	Sukekholsi	Khairmara	Mahottari
142_26.3	485	85.79728252490	27.13536057420	Raidamar	Khairmara-1	Mahottari
142_26.1	442	85.79731150480	27.13265264640	Sukekhola	KHAYER MARA-1	Mahottari
142_26.6	462	85.80030922090	27.13538647130	Sukejhori	Khairmara	Mahottari
142_26.4	435	85.80033812800	27.13267854050	Sukekhola	Kharmara	Mahottari
139_30.1	660	85.67845402740	27.27859098690	AJINGAR	KAPILAKOT	Sindhuli
139_30.2	424	85.67843800630	27.27994486060	Durbar Danda CF	Kapilakot	Sindhuli
139_30.3	469	85.67842198410	27.28129873400	Durbardanda CF	Kapilakot	Sindhuli
139_30.4	650	85.68148445620	27.27861958350	Garduwa khola	Kapilakot	Sindhuli
139_30.5	378	85.68146847180	27.27997345880	N/A	N/A	Sindhuli
139_30.6	333	85.68145248630	27.28132733390	Durbardanda CF	Kapilakot	Sindhuli
182_18.6	443	87.40542808560	26.81618406750	Chanaute pakho	Yangshila	Morang
96_39.1	201	83.93993521310	27.61351289190	Arunkhola CF	Naya Belhani-8	Nawalparasi
96_39.2	200	83.93997135390	27.61486527250	Arunkhola CF	Nayabelhani-8	Nawalparasi
96_39.3	207	83.94000749720	27.61621765280	Arunkhola CF	Naya Belhani-8	Nawalparasi
96_39.4	197	83.94297159410	27.61344847370	Arun Khola CF	Nayabelhani-8	Nawalparasi
96_39.5	196	83.94300777210	27.61480085070	Arun Khola CF	Naya Belhni-8	Nawalparasi
96_39.6	200	83.94304395260	27.61615322730	Arun Khola CF	Naya Belhani-8	Nawalparasi
39_60.6	556	81.61730584010	28.35431487450	N/A	N/A	Bardiya
34_64.2	350	81.40681187380	28.49377130810	Basaha khola Danda	N/A	Bardiya
34_64.4	343	81.40987183400	28.49240813890	Barahakhola danda	BNP	Bardiya
34_64.5	358	81.40987706430	28.49376210100	basahakhola dandA	N/A	Bardiya
34_64.6	367	81.40988229500	28.49511606290	N/A	BNP	Bardiya
37_63.1	322	81.53019629640	28.45851492390	Khare Pani	Bardiya national park	Bardiya
37_63.2	279	81.53020305250	28.45986886940	Guthi	N/A	Bardiya
37_63.4	332	81.53326041490	28.45850294840	Khahare Pani	Bardia National Park	Bardiya
38_61.2	391	81.57263744700	28.38837875380	Miring Khola	Thulo Siri	Bardiya
38_61.3	504	81.57264472270	28.38973270350	Miring Khola Bhir	Thulo Siri	Bardiya
38_61.4	384	81.57569221060	28.38701190230	Milan Khola	Bardiya National Park	Bardiya
38_61.5	323	81.57569952470	28.38836585160	Milan Khola	Bardiya National Park	Bardiya
39_60.1	628	81.61422917830	28.35162080310	N/A	N/A	Bardiya
39_60.3	586	81.61424476310	28.35432869650	N/A	N/A	Bardiya
39_60.4	589	81.61729017760	28.35160698270	N/A	N/A	Bardiya
39_60.2	526	81.61423697040	28.35297474990	N/A	N/A	Bardiya
38_61.6	410	81.57570683930	28.38971980060	Milan Khole Danda	Bardiya National Park	Bardiya
38_61.1	270	81.57263017180	28.38702480380	Miringi Khola	Thulo siri	Bardiya
39_60.5	575	81.61729800860	28.35296092870	N/A	N/A	Bardiya
36_65.2	1143	81.48771211400	28.53134574460	Baspani	N/A	Bardiya
36_65.3	1215	81.48771834760	28.53269968450	Bas Pani	N/A	Bardiya
36_65.4	1088	81.49077208450	28.52998076060	Baspani	Bardiya National Park	Bardiya
40_60.3	307	81.65505237470	28.35501148480	Deurali chure	Beluwa	Bardiya
40_60.1	587	81.65503575400	28.35230361320	deurali chure	beluwa	Bardiya
40_60.2	541	81.65504406410	28.35365754910	Deuralichure	Beluwa	Bardiya
40_60.5	556	81.65810509750	28.35364281170	N/A	N/A	Bardiya
40_60.6	467	81.65811344700	28.35499674650	Deuralichure	Beluwa	Bardiya
34_64.3	339	81.40681706530	28.49512527050	Basha Khola danda	N/A	Bardiya

Annex 8: Sub-Plots locations in the churia Forest

PLotID	Altitude	Longitude	Latitude	Forest name	VDC	District
40_60.4	604	81.65809674860	28.35228887650	N/A	N/A	Bardiya
36_65.5	1149	81.49077835700	28.53133470010	Bas pani	Bardiya National park	Bardiya
36_65.6	1208	81.49078462980	28.53268863940	Baspani	Bardiya National Park	Bardiya
36_65.1	1105	81.48770588070	28.52999180440	Baspani	N/A	Bardiya
37_63.5	379	81.53326721010	28.45985689320	Khahare Pani	Bardiya National Park	Bardiya
37_63.6	358	81.53327400580	28.46121083770	Guthi	N/A	Bardiya
34_64.1	322	81.40680668260	28.49241734550	Lami damar	BNP	Bardiya
37_63.3	268	81.53020980920	28.46122281460	Guthi	N/A	Bardiya
41_61.2	976	81.69510016570	28.39042716870	Bardia BUfferzone	Chhinchu	Bardiya
41_61.1	911	81.69509133400	28.38907325120	Neupane	Chhinchu	Bardiya
41_61.4	783	81.69815335870	28.38905759710	Thulogauda	Chhinchu	Bardiya
41_61.5	812	81.69816222930	28.39041151370	NA	Chhinchu	Bardiya
41_61.6	496	81.69817110060	28.39176543000	N/A	Chhinchu	Bardiya
41_61.3	554	81.69510899800	28.39178108590	Chaurigatha	Chhinchu-3	Bardiya
9_79.2	620	80.36742656730	29.01249391210	khargad	Jhalari	Kanchanpur
9_79.3	535	80.36741831980	29.01384772190	Khargari Jungle	jhalari	Kanchanpur
9_79.4	535	80.37051504150	29.01115456480	Kharchand jungle	Jhagadi kalapani	Kanchanpur
9_79.6	605	80.37049862740	29.01386218640	Tal forest	Jalari-2	Kanchanpur
9_79.1	631	80.36743481420	29.01114010200	Khadghad Jungle	Jhalari	Kanchanpur
9_79.5	595	80.37050683470	29.01250837570	kHarchand jungle	Jhalare	Kanchanpur

Annex 9. Annotated Checklist of Shrubs

SpID	Family	Botanical Name	Local Name
5175	Acanthaceae	*Dicliptera bupleuroides* Nees	
5412	Acanthaceae	*Justicia adhatoda* Linn.	Asuro, Kalo Bhasak, Yasur, Aleha
5434	Acanthaceae	*Lepidagathis incurva* Buch.-Ham. ex D.Don	Dhobini
5661	Acanthaceae	*Phlogacanthus thysiflorus* Nees.	Chuwa
5929	Acanthaceae	*Strobilanthes capitata* (Nees) T. Anderson	
5930	Acanthaceae	*Strobilanthes colorata* (Steud.) Bosser & Heine	
5939	Acanthaceae	*Strobilanthes oligocephala* T.Anders.ex C.B. Clarke	
6044	Agavaceae	*Yucca gloriosa* L.	Kettuke, Kettaki, Kettak
5765	Anacardiaceae	*Rhus parviflora* Roxb.	Sativayar
5347	Apocynaceae	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don	Indra Jau, Kurchi, Kebat, Madise Khirro, Dudh Khirro, Dudh Kira, Bhate Khirro
5715	Apocynaceae	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Sarpagandha, Chand Maruwa,, Jhar Mauro, Dhar Maruwa, Chandmari
6040	Apocynaceae	*Wrightia arborea* (Dennst.) Mabberly	Ban Kera, Thulo Bankera, Thulo kuro, Kiringi, Kaling
4960	Araliaceae	*Brassaiopsis hainla* (Buch.-Ham. ex D.Don) Seem	Seto Chutro
5019	Arecaceae	*Caryota urens* L.	Ban Supari, Rangbhang, Jagar
4983	Asclepiadaceae	*Calotropis gigantea* (L.) Dryand.	Aank, Seto Aank, Baramase Aank, Arka, Aakon, Arka, Madar, Safed
5391	Asteraceae	*Inula cappa* (Buch.-Ham. ex D.Don)DC.	Gaitihare, Kanpate
5392	Asteraceae	*Inula cuspidita* (DC.)C.B.Clarke	
4893	Berberidaceae	*Berberis aristata* DC.	Chutro, Kinsi, Kirmando, Kirmundo, Marpyasi, Kerpark
4897	Berberidaceae	*Berberis asiatica Roxb. ex DC.*	Chutro
5598	Bignoniaceae	*Oroxylum indicum* (L.) Kurz	Tatelo, karam, Kanda, Sauna, Sontat, Totilla, Laamendho
4996	Burseraceae	*Canarium benghalensis* Roxb.	Gokuldhup
5863	Buxaceae	*Sarcococca coriacea* (Hook.) Sweet	Phittephiya
5864	Buxaceae	*Sarcococca hookeriana* Baill.	Telparo
5864	Buxaceae	*Sarcococca hookeriana* Baill.	Telparo
5037	Celastraceae	*Celastrus paniculatus* Willd.	Malkagunu
5718	Celastraceae	*Reissantia arborea* (Roxb.) Hara	
5361	Clusiaceae	*Hypericum cordifolium* Choisy	
5366	Clusiaceae	*Hypericum japonicum* Thunb.ex Murray= Sarothra laxa	Undalu, Kanike Ghas
5373	Clusiaceae	*Hypericum uralum* Buch.-Ham. ex D.Don	Khareto, Urilo
5562	Commelinaceae	*Murdannia divergens* (C. B. Clarke) Bruckn.	
5563	Commelinaceae	*Murdannia japonica* (Thunb.) Faden	Nigale Gava
5566	Commelinaceae	*Murdannia scapiflora* (Roxb.) Royle	Siyaha Musli, Pate Phool, Musli
5400	Convolvulaceae	*Ipomoea carnea* Jacq.	Ajambari, Bisari Jhar
5953	Cornaceae	*Swida oblonga* (Wall.) Sojak	Lato Kath, Lati Kath
5147	Cupressaceae	*Cupressus sempervirens* L.	
5200	Elaeagnaceae	*Elaeagnus infundibularis* Momiyama	Timru, Madilo, Goili, Guyali
5202	Elaeagnaceae	*Elaeagnus parvifolia* Wall. ex Royle	Guyanli, Kankol, Madilo

Annex 9. Annotated Checklist of Shrubs

SpID	Family	Botanical Name	Local Name
5291	Ericaceae	*Gaultheria fragrantissima* Wall.	Patpate, Dhasingare, Chenjen, Dabdabe
5983	Ericaceae	*Vaccinium dunalianum* Wight	
4842	Euphorbiaceae	*Antidesma acidum* Retz.	Archale, Himalcheri, Amari, Imili, Kali Katai
4844	Euphorbiaceae	*Antidesma bunuis* (L.) Spreng.	Archale, Aule Ghas, Himal Cheri
5251	Euphorbiaceae	*Euphorbia royleana* Boiss.	Siundi
5301	Euphorbiaceae	*Glochidion assamicum* (Mull.-Arg.) Hook.f.	
5306	Euphorbiaceae	*Glochidion velutinum* Wight	Anbin, Chamari, Kath Mauwa
5405	Euphorbiaceae	*Jatropha curcas* Linn.	Sajiwa, nirguni, Sajiwa, Ratanjot, Saruwa, Sajiyon, Hatti Kane, Batti Bal, Baghandi, Arin
5662	Euphorbiaceae	*Phyllanthus parvifolius* Buch.- Ham.ex D. Don	Khareto, Thulo Khareto
5663	Euphorbiaceae	*Phyllanthus sikkimensis* Mtill.-Arg.	
5777	Euphorbiaceae	*Ricinus communis* Linn.	Andir, Adir, Ander, Arin, Anderi, Andel, Aderi
4813	Fabaceae	*Acacia pennata* (L.) Willd.	Aradi, Arare, Arphu
4969	Fabaceae	*Butea minor* Buch.-Ham. ex Baker	Bhuletro, Bhujetro
4973	Fabaceae	*Caesalpinia bonduc* (L.) Roxb.	Gainde Kanda, Kanju, Kande Kuberachhya, Karaunju, Karaunji
4975	Fabaceae	*Caesalpinia decapetala* (Roth) Alston	Arile Kanda, Arille, Lata, Ulte Kanda, karanga, Arari Kanda
4976	Fabaceae	*Caesalpinia digyna* Rottler	
5020	Fabaceae	*Cassia floribunda* Cav.	Chhinchhine Bish
5022	Fabaceae	*Cassia mimosoides* Linn. *subsp. lechenaultiana* (DC.) Ohashi	Amala Jhar
5025	Fabaceae	*Cassia occidentalis* L.	Tapre, Panwar, kasaudi, Thulo Tapre, Chakunda
5026	Fabaceae	*Cassia sophera* Linn.	Tapre Panwar, kasaudi, Thulo Tapre, Chakunda
5165	Fabaceae	*Desmodium elegans* DC.= D. tiliaefolium	Chamle, Rato bakhre Ghas
5168	Fabaceae	*Desmodium gangeticum* (L.) DC.	Salparni, Ban Gahate, Presni Panni, Karochi Jhar
5170	Fabaceae	*Desmodium triflorum* (L.) DC.	Sarkhinu
5283	Fabaceae	*Flemingia macrophylla* (Willd) Corner	Thulo Bansapti, Bansapti,Bhatwasi
5284	Fabaceae	*Flemingia strobilifera* (L.) Ait.	Sano Bansapti, Bansapti, Bisahari jhar
5376	Fabaceae	*Indigofera atropurpurea* Buch.-Ham. ex Hornem.	Neer, Sakhinu
5386	Fabaceae	*Indigofera pulchella* Roxb.	Mirmire, Phusre Ghas, Rato Mirmire, Sakhinu
5447	Fabaceae	*Leucaena leucocephala* (Lam.) De Wit	Ipil Ipil
5547	Fabaceae	*Millettia extensa* (Benth.) Baker	Gonjo, Gauj
5550	Fabaceae	*Millettia nepalensis* R.N. Parker	
5282	Flacourtiaceae	*Flacourtia indica* (Burm. f.) Merr.	Kandail
5348	Flacourtiaceae	*Homalium napaulense* (DC.) Benth.	Phalame Kande, Aaluya, Kuphre, Pasing, Mangpuju
5355	Hydrangeaceae	*Hydrangea robusta* Hook. f. & Thomson	Phirphire Ghas
5080	Labiatae	*Colebrookea oppositifolia* Sm.	Dhursul, Dhursule, Sitroma, Dosul, Dosro, Dhusure, Budhana, Dhurseta
5458	Lauraceae	Litsea lancifolia (Roxb. ex Nees) Hook. f.	kali Paheli, Kali Pahele

Annex 9. Annotated Checklist of Shrubs

SpID	Family	Botanical Name	Local Name
5427	Leeaceae	*Leea compactiflora* Kurz	
5431	Leeaceae	*Leea macrophylla* Roxb. ex Hornem.	Bulebhetra, Balyatra, Galeni, Galoni, Dadhuwahi Jhangi, Kawa Okhar
5284	Leguminosae	*Flemingia strobilifera* (L.) Ait.	Sano Bansapti, Bansapti, Bisahari jhar
5717	Linaceae	Reinwardtia indica Dumort.	Pyauli, Basanta, Pengun, Kyonbi
5163	Loranthaceae	*Dendrophthoe falcata* (L.f.) Etring.	Ainjeru, Riniya, Ajeru
5875	Loranthaceae	*Scurrula parasitica* Linn.	Lisso, Ainjeru
6019	Loranthaceae	*Viscum articulatum* Burm. f.	Harchu,Hadchure
6021	Loranthaceae	*Viscum articulatum* Burm. f. *var. liquidambaricolum* (Hayata)	Harchu,Hadchure
4836	Lythraceae	*Ammannia baccifera* Linn.	Ambar, Dadmeri
5421	Lythraceae	*Lagerstroemia reginae* Roxb.	Asare phool, Thulo Asare Phool
6039	Lythraceae	*Woodfordia fruticosa* (L.) Kurz.	Dhaiyaro, Dhuinya, Amar Phool, Dhayaro
4802	Malvaceae	*Abelmoschus manihot* (L.) Moench.	Ban Nalu, Odal, Odale
4804	Malvaceae	*Abelmoschus manihot* (L.) Medik. subsp. *tetraphyllus*	Ban Nalu, Odal, Odale
4806	Malvaceae	*Abelmoschus moschatus* Medik.	Kasturi, Lata Kasturi, Ban Nalu
5337	Malvaceae	*Hibiscus manihot* L.	Ban lasun
5341	Malvaceae	*Hibiscus schizopetalus* (Mast.) Hook.f.	
5973	Malvaceae	*Thespesia lampas* (Cav.) Dalz. & Gibs.	Ban Kapas, Lata Kasturi
5529	Melastomataceae	*Melastoma melabathricum* Linn.	Angeri, Culesi, Kalipapa
5607	Melastomataceae	*Osbeckia nepalensis* Hook.	Sidure, Chuwa, Seto Chulsi
5609	Melastomataceae	*Osbeckia rostrata* D.Don	Rato Chulesi
5611	Melastomataceae	*Osbeckia stellata* Buch.- Ham.ex D. Don	Thulo Chulesi, Rato Chulesi, Asare
5051	Meliaceae	*Cipadessa baccifera* (Roth) Miq.	Masgede
6105	*Mimosaceae*	*Alblzla lebbeck* (L.) Benth.	Black Sirish, Parrot Tree, East Indian Walnut, Kokko
5256	Moraceae	*Ficus altissima* Blume	
5270	Moraceae	*Ficus pubigera* (Wall. ex Miq.) Brandis	Gular
5272	Moraceae	*Ficus sarmentosa* Buch.-Ham. ex Sm.	Berulo, Ban Timilo, Kathe Dumri, Bihar Khanyau
5274	Moraceae	*Ficus subincisa* Buch.-Ham. ex Sm.	Berulo, Berilo, Gedilo, Ankhapakuwa
5492	Moraceae	*Maclura cochinchinensis* (Lour.) Corner	Debar, Damaru
5556	Moraceae	*Morus australis* Poir.	Kimbu, Kut Simal
5558	Moraceae	*Morus nigra* L.	Kimbu, Kimmu, Kalo Kimbu
5559	Moraceae	*Morus serrata* Roxb.	Kimbu, Musleri, Kalo, Kaphal
5571	Musaceae	*Musa balbisiana* Colla	Jangali Kera
5572	Musaceae	*Musa paradisiaca* L.	Kera, Moje
4847	Myrsinaceae	*Ardisia macrocarpa* Wall.	Dam Phai, Damai Phal
4848	Myrsinaceae	*Ardisia solanacea* Roxb.	Damai Phul, Damai Phal, Lawathi, Bhanti
5209	Myrsinaceae	*Embelia vestita* Roxb.	Amile Ghas
5498	Myrsinaceae	*Maesa chisia* Buch.- Ham.ex D. Don	Bilaune
5499	Myrsinaceae	*Maesa macrophylla* (Wall.) A.DC.	Paha, Phogate, Pakha Phal, Ban Bhogate
5583	Myrsinaceae	*Myrsine capitellata* Wall.	Settee Kath
5584	Myrtaceae	*Myrsine semiserrata* Wall.	Kali Kath

