

# **Non-Detriment Findings (NDF) Study For Cultivated Red Sanders (*Pterocarpus santalinus* L. f.) Trees in Gujarat State.**



**Conducted Jointly By**

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# **Non-Detriment Findings (NDF) Study For Cultivated Red Sanders (*Pterocarpus santalinus* L. f) Trees in Gujarat State.**

## **1. Background of the Study**

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Levels of exploitation of some animal and plant species are so high and the trade, together with other factors, such as habitat loss, is capable of depleting their populations and even bringing the species close to extinction. Since its adoption in 1963, CITES is providing varying degrees of protection to more than 30,000 species of endangered animals and plants in the world (<https://cites.org>).

The species covered by CITES are listed in three Appendices, according to the degree of protection they need. Appendix-I includes species most endangered and are threatened with extinction. Appendix-II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid over-utilization which is detrimental to survival of the species. Appendix III is a list of species included at the request of a country that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation. CITES decides whether a species is over exploited or trade is detrimental to survival of the species through a 'Non-Detriment Findings (NDFs)' study conducted by a designated Scientific Authority of the country (Hegde *et al* 2013).

NDF is a conclusion by a Scientific Authority that the export of specimens of a particular species will not impact negatively the survival of that species in the wild. As per CITES resolutions NDF should be conducted by a Scientific Authority and it should be based on species distribution, population status, population trends, harvesting techniques, other biological and ecological factors and utilization and trade information. As per CITES, NDF is must for trade of Appendix-I and Appendix –II species and it is not required for Appendix-III species (Hegde *et al* 2013).

*Pterocarpus santalinus* L. f. belongs to family Fabaceae and popularly known as Red Sanders all over the world and 'Lalchandani' or 'Raktachandani' in many parts of India. The wood of this species is in heavy demand outside India as a high quality timber, a source of dyes and less importantly for other uses such as incense and soap. The heartwood is first reduced to chips or powder and then a colourant is extracted. This colourant is being imported into several countries. Very large quantity of heartwood is being smuggled out of India every year. The species is endemic to India particularly to small hilly area in south and central eastern ghats in Andhra Pradesh. The area under natural distribution is around 4.0 lakh hectares (Hegde, 2011.) It was included in CITES Appendix II during 1995 due to narrow distribution, slow growth rate,

increasing level of threat, high level of international trade/ smuggling. Since then CITES is monitoring the international trade of the species.

The first detailed NDF study was conducted for natural (wild) populations of *Pterocarpus santalinus* L. f. (Red Sanders) by IFGTB during 2011 (Hegde, et al., 2012). Botanical Survey of India (BSI) has conducted the second NDF for wild as well as planted populations of Red Sanders in 2019 (BSI, 2019).

As part of this NDF study, BSI had assessed the cultivated stock of red sanders across the states where it is being grown and had suggested yearly quota of 1190 MT per annum from the states of Tamil Nadu (900 MT per annum), Andhra Pradesh (280 MT per annum) and Karnataka (10 MT per annum). In this report, Gujarat has been assessed to have a harvestable tree volume of 8.58 MT and but no quota was allocated to Gujarat state.

Subsequently, the Directorate General of Foreign Trade (DGFT) of India, based on the NDF report of BSI (2019), issued a notification (No.25/2023 dt. 3<sup>rd</sup> August, 2023) to amendment to export policy of Red Sanders wood exclusively sourced from cultivation origin obtained from private land (including Pattaland) and confiscated source. It allowed (a) an annual export quota (April to March) of 900 MT for Tamil Nadu for artificially propagated Red Sanders and (b) a zero export quota for wild specimens of red sanders with some specific conditions.

Meanwhile, many progressive farmers of Gujarat State who have grown Red Sanders trees in their private lands since many years have started approaching State Forest Department for permission to harvest trees and export the wood. The state of Gujarat approached MoEF &CC and requested for specific export quota for cultivated trees of Red Sanders of Gujarat.

Subsequently, the CITES Management Authority, the Ministry of Environment, Forest and Climate Change (MoEF & CC) entrusted to ICFRE-Arid Forest Research Institute (AFRI), Jodhpur and ICFRE-Institute of Forest Genetics and Tree Breeding(IFGTB) Coimbatore (designated CITES scientific authorities) to conduct an NDF for cultivated Red Sanders in Gujarat State and suggest the export quota. Therefore, the current study has been taken up. Objective of this study is to assess the extent of plantations of red sanders under farmland in various districts of Gujarat and estimate the current growing stock of red sanders, so that annual quota for export of cultivated red sanders may be fixed for the Gujarat State.