Annex 9. Annotated Checklist of Shrubs

SpID	Family	Botanical Name	Local Name
4953	Nyctaginaceae	*Boerhavia diffusa* Linn.	Lal Gajaparni, lal Punarnawa, Punarwa, Sanu Pate
5402	Oleaceae	*Jasminum arborescens* Roxb.	Chameli Phool
5403	Oleaceae	*Jasminum arborescens* Roxb. var. *latifolium* (Roxb.) C.B.Clarke	
5404	Oleaceae	*Jasminum mesney* Hance	Dabal Jai,Lahare Jai, Jai
5674	Portulacaceae	*Portulaca oleracea* Linn.	Kulpha Sag, Noon Dhiki
6053	Rhamnaceae	*Zizyphus apetala* Hook. F. ex Lawson	
6055	Rhamnaceae	*Zizyphus oenoplia* (L.) Mill.	Aule Bayar
5680	Rosaceae	*Potentilla fulgens* Wall. ex Hook	Bajra Danti
5708	Rosaceae	*Pyracantha crenulata* (D.Don) M.Roemer	Ghangaru, Kath Gedi
5783	Rosaceae	*Rosa brunonii* Lindl.	Baramase Gulaf, Bhaisikande Gulaf, Bhaisi kanda
5795	Rosaceae	*Rubus betulinus* D.Don	
5798	Rosaceae	*Rubus ellipticus* Smith	Ainselu, Isi, Polong
5803	Rosaceae	*Rubus hamiltonii* Hook.f.	
5806	Rosaceae	*Rubus indotibetanus* Koidz.	
5813	Rosaceae	*Rubus rugosus* Smith	Goru Ainselu, Bipen Kanda
5079	Rubiaceae	*Coffea benghalensis* Heyne ex Roem. & Schult.	Asare Phool, Ban Kaphi, Jangali Kaphi, Baramase
5357	Rubiaceae	*Hymenopogon parasiticus* Wall.	Hansaraj, Ban Biri, Ban Gaja, Gobre Kath, Gabre Kath
5481	Rubiaceae	*Luculia gratissima* (Wall.) Sweet	Bankagiyo, Gai Phool, Bari, Darbari
5573	Rubiaceae	*Mussaenda frondosa* Linn.	Asare, Dhobini
5574	Rubiaceae	*Mussaenda glabra* Vahl	
5575	Rubiaceae	*Mussaenda incana* Wall.	
5577	Rubiaceae	*Mussaenda roxburghii* Hook.f.	Dhobini
5578	Rubiaceae	*Mussaenda treutleri* Stapf	Dhobini
5636	Rubiaceae	*Pavetta indica* Linn.	Kagiyo Phool, Takali
5712	Rubiaceae	*Randia tetrasperma* (Roxb.) Benth. & Hook. f. ex Brandis	Kanda, Haku Geda, Bhedra, Danwa, Chhota, Gigaru
6028	Rubiaceae	*Wendlandia coriacea* (Wall.) DC.	---
6029	Rubiaceae	*Wendlandia exserta* (Roxb.) DC.	Rato kaiyo, Ban Kaiyo,Badhuwa, Chaulai, Tilko, Tiluko
6031	Rubiaceae	*Wendlandia proxima* (D. Don) DC.	
5287	Rutaceae	*Fortunella japonica* (Swingle)	Muntala
5569	Rutaceae	*Murraya koenigii* (L.) Spreng.	Asare, Mitho nim, Khole jamun, Machimer, Mechiya Sag
5570	Rutaceae	*Murraya paniculata* (L.) Jack	Kamana phul, Kamini, Simali, Bajradanti
5975	Rutaceae	*Toddalia asiatica* (L.) Lam.	Mainkara, Mainkangra
6046	Rutaceae	*Zanthoxylum acanthopodium* DC.	Bogya Timur, Boke Timur
6047	Rutaceae	*Zanthoxylum armatum* DC.	Timur, Yerma, Primu
5859	Sambucaceae	Sambucus canadensis L.	Kanike Phool
5860	Sambucaceae	*Sambucus hookeri* Rehder	Galeni
6006	Sambucaceae	*Viburnum colebrookianum* Wall.	---
6006	Sambucaceae	*Viburnum colebrookianum* Wall.	---
6008	Sambucaceae	*Viburnum continifolium* D.Don. var. wallichii T.R.Dudley	Ghodekhari, Bakal Pate, Gharghuri

Annex 9. Annotated Checklist of Shrubs

SpID	Family	Botanical Name	Local Name
6018	Sambucaceae	*Viburnum punctatum* Buch.-Ham. ex D.Don	
5615	Santalaceae	*Osyris wightiana* Wall.	Noon Dhiki, Noon Dhijhi, Numnugi, Jhuri
5350	Saururaceae	*Houttuynia cordata* Thunb.	Gane, Gandhe
5664	Simaroubaceae	*Picrasma javanica* Blume	Teju, Taju
5156	Solanaceae	*Datura stramonium* Linn.	Dhaturo, Seto Dhaturo
5884	Solanaceae	*Solanum erianthum* D.Don= *S. verbascifolium*	Dursul
5890	Solanaceae	*Solanum torvum* Swartz	Thulo Bihi, Kacher, kachera, Chusai, Bihi
6036	Solanaceae	*Withania coagulans* (Stocks) Dunal	
5920	Stachyuraceae	*Stachyurus himalaicus* Hook.f. & Thoms. ex Benth.	Seto Bhasak, Lahare Chunetro
5329	Sterculiaceae	*Helicteres isora* Linn.	Kapasi, Maror Phal, Simthi
5535	Sterculiaceae	*Melochia corchorifolia* Linn.	Patuwa Jhar, Phuli Jhar
10004	Theaceae	*Camellia drupifera*	
5090	Tiliaceae	*Corchorus capsularis* L.	Patuwa, Tito Pate, Sanpat, Simthi, Titepati
5324	Tiliaceae	*Grewia helicterifolia* Wall.	Ban Makai
5326	Tiliaceae	*Grewia optiva* Drumm. ex Bturet	Bhimal, Bhebul, Bheol, Syal Phusre
5328	Tiliaceae	*Grewia sclerophylla* Roxb.	Pharso, Pama, Gurveli, Pharse
5979	Ulmaceae	*Trema politoria* (Planch.) Blume	
4951	Urticaceae	*Boehmeria rugulosa* Wedd.	Daar, Getha, Jenthi, Jenti
5160	Urticaceae	*Debregeasia salicifolia* (D. Don) Rendle	Dar Tusare
5299	Urticaceae	*Girardinia diversifolia* (Link) Friis	Allo, Hatti Sisnu, Thulo Sisnu, Susuni, Ullu Sisnu
4981	Verbenaceae	*Callicarpa macrophylla* Vahl	Daikamla, Daichamle, Guyalo, Datiwanak Phal, mas gede
5068	Verbenaceae	*Clerodendrum indicum* (L.) Kuntze	Chinde, Bhargi, Angiyaha
5070	Verbenaceae	*Clerodendrum lasiocephalum* C.B.Clarke	
5072	Verbenaceae	*Clerodendrum serratum* (L.) Moon	Anekhi, Akhandi, Andekhi, Chuwa, Golaichi
5075	Verbenaceae	*Clerodendrum viscosum* Vent.	Venta, Chitu, Rajbeli, kalo, Baklepate, Bhati, Bhathi, Dhusi
5076	Verbenaceae	*Clerodendrum viscosum* Vent. f.*rubrum* Moldenke	Venta, Chitu, Rajbeli, Kalo Baklepate, Bhati, Bhathi, Dhusi
5077	Verbenaceae	*Clerodendrum viscosum* Vent. f. *viscosum*	Venta, Chitu, Rajbeli, Kalo Baklepate, Bhati, Bhathi, Dhusi
5193	Verbenaceae	*Duranta repens* Linn.	Nilkanda
5422	Verbenaceae	*Lantana camara* Linn.	Masino kanda, Ban Phanda Kanda, Lwang Phool, Ban Phada
5681	Verbenaceae	*Premna barbata* Wall.	Ginneri
5682	Verbenaceae	*Premna barbata* Wall. var. *barbata*	Ginneri
5688	Verbenaceae	*Premna interrupta* Wall.	Ginneri, Giniyar, Gideri
5693	Verbenaceae	*Premna barbata* Wall. var. *anodon* C.B Clarke	Ginneri
6022	Verbenaceae	*Vitex negundo* Linn.	Simali
6024	Verbenaceae	*Vitex negundo* Linn. var. *negundo*	Simali, Indrayani

Annex 10. Annotated Checklist of Herbs

Sp.Code	Family	Botanical name	Local name
1285	Acanthaceae	*Barleria cristata* Lirur.	Bhede kuro, katsaraiya, Lariphool
1286	Acanthaceae	*Barleria strigosa* Willd.	
2133	Acanthaceae	*Echinacanthus attenuatus* Nees	Nil ganthe
2640	Acanthaceae	*Hypoestes triflora* (Forssk.) Roem. & Schult.	Simkuro
2766	Acanthaceae	*Justicia procumbens* Linn.	Phool Phar
1008	Acanthaceae	*Justicia vahlii* Roth	
931	Acoraceae	*Acorus calamus* Linn.	Bojho, Syuada Bach
6707	Adiantaceae	*Adiantum capillus*-veneris	
6708	Adiantaceae	*Adiantum caudatum* Linn.	Seto Sinki
879	Amaranthaceae	*Achyranthes aspera* Linn.	Datiwan, Apamarga, Nak Siruka, Ultakur, Garsabe
882	Amaranthaceae	*Achyranthes bidentata* Blume	Rato Datiwan, Rato Apamarga
1016	Amaranthaceae	*Alternanthera sessilis* (L.) DC.	Bhiringi jhar, Bhringraj, Gibre pate, Saraci
1024	Amaranthaceae	*Amaranthus spinosus* Linn.	Kandelunde, Katari, Kathgaiya, Lunde latte, Bakancha, Ban lunde
1027	Amaranthaceae	*Amaranthus viridis* Linn.	Latte Sag, Lunde, lunde Sag
2504	Amaranthaceae	*Gomphrena globosa* L.	Makhamali Phool, Lal Murga
1003	Amaryllidaceae	*Allium sativum* L.	Lasun, No
1871	Amaryllidaceae	*Crinum amoenum* Roxb. ex Ker Gawl.	Hade Lasun, Hare Lasun
1682	Anthericaceae	*Chlorophytum arundinaceum* Baker	Dati Sag
1684	Anthericaceae	*Chlorophytum nepalense* (Lindl.) Baker	
1634	Apiaceae	*Centella asiatica* (L.) Urb.	Ghodtapre, kholcha Dhaya, Bramhi, Bramha Buti, Chakror
1202	Araceae	*Arisaema tortuosum* (Wall.) Schott Var. *tortuosum*	Sarpako Makai, Birbanka, Banko
1757	Araceae	*Colocasia esculenta* (L.) Schott	Gava, Pindalu, karkalo, Taya
3842	Araceae	*Rhaphidophora decursiva* (Roxb.) Schott	
4101	Araceae	*Scindapsus officinalis* (Roxb.) Schott	Gajpipli, Gajpipli, Pipri
2620	Araliaceae	*Heteropanax fragrans* (Roxb.) Seem.	Tarla
259	Asclepiadaceae	*Marsdenia tinctoria* R.Br.	Panari, Kali Lara, Kali Lahara
1232	Asclepiadaceae	*Asclepias curassavica* L.	Machha Phul, Khursani Kose Phool, Khursani Phool
1235	Asparagaceae	*Asparagus filicinus* Buch.-Ham. ex D.Don.	Ban Kurilo
1240	Asparagaceae	*Asparagus racemosas* Willd. Var. *racemosus*	Satawari, kurilo, Makuri
1011	Asphodelaceae	*Aloe vera* (L.) Burm. f.	Ghiu kumari
950	Asteraceae	*Adenostemma lavenia* (L.) Kuntze	Rato Danthe Ghas
962	Asteraceae	*Ageratum conyzoides* Linn.	Gandhe, Boke Ghas, Ganaune jhar, gane ganemane ghas
963	Asteraceae	*Ageratum houstonianum* Mill.	Nilo Gandhe
1041	Asteraceae	*Anaphalis adanata* Wall.ex DC.	
1208	Asteraceae	*Artemisia absinthum* L.	Dumura
1212	Asteraceae	*Artemisia dubia* Wall. ex Besser	Tite pati, Gandhe jhar
1215	Asteraceae	*Artemisia indica* Willd.	Titepati, Nag Damani, khamba, Gandhe jhar, Dhuswan
1257	Asteraceae	*Aster indamellus* Grierson	
1319	Asteraceae	*Bidens pilosa* Linn.	Kuro, Thulo kuro, Kurkur, Kalo Kuro, Maha Rathi
1342	Asteraceae	*Blumea balsamifera* (L.) DC.	Gaitihare
1346	Asteraceae	*Blumea lacera* (Burm.f.) DC.	Kurkure, Kukuradra
1398	Asteraceae	*Breea arvensis* (L.) Less.	Thakal
1457	Asteraceae	*Calamixis baccharoides* Thoms.	Gaitihare

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1635	Asteraceae	*Centipeda minima* (L.) A.Br. & Aschers.	Chuke Jhar
1851	Asteraceae	*Crassocephalum crepidioides (Benth.) S. Moore*	Anikale Jhar, Bhuwa
2157	Asteraceae	*Elephantopus scaber* Linn.	Halhale, Bhedo Kuro, Gomukhi, Bhiringi Jhar
2272	Asteraceae	*Ageratina acuminatum = Eupatorium acuminatum* D. Don	Ban mara
2273	Asteraceae	*Ageratina adenophora = Eupatorium adenophorum* Spreng.	Ban mara, Kangresi Jhar, Kal Jhar
2496	Asteraceae	*Gnaphalium affine* D.Don	Boke Phool, Kairo Jhar, Jyapu Dhaya, Bokre Phool
2517	Asteraceae	*Grangea maderaspatana* (L.) Poir.	Gobre Jhar
2822	Asteraceae	*Launaea procumbens* (Roxb.) Ramayya & Rajagopal	Dudhe
3974	Asteraceae	*Saussurea heteromalla* (D.Don) Hand.-Mazz.	Mula pate
4262	Asteraceae	*Sonchus arvensis L.= Sonchus wightianus* DC.(4265)	Ban Rayo, Kasni Sag, Dudhe
4263	Asteraceae	*Sonchus asper*(L.) Hill.	Dudhe
4265	Asteraceae	*Sonchus wightianus* DC.	Mula pate, Omche
4285	Asteraceae	*Spilanthes paniculata* Wall.	Lato ghas, Marati
4380	Asteraceae	*Tagetes erecta* L.	Sayapatri, Kanak Puspika, Gaida
4624	Asteraceae	*Xanthium strumarium* Linn.	Kastolo, Kangara, Kukkuchiyak, Bhede Kurro, Kastolo
10007	Asteraceae	*Gnaphalium purpureum* (L.) Cabrera	
2279	Asteraceae	*Chromolaena odorata = Eupatorium odoratum* Linn.	Kalo Ban mara
6812	Azollaceae	*Azolla pinnata* R.Br.	Pani Unau
1301	Begoniaceae	*Begonia picta* Smith	Magarkanche, Shovaparni
6814	Blechnaceae	*Blechnum orientale* Linn.	
7232	Blechnaceae	*Woodwardia biserrata = W. unigemmata*	
1950	Boraginaceae	*Cynoglossum zeylanicum* (Vahl) Thunb. ex Lehm.	Kanike Kuro
3838	Brassicaceae	*Raphanus sativus* L.	Mula, Murai, Labu
3892	Brassicaceae	*Rorippa benghalensis* (DC.) H. Hara	
3895	Brassicaceae	*Rorippa nasturtium* (L.) Hayek	Tori Jhar, Sim Rayo, Pani Sagh
1040	Bromeliaceae	*Ananas comosus* (L.) Merr.	Bhuin Katahar
2941	Campanulaceae	*Lobelia alsinoides* Lam.	Aklebir
1499	Cannabaceae	*Cannabis sativa* Linn.	Bhango, Bhang,Ganja, Charesh, Gajima
1728	Capparaceae	*Cleome viscosa* Linn.	Hurhure, Bantori
246	Caprifoliaceae	*Lonicera japonica* Thunb.	Juhi
2123	Caryophyllaceae	*Drymaria diandra* Blume	Abhijalo, KholchaDhayn
4225	Caryophyllaceae	*Silene stracheyi* Edgew.	Nemsi
3069	Chenopodiaceae	*Microgynoecium tibeticum* Hook.f.	
1763	Commelinaceae	*Commelina benghalensis* Linn.	Bankane, Kane Sag, Patpate, Kane Jhar
4140	Crassulaceae	*Sedum rhombifolia* L.	Atibala
261	Cucurbitaceae	*Melothria mucronata* Cogn.	Tarisokoto
4654	Cyperaceae	*Bulbostylis barbata* (Rottb.) C. B. clarke	Jhuse jhar
4661	Cyperaceae	*Cyperus compressus* L.	Mothe Jhar
4673	Cyperaceae	*Cyperus iria* L.	Thulo Mothe, Chhate Mothe, Chhatare
4683	Cyperaceae	*Cyperus rotundus* Linn.	Nagar Mothe, Mothe, Motha
4771	Cyperaceae	*Mariscus sumatrensis* (Retz.) T. Koyama	Karaunte
4785	Cyperaceae	*Schoenoplectus juncoides* (Roxb.) Palla	Suire

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6886	Dennstaedtiaceae	*Dennstaedtia appendiculata* (Wallich ex Hooker) J. Smith	Gothale Unau
2088	Dipsacaceae	*Dipsacus inermis* Wall. = *Dipsacus strictus*	Mulapat
6927	Dryopteridaceae	*Dryopsis manipurensis* (Bedd.) Holttum & P.J.Edwards	
6932	Dryopteridaceae	*Dryopteris atrata* (Wallich ex Kunze) Ching	Jhuselo Niuro
6937	Dryopteridaceae	*Dryopteris cochleata* (Buchanan-Hamilton ex D. Don) C. Christensen	Danthe Nyuro, Nyuro, Unau, Pani Nyuro
6956	Dryopteridaceae	*Dryopteris sparsa* (D.Don) Kuntze	Jhusilo Unyu
6970	Equisetaceae	*Equisetum arvense* Linn.	Ankhe Jhar, Talche Jhar
6971	Equisetaceae	*Equisetum diffusum* D.Don	Ankhe Jhar, Ankhle Jhar, Kurkure Ghas
6972	Equisetaceae	*Equisetum palustre* Linn.	
2239	Eriocaulaceae	*Eriocaulon nepalense* Prescott ex Bong.	Ghas, Bhuri Ghas, Bhusi Ghas
2280	Euphorbiaceae	*Euphorbia dracunculoides* Lam.	Dudhe Jhar
2285	Euphorbiaceae	*Euphorbia hirta* Linn.	Ban Dudhe, Dudhe, Rato Mas lahare, Dudhe Jhar
2287	Euphorbiaceae	*Euphorbia ligularia* Roxb.	Sudi, Sij
2289	Euphorbiaceae	*Euphorbia milii* Des Moul.	Simri
3465	Euphorbiaceae	*Phyllanthus urinarima* L.	Bhuin Amala, Ajata
960	Fabaceae	*Aeschynomene asper* L.	Dhodiya, Sakla
1478	Fabaceae	*Calopogonium macunoides* Desv.	Gahatejhar
1624	Fabaceae	*Cassia mimosoides* Linn.	Amala Jhar
1876	Fabaceae	*Crotalaria alata* Buch.-Ham. ex D.Don	Chin chine
1888	Fabaceae	*Crotalaria prostrata* Rottb. ex Willd.	Chhinchhine
1892	Fabaceae	*Crotalaria tetragona* Andrews	Sanai, Chhinchhine, Chhichhike San
2034	Fabaceae	*Desmodium confertum* DC.	
2035	Fabaceae	*Desmodium heterocarpon* (L.) DC.	Sakhino
2038	Fabaceae	*Desmodium khasianum* Prain	
2039	Fabaceae	*Desmodium laxiflorum* DC.	
2051	Fabaceae	*Desmodium sequax* Wall.	
2323	Fabaceae	*Flemingia paniculata* Wall.	
2495	Fabaceae	*Glycorrhiza glabra* L.	Jethi Madu, Istami
3081	Fabaceae	*Mimosa pudica* Linn.	Lajjawati, Lajabanti, Buhari Jhar, Lajauni
3082	Fabaceae	*Mimosa rubicaulis* Lam.	Boksi Ghas
3213	Fabaceae	*Ormosia glauca* Wall.	
4476	Fabaceae	*Trifolium repens* L.	Tinpate, Behauli, Pyauli
4623	Fabaceae	*Wisteria sinensis* Sweet	Nillahar, Garal Kalab
2406	Gentianaceae	*Gentiana kurroo* Royle.	Karu
4345	Gentianaceae	*Swertia angustifolia* Buch.-Ham. ex D. Don	Chiraito
4366	Gentianaceae	*Swertia nervosa* (G. Don) C.B. Clarke	Tite, Aulo Ghas, Kalo Chiraito
1679	Gesneriaceae	*Chirita urticifolia* Buch.-Ham. ex D. Don	Bhende, Ankhe Ghas
2069	Gesneriaceae	*Didymocarpus albicalyx* C.B.Clarke	Kumkum
6897	Gleicheniaceae	*Dicranopteris linearis* (Burm. f.) Underw.	Unau
6974	Gleicheniaceae	*Gleichenia gigantea*	Hade Unau
601	Gramineae	*Eragrostis japonica* (Thunb.) Trin.	
874	Gramineae	*Isachne albens* Trin.	
6864	Hymenophyllaceae	*Crepidomanes birmanicum*	
1904	Hypoxidaceae	*Curculigo gracilis* (Kurtz) Wall.	
1905	Hypoxidaceae	*Curculigo orchioides* Gaertn.	Musli Kanda, Musli, Kalo Musli
3797	Labiatae	*Rabdosia ternifolia* (D. Don) Hara	

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980	Lamiaceae	*Ajuga macrosperma* Wall. var. *marcosperma*	Ghoke Ghas
1123	Lamiaceae	*Anisomeles indica* (L) Kuntze	Rato Charpate
1730	Lamiaceae	*Clinopodium umbrosum* (M. Bieb.) C.Koch	Bilajor
2160	Lamiaceae	*Elsholtzia blanda* Benth.	Ban Silam, Lha Silam
2306	Lamiaceae	*Eusteralis stellata* (Lour.) Panigrahi	
2852	Lamiaceae	*Leucas cephalotes* (Roth) Spreng.	Dronapuspi, Gupati, Supari Jhar, Gumpati, Gante Jhar
3061	Lamiaceae	*Mentha arvensis* Linn.	Babari, Pudina
3177	Lamiaceae	*Ocimum americanum* L.	Babari, Tulasi
3178	Lamiaceae	*Ocimum basilicum* Linn.	Tulasi, Babari Phool
3179	Lamiaceae	*Ocimum gratissimum* Linn.	Ban Tulasi, Tulasi, Ram
3371	Lamiaceae	*Perilla frutescens* (L.) Britton	Ban Silam, Silam
3572	Lamiaceae	*Pogostemon benghalensis* (Burm. f.) Kuntze	Rudilo Sihuwa
4117	Lamiaceae	*Scutellaria discolor* Colebr.	
4121	Lamiaceae	*Scutellaria repens* Buch.-Ham. ex D. Don	Seto Charpate
10009	Lamiaceae	*Calamuntha tongicaulis= C. hydaspidis*	
4975	Leguminosae	*Caesalpinia decapetala* (Roth) Alston	Arile Kanda, Arille, Lata, Ulte Kanda, Karanga, Arari Kanda
334	Liliaceae	*Smilax aspera L.*	Kukurdaino, Chopchini, Kubhi Ghaino
4611	Loranthaceae	*Viscum album* Linn.	Hadchur
7025	Lygodiaceae	*Lygodium flexuosum* (Linnaeus) Swartz	
7026	Lygodiaceae	*Lygodium japonicum* (Thunberg) Swartz	
4194	Malvaceae	*Sida acuta* Burm. f.	Walu, Balu. Jari Jhar, Khareti
4195	Malvaceae	*Sida cordata* (Burm.f.)Borss.	Balu Jari Jhar
4196	Malvaceae	*Sida cordifolia* L.	
4198	Malvaceae	*Sida rhombifolia* Linn.	Sano Chilya, Balu, Bariara, Khareti, Banpat
4522	Malvaceae	*Urena lobata* Linn.	Nalu Kuro,Unga, Kuro, Bariyar, Bhere Jhar
7053	Nephrolepidaceae	*Nephrolepis auriculata*	Pani Amala, Pani Saro
2969	Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	Khursani Jhar
7069	Ophioglossaceae	*Ophioglossum reticulatum* Linn.	Jibresag
955	Orchidaceae	*Aerides multiflora* Roxb.	Pyaji Sunakhari
956	Orchidaceae	*Aerides odorata* Lour.	
958	Orchidaceae	*Aerides vandarum* Reichneb. f.	
1410	Orchidaceae	*Bulbophyllum careyanum* (Hook.) Spreng.	
1463	Orchidaceae	*Calanthe masuca* (D.Don) Lindl.	Pankha Phool, Pakha Phool
1648	Orchidaceae	*Ceratostylis himalaica* Hook. f.	
1721	Orchidaceae	*Cleisostoma filiforme* (Lindl.) Garay	
1739	Orchidaceae	*Coelogyne cristata* Lindl.	Chandi Gava
1742	Orchidaceae	*Coelogyne fuliginosa* Hook.	
1932	Orchidaceae	*Cymbidium bicolor* Lindl.	
1994	Orchidaceae	*Dendrobium aphyllum* (Roxb.) G. E. C. Fisher	
2003	Orchidaceae	*Dendrobium fimbriatum* Hook.	
2005	Orchidaceae	*Dendrobium formosum* Roxb.	
2011	Orchidaceae	*Dendrobium moschatum* (Buch.-Ham.) Swartz	
2018	Orchidaceae	*Dendrobium transparens* Wall.	
2056	Orchidaceae	*Desmotrichum fimbriatum* Bl.	Jibanti, Jiri
2174	Orchidaceae	*Ephemerantha macraei* (Lindl.) P.F. Hunt & Summerh.	

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2175	Orchidaceae	*Epigeneium amplum* (Lindl.) Summerh.	
2222	Orchidaceae	*Eria spicata* (D. Don) Hand.-Mazz.	
2262	Orchidaceae	*Eulophia bicallosa* (D.Don) P.F.Hunt & Summerh.	
2979	Orchidaceae	*Luisia zeylanica* Lindl.	
3163	Orchidaceae	*Oberonia caulescens* Lindl.	
3172	Orchidaceae	*Oberonia pachyphylla* King & Pantl.	
3365	Orchidaceae	*Pelatantheria insectifera* (Reichenb. f.) Ridl.	
3452	Orchidaceae	*Pholidota imbricata* Hook. f.	
3542	Orchidaceae	*Platanthera stenantha= Habenaria stenantha*	
4550	Orchidaceae	*Vanda roxburghii* R. Br.	
4551	Orchidaceae	*Vanda teres* Lindl.	Gaitihare
3215	Orobanchaceae	*Orobanche aegyptiaca* Pers.	Nile Jhar, Thakra Jhar, Tori Jhar
3233	Oxalidaceae	*Oxalis corniculata* Linn.	Chari amilo, Amila
1173	Papavaraceae	*Argemone mexicana* Linn.	Thakal, Sungure kanda, Satyanashi, Palanti kanda
1794	Papaveraceae	*Corydalis chaerophylla* DC.	Pahele,bKarme Jhar, Okhare Ghas
2333	Papaveraceae	*Fumaria indica* (Hausskn.) Pugsley	Ban Gajar, Dhukure, Ban Sauf
3479	Phytolaccaceae	*Phytolacca americana* L.	Jaringo, Jarka, Jarrang
291	Piperaceae	*Piper longum L.*	Pipla, Sano Pipla, Pipari, Murjhang, Gajpipla
3526	Pittosporaceae	*Pittosporum nepaulense* DC.	Phurke, Tibiloti, Tibilti, Khorsane
428	Poaceae	*Apluda mutica* L.	Dakle Khar, Dakle Jhar, Sali Banso
435	Poaceae	*Arthraxon lancifolius* (Trin.) Hochst.	Chitre Ghas
438	Poaceae	*Arthraxon quartinianus* (A. Rich.) Nash	Jhyamte
444	Poaceae	*Arundinella nepalensis*Trin.	Kharuki, Ikro, Yanaru, Muse Khari
446	Poaceae	*Arundinella setosa* Trin.	
455	Poaceae	*Avena sativa* L.	Jai
458	Poaceae	*Bambusa arundinacea* Willd.	Tamabas, Bhalu Bas, Taru Bas, Kata Bas
459	Poaceae	*Bambusa balcooa* Roxb.	
461	Poaceae	*Bambusa nepalensis* Stapleton	
465	Poaceae	*Bambusa tulda* Roxb.	Tama Bas
466	Poaceae	*Bambusa vulgare* Schrad.	Tama Bas, Bansi Bas, Sin
467	Poaceae	*Borinda chigar* Stapleton	
485	Poaceae	*Brachiaria villosa* (Lam.) A. Camus	
505	Poaceae	*Capillipedium assimile* (Steud.) A. Camus	Muse Kharuki, Muse Khari
510	Poaceae	*Cephalostachyum latifolium* Munro	Gopi Bas
514	Poaceae	*Chrysopogon aciculatus* (Retz.) Trin.	Kure Ghas, Kuro, Subara
515	Poaceae	*Chrysopogon fulvus* (Spreng.) Chiov.	Ghoriya
516	Poaceae	*Chrysopogon gryllus* (L.) Trin.	Salima
517	Poaceae	*Chrysopogon serrulatus* Trin.	
521	Poaceae	*Cymbopogon distans* (Nees ex Steud.) W. Watson	Pire Ghas
523	Poaceae	*Cymbopogon jawarancusa* (Jones) Schult.	Urba, Dhaddi, Kagati Ghas
530	Poaceae	*Cynodon dactylon* (L.) Pers.	Doobo, Itu, Panja, Seto Dubo, Dubhi, Gorharki Dubhiya
538	Poaceae	*Dendrocalamus hamiltonii* Nees & Arn. ex Munro	Tamabans, Choya Bans, Dhungre Bans
542	Poaceae	*Dendrocalamus strictus* (Roxb.) Nees	Mal Bans, Kaban Bans
545	Poaceae	*Desmostachya bipinnata* (L.) Stapf.	Kush
556	Poaceae	*Digitaria ciliaris* (Retz.) Koeler	Banso, Chitre Banso
558	Poaceae	*Digitaria longiflora* (Retz.) Pers.	

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569	Poaceae	*Drepanostachyum falcatum* (Nees) Keng f.	Go Nigalo, Phurke Ghas, Nigalo Tusa
570	Poaceae	*Drepanostachyum intermedium* (Munro) Keng f.	Nigalo, Ma
576	Poaceae	*Echinochloa crus-galli* (L.) P. Beauv.	Sawa, Sama, Tunde Sama, Sawana
595	Poaceae	*Eragrostiella nardoides* (Trin.) Bor	Chhupi
607	Poaceae	*Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.	Banso
625	Poaceae	*Eulaliopsis binata* (Retz.) C. E. Hubb.	Babiyo
647	Poaceae	*Garnotia emodi* (Arn. & Nees) Janowski	
654	Poaceae	*Hemarthria compressa* (L. f.) R. Br.	Ghode Dobo
655	Poaceae	*Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult.	Arthunge
658	Poaceae	*Himalayacalamus asper* Stapleton	
659	Poaceae	*Himalayacalamus brevinodes* Stapleton	
673	Poaceae	*Imperata cylindrica* (L.) Beauvois *var. major* (Nees)C.E. Hubbard ex C.E. Hubbard & Vaughan	Siro, Khar, Dabhi
679	Poaceae	*Ischaemum rugosum* Salisb.	Mallido, Maldero
688	Poaceae	*Imperata cylindrica* (L.) Beauvois Var. *cylindrical*	Siro, Khar, Dabhi
692	Poaceae	*Microstegium ciliatum* (Trin.) A. Camus	
729	Poaceae	*Paspalum conjugatum* Bergius	
730	Poaceae	*Paspalum distichum* L.	Janai Ghas
738	Poaceae	*Pennisetum purpurcum* Schumach.	Nepiyar Ghas
747	Poaceae	*Phragmites karka* (Retz.) Trin. ex Steud.	Narkat, Larkat
801	Poaceae	*Saccharum spontaneum* L.	Kans, Jhaksi, Selme
809	Poaceae	*Setaria forbesiana* (Nees ex Steud.) Hook. f.	
823	Poaceae	*Sporobolus diander* (Retz.) P. Beauv.	Khude Jhar, Khunde Ghas
825	Poaceae	*Sporobolus helvolus* (Trin.) T. Dur. & Schinz	
837	Poaceae	*Thamnocalamus falconeri* Hook. f. ex Munro	
843	Poaceae	*Themeda arundinacea* (Roxb.) Ridl.	Ureli, Dhaddi
844	Poaceae	*Themeda caudata* (Nees) A. Camus	Ureli, Ulla
846	Poaceae	*Themeda quadrivalvis* (L.) Kuntze	
847	Poaceae	*Themeda triandra* Forssk.	Khar
849	Poaceae	*Thysanolaena maxima* (Roxb.) Kuntze	Amriso, Amliso, Mujo, Gerai, Amreso, Phya
866	Poaceae	*Vetiveria zizanoides* (L.) Hash	Usir, Khas Khas, Kans
	Poaceae	*Helictotrichon junghuhnii* (Buse) Henrard	
6847	Polipodiaceae	*Colysis elliptica* (Thunb.) Ching	Kalo Niyuro
923	Polygonaceae	*Aconogonum molle* (D. Don) Hara	Thotne, Tuknu, Patu Swan, Tipun
1128	Polygonaceae	*Antigonon leptopus* Hook. & Arn.	Charpate ,Janu Stambha
1326	Polygonaceae	*Bistorta amplexicaulis* (D.Don) Greene	Ratnaulo, Ratnyaulo, Kyunbro
2312	Polygonaceae	*Fagopyrum dibotrys* (D. Don) H. Hara	Ban Phapar
3385	Polygonaceae	*Persicaria barbata* (L.) H. Hara	Pire, Totaiya, Machharimara Jhar, Ratnyaule Jhar
3923	Polygonaceae	*Rumex dentatus* Linn.	Ban Palungo, Banspate
6922	Polypodiaceae	*Drynaria mollis* Beddome	
6923	Polypodiaceae	*Drynaria propinqua* (Wallich ex Mettenius) J. Smith	Rukh Unau
7003	Polypodiaceae	*Lepisorus loriformis* (Wallich ex Mettenius) Ching	
2138	Pontederiaceae	*Eichhornia crassipes* (Martius) Solms	Jaluko, Jal, Kumbhi, Pureni, Jaluki