## **2. Methodology Adopted for Rapid Survey**

Initially, the Gujarat Forest Department was contacted and staff from both AFRI and IFGTB visited the Aranya Bhavan at Gandhinagar during the first week of June, 2023. They met key officials of Gujarat Forest Department in their office. The AFRI and IFGTB team apprised them of the NDF study of Red Sanders to be taken up in Gujarat. The Gujarat Forest Department officials provided a copy of list of red sanders farmers of Gujarat and earlier this list had been submitted to MoEF &CC by Gujarat SFD in 2020-21. The senior Forest officials also explained that the demand for export quota for Gujarat state was raised by farmers and the Forest

Department had requested the MoEF & CC and they handed over various letters sent to MoEF & CC, GoI by Gujarat Forest Department along with the letters sent by the Honourable State Minister of Agriculture and Forests. They also handed over the list of Red Sander seizures in various locations in Gujarat by various enforcement agencies viz., Police Department, DRI, Customs and Forest Department.

The list of red sanders farmers was collected and was compiled district-wise, teams were formed and data collection format was prepared. For rapid survey, minimum of 5% sampling intensity was fixed. In plantations of harvestable age and of smaller sizes complete enumeration and 100% trees were measured. The format for data collection included location details, spacing, details of planting and also contact information of farmers. The information on growth details, viz., tree height, clear bole height, girth at breast height, stem form and health of trees were collected from sampled trees.

#### FORMAT OF FIELD DATA SHEET

<b>Sample Plot Details</b>	<b>Date of Visit:</b>
<b>Sample Plot No:</b>	<b>Team:</b>
<b>District:</b>	<b>Name of the farmer:</b>
<b>Tehsil:</b>	<b>Mobile No.:</b>
<b>Village:</b>	<b>Contact address:</b>
<b>Location:</b>	<b>Total Area of RS plantation:</b>
<b>Forest Division:</b>	<b>Total Nos. of trees planted:</b>
<b>Forest Range:</b>	<b>Date&amp; Year of planting:</b>
<b>Forest Beat/Section:</b>	<b>Spacing:</b>
<b>Latitude:</b>	<b>Type of plantation: Row planting/Block Plantation</b>
<b>Longitude:</b>	<b>Present survival:</b>
<b>Altitude:</b>	<b>Source of seedlings/Planting material:</b>
<b>Soil type:</b>	<b>Cultural practices adopted:</b>
<b>Any other information :</b>	

#### Sample Plot Data collection:

Tree No.	Total Height (m)	Girth (cm)	Clear bole Height (m)	Stem straightness (1-4 scale)	Health of trees	Remarks on flowering/fruitle	Any other information
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**Stem Straightness was scored on following scale (STR 1-4 scale)**

<b>Straightness Score</b>	<b>Description</b>	<b>Guidelines for Assessment</b>
1	Very crooked tree	The main stem of the tree is having more than 3 bends

2	Medium crooked tree	The main stem of the tree is having 2 bends
3	Medium straight tree	The main stem of the tree is having one noticeable bend
4	Straight tree	The main stem of the tree is not having any major noticeable bends

### 3. Major Findings of the Study

The list of red sanders farmers were collected and were compiled district-wise, teams were formed and data collection format was printed and distributed to team members. The list provided by Gujarat Forest Department showed that red sanders being cultivated in 18 districts across Gujarat state in different agro climatic zones. Therefore, extensive field visits were conducted to all the farmer's field to estimate growing stock in plantations of various ages. Based on the harvestable growing stock of red sanders the "export quota" for Gujarat state needed to be fixed.

Four teams from AFRI Jodhpur visited all 18 districts and details of district-wise summary of red sanders plantations by farmers is given in Table 1. The visits and data collections were carried out from June 2023 and completed in August 2023. Because of heavy rains all over Gujarat, especially, in southern Gujarat the field visits and data collection were slightly delayed. It was completed during last week of August 2023.