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6832	Pteridaceae	*Cheilanthes bicolor* (Roxb.) Fraser-Jenk	Dubini Sinki, Kali Sinki
6834	Pteridaceae	*Cheilanthes dalhousiae* = C. albomarginata	Rani Sinka, Damkannu
6837	Pteridaceae	*Cheilanthes formosana* Hayata	
6846	Pteridaceae	*Cheilanthes tenuifolia* (N. L. Burman) Swartz	
7064	Pteridaceae	*Onychium japonicum* = *O. Lucidum*	
7137	Pteridaceae	*Pteris biaurita* Linn.	
7146	Pteridaceae	*Pteris pellucida* Presl.	
7150	Pteridaceae	*Pteris* sp	
7155	Pteridaceae	*Pteris wallichiana* J. Agardh	
1111	Ranunculaceae	*Anemone vitifolia* Buch.-Ham. ex DC.	Kaptase
1480	Ranunculaceae	*Caltha govaniana* Wall.	
1483	Ranunculaceae	*Caltha palustris* L.	
2329	Rosaceae	*Fragaria nubicola* Lindl.ex Lacaita	Bhuin Ainselu
306	Rubiaceae	*Rubia manjith* Roxb. ex Fleming	Majito
1175	Rubiaceae	*Argostemma sarmentosum* Wall.	Satuwa Ghas
2575	Rubiaceae	*Hedyotis corymbosa* (L.) Lam.	Majithe Jhar
2578	Rubiaceae	*Hedyotis ovatifolia* Cav.	
3123	Rubiaceae	*Neanotis ingrata* (Wall. ex Hook. f.) W. H. Lewis	Pani Ghas
1309	Saxifragaceae	*Bergenia ciliata* (Haw.) Sternb.	Pashanbhed, Pakhanbed
1311	Saxifragaceae	*Bergenia ciliata* (Haw.) Sternb. T. ciliata Yeo	Pashanbhed, Pakhanbed
1279	Scrophulariaceae	*Bacopa hamiltoniana* (Benth.) Wettst.	
4104	Scrophulariaceae	*Scoparia dulcis* L.	Chini Jhar, Mitha Jhar, Patal Misri
7169	Selaginellaceae	*Selaginella ciliaris* (Retzius) Spring	
3150	Solanaceae	*Nicotiana tabacum* L.	Surti, Kanchopat, Kancha Pat
4257	Solanaceae	*Solanum surattense* Burm.f.	Kantakari, Bad bedi, Bhat Kataiya, gurmi kant
1006	Solanaceae	*Solanum indicum* L.	
4498	Tiliaceae	*Triumfetta annua* Linn.	Dalle Kuro, Jhinjhatiya, Khangra
861	Typhaceae	*Typha angustifotia* L.	Pater,Khar
2256	Umbelliferae	Eryngium foetidum L.	Barmeli Dhaniya
1363	Urticaceae	*Boehmeria platyphylla* D.Don *var.* platyphylla	Gargalo
2019	Urticaceae	*Dendrocnide sinuata* (Blume) Chew	Maringe
2152	Urticaceae	*Elatostema sessile* J.R.Forst & G. Forst	Gagleto
2507	Urticaceae	*Gonostegia pentandra* (Roxb.) Miq.	Chiple, Chiple Ghas
1619	Verbenaceae	*Caryopteris foetida* (D. Don) Thell.	Khursane Ghas, Bagh Mukhe
6904	Woodsiaceae	*Diplazium esculentum* (Retzius) Swartz	Nyuro, Pani Nyuro, Kochaiya, Khatilak Sag, Kuta
1032	Zingiberaceae	*Amomum subulatum* Roxb.	Alinchi
1906	Zingiberaceae	*Curcuma angustifolia* Roxb.	Kaledo, Kalo Haledo, Katahare Phool, Ban Besar
1907	Zingiberaceae	*Curcuma aromatica* Salisb.	Ban Haledo, Ban Dhale, Haledo, Hardi, Ban Hardi
1908	Zingiberaceae	*Curcuma zedoaria* Rosc.	Ban Haledo, Sathi, Kachur
2493	Zingiberaceae	*Globba racemosa* Sm.	Lahare Priya Ghas
2563	Zingiberaceae	*Hedychium ellipticum* Buch.-Ham. ex Sm.	Rato Saro, Saro, Kayamana
2566	Zingiberaceae	*Hedychium glaucum* Roscoe	
2570	Zingiberaceae	*Hedychium spicatum* Sm.	Pankha Phool, Gaisaro
4647	Zingiberaceae	*Zingiber officinale* Rosc.	Aduwa, Sutho, Yad, Agnimantha, Tunga
1001	Zingiberaceae	*Roscoea amplexicaulis*	

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Sp Code	Family	Botanical Name	Local name
374	Acanthaceae	*Thunbergia coccinea* Wall. ex D. Don	Sigarne Lahare
4	Actinidiaceae	*Actinidia callosa* Lindl.	Tiku Phul
283	Anacardiaceae	*Pegia nitida* Colebr.	Chuti Lahara, Lahari aanp, Masul
197	Apocynaceae	*Ichnocarpus frutescens* (L.) R. Br.	Sariwa, Bakhre Lahare, Shyam Lata
381	Apocynaceae	*Trachelospermum lucidum* (D. Don) K. Schum.	Dudhe lahara, Salikal Lahara,Bedule, DabariLahara
39	Arecaceae	*Calamus acanthospathus* Griff.	Bet, Gauri Bet
42	Arecaceae	*Calamus tenuis* Roxb.	Bet, Bet Lauri, Betak Lathi
26	Aristolochiaceae	*Aristolochia griffithii* Hook. f. & Thomson ex Duch.	
63	Asclepiadaceae	*Ceropegia macrantha* Wight	
66	Asclepiadaceae	*Ceropegia pubescens* Wall.	Mike laharo, Ban Simi
125	Asclepiadaceae	*Cryptolepis buchananii* Roem. & Schult.	
142	Asclepiadaceae	*Cynanchum calliatum* Buch.-Ham. ex Wight	
176	Asclepiadaceae	*Gymnema tingens* (Roxb.) Spreng.	
191	Asclepiadaceae	*Hoya lanceolata* Wall. ex D. Don	
256	Asclepiadaceae	*Marsdenia tenacissima* (Roxb.) Moon	Bahuni Lahara
257	Asclepiadaceae	*Marsdenia roylei* Wight	Dudhe Lahara
258	Asclepiadaceae	*Marsdenia tenacissima* (Roxb.) Moon	Bahuni Lahara, Sunamariya
259	Asclepiadaceae	*Marsdenia tinctoria* R. Br.	Panari, Kali Lara, Kali Lahara
261	Asteraceae	*Mikania micrantha* Kunth	
240	Caprifoliaceae	*Lonicera acuminata* Wall.	
13	Convolvulaceae	*Argyreia argentia* (Roxb.) Choisy	
22	Convolvulaceae	*Argyreia setosa* (Roxb.) Choisy	
136	Convolvulaceae	*Cuscuta reflexa* Roxb.	Akashbeli, Amarlata, Amarbel
205	Convolvulaceae	*Ipomoea muricata* (L.) Jacq.	
209	Convolvulaceae	*Ipomoea purpurea* (L.) Roth.	
297	Convolvulaceae	*Porana grandiflora* Wall.	Aakashbeli, Chamero Laharo
37	Cucurbitaceae	*Benicasa hispada* (Thunb.) Cong.	Kubhindo, Petha
105	Cucurbitaceae	*Coccinea grandis* (L.) Voigt.	Bankakri, Golkakri, Akhu Parni
127	Cucurbitaceae	*Cucumis melo* L.	Kakri, Kakadi, Ghiraule Kakri, Phunt, Ghurmi, Gurmi, Phuti, Phunt
128	Cucurbitaceae	*Cucumis sativus* L.	Kankro, Bhadaure Kakro, Airelu Kakro, Asare Kakro, Asare Kakro, Khira, Langai
264	Cucurbitaceae	*Momordica cochinchinensis* (Lour.) Spreng.	Jhuse Karela,Chattel, Kheksa
357	Cucurbitaceae	*Solena heterophylla* Lour.	Tal Kore, Ban Kakri, Tilkore
373	Cucurbitaceae	*Thladiantha cordifolia* (Blume) Cogn.	
385	Cucurbitaceae	*Trichosanthes dioica* Roxb.	Parbar, Parbal, Parorak Phar
357	*Cucurbitaceae*	*Melothria heterophylla* (Lour.) Cogn = *Solena heterophylla* Lour.	Golkakri
146	Dioscoreaceae	*Dioscorea alata* L.	Ghar Tarul, Kukur Tarul, Teme
147	Dioscoreaceae	*Dioscorea belophylla* (Prain) Voigt ex Haines	
148	Dioscoreaceae	*Dioscorea bulbifera* L.	Gittha, Ban Tarul, Jada Bish, Gitthe Tarul, Kukur Tarul
149	Dioscoreaceae	*Dioscorea deltoidea* Wall. ex Griseb.	Bhyakur
150	Dioscoreaceae	*Dioscorea esculenta* (Lour.) Burkill	Suthani Tarul
156	Dioscoreaceae	*Dioscorea pentaphylla* L.	Kanta alu, Mitho Gittho
157	Dioscoreaceae	*Dioscorea prazeri* Prain & Burkill,	Kukur Tarul
158	Dioscoreaceae	*Dioscorea pubera* Blume	
2	Fabaceae	*Abrus precatorius* L.	Lal Gedi, Ratigedi
36	Fabaceae	*Bauhinia vahlii* Wight & Arn	Bhorla, Balu

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108	Fabaceae	*Cochlianthus gracilis* Bentham in Miquel	Bhatmase Lahara, Khose Lahara, Khosre Lahara
166	Fabaceae	*Entada phaseoloides* (L.) Merr.	Lekh Pangra, Pangra
267	Fabaceae	*Mucuna macrocarpa* Wall.	Baldyangra
269	Fabaceae	*Mucuna pruriens* (L.) DC.	Kauso, Kothcha, Kause Simi, Kauchir, Kauchir, Kauchho
300	Fabaceae	*Pueraria peduncularis* (Benth.) Graham ex Benth.	Bidari Laharo, Kadaju Ghas
302	Fabaceae	*Pueraria tuberosa* (Roxb. ex Willd.) DC.	Birali Kunda, Birali Mando
358	Fabaceae	*Spatholobus parviflorus* (Roxb.) Kuntze	Debre Lahara, Maula, Malha Bel, Madane
391	Fabaceae	*Vigna unguiculata* (L.) Walp.	Bodi, Kattike Bodi
505	Gramineae	*Capillipedium assimile* (Steudel) A. Camus	Muse Kharuki, Muse Khari
555	Gramineae	*Digitaria bicornis* (Lam.) R.&S. ex Loud.	
625	Gramineae	*Eulaliopsis binata* (Retz.) C.E. Hubbard	Babiyo
334	Liliaceae	*Smilax aspera* L.	Kukurdaino, Chopchini, Kubhi Ghaino
337	Liliaceae	*Smilax elegans* Wall. subsp. *glaucophylla* (Klotzsch) Noltie	
340	Liliaceae	*Smilax ferox* Wall.	Chatlang
351	Liliaceae	*Smilax ovalifolia* Roxb. ex D. Don	Kukurdaino, Ram Datun, Resi Chopchini, Nadar
352	Liliaceae	*Smilax perfoliata* Lour.	
356	Liliaceae	*Smilax zeylanica* L.	Kukurdaino,Chopchini, Chopchini
183	Malpighiaceae	*Hiptage benghalensis* (L.) Kurz	Madhavi Lata, Madhu Lata, Maha Malati
68	Menispermaceae	*Cissampelos pareira* L.	Jundar Gano, Jugar Gano, Batulpate
106	Menispermaceae	*Cocculus hirsutus* (L.) Diels	Kanse Laharo
359	Menispermaceae	*Stephania elegans* J.D. Hooker & Thomson	
360	Menispermaceae	*Stephania glabra* (Roxburgh) Miers	Nimi lahara, Nim Lahara, Barkuli Lahara
361	Menispermaceae	*Stephania glandulifera* Miers.	Batule Lahara
362	Menispermaceae	*Stephania gracilenta* Miers.	
363	Menispermaceae	*Stephania japonica* (Thunb.) Miers	Batulpate, Batulpati
379	Menispermaceae	*Tinospora sinensis* (Lour.) Merr.	Gurjo, Guruj, Gurcha, Gulancha
220	Oleaceae	*Jasminum humile* L.	Jai, Pili, Chameli
225	Oleaceae	*Jasminum multifolrum* (Burm. f.) Andrews	Beli Phool, Kunda Puspa, Chamelli
2056	Orchidaceae	*Desmotrichum fimbriatum* Bl.	Jibanti, Jiri
1648	Orchidaceae	*Ceratostylis himalaica* Hook. f.	
2175	Orchidaceae	*Epigeneium amplum* (Lindl.) Summerh.	
3542	Orchidaceae	*Platanthera stenantha* (J. D. Hooker) Soó = *Habenaria stenantha*	
2262	Orchidaceae	*Eulophia bicallosa* (D.Don) P.F.Hunt & Summerh.	
3550	Orchidaceae	*Pleione praecox* (Sm.) D.Don	Lasun Pate
3797	Orchidaceae	*Dendrobium parviflorum* D.Don	
4551	Orchidaceae	*Vanda teres* Lindl.	Gaitihare
10002	Orchidaceae	*Phalaenopsis taenialis* (Lindley) Christenson & Pradhan	
145	Papaveraceae	*Dicentra scandens* (D.Don) Walp.	Bichkane, Sano Paheli, Chhotang, Jogi Lahara
188	Passifloraceae	*Passiflora edulis* Sims	
285	Piperaceae	*Peperomia pellucida* (L.) Kunth	Hadchur
289	Piperaceae	*Piper betle* L.	Pan, Nag Balli
290	Piperaceae	*Piper boehmeriifolia* (Miq.) DC.	Thulo Pipla, Lamo Pipla, Jangali Pan
291	Piperaceae	*Piper longum* L.	Pipla, Sano Pipla, Pipari, Murjhang, Gajpipla
295	Piperaceae	*Piper suipigua* Buch.-Ham. ex D.Don	

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Sp Code	Family	Botanical Name	Local name
80	Ranunculaceae	*Clematis buchananiana* DC.	Junge Lahara, Bagh Junghe Bheda Lahara
103	Ranunculaceae	*Clematis triloba* Heyne	Dudhe Maruie Laharo
272	Rosaceae	*Neillia thrysiflora* D.Don	Hatti Laharo
319	Rosaceae	*Rubus paniculatus* Smith	Kalo Aaiselu, Rukh Aaiselu
306	Rubiaceae	*Rubia manjith* Roxb. ex Fleming	Majito
7025	Schizaeaceae	*Lygodium flexuosum* (L.) Swartz	Parebamuri, Bakliuki, Lahare Unau
7026	Schizaeaceae	*Lygodium japonicum* (Thunb.) Sw.	Lahare Unau
6	Vitaceae	*Ampelocissus divaricata* (Wall. ex M.A. Lawson) Planch.	Chorkholi, Pureni
10	Vitaceae	*Ampelocissus sikkimensis* (M.A. Lawson) Planch.	Pureni
11	Vitaceae	*Ampelopsis glandulosa* (Wall.) Momiyama	
58	Vitaceae	*Cayratia trifolia* (L.) Domin	Karaunja, Karaunj
73	Vitaceae	*Cissus repens* Lam.	Pureni, Kastha Drachhya, Joge Laharo, Charchare Laharo, Jaril Laharo
279	Vitaceae	*Parthenocissus semicordata* (Wall.) Planch.	Charchare Laharo, Khasurari Jhagiya
367	Vitaceae	*Tetrastigma bracteolatum*(Wall.) Planch.	
368	Vitaceae	*Tetrastigma dubium* (M.A. Lawson) Planch.	Chyrchyare Laharo
369	Vitaceae	*Tetrastigma hookeri* (M.A. Lawson) Planch.	
371	Vitaceae	*Tetrastigma rumicispermum* (M.A. Lawson) Planch.	
372	Vitaceae	*Tetrastigma serrulatum* (Roxb.)	Pani Lahara,Chyrchyare Laharo
396	Vitaceae	*Vitis lanata* Roxb.	Mahur, Van Angur
402	Vitaceae	*Vitis virgata*	Sano Puruni

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Scientific name	Common name	Uses
Thunbergia coccinea Wall. ex D. Don	Sigarne Lahare	5 6 23
Barleria cristata Lirur.	Bhede kuro, katsaraiya	1
Justicia adhatoda Linn.	Asuro, Kalo Bhasak	1 6 8 9 11 16 23 24
Lepidagathis incurva Buch.-Ham. ex D.Don	Dhobini	5
Phlogacanthus thysiflorus Nees.	Chuwa	6
Acer caesium Wall. ex Brandis	Sano Firfire, Kainju	5 6
Acer campbellii Hook.f. & Thomson ex Hiern	Kapasi, Yali, Yarla, Kabasi	2 4 7 24
Acer oblongum Wall. ex DC.	Firfire, Putali Phool	1 5 6 8 15 19
Acorus calamus Linn.	Bojho, Syuada Bach	5 8 9 11
Actinidia callosa Lindl.	Tiku Phul	18
Yucca gloriosa L.	Kettuke, Kettaki, Kettak	5 22
Agave angustifolia Haw.		14 24
Agave cantula Roxb.	Kettuke, Nalu	5 11 22
Achyranthes aspera Linn.	Datiwan, Apamarga	11 23 24
Achyranthes aspera Linn. var. *aspera*	Datiwan, Apamarga, Nak Siruka, Ultakur, Garsabe	11 24
Achyranthes bidentata Blume	Rato Datiwan, Rato Apamarga	11
Alternanthera sessilis (L.) DC.	Bhiringi jhar, Bhringraj	11 17
Amaranthus spinosus Linn.	Kandelunde, Katari	11
Amaranthus viridis Linn.	Latte Sag, lunde Sag	11
Allium fascicutatum Remdle	Jimbu	11 14
Allium sativum L.	Lasun, No	14
Allium wallichii Kunth.	Ban Lasun, Jimbu Jhar, Dhwapa, Jorbang	9 11 14 15 17 23
Crinum amoenum Roxb. ex Ker Gawl.	Hade Lasun, Hare Lasun	11 23
Rhus parviflora Roxb.	Sativayar	1 7
Buchanania latifolia Roxb.	Piyari, Kaja, Gayo	1 4 6 7 8 11 12 18 19 22
Choerospondias axillaris (Roxb.) B.L. Burtt&A.W. Hill	Lapsi, Amali, Laalang, Kalang	14
Lannea coromandelica (Houtt.) Merr.	Dabdabe, Chainchuinge, hallaure, Dabdabi, bara,	1 4 6 9 11 12 18 19 22
Mangifera indica Linn.	Aanp, Amchur, Yam, Aam	2 6 7 11 14 15 19 24
Mangifera sylvatica Roxb.	Chhuchi Aanp, Ban Aanp	6 7 11 24
Rhus javanica L.	Bhakimlo, Dudhe	6 7 9 11 14
Rhus wallichii Hook.f.	Thulo Bhalayo, Bhalayo	7 11 18 19 24
Semecarpus anacardium L.f	Bhalayo, Bhela, Kumbha	1 3 4 6 7 9 10 11 18 19 21 23 24
Spondias pinnata (L.f.) Kurz	Amaro, Yamar	1 2 6 7 8 9 11 12 14 16 17 18
Annona reticulata L.	Anti, Ramphal	1 3 11 16 24
Annona squamata L.	Sitaphal, Sarifa	7 9 11 23
Miliusa velutina (Dunal) Hook. f.& Thoms.	Karyauta, kalikath	1 6 7 18 19
Chlorophytum arundinaceum Baker	Dati Sag	11
Chlorophytum nepalense (Lindl.) Baker		11

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Scientific name	Common name	Uses
Carum carvi Linn.		14
Centella asiatica (L.) Urb.	Ghodtapre, Bramhi,	6 11 23
Trachelospermum lucidum (D. Don) K. Schum.	Dudhe lahara, Salikal Lahara, Bedule	5 6 11
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don	Indra Jau, Kurchi, Kebat, Madise Khirro, Dudh Khirro	1 6 11 17
Rauvolfia serpentina (L.) Benth. ex Kurz	Sarpagandha, Chand Maruwa,, Jhar Mauro	6 9 11
Wrightia arborea (Dennst.) Mabberly	Ban Kera, Thulo Bankera, Thulo kuro, Kiringi, Kaling	6 7 10 11 14 17 20 24
Alstonia neriifolia D. Don		11
Alstonia scholaris (L.) R. Br.	Chalamain, Chativan	6 9 11 19 20 23
Carissa carandas L.	Paner, Karonda, Karauna	4 6 7 11 18 19
Carissa spinarum L.	Karauna	7
Thevetia peruviana = *Cascabela thevetia* (L.) Lippold	Pahelo Karabir, Kandel, Kanail	19
Ilex godajam Colebr. ex Hook.f.	Gurbe	17
Arisaema tortuosum (Wall.) Schott var. *curvatum* (Roxb.) Engler	Sarpako Makai, Birbanka, Banko	11 17
Arisaema tortuosum (Wall.) Schott	Sarpako Makai, Birbanka, Banko	11 14 17
Arisaema tortuosum (Wall.) Schott Var. *tortuosum*	Sarpako Makai, Birbanka, Banko	17
Colocasia esculenta (L.) Schott	Gava, Pindalu, karkalo, Taya	6 15 17 23
Scindapsus officinalis (Roxb.) Schott	Gajpipli, Gajpipli, Pipri	1 6 22
Heteropanax fragrans (Roxb.) Seem.	Tarla	11
Brassaiopsis hainla (Buch.-Ham. ex D.Don) Seem	Seto Chutro	6
Schefflera venulosa (Wight & Arn.) Harms	Khursimlo, Kusmero, Kursimlo	18
Calamus acanthospathus Griff.	Bet, Gauri Bet	11 18 19
Calamus tenuis Roxb.	Bet, Bet Lauri, Betak Lathi	11 18 19 23
Caryota urens L.	Ban Supari, Rangbhang	7 11 14 17
Areca catechu (L. f.) Willd.	Supari	8
Phoenix acaulis Roxb.	Khajur, Thakal, Khajuriya	6 7 15 18 19
Phoenix humilis Royle ex Becc. & Hook. f.	Khajur, Thakal :	1 2 5 6 7 11 14 15 16 17 18 19 20 22
Phoenix sylvestris Roxb.	Khajur, Kandel, Tadi	3 4 6 7 11 17 18 19
Trachycarpus takil Becc.		5 6 18
Ceropegia pubescens Wall.	Mike laharo, Ban Simi	5 6
Marsdenia tenacissima (Roxb.) Moon	Bahuni Lahara	6 7 11
Marsdenia roylei Wight	Dudhe Lahara	27
Marsdenia tinctoria R. Br.	Panari, Kali Lara	1 6 9
Asclepias curassavica L.	Machha Phul, Khursani Phool	15 17
Calotropis gigantea (L.) Dryand.	Aank, Seto Aank, Baramase Aank, Arka	4 5 6 7 8 11 24
Asparagus filicinus Buch.-Ham. ex D.Don.	Ban Kurilo	11
Asparagus penicillatus Hara	Kurilo	11 12 13 14 15 17 23

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Scientific name	Common name	Uses
Asparagus racemosas Willd. Var. *racemosus*	Satawari, kurilo, Makuri	6 9 11 12 13 14 16 17 23 24
Asparagus racemosus Willd.	Satawari, kurilo, Makuri, Thota	1 2 11 13 14 17 23 24
Asparagus racemosus Willd. Var. Subacerosus Baker	Satawari, kurilo, Makuri	11 23
Aloe vera (L.) Burm. f.	Ghiu kumari	11
Asplenium tenuifolium D.Don		6
Mikania micrantha Kunth		1 6
Ageratum conyzoides Linn.	Gandhe, Boke Ghas	6 11
Arctium lappa Linn.	Tine	8
Bidens pilosa Linn.	Kuro, Thulo kuro	6
Centipeda minima (L.) A.Br. & Aschers.	Chuke Jhar	11
Elephantopus scaber Linn.	Halhale, Bhedo Kuro	2 8 11 14 23
Eupatorium acuminatum D. Don	Ban mara	9
Eupatorium adenophorum Spreng.	Ban mara, Kangresi Jhar, Kal Jhar	1 6 9 11 19
Gnaphalium affine D. Don	Boke Phool, Kairo Jhar	6 11 24
Grangea maderaspatana (L.) Poir.	Gobre Jhar	1
Saussurea heteromalla (D.Don) Hand.-Mazz.	Mula pate	11 23
Sonchus wightianus DC.	Mula pate, Omche	11
Spilanthes paniculata Wall.	Lato ghas, Marati	11 14
Tagetes erecta L.	Sayapatri, Kanak Puspika	11
Xanthium strumarium Linn.	Kastolo, Bhede Kurro	6
Inula cappa (Buch.-Ham. ex D.Don)DC.	Gaitihare, Kanpate	1 2 6 11 20 24
Eupatorium odoratum Linn.	Kalo Ban mara	1 6 9 11 19
Basella alba L.	Poisag, Pawai	5 11 19
Begonia picta Smith	Magarkanche, Shovaparni	11
Berberis aristata DC.	Chutro, Kinsi, Kirmando	2 3 6 7 11
Berberis aristata DC. *Var. aistata* Hook.f. & Thoms.	Chutro, Kinsi, Kirmando, Kirmundo	7
Berberis asiatica Roxb. ex DC.	Chutro	6 7 23
Alnus nepalensis D.Don	Uttis	1 6 7 12 18
Alnus nitida (Spach) Endl.	Uttis	7
Betula alnoides Buch.-Ham. ex D. Don	Saur, Painyu, Lekh Saur	1 6 11 18 19 24
Betula utilis D.Don *Subsp. utilis*	Bhojpatra, Bhujapat, Bhugpat	7
Oroxylum indicum (L.) Kurz	Tatelo, Karam, Kanda	6 10 11 12 17 23 24
Jacaranda mimosifolia D. Don	Nilo Phool, Birendra Phool	6 17
Stereospermum chelonoides (L.f.) DC.	Kuber Kach, Pandari	1 6
Stereospermum personatum (Hassk.) Chatterjee	Padari, Parari, padari, Kunda, Kuber Kacha	6 11 18 19
Bombax ceiba L.	Simal, Simar	1 4 5 6 7 11 12 14 15 18 19
Cynoglossum zeylanicum (Vahl) Thunb. ex Lehm.	Kanike Kuro	6
Raphanus sativus L.	Mula, Murai, Labu	23

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Scientific name	Common name	Uses
Rorippa nasturtium (L.) Hayek	Tori Jhar, Sim Rayo, Pani Sagh	11
Canarium benghalensis Roxb.	Gokuldhup	4 24
Garuga pinnata Roxb.	Dabdabe, Aule Dabdabe	1 3 4 6 11 18 19 23
Sarcococca coriacea (Hook.) Sweet	Phittephiya	1 6 18 19
Lobelia alsinoides Lam.	Aklebir	6
Cannabis sativa Linn.	Bhango, Bhang, Ganja	8 23
Cleome viscosa Linn.	Hurhure, Bantori	6
Crateva unilocularis Buch.-Ham.	Siplikan, Khaichola	17
Cerastium fontanum Baumg. *Subsp. trivial* (Link) Jalas		11
Drymaria diandra Blume	Abhijalo, KholchaDhayn	11
Silene stracheyi Edgew.	Nemsi	9
Celastrus paniculatus Willd.	Malkagunu	11
Reissantia arborea (Roxb.) Hara		1 19 22
Microgynoecium tibeticum Hook. f.		24
Hypericum cordifolium Choisy		11
Hypericum uralum Buch.-Ham. ex D.Don	Khareto, Urilo	18
Garcinia xanthochymus Hook. f. ex J. Anderson	Chuyal, Chunyal, Chunel	2
Mesua ferrea L.	Nageswar, Phalame	6
Cochlospermum religiosum (L.) Alston	Kumbhi, Rukh Kumbhi	1 3 5 6 11 19
Terminalia alata Heyne ex Roth	Asna, Saj, Yasal,: 1,2, 3	4 6 7 8 9 11 12 13 18 19 22
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Arjun, Kahulo, Kahu	11
Terminalia bellirica (Gaertn.) Roxb.	Barro, Barai, Bahera	1 2 6 7 11 16 19 24
Terminalia chebula Retz.	Harro, Jange Harro	1 2 6 7 8 11 12 19 24
Anogeissus latifolius (Roxb. ex DC.) Bedd.	Banjhi, Bad dhaera, Vakli, Dhavadan	1 4 6 7 11 12 17 18 19 22
Murdannia scapiflora (Roxb.) Royle	Siyaha Musli, Pate Phool, Musli	11
Artemisia absinthum L.	Dumura	6 7
Artemisia dubia Wall. ex Besser	Tite pati, Gandhe jhar	1 4 6 8 9 11 14 23 24
Artemisia indica Willd.	Titepati, Nag Damani	1 6 8 9 11 23 24
Blumea lacera (Burm.f.) DC.	Kurkure, Kukuradra	6
Breea arvensis (L.) Less.	Thakal	7 19
Smilacina oleracea (Baker) Hook.f.		6 19
Cuscuta reflexa Roxb.	Akashbeli, Amarlata	11
Cuscuta reflexa Roxb. *var. brachystigma* Engelm.	Akashbeli, Amarlata, Amarbel	6 11 23
Porana grandiflora Wall.	Aakashbeli, Chamero Laharo	5 11 23

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Scientific name	Common name	Uses
Ipomoea carnea Jacq.	Ajambari, Bisari Jhar	1
Ehretia acuminata R. Br.	Cille,Dhatarunga,Nalsuna	11
Ehretia laevis Roxb.	Loro, Pan, Datrung	1 6 7 11 19
Cornus oblonga (Wall.) Sojak	Latikath, Latikath	1 6 11 19
Corylus ferox Wall		6 7
Corylus jacquemontii Decne.	Dante Okhar	18 24
Sedum rhombifolia L.	Atibala	11
Sedum trullipetalum Hook.f.& Thoms.		6
Benicasa hispada (Thunb.) Cong.	Kubhindo, Petha	11
Melothria heterophylla= Solena heterophylla	Golkakri	7
Coccinea grandis (L.) Voigt.	Bankakri, Golkakri	7 11 23
Cucumis sativus L.	Kankro, Airelu Kakro	11
Momordica cochinchinensis (Lour.) Spreng.	Jhuse Karela,Chattel, Kheksa	17
Solena heterophylla Lour.	Tal Kore, Ban Kakri	17
Trichosanthes dioica Roxb.	Parbar, Parorak Phar	17
Cupressus sempervirens L.		6
Juniperus recurva Buch.-Ham. ex D. Don	Dhupi, Guggal	6 11
Cycas pectinata Griff.	Kalbal, Thakal	7 19 20
Cyperus rotundus Linn.	Nagar Mothe, Mothe	1 6
Mariscus sumatrensis (Retz.) T. Koyama	Karaunte	6
Schoenoplectus juncoides (Roxb.) Palla	Suire	6
Daphniphyllum himalense (Benth.) Mull.-Arg.	Rakcha, Rakta Chandan	24
Dennstaedtia appendiculata (Wall. ex Hook.) J.Sm.	Gothale Unau	1
Dillenia aurea Smith		6
Dillenia pentagyna Roxb.	Tantari, Agai, Chalta	1 2 6 7 10 14 17 18 19 22 24
Dioscorea alata L.	Ghar Tarul, Kukur Tarul	15 23
Dioscorea bulbifera L.	Gittha, Ban Tarul	1 5 6 7 10 11 13 14 15 16 17 23 24
Dioscorea deltoidea Wall. ex Griseb.	Bhyakur	5 6 7 9 11 14 15 17
Dioscorea pentaphylla L.	Kanta alu, Mitho Gittho	5 6 15 16 17
Dioscorea prazeri Prain & Burkill,	Kukur Tarul	15
Dioscorea pubera Blume		18
Shorea robusta Gaertn.	Sal	1 2 3 4 6 7 8 9 11 12 13 14 16 18 19 20 21 22 23 24
Dryopteris atrata (Wallich ex Kunze) Ching	Jhuselo Niuro	17
Dryopteris cochleata (Buch-Ham ex D. Don) C. Chr	Danthe Nyuro, Nyuro, Unau, Pani Nyuro	1 6 17 20
Dryopteris sparsa (D. Don) Kuntze	Jhusilo Niuro	6 17