**Table 1. District-wise details of Red Sanders plantations on farmland in Gujarat State**

Sl. No.	Name of the district	No. of farmers growing Red Sanders	Total Area of Red sanders Plantation	Range of age of plantation	Maximum age	Total number of Red sanders plants	Area of Red Sanders Plantations above 20 years
1	Mahisagar	1	3	4	4	200	-
2	Dahod	34	8.931	1-9	9	2703	-
3	Panchmahal	3	0.5	5-27	27	404	0.20
4	Banaskantha	1	2	7	7	1000	-
5	Mehsana	1	0.1	4	4	39	-
6	Gandhinagar	1	0.1	4	4	70	-
7	Ahmedabad	1	0.01	6	6	21	-
8	Surendranagar	Farmers have planted white sandalwood					
9	Anand	One farmer has planted <i>Adenanthera pavonina</i> (Ratangunja Hindi: रतनगुंज Gujarati badigumchi), not redsanders					
10	Bhavnagar	3	2.501	5-38	38	825	0.01
11	Sabarkantha	Farmers have planted white sandalwood					
12	Aravalli	8	1.612	4-20	20	547	3 Plants
13	Bharuch	3	18.5	4-8	8	21254	-
14	Surat	2	10	10-16	16	11800	-
15	Tapi	Farmers have planted <i>Pterocarpus marsupium</i> (Bijasal) not red sanders					

16	Navsari	-Do-					
17	Dang	2	0.75	7-15	15	70	-
18	Valsad	Farmers have planted <i>Pterocarpus marsupium</i> (Bijasal) not red sanders					
	Total	60				38933	0.21

The Table 1 indicates that actually red sanders plantations have been taken up by farmers only in 13 districts of Gujarat state out of 18 districts listed. In five districts namely, Surendranagar, Anand, Tapi, Navsari and Valsad districts some other species have been planted. In Surendranagar and Sabarakantha white sandalwood (*Santalum album*) has been planted and no red sanders farmers were found here. In Anand, one farmer has planted Ratangunj (*Adenanthera pavonina*) by mistaking with red sanders. In Tapi, Navsari and Valsad Bijasal (*Pterocarpus marsupium*) has been planted by farmers by mistaking with red sanders. Many plantations are of young age and very few plantations are above 20 years age. About 0.21 hectares area has been found to have red sanders plantations of above 20 years age.

Details of red sanders plantations by farmers in each of 13 districts are given in Tables 2 to Table 14. The Dahod district found to have maximum number of red sanders farmers (34). The Bharuch district found to have maximum area under red sanders (18.5 hectares).

**Table 2. Details of Red sander plantations by Farmers in Mahisar district, (Division: Godhara , Circle: Godhara) and**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants as per report	Actual no. of plant	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Shri Parsottambhai Shivabhai Patel	Madhvas	2019-20	4	400	200	1.2	1.98	9.6

**Table 3. Details of Red sander plantations by Farmers in Panchmahal district, (Division: Godhara , Circle: Godhara).**

Sl No.	Farmers Name	Village	Year of plantation	Age	No. of Plants as per report	Actual no. of trees	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Shri Chandrsinh Kanaksinh Raulji	Gadukpur Godhara	1996-97	27	55	44	0.20	13.19	123.98



2.	Shri Mangaisinh Zavrabhai Pateliya	Rinchhvani Ghoghamba	2017-18	6	160	160	0.25	5.56	37.73
3.	Shri Natvarsinh Ramajibhai Bariya	Damavav Ghoghamba	2017-18	6	325	200	0.25	3.42	11.50

**Table 4. Details of Red sander plantations by Farmers in Dahod district, (Division: Bariya Circle: Vadodara).**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants as per report	Actual no. of trees	Area in ha	Av. Height (M)	Av. Girth (CM)
1	Shri, Subhashbhai Mangabhai Patel	Uchvan	2022	1	80	66	0.2	-	-
2	Shri, Harishbhai Karansinh Patel	Nani Khajuri	2018	5	25	34	0.25	3.3	27.4
3	Shri, Nareshbhai Chamanbhai	Uchvan	2018	5	20	55	0.30	-	-
4	Shri, Babubhai Chhaganbhai	Uchvan	2018	5	30	70	0.10	3.44	24.04
5	Shri, Keshrsinh Chhaganbhai Patel	Ughavla	2014	9	123	120	0.75	5.57	44.6
6	Shri, Pratapbhai Vechatbhai	Vadodara	2021	2	20	3	0.01	Seedlings	-
7	Shri, Haribhai Gulabbhai	Saliya	2021	2	70	70	0.20	do	-
8	Shri, Narpadbhai Ranchhodbhai	Bhathvada	2018	5	80	20	0.01	4.46	31.2
9	Shri, Gulabbhai Somabhai	Panchela	2015	8	170	40	0.20	5.82	45.50
10	Shri, Ramsubhai Dalabhai Hathila	Sarjumi	2017	6	200	194	0.50	5.54	27.4
11	Shri, Alkeshbhai Manjibhai Hathila	Sarjumi	2017	9	113	41	0.25	2.83	23.2
12	Shri, Atulbhai Anopbhai Bamaniya	Dhedhiyanonalo	2020	3	150	145	0.25	seedling	-