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Scientific name	Common name	Uses
Diospyros malabarica (Desr.) Kostel.	Allo, Kalo Tendu, Khallu, Teju, Halabed	1 6 7 8 12 16 18
Diospyros tomentosa Roxb.	Abinas,Bidi Pat, Tendu	1 6 7 8 18
Elaeagnus parvifolia Wall. ex Royle	Guyanli, Kankol, Madilo	6
Equisetum diffusum D. Don	Ankhle Jhar, Ankhe Jhar, Kurkure, Kurkure ghas	6
Gaultheria fragrantissima Wall.	Patpate, Dhasingare, Chenjen, Dabdabe	6 11 12 18 19 22
Rhododendron thomsonii Hook.f.		7 11
Vaccinium dunalianum Wight		11
Lyonia ovalifolia (Wall.) Drude	Angeri, Angir, Chele, Jaggu Chal, Gobre, Tissi	1 7 8 9 11 18 22 23
Lyonia villosa (Hook.f.) Hand.- Mazz.	Angeri	5 7
Rhododendron arboreum Smith	Lali Guras, Tango, Bhorans, Dotiyal, Ghoras	7
Rhododendron arboreum Smith *var. cinnamomeum* (Wall. ex G.)	Lali Guras, Tango, Bhorans, Dotiyal, Ghoras, Guras, Taggu	2 7 11 20
Rhododendron arboreurn Smith *var. arboretum*	Lali Guras, Tango, Bhorans, Dotiyal, Ghoras	3 11 22
Euphorbia dracunculoides Lam.	Dudhe Jhar	11
Euphorbia hirta Linn.	Ban Dudhe, Dudhe	6
Euphorbia ligularia Roxb.	Sudi, Sij	1
Euphorbia milii Des Moul.	Simri	1 3
Antidesma acidum Retz.	Archale, Himalcheri	6 7 14 17
Euphorbia royleana Boiss.	Siundi	4 9 11 13 23
Glochidion velutinum Wight	Anbin, Chamari	7
Jatropha curcas Linn.	Sajiwa, nirguni, Sajiwa	11 21
Phyllanthus parvifolius Buch.- Ham.ex D. Don	Khareto, Thulo Khareto	6 11 18 19
Phyllanthus sikkimensis Mtill.-Arg.		18
Ricinus communis Linn.	Andir, Adir, Ander, Arin	6 11 16 18 21 23
Aporusa octandra (Buch.- Ham. ex D. Don) A. R. Vickery	Hade	1 6 19 22
Bridelia retusa (L.) Spreng.	Gayo, Kaja	1 6 18 19
Macaranga denticulata (Blume) Mull-Arg.	Mallato	6 9 18
Macaranga indica Wight.	Papri, Maledo, Malata	6
Macaranga pustulata King ex Hook.f.	Mallito	1 6 18
Mallotus philippensis (Lam.) Mull.- Arg.	Rohini, Ruina, Sindur, Sindure	1 3 6 7 8 11 13 18 19 22
Phyllanthus acidus (L.) Skeels	Pate Amala, Kathe Amala, Hari Phal	7 19
Phyllanthus emblica Linn.	Amala, Yabara, Aaura	2 6 7 11 12 13 14 15 16 17 19 22 24
Sapium insigne (Royle) benth. Ex Hook.f.	Ban Peepal, Khirro, Kherra	1 4 6 7 9 11 18 19 22
Trewia nudiflora Linn.	Gutel, Vellor, Ramrittha	1 6 18 22
Abrus precatorius L.	Lal Gedi, Ratigedi	5 6 11 23 34

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Scientific name	Common name	Uses
Entada phaseoloides (L.) Merr.	Lekh Pangra, Pangra	5 13
Mucuna pruriens (L.) DC.	Kauso, Kothcha	3 6 11 23
Pueraria peduncularis (Benth.) Graham ex Benth.	Bidari Laharo, Kadaju Ghas	5 6 7 10 11 16 17 18
Pueraria tuberosa (Roxb. ex Willd.) DC.	Birali Kunda, Birali Mando	5
Spatholobus parviflorus (Roxb.) Kuntze	Debre Lahara, Maula, Malha Bel, Madane	1 4 5 6 10 11 16 19 21 23
Vigna unguiculata (L.) Walp.	Bodi, Kattike Bodi	11 14 17
Crotalaria alata Buch.-Ham. ex D.Don	Chin chine	1 6
Crotalaria prostrata Rottb. ex Willd.	Chhinchhine	6
Crotalaria tetragona Andrews	Sanai, Chhinchhine, Chhichhike San	5
Desmodium heterocarpon (L.) DC.	Sakhino	6 18
Desmodium khasianum Prain		17
Desmodium sequax Wall.		6
Flemingia procumbens Roxb.	Tendo	8
Glycorrhiza glabra L.	Jethi Madu, Istami	11
Mimosa rubicaulis Lam.	Boksi Ghas	6
Ormosia glauca Wall.		6
Trifolium repens L.	Tinpate, Behauli, Pyauli	6 11
Acacia pennata (L.) Willd.	Aradi, Arare, Arphu	3 11
Butea minor Buch.-Ham. ex Baker	Bhuletro, Bhujetro	1 11 12 19 23
Caesalpinia bonduc (L.) Roxb.	Gainde Kanda, Kanju, Kande Kuberachhya	6 7 10 18 19
Caesalpinia decapetala (Roth) Alston	Arile Kanda, Arille, Lata, Ulte Kanda	6 9 11 22
Caesalpinia digyna Rottler		6 11 20 22
Desmodium multiflorum DC.	Bakhre Ghas, Bhatmase Phool, Kairochi	6
Flemingia macrophylla (Willd) Corner	Thulo Bansapti, Bansapti,Bhatwasi	6
Indigofera atropurpurea Buch.-Ham. ex Hornem.	Neer, Sakhinu	6 14 18
Indigofera pulchella Roxb.	Mirmire, Phusre Ghas	6 11 14 15 17 18 19
Leucaena leucocephala (Lam.) De Wit	Ipil Ipil	6 12
Millettia nepalensis R.N. Parker		1 6
Acacia catechu (L. f.) Willd.	Khayar:	1 2 3 4 6 7 8 11 12 14 15 18 19 22 23 27
Acacia rugata (Lam.) Voigt	Rasula, Sikakai	13
Albizia julibrissin Durazz.	Lakhe, Padke Sirish	6
Albizia odoratissima (L. f.) Benth.	Karkur, Sirish, Siran, Padke, Karkure Siris	6 10 11 19 24
Albizia lebbeck (L.) Benth.	Kalo Siris	1 6 9 13 19
Bauhinia malabarica Roxb.	Tanki, Amil Tanki, Asoti	1 6 7 10 11 12 14 16 17
Bauhinia purpurea L.	Tanki, Rato Koiralo: 1,5,6	7 10 11 12 14 15 16 17 18 19 20 23
Bauhinia scandens L.		12

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Scientific name	Common name	Uses
Bauhinia variegata L.	Kanabu, Seto Koiralo	1 4 6 7 11 13 14 16 17
Butea monosperma (Lam.) Kuntze	Palas, Dhak, Tesu, Hastakarni, Palas	1 6 11 18 19 24
Dalbergia pinnata (Lour.) Prain	Damar	1 6
Dalbergia sissoo Roxb. ex DC.	Sisam, Sissoo, Sisawa	1 5 6 11 12 17 18 19 21 2223
Dalbergia stipulacea Roxb.	Tantebiri, Tate vari	6 10
Delonix regia (Bojer. ex Hook.f.) Rafin.	Gulmohar	2 7 20
Desmodium oojenense (Roxb.) Ohashi	Sadan, Pandan, Tinkire, Sandan pipli	1 3 4 6 9 11 12 17 18 1922 24
Pithecellobium bigeminum (L.) Benth.		1 4
Pterocarpus marsupium Roxb.	Bijaya Sal, Bijaya Sar, Bandhuk Puspa	1 4 6 11 18 19 20
Tamarindus indica L.	imili, Titri, Tetor	2 7 14 17 22
Albizia chinensis (Osbeck) Merr.	Kalo Siris	6 9 13 19
Albizia procera (Roxb.) Benth.	Seto Siris	1 6 7 9 10 13 18 19 20
Dalbergia latifolia Roxb.*	Satisal	1 6 7 11 18 19 22
Castanopsis echinocarpa Miq.		14
Castanopsis indica (Roxb.) Miq.	Dhale katus, Katus, Dhalne Katus, Chyakpal	1 3 4 6 7 8 12 18 1922
Castanopsis lancifolia (Kurz) Hickel & A. Camus	Aaule Katus, Patle Katus	6
Castanopsis tribuloides (Sm.) A. DC.	Musure Katus, Singara	1 3 6 7 8 12 19
Lithocarpus pachyphylla (Kurz) Rehder	Arkhaulo, Bada Katus, Thulo Katus, Sindhe Katus	7
Quercus floribunda Lindl.	Belekharmendo, More	1 6
Quercus glauca Thunb.	Sano Phalant, Phalant	1 6 18
Quercus glauca Thunb. v*ar. glauca*	Sano Phalant, Phalant	6 18
Quercus lamellosa Sm.	Thulo Phalant, Gogane	7 18
Quercus lanata Sm.	Banjh, Phalant	1 4 6 18 22
Quercus leucotrichophora A.Camus	Tikhe Banjh, Tikhe Ghas, Banjh, Sano Banjh	1 6
Quercus semecarpifolia Sm.	Banjh, Phalant	6
Flacourtia indica (Burm. f.) Merr.	Kandail	6 18 22
Homalium napaulense (DC.) Benth.	Phalame Kande, Aaluya, Kuphre	16 22
Casearia elliptica Willd.	Thulo Deri, Sano Bethe	1 6 9 22
Casearia graveolens Dalzell	Badkaule, Pipane	1 6 7 19 22
Flacourtia jangomas (Lour.) Raeusch.		6 19
Xylosma longifolium Clos	Chirauda, Sallu	18
Gentiana kurroo Royle.	Karu	6
Swertia angustifolia Buch.-Ham. ex D. Don	Chiraito	11
Swertia angustifolia Buch.-Ham. ex D. Don *var. angustifolia*	Chiraito	11
Swertia angustifolia Buch.-Ham. ex D. Don *var. wallichiana* Burkill	Chiraito	11
Swertia macrosperma C.B. Clarke		6
Swertia nervosa (G. Don) C.B. Clarke	Tite, Aulo Ghas, Kalo Chiraito	1 6 11 24

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Scientific name	Common name	Uses
Didymocarpus albicalyx C.B.Clarke	Kumkum	4 11 14 24
Dicranopteris linearis (Burm.) Underw.	Unau	1 11
Exbucklandia populnea (R. Br. ex Griff.) R. W. Br.	Piple, Pipli	1 19
Aesculus indica (Colebr. ex Cambess.) Hook.	Pangra, Panger, Pangro, Karingi, Karu	11
Hydrangea robusta Hook. f. & Thomson	Phirphire Ghas	5 22
Curculigo capitulata (Lour.) Kuntze	Musli, Kanda, Datgijari, Musli, Kalo, Musli	11
Curculigo gracilis (Kurtz) Wall.		11
Curculigo orchioides Gaertn.	Musli Kanda, Kalo Musli	11
Engelhardia spicata Leschen. ex Blume	Mahuwa	1 2 6 8 9 11 15 17 18 1923
Engelhardia spicata Lesch. ex Blume *var. colebrookeana* Lesch. ex Blume	Mahuwa	1
Juglans regia L.	Okhar, Hade Okhar, Akhrot	7
Clinopodium umbrosum (M. Bieb.) C.Koch	Bilajor	11 23
Colebrookea oppositifolia Sm.	Dhursul, Dhursule, Sitroma, Dosul, Dosro	1 6 9 11 18 20 23 24
Eusteralis stellata (Lour.) Panigrahi		6 7 12
Mentha arvensis Linn.	Babari, Pudina	6 11 14
Mentha spicata Linn.	Pudina, Patame, Babari	14 17
Ocimum basilicum Linn.	Tulasi, Babari Phool	11 24
Ocimum gratissimum Linn.	Ban Tulasi, Tulasi, Ram	11
Origanum vulgare Linn.	Sajiwan, Sathra	1 16 18 19 21 22
Pogostemon benghalensis (Burm. f.) Kuntze	Rudilo Sihuwa	1 6 9 11 23 24
Litsea lancifolia (Roxb. ex Nees) Hook.f.	Kali Paheli, Kali Pahele	6
Beilschmiedia roxburghiana Nees.		6 22
Cinnamomum bejolghota (Buch.-Ham.) Sweet	Sinkauli, Bara Singoli	14
Cinnamomum glanduliferum (Wall.) Meisn.	Mareche Malawi, Sinkauli, Marisgiri, Maligiri, Kawala	5 6
Cinnamomum parthenoxylon (Jack) Meisn.		14
Cinnamomum tamala (Buch.-Ham.) Nees & Eberm.	Tejpat, Shisi	6 7 11 12 13 14
Cinnamomum zeylanicum Breyn.	Dalchini	11 14
Litsea cubeba (Lour.) Pers.	Siltimbur	23
Litsea doshia (Buch.-Ham. ex D.Don) Kosterm.	Jhakre Seula, Paheli, Padke Kath	6
Litsea monopetala (Roxb.) pers.	Kutmero, Ghante Phool, Ratmate, Kadmero	1 6 11 12 19
Litsea salicifolia (Roxb. ex Nees) Hook.f.	Paheli	6
Neolitsea umbrosa (Nees) Gamble	Putali, Khapate, Phephe, Potele	6 7
Persea duthiei (kingex Hook.f.) Kosterm	Kaulo, Mahilo Kaulo	1 4 6 11 14
Persea odoratissima (Nees) Kosterm.	Seto Kaulo, Kaulo, Roro	6 11 14 23

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Scientific name	Common name	Uses
Persea villosa (Roxb.) Kosterm.		2
Phoebe lanceolata (Nees) Nees	Jhakri, Syaula, Jhakri Kath	6 12
Careya herbacea Roxb.	Kumbhi, Kuma, Bodar	1 3 4 5 6 7 8 9 11 13 18 19 22
Leea compactiflora Kurz		1
Leea macrophylla Roxb. ex Hornem.	Bulebhetra, Balyatra, Galeni, Galoni	1 6 7 11 23
Bauhinia vahlii Wight & Arn	Bhorla, Balu	13 4 5 6 7 8 9 10 11 12 16 18 19 24
Cochlianthus gracilis	Bhatmase Lahara, Khose Lahara, Khosre Lahara	10
Calopogonium macunoides Desv.	Gahatejhar	6 11
Cassia mimosoides Linn.	Amala Jhar	11
Mimosa pudica Linn.	Lajjawati, Lajabanti	11 23
Cassia occidentalis L.	Tapre, Panwar, kasaudi	6
Flemingia strobilifera (L.) Ait.	Sano Bansapti, Bansapti, Bisahari jhar	6
Millettia extensa (Benth.) Baker	Gonjo, Gauj	1 5 6 9 11 19 23
Acacia nilotica (L.) Willd. ex Del. *Subsp. indica* (Benth.) Brenan	Babul, Kikar	5 9
Acacia nilotica (L.) Willd. ex Delile	Babul, Kikar, Babur, Jharkat	3
Cassia fistula L.	Rajbrikshya, Amaltas	1 6 7 10 11 12 17 18 19 20 22 23 24
Erythrina arborescens Roxb.	Phaledo, Theki Kath	6 11 23
Erythrina stricta Roxb.	Mandar, Panjir, Parijat	1 6 7 11 20 24
Saraca asoca (Roxb.) De Wilde	Ashok, Asau	6 20
Smilax aspera L.	Kukurdaino, Chopchini, Kubhi Ghaino	6 11 17 24
Smilax elegans Wall. subsp. *glaucophylla* (Klotzsch) Noltie		11
Smilax ferox Wall.	Chatlang	6 17 24
Smilax ovalifolia Roxb. ex D. Don	Kukurdaino, Ram Datun, Resi Chopchini, Nadar	1 5 6 7 9 11 17 24
Smilax perfoliata Lour.		6 11 24
Smilax zeylanica L.	Kukurdaino,Chopchini	5 6 14 17 19 24
Reinwardtia indica Dumort.	Pyauli, Basanta, Pengun	6
Buddleja asiatica Lour.	Sina Swan, Bhimsen Pate	11 18 24
Buddleja macrostachya Benth.	Bhimsen pati	6 24
Viscum album Linn.	Hadchur	6 11 12 23
Dendrophthoe falcata (L.f.) Etring.	Ainjeru, Riniya, Ajeru	6
Scurrula parasitica Linn.	Lisso, Ainjeru	11
Viscum articulatum Burm. f.	Harchu,Hadchure	11 23
Viscum articulatum Burm. f. *var. liquidambaricolum* (Hayata)	Harchu, Hadchure	1 11 23
Huperzia pulcherrima (Wall. Ex Hook. & Greve)	Jhyau	11 14
Lycopodiella cernua (L.) P. Beauv.		5
Lycopodium japonicum Thunb.= *L. clavatum* L.	Jhyau	5 11 18 20

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Scientific name	Common name	Uses
Woodfordia fruticosa (L.) Kurz.	Dhaiyaro, Dhuinya, Amar Phool, Dhayaro	1 2 6 7 8 11 18 19 22 23 24
Lagerstroemia indica L.	Asare Phool	1 6 18
Lagerstroemia parviflora Roxb.	Bot Dhaiyaro, Asare, Sidda, Hade	1 4 6 7 9 11 14 16 17 18 19 22 23 24
Magnolia campbellii Hook.f. & Thoms.	Chanp, Purbeli	24
Magnolia pterocarpa Roxb.	Patpate	6 13 18
Michelia champaca L.	Chanp, Aule Chanp	1 6 18 19 24
Sida rhombifolia Linn.	Sano Chilya, Balu	18
Abelmoschus manihot (L.) Moench.	Ban Nalu, Odal, Odale	1 4 5 6 8 18 19
Abelmoschus manihot (L.) Medik. *subsp.tetraphyllus*	Ban Nalu, Odal, Odale	5
Abelmoschus moschatus Medik.	Kasturi, Lata Kasturi	11
Hibiscus manihot L.	Ban lasun	11 15
Hibiscus schizopetalus (Mast.) Hook.f.		7
Thespesia lampas (Cav.) Dalz. & Gibs.	Ban Kapas, Lata Kasturi	2 5 6 11
Kydia calycina Roxb.	Kubhinde, Bori, Pali, Pala	4 6 7 9 11 14 18
Melastoma melabathricum Linn.	Angeri, Culesi, Kalipapa	1 6 7 9
Osbeckia nepalensis Hook.	Sidure, Seto Chulsi	6 11
Osbeckia stellata Buch.- Ham.ex D. Don	Thulo Chulesi, Rato Chulesi, Asare	7
Azadirachta indica A. Juss.	Neem Tree, Margosa Tree	2 6 7 9 11 13 16 19 23 24
Dysoxylum binectariferum (Roxb.) Hook. f. ex Bedd.	Bauri Phal, Dhamina, Sano Dhamina	1 6 9 11 14
Dysoxylum gobara (Buch.-Ham.) Merr.	Lasune, Thulo Dhamina, Dhamina	5 9 11
Melia azedarach Linn.	Bakenu, Bakaino	1 4 6 9 11 12 14 18 22 23
Toona ciliata M. Roem.	Tooni, Tuna, Tuni	1 6 9 18 19 22
Trichilia connaroides (Wight & Arn) Benfvelzen	Chaichunge, Singmur,Ankha Tare	1 5 6 9 11 14 16 19 21 22 23
Cissampelos pareira L.	Jundar Gano, Jugar Gano, Batulpate	6 11 23
Cissampelos pareira L. *var. hirsuta* (Buch.-Ham. ex DC.) Forman	Jundar Gano, Jugar Gano, Batulpate	6 11
Stephania glandulifera Miers.	Batule Lahara	12
Stephania gracilenta Miers.		6 11
Tinospora sinensis (Lour.) Merr.	Gurjo, Guruj, Gurcha, Gulancha	6 9 11 15 17 23 24
Ficus altissima Blume		7 18
Ficus pubigera (Wall. ex Miq.) Brandis	Gular	4
Ficus subincisa Buch.-Ham. ex Sm.	Berulo, Berilo, Gedilo, Ankhapakuwa	6 7 9 11
Maclura cochinchinensis (Lour.) Corner	Debar, Damaru	6 7
Morus australis Poir.	Kimbu, Kut Simal	3 5 6 7 11
Morus nigra L.	Kimbu, Kimmu	6 7 11
Morus serrata Roxb.	Musleri, Kalo, Kaphal	7
Artocarpus chaplasha Roxb.	Later	6 7 17 18
Artocarpus heterophyllus Lam.	Katahar	6 7 17
Artocarpus lakoocha Wall. ex Roxb.	Badahar	4 6 7 11 12 17 19 23
Ficus arnottiana (Miq.) Miq.		6

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Scientific name	Common name	Uses
Ficus auriculata Lour.	Nimaro, Timile, Khamare	1 4 6 7 11 12 15 18 24
Ficus benghalensis Linn.	Bar	1 4 6 7 11 12 20 24
Ficus benjamina L.	Sami, Swami, Chonkar	4 5 6 24
Ficus benjamina L. *var. benjamina*	Sami, Swami, Chonkar	1 6 18 19 22 24
Ficus benjamina L. *var. nuda* (Miq.) Barrett		24
Ficus carica L.	Anjir, Bhote Dakhh	6
Ficus hispida L.f.	Kharseto, Kharawa	1 6 7 11 17
Ficus lacor Buch.-Ham.	Kabhro, Pakadi, Palaksa	1 4 6 7 11 12 14 15 17 1922
Ficus neriifolia Sm.	Dudhilo, Dudh Karaiya	1 6 9 18
Ficus neriifolia Sm. var. neriifolia	Dudhilo, Dudh Karaiya, Magoo(Tam.)	6
Ficus racemosa L.	Pakar, Dumri, Gullar	1 3 4 6 7 11 12 17 24
Ficus religiosa L.	Pipal, Pipar	4 6 7 11 12 20 24
Ficus rumphii Blume	Pakar, Pakhar, Sammi	6 24
Ficus semicordata Buch.-Ham. ex Sm.	Khanya, Khanayo, Khaniyo, Khurhuri	1 2 5 6 7 11 12 15 18 1924 27
Ficus semicordata Buch.-Ham. ex Sm. *var. montana* Amatya	Khanya, Khanayo, Khaniyo, Khurhuri	5 6 11 23 24
Streblus asper Lour.	Bedula,Kakshi	5 6 9
Musa balbisiana Colla	Jangali Kera	6 24
Musa paradisiaca L.	Kera, Moje	2 6 7 24
Myrica esculenta Buch.-Ham. ex D.Don	Kaphal, Kawasi, Kapsi	2 7 11
Ardisia macrocarpa Wall.	Dam Phai, Damai Phal	7
Ardisia solanacea Roxb.	Damai Phul, Damai Phal	1 6 9 11
Maesa chisia Buch.- Ham.ex D. Don	Bilaune	1 6 22
Maesa macrophylla (Wall.) A.DC.	Paha, Phogate, Pakha Phal, Ban Bhogate	1 11
Myrsine semiserrata Wall.	Kali Kath	1 6 18
Cleistocalyx operculatus (Roxb.) Meer. & Perry	Kyamuna, Phulepa, Phandir	1 2 3 6 7 8 11 12 14 17 18 19 22
Eucalyptus alba Reinw. ex Blume	Masala, Gorharki Gachha	18 19
Eucalyptus camaldulensis Dehn.	Masala	6 14 18 19
Psidium guajava Linn.	Amba, belauti, Ambak	3 6 7 8 9 11 22 24
Syzigium aromaticum (L.) Merr. & Perry	Lwang	6
Syzygium cumini (L.) Skeels	Jamuna, Jambu, Phadir	1 2 3 6 7 9 11 12 18 1922 23 24
Nephrolepis auriculata (L.) K. Presl.	Pani Amala, Pani Saro	7 11
Jasminum multifolrum (Burm. f.) Andrews	Beli Phool, Kunda Puspa, Chamelli	6 20 24
Jasminum arborescens Roxb.	Chameli Phool	6 7
Jasminum mesney Hance	Dabal Jai,Lahare Jai, Jai	4 11 16 21 22
Fraxinus floribunda Wall.	Lankuri	6 18 19 22
Nyctanthes arbor-tristis Linn.	Parijat, Ratgamki, Kurri	1 6 7 11 18 22 24
Osmanthus fragrans Lour.	Silinge, Siringe	1
Ophioglossum nudicaule L.	Jibresag	17
Ophioglossum reticulatum Linn.	Jibresag	17

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Scientific name	Common name	Uses
Ceratostylis himalaica Hook. f.		14
Desmotrichum fimbriatum Bl.	Jibanti, Jiri	9 11 20
Epigeneium amplum (Lindl.) Summerh.		2 14
Eulophia bicallosa (D.Don) P.F.Hunt & Summerh.		1 6
Platanthera stenantha= Habenaria stenantha		23
Oxalis corniculata Linn.	Chari amilo, Amila	6 11
Borassus flabellifer L.	Tad, Tadi, Tal, Dariwal	6
Argemone mexicana Linn.	Thakal, Sungure kanda	1 6 7 15 17 18 19
Dicentra scandens (D.Don) Walp.	Bichkane, Sano Paheli, Chhotang, Jogi Lahara	9 11
Corydalis chaerophylla DC.	Pahele,bKarme Jhar	6
Fumaria indica (Hausskn.) Pugsley	Ban Gajar, Dhukure, Ban Sauf	14 23
Hypecoum parviflorum Kar. & Kir.	Areli	6 11
Phytolacca americana L.	Jaringo, Jarka, Jarrang	2 11
Pinus roxburghii Sarg.	Salla, Khote salla	1 3 4 5 6 7 8 11 12 18 19 20 21 22 24
Peperomia pellucida (L.) Kunth	Hadchur	6 11 23
Piper betle L.	Pan, Nag Balli	5 7 20
Piper boehmeriifolia (Miq.) DC.	Thulo Pipla, Lamo Pipla, Jangali Pan	6 8 11 14 24
Piper longum L.	Pipla, Sano Pipla, Pipari, Murjhang, Gajpipla	7 8 11 12 14 17 24
Piper suipigua Buch.-Ham. ex D. Don		24
Pittosporum nepaulense DC.	Phurke, Tibiloti, Tibilti	19
Apluda mutica L.	Dakle Khar, Dakle Jhar, Sali Banso	1
Arthraxon quartinianus (A. Rich.) Nash	Jhyamte	6
*Arundinella nepalensis*Trin.	Kharuki, Ikro, Yanaru	1 5 6 11 18 19
Arundinella setosa Trin.		6
Bambusa arundinacea Willd.	Tamabas, Bhalu Bas, Taru Bas, Kata Bas	5 6 14 16 17 18 19 22
Bambusa balcooa Roxb.		6
Bambusa tulda Roxb.	Tama Bas	1 5 6 10 11 12 15 17 18 19 20 22 24
Bambusa vulgare Schrad.	Tama Bas, Bansi Bas, Sin	5 6 12 14 18 19 22 24
Brachiaria villosa (Lam.) A. Camus		14 17 18
Brachypodium sylvaticum (Huds.) P. Beauv.		6
Capillipedium assimile (Steud.) A. Camus	Muse Kharuki, Muse Khari	6 7 11 19
Cephalostachyum latifolium Munro	Gopi Bas	6 12 18 19
Chrysopogon aciculatus (Retz.) Trin.	Kure Ghas, Kuro, Subara	6
Chrysopogon fulvus (Spreng.) Chiov.	Ghoriya	19
Chrysopogon gryllus (L.) Trin.	Salima	6
Cymbopogon distans (Nees ex Steud.) W. Watson	Pire Ghas	6 9
Cymbopogon jawarancusa (Jones) Schult.	Urba, Dhaddi, Kagati Ghas	6 18 19
Cynodon dactylon (L.) Pers.	Doobo, Itu, Panja	1 6 11 24

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Scientific name	Common name	Uses
Danthonia cachemyriana Jaub. & Spach		6
Dendrocalamus hamiltonii Nees & Arn. ex Munro	Tamabans, Choya Bans, Dhungre Bans	5 6 15 17 18 19 20 22 24
Dendrocalamus hamiltonii Nees & Arn. ex Munro *var. hamiltoni*	Tamabans, Choya Bans, Dhungre Bans	19 22
Dendrocalamus strictus (Roxb.) Nees	Mal Bans, Kaban Bans	5 6 18 19 20 22 24
Desmostachya bipinnata (L.) Stapf.	Kush	5 6 11 18 19 24
Digitaria ciliaris (Retz.) Koeler	Banso, Chitre Banso	1 6
Drepanostachyum falcatum (Nees) Keng f.	Go Nigalo, Phurke Ghas, Nigalo Tusa	6
Drepanostachyum intermedium (Munro) Keng f.	Nigalo, Ma	1 5 6 17 18 19
Echinochloa crus-galli (L.) P. Beauv.	Sawa, Sama, Tunde Sama, Sawana	6 19
Eragrostis tenella (L.) P.Beauv. ex Roem. & Schult.	Banso	1 6
Eulaliopsis binata (Retz.) C. E. Hubb.	Babiyo	1 5 6 11 12 15 16 18 19 24
Festuca undata Stapf		23
Garnotia emodi (Arn. & Nees) Janowski		6
Hemarthria compressa (L. f.) R. Br.	Ghode Dobo	17
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	Arthunge	1 6 11 18 19
Imperata cylindrica (L.) P. Beauv.	Siro, Khar, Dabhi	1 5 6 11 18 19 22 24
Imperata cylindrica (L.) Beauvois *var. major* (Nees)C.E. Hubbard ex C.E. Hubbard & Vaughan	Siro, Khar, Dabhi	5 6 11 19
Imperata cylindrica (L.) Beauvois Var. cylindrical	Siro, Khar, Dabhi	5 6 19
Pennisetum purpurcum Schumach.	Nepiyar Ghas	6 25 27
Phragmites karka (Retz.) Trin. ex Steud.	Narkat, Larkat	19
Saccharum spontaneum L.	Kans, Jhaksi, Selme	1 5 6 18 19 24
Setaria forbesiana (Nees ex Steud.) Hook. f.		6 19
Sporobolus helvolus (Trin.) T. Dur. & Schinz		11 24
Themeda arundinacea (Roxb.) Ridl.	Ureli, Dhaddi	6
Thysanolaena maxima (Roxb.) Kuntze	Amriso, Amliso, Mujo, Gerai, Amreso, Phya	1 5 6 9 11 12 16 18 19 23 24
Polygala crotalarioides Buch.-Ham. ex DC.		4
Aconogonum molle (D. Don) Hara	Thotne, Tuknu, Patu Swan, Tipun	6 17
Bistorta amplexicaulis (D.Don) Greene	Ratnaulo, Ratnyaulo, Kyunbro	6
Rheum webbianum Royle.	Amalbed, Chulthi Amilo	11
Rumex dentatus Linn.	Ban Palungo, Banspate	1
Colysis elliptica (Thunb.) Ching	Kalo Niyuro	6 11 17
Colysis insignis (Blume) J. Sm.	Kalo Niyuro	17
Lepisorus loriformis (Wallich ex Mettenius) Ching	Rukh Unau	1

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Scientific name	Common name	Uses
Neocheiropteris subhemionitidea Fraser-Jenk.		30
Eichhornia crassipes (Martius) Solms	Jaluko, Jal, Kumbhi, Pureni, Jaluki	6 7 17 18 23
Portulaca oleracea Linn.	Kulpha Sag, Noon Dhiki	6 11
Grevillea robusta A.Cunn. ex R. Br.	Kagiyo, Kagiyo Rukh	6 18
Cheilanthes bicolor (Roxb.) Fraser-Jenk.	Dubini Sinki	11 17
Cheilanthes dalhousiae Hook.= *C. albomarginata* C.B. Clarke	Rani Sinka, Damkannu	6 11 24
Pteris biaurita (Linn.) Hook.		1
Clematis buchananiana DC.	Junge Lahara, Bagh Junghe Bheda Lahara	5
Zizyphus apetala Hook. F. ex Lawson		7
Zizyphus oenoplia (L.) Mill.	Aule Bayar	7 14 22
Zizyphus incurva Roxb.	Hade Bayar, Damlashi	7 11
Zizyphus mauritiana Lam.	Bayar, Bayari, Pewandi	6 7 11 12 13 14 24
Zizyphus rugosa Lam.	Kanta Bayar, Rukh Bayari	2 6 7 19 22
Neillia thrysiflora D. Don	Hatti Laharo	6
Rubus paniculatus Smith	Kalo Aaiselu, Rukh Aaiselu	7
Rubus paniculatus Smith f. *tiliaceus* (Smith) Hara	Kalo Aaiselu, Rukh Aaiselu	7
Potentilla festiva Sojak		11
Cotoneaster bacillaris Wall.	Khokre, Limi Chiya	12
Potentilla fulgens Wall. ex Hook	Bajra Danti	11
Pyracantha crenulata (D.Don) M. Roemer	Ghangaru, Kath Gedi	7
Rubus betulinus D.Don		9 11
Rubus ellipticus Smith	Ainselu, Isi, Polong	2 6 7 8 11
Rubus hamiltonii Hook.f.		7 11
Rubus indotibetanus Koidz.		1
Prunus amygdalus Batsch	Kagaji Badam	24
Prunus cerasoides D.Don	Paiyun	20 24
Prunus persica (L.) Batsch	Aaru, Aadu, Khale	9 11 23
Pyrus pashia Buch.- Ham. ex D.Don	Mayal, Pana	2 6 7 18 19 22
Sorbus cuspidata (Spach) Hedlund	Male	6
Sorbus foliolosa (Wall.) Spach		1
Sorbus hedlundii Schenid.	Najhil	7
Sorbus ursina (Wenzig) Decne. *var. wenzigiana* Schneid.		22
Rubia manjith Roxb. ex Fleming	Majito	3 6 11 23
Argostemma sarmentosum Wall.	Satuwa Ghas	23
Coffea benghalensis Heyne ex Roem. & Schult.	Asare Phool, Ban Kaphi, Jangali Kaphi, Baramase	22

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Scientific name	Common name	Uses
Hymenopogon parasiticus Wall.	Hansaraj, Ban Biri, Ban Gaja, Gobre Kath	1 6
Luculia gratissima (Wall.) Sweet	Bankagiyo, Gai Phool, Bari, Darbari	22
Mussaenda glabra Vahl		11
Mussaenda treutleri Stapf	Dhobini	6 11
Wendlandia exserta (Roxb.) DC.	Rato kaiyo, Ban Kaiyo,Badhuwa, Chaulai	1 2 3 6 12 18 19 21 22
Wendlandia proxima (D. Don) DC.		7
Adina cordifolia (Willd. ex Roxb.) Benth. & Hook. f. ex Brandis	Karam, Haldu, Karma	1 6 18 19 20 22 24
Anthocephalus chinensis (Lam.) A. Rich. ex Walp.	Kadam	1 6 7 11 12 14 19 20 21 22
Hymenodictyon excelsum (Roxb.) Wall.	Lati Karam, Seti Kath, Bhurkul,Bhudkul	1 6 7 18 19 22
Hymenodictyon flaccidum Wall.	Karam	6
Mitragyna parviflora (Roxb.) Korth.	Tikul, Sano Haldu, Phaldu, Kaim	1 6 7 19
Wendlandia puberula DC.	Kainyu, Ban Kanyau	6
Xeromphis spinosa (Thunb) Keay	Main kanda, Main Phal, Maidal, Madan Phal	1 6 7 9 11 13 14 17 18 19 22
Xeromphis uliginosa (Retz.) Maheshwari	Pindar, Pirar, Maidal	6 11 13 17
Clausena pentaphylla DC.	Raunne, Asare Phool	6
Fortunella japonica (Swingle)	Muntala	7
Murraya koenigii (L.) Spreng.	Asare, Mitho nim, Khole jamun	1 6 7 8 9 11 13 14 22 23
Murraya paniculata (L.) Jack	Kamana phul, Simali	6 14
Toddalia asiatica (L.) Lam.	Mainkara, Mainkangra	6 7 9 11 12 13 14 15 17 22
Zanthoxylum acanthopodium DC.	Bogya Timur, Boke Timur	18
Zanthoxylum armatum DC.	Timur, Yerma, Primu	7 9 11 12 13 14 23
Aegle marmelos (L.) Correa	Bel, Bel patra	1 2 3 4 6 7 11 19 24
Citrus aurantifolia (Christ.) Swingle	Kagati	7
Citrus limon (L.) Burm.f.	Nibuwa, Lembakyumba	7 9
Citrus maxima (Burm. ex Rumph.) Merr.	Bhogate	1 22 23
Citrus reticulata Blanco	Suntola	7 9
Feronia limonia (L.) Swingle	Amilo Bel, Kaitho,	2 6 7 11 19 23
Salix ovatomicrophylla K.S.Hao		8
Populus ciliata Wall. ex Royle	Bhote Pipla Bange Kath, Lekh Pipla	6 22
Salix babylonica L.	Bains, Tissi	1
Sambucus canadensis L.	Kanike Phool	6 7
Sambucus hookeri Rehder	Galeni	1 3 6 7 11
Viburnum continifolium D.Don	Ghodekhari, Bakal Pate, Gharghuri	6

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Scientific name	Common name	Uses
Viburnum continifolium D.Don. var. wallichii T.R. Dudley	Ghodekhari, Bakal Pate, Gharghuri	11
Viburnum punctatum Buch.-Ham. ex D.Don		19
Osyris wightiana Wall.	Noon Dhiki, Noon Dhijhi	6
Santalum album L.	Shree Kanda, Chandan	3 24
Sapindus mukorossi Gaertn.	Rittha	3 6 11 13 14 16
Schleichera oleosa (Lour.) Oken	Kusum, Gosum, Gausam	1 2 3 5 6 7 11 14 16 19 22
Diploknema butyracea (Roxb.) H.J. Lam = *Aesandra butyracea* (Roxb.) Baehni	Chiuri, Mahuwa	1 2 4 6 7 8 9 10 11 12 13 14 15 16 17 18 19 24
Diploknema butyracea (Roxb.) H.J. Lam = *Aesandra butyracea* (Roxb.) Baehni		6 7 16
Madhuca latifolia (Roxb.) Macbride	Latimauwa, Mahuwa	1 2 6 7 9 11 12 16 18
Madhuca longifolia (Koeing) Macbride	Mahuwa, Chiuri	1 2 4 6 7 9 16 18
Saurauia napaulensis DC.	Gogan. Gogane, Tonsi	6 7
Astilbe rivularis Buch.-Ham. ex D. Don	Thulo Aushadhi, Gane Gurjo, Bedango	11
Bergenia ciliata (Haw.) Sternb.	Pashanbhed, Pakhanbed	11
Bergenia ciliata (Haw.) Sternb. T. ciliata Yeo	Pashanbhed, Pakhanbed	11
Chrysosplenium nepalense D.Don.		14
Lygodium flexuosum (L.) Swartz	Parebamuri, Bakliuki, Lahare Unau	9 24
Lygodium japonicum (Thunb.) Sw.	Lahare Unau	17
Picrorhiza scrophulariiflora (Pennell) D.Y. Hong	Kutki, Gorki, Gurki	17
Scoparia dulcis L.	Chini Jhar, Mitha Jhar	11
Picrasma javanica Blume	Teju, Taju	7
Nicotiana tabacum L.	Surti, Kanchopat	8
Solanum surattense Burm.f.	Kantakari, Bad bedi	11 13
Datura stramonium Linn.	Dhaturo, Seto Dhaturo	23
Solanum torvum Swartz	Thulo Bihi, Kacher	13
Withania coagulans (Stocks) Dunal		7 18
Duabanga grandiflora (Roxb. ex DC.) Walp.	Lampate, Odhane, Lampatiya	1 6 11 18 19 22
Stachyurus himalaicus Hook.f. & Thoms. ex Benth.	Seto Bhasak, Lahare Chunetro	6
Bischofia javanica Blume	Kainjal, Adhikrini, Ken	1 6 11 18 22
Melochia corchorifolia Linn.	Patuwa Jhar, Phuli Jhar	17
Firmiana colorata (Roxb.) R. Br.		24
Pterospermum acerifolium (L.) Willd.	Hatti Pailo, Golaicho, Mayang, Kanak Champa	6 7
Sterculia balanghas L. *var. angustifolia* (Roxb. ex G. Don) Mast.		5
Sterculia foetida L.	Kaju	1 6 18
Sterculia villosa Roxb.	Odal, Odane, Andal	1 4 5 6 11 12 14 15 16 18 19 23
Symplocos pyrifolia Wall. ex G. Don	Kholme, Seti Kath	1
Symplocos racemosa Roxb.	Lodh, Kholme	1

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Scientific name	Common name	Uses
Symplocos racemosa Roxb. *var. racemosa*	Lodh, Kholme, Seti Biraunli	11 19
Symplocos ramosissima Wall. ex G. Don	Kharane, Dabdabe	11
Tetrameles nudiflora R. Br.		6 11 24
Cleyera japonica Thunb.	Baklopati, Kalo Baklepate	1 6
Eurya acuminata DC.	Jhigane, Jhyanu, Pate	5 6 11 24
Schima wallichii (DC.) Korth.	Chilaune, Aule Chilaune	1 3 6 9 11 13 18 19 22 23
Daphne bholua Buch.-Ham. ex D. Don	Lokta, Kagat Pate, Shigu	5
Triumfetta annua Linn.	Dalle Kuro, Jhinjhatiya	6 11
Corchorus capsularis L.	Patuwa, Tito Pate, Sanpat	5 7 11 24
Grewia optiva Drumm. ex Bturet	Bhimal, Bhebul, Bheol, Syal Phusre	5 6
Grewia subinaequalis DC.	Falsa, Fussi, Syal Phusro	1 5 6 7 11 18
Typha angustifotia L.	Pater,Khar	1 5 6 18 19
Celtis australis L.	Khari, Khadko	6 11 18
Holoptelea integrifolia (Roxb.) Planch.	Khamari, kanju, papari, Methe Phal, Sano Pangre	1 6 11 18 19 23
Bupleurum longicaule Wall.	Mirmire	11
Elatostema sessile J.R.Forst & G. Forst	Gagleto	6
Gonostegia pentandra (Roxb.) Miq.	Chiple, Chiple Ghas	6
Pilea symmeria Wedd.	Kamle	6
Urtica dioica L.	Sisnu, Lekh Sisnu	1 6 8 9 11 17 18 19 23
Boehmeria rugulosa Wedd.	Daar, Getha, Jenthi, Jenti	5 6 7 11 14 18 19 20
Debregeasia salicifolia (D. Don) Rendle	Dar Tusare	2 6 18 19 23
Girardinia diversifolia (Link) Friis	Allo, Hatti Sisnu, Thulo Sisnu, Susuni, Ullu Sisnu	5 9 11 23
Caryopteris foetida (D. Don) Thell.	Khursane Ghas, Bagh Mukhe	6 11
Callicarpa macrophylla Vahl	Daikamla, Daichamle	1 3 6 7 11 18 19 24
Clerodendrum indicum (L.) Kuntze	Chinde, Bhargi, Angiyaha	1 11
Clerodendrum serratum (L.) Moon	Anekhi, Akhandi, Andekhi, Chuwa, Golaichi	14
Clerodendrum viscosum Vent.	Venta, Chitu, Rajbeli, kalo, Baklepate	1 6 11
Clerodendrum viscosum Vent. f. *viscosum*	Venta, Chitu, Rajbeli, Kalo Baklepate	6 7 11 23
Duranta repens Linn.	Nilkanda	6 22
Lantana camara Linn.	Masino kanda, Ban Phada	1 6 8 11 22
Premna barbata Wall.	Ginneri	6 9 11
Premna barbata Wall. *var. barbata*	Ginneri	23
Premna interrupta Wall.	Ginneri, Giniyar, Gideri	6 9 11 18 23
Premna barbata Wall. *var. anodon* C.B Clarke	Ginneri	2 6 9

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Scientific name	Common name	Uses
Vitex negundo Linn.	Simali	11 19 22 23 24
Vitex negundo Linn. *Var. negundo*	Simali, Indrayani	1 11 22
Callicarpa arborea Roxb.	Gaulo, Mas Gede,Thulo Daikamala	1 19
Gmelina arborea Roxb.	Khamari, Gambari	1 6 7 11 12 18 19
Tectona grandis L.f.	Teak, Sagawan, Saguan	1 3 6 18 19
Ampelocissus divaricata (Wall. ex M. A. Lawson)	Chorkholi, Pureni	1 4 6 7 11 14 15 18
Ampelocissus sikkimensis (M. A. Lawson) Planch.	Pureni	7 11 16
Cissus repens Lam.	Pureni, Charchare Laharo, Jaril Laharo	1 5 6 7 9 11 16 19 23
Parthenocissus semicordata (Wall.) Planch.	Charchare Laharo, Khasurari Jhagiya	5 6 23
Tetrastigma bracteolatum(Wall.) Planch.		6
Tetrastigma dubium (M. A. Lawson) Planch.	Chyrchyare Laharo	5
Tetrastigma rumicispermum (M. A. Lawson) Planch.		6
Tetrastigma serrulatum (Roxb.)	Pani Lahara,Chyrchyare Laharo	5 6 11
Vitis lanata Roxb.	Mahur, Van Angur	23
Vitis virgata	Sano Puruni	7
Diplazium esculentum (Retz.) Sw.	Nyuro, Pani Nyuro, Kochaiya, Khatilak Sag	11 17
Amomum subulatum Roxb.	Alinchi	14
Cautleya spicata (Smith) Baker	Gogleti, Sano Saro, Pani Saro	6
Curcuma angustifolia Roxb.	Kaledo, Kalo Haledo	11 14 17 18 24
Curcuma aromatica Salisb.	Ban Haledo, Ban Dhale	11 14 15
Curcuma zedoaria Rosc.	Ban Haledo, Sathi, Kachur	11 14
Zingiber officinale Rosc.	Aduwa, Sutho, Yad	11
Accipiter gentilis	Northern Goshawk	27
Circus aeruginosus	Eurasian Marsh Harrier	25 27 28 33
Gyps fulvus	Eurasian Griffon	27 30 33
Neophron percnopterus	Egyptian Vulture	27
Clangula hyemalis	Long-tailed Duck	7
Naemorhedus goral	Himalayan Goral	15 25 27 29 30
Capricornis sumatraensis	Mainland Serow	25 27
Ocyceros birostris	Indian Grey-Hornbill	27
Cuon alpinus	Asiatic Wild-dog, Dhole	25
Canis aureus	Syal	27 28 29 30 31
Macaca assamensis	Assamese Macaque	25 27
Semnopithecus entellus	Hanuman Langur	25 27 29 30
Macaca mulatta	Rato Bandar	25 27 29 30
Muntiacus muntjak	Ratuwa, Rate	25 27 29 30 32 33 34

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Scientific name	Common name	Uses
Axis porcinus	Laguna, Pade	30
Cervus unicolor	Sambar Deer	27 29 32 33 34
Axis axis	Chhital	25 27 29 33 34
Vanellus indicus	Huttityaun	27 28
Columba palumbus	Ban parewa	25 27
Streptopelia chinensis	Thople dhukur	25 27 28 34
Treron sphenura	Haleso	25 27
Corvus macrorhynchos	Large-billed Crow	34
Corvus splendens	Kaag	34
Dendrocitta vagabunda	Rufous Treepie	27 28
Urocissa erythrorhyncha	Red-billed Blue Magpie	27 28 30
Eudynamys scolopacea	Asian Koel	25 27
Hierococcyx fugax	Koieli	25 27 28 30
Elephas maximus	Hatti	34
Panthera tigris	Bengal Tiger	29 30
Pardofelis nebulosa	Clouded Leopard	29
Panthera pardus	Chituwa	29
Felis chaus	Ban Biralo	27 29
Grus antigone	Sarus	27
Halcyon smyrnensis	White-throated Kingfisher	27 28
Herpestes edwardsii	Thulo Nyaurimuso	25 27
Herpestes nyula	Indian Mongoose	25 27
*Hystrix indic*a	Dumsi	25 27 28 29 30 31 32 34
Caprolagus hispidus	Hispid Hare	25 27
Lepus nigricollis	Khairo Kharayo	25 27 29 30
Lepus oiostolus	Woolly Hare	27
Manis pentadacyla	Chinese Pangolin	25 27
Manis crassicaudata	Indian Pangolin	27 28 30
Moschus chrysogaster	Musk Deer	25 27 29
Lutrogale perspicillata	Smooth Coated Otter	27
Martes flavigula	Yellow-throated Marten	27 28 29
Ochotona curzoniae	Black-lipped Pika	25 27
Arborophila torqueola	Hill Partridge	25 27
Coturnix coturnix	Common Quail	25 27
Francolinus francolinus	Titra	25 27 28
Gallus gallus	Ban kukhura	25 27 28 29
Lophura leucomelanos	Kalij	27 28
Pavo cristatus	Mayur	24 25 27 28 29 33 34
Psittacula himalayana	Suga	25 27 28
Petaurista nobilis	Flying Squirrel	25 27
Pycnonotus cafer	Red-vented Bulbul	25 27
Rhinoceros unicornis	Gaida	30 34

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Scientific name	Common name	Uses
Rhinolophus luctus	Greater Woolly Horseshoe Bat	25
Callosciurus pygerythrus	Irrawaddy Squirrel	25 27
Sorex bedfordiae	Striped-backed Shrew	25
Ninox scutulata	Brown Hawk-Owl	25
Acridotheres fuscus	Myna	25
Acridotheres tristis	Common Myna	25 27
Sturnus contra	Asian Pied Starling	25
Sus scrofa	Bandel	25 27 28 29 30
Garrulax caerulatus	Grey-sided Laughingthrush	11
Garrulax squamatus	Blue-winged Laughingthrush	25 27 30
Euroscaptor micrura	Himalayan Mole	25 27
Ursus thibetanus	Himalayan Black Bear	29 30
Ursus ursinus	Sloth Bear	25 28 30
Varanus flavescens	Sun gohoro	29
Varanus monitor	Gohoro	27 29 30 32
Arctictis binturong	Binturong	29

Usage	Usage code	Usage	Usage code
Animal bedding	1	Utensils, handicrafts	18
Beverage	2	Construction material	19
Drying/tanning	3	Ornamentals	20
Exudates	4	Biofuel	21
Fibre and fiber yeilding	5	Support for climbers/Thankro	22
Fodder	6	Veterinary medicine	23
Fruit and nuts	7	Religious plant	24
Fumitory and masticator materials	8	Living animal	25
Insecticieds and herbicides	9	Honey, beewax	26
Legumes or pulses	10	Bushmeat	27
Medicinal plants	11	Other edible animal products	28
Seeds	12	Hides, skins for trophies	29
Soap/cosmetics	13	Medicines from animals	30
Spices, condiments and other flavorings	14	Drying/tanning	31
Starches and cellulose products	15	Tools	32
Vegetable oils and fats	16	Ornaments	33
Vegetables	17	Religious	34

Annex 13. List of Flora under CITES Appendix

Sp.Code	Family	Botanical name	Life Form	CITES Appendix
5715	Apocynaceae	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Shrub	II
66	Asclepiadaceae	*Ceropegia pubescens* Wall.	Climber	II
6228	Cycadaceae	*Cycas pectinata* Griff.	Tree	II
6228	Cycadaceae	*Cycas pectinata* Griff.	Tree	II
149	Dioscoreaceae	*Dioscorea deltoidea* Wall. ex Griseb.	Climber	II
6439	Magnoliaceae	*Michelia excelsa* Blume.	Tree	II
6437	Magnoliaceae	*Michelia champaca* L.	Tree	II
6418	Magnoliaceae	*Magnolia pterocarpa* Roxb.	Tree	II
6413	Magnoliaceae	*Magnolia campbellii* Hook.f. & Thoms.	Tree	II
955	Orchidaceae	*Aerides multiflora* Roxb.	Grass	II
956	Orchidaceae	*Aerides odorata* Lour.	Herb	II
958	Orchidaceae	*Aerides vandarum* Reichneb. f.	Herb	II
1410	Orchidaceae	*Bulbophyllum careyanum* (Hook.) Spreng.	Herb	II
1463	Orchidaceae	*Calanthe masuca* (D.Don) Lindl.	Herb	II
1648	Orchidaceae	*Ceratostylis himalaica* Hook. f.	Herb	II
1721	Orchidaceae	*Cleisostoma filiforme* (Lindl.) Garay	Herb	II
1739	Orchidaceae	*Coelogyne cristata* Lindl.	Herb	II
1739	Orchidaceae	*Coelogyne cristata* Lindl.	Herb	II
1742	Orchidaceae	*Coelogyne fuliginosa* Hook.	Herb	II
1932	Orchidaceae	*Cymbidium bicolor* Lindl.	Herb	II
1994	Orchidaceae	*Dendrobium aphyllum* (Roxb.) G. E. C. Fisher	Herb	II
2003	Orchidaceae	*Dendrobium fimbriatum* Hook.	Herb	II
2005	Orchidaceae	*Dendrobium formosum* Roxb.	Herb	II
2011	Orchidaceae	*Dendrobium moschatum* (Buch.-Ham.) Swartz	Herb	II
2018	Orchidaceae	*Dendrobium transparens* Wall.	Herb	II
2056	Orchidaceae	*Desmotrichum fimbriatum* Bl.	Epiphytes	II
2174	Orchidaceae	*Ephemerantha macraei* (Lindl.) P.F. Hunt & Summerh.	Herb	II
2175	Orchidaceae	*Epigeneium amplum* (Lindl.) Summerh.	Herb	II
2222	Orchidaceae	*Eria spicata* (D. Don) Hand.-Mazz.	Herb	II
2262	Orchidaceae	*Eulophia bicallosa* (D.Don) P.F.Hunt & Summerh.	Herb	II
2979	Orchidaceae	*Luisia zeylanica* Lindl.	Herb	II
3163	Orchidaceae	*Oberonia caulescens* Lindl.	Herb	II
3172	Orchidaceae	*Oberonia pachyphylla* King & Pantl.	Herb	II
3365	Orchidaceae	*Pelatantheria insectifera* (Reichenb. f.) Ridl.	Herb	II
3452	Orchidaceae	*Pholidota imbricata* Hook. f.	Herb	II
3542	Orchidaceae	*Platanthera stenantha= Habenaria stenantha*	Herb	II
4550	Orchidaceae	*Vanda roxburghii* R. Br.	Herb	II
4551	Orchidaceae	*Vanda teres* Lindl.	Herb	II

Annex 14. Project Steering Committee Members

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Mr. Braj K. Yadav, MoFSC, Member
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