13	Shri, Navinbhai Palas	TrakdaMahudi	2018/2015	8/5	200	200	0.50	3.07	21.0
14	Shri, Bhopatbhai Varsingbhai Ravat	Zusa (Kasanpur)	2018	5	30	30	0.10	4.34	18.93
15	Shri, Sursintgbhai Jalabhai Bhedi	Jusani	2018	5	20	20	0.10	3.11	2.12
16	Shri, Shaileshbhai Makanbhai Bhagora	Zusa	2020	3	4	12	0.01	6.50	71.50
17	Shri, Pravinsinh Sursingbhai	Aankli	2018	5	90	75	0.20	3.15	27.23
18	Shri, Bachubhai Saybabhai	Dudhiya	2013	10	3	1	0.001	6	43.0
19	Shri, Himmatbhai Vajesingbhai	Nagvav	2018	5	150	150	0.25	3.15	17.10
20	Shri, Narusungbhai Dinabhai Palas	Aamlimenpur	2018/2020	5/3	1400	1400	1.25	4.15	12.63
21	Shri, Babubhai Gulabbhai Bariya	Aamlimenpur	2020	3	100	100	0.25	seedlings	-
22	Shri, Mangabhai Narsubhai Bariya	Aamlimenpur	2022	1	80	47	0.25	seedlings	-
23	Shri, Babubhai Valabhai Palas	Aamlimenpur	2020	3	150	140	0.25	4.23	12.30
24	Shri, Sapubahi Valabhai Palas	Aamlimenpur	2021	2	172	133	0.25	Seedlings	-
25	Shri, Titarbhai Valabhai Palas	Aamlimenpur	2022	1	120	115	0.25	Seedlings	-
26	Shri, Dineshbhai Khaparbhai Palas	Aamlimenpur	2023	0	120	100	0.20	To be planted	-
27	Shri, Saniyabhai Manabhai Palas	Aamlimenpur	2021	2	220	120	0.50	Seedlings	-
28	Shri, Mathurbhai Kakudabhai Ganava	Aamlimenpur	2018	5	12	20	0.25	4.15	38.20
29	Shri, Bhamsing Gulabhai Palas	Aamlimenpur	2022	1	300	250	0.50	seedling	
30	Shri, Bharatbhai	Aamlimenpu	2018	5	3	3	-	4.5	14.20

	Mansingbhai Bhura	r							
31	Shri, Gulabbhai Saklabhai Psaya	Aamlimenpur	2022	1	40	40	0.25	grazed	-
32	Shri, Shankarbhai Zujarbhai Parmar	Pipero	2018		270	90	0.25	seedling	-
33	Shri, Sardarbhai Kaliyabhai Parmar	Kotambi	2018	5	7	7	-	3.01	10.14
34	Shri, Narvatbhai Juvansing Maida	Dumka	2019	4	20	20	0.001	3.56	10.6

**Table 5. Details of Red sander plantations by Farmers in Banaskantha district, (Division: Banaskantha Circle: Mehsana).**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants	Actual No. of plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Desai Dineshbhai Muljibhai	Rampura (Vadala)	2016	7	2000	1000	2.0	3.79	23.55

**Table 6. Details of Red sander plantations by Farmers in Mehsana district, (Division: Mehsana, Circle: Mehsana).**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants	Actual Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Patel Bhailabhai Manilal	Palavasana	2019-20	4	50	39	0.1	2.02	7.92

**Table 7. Details of Red sander plantations by Farmers in Gandhinagar district, (Division: Gandhinagar , Circle: Gandhinagar).**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants	Actual Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Patel	Karoli	2019-20	4	200	70	0.1	2.32	15.65

	Hasmukhbhai Manubhai								
2.	Patel Rajesh Manibhai	Nandol	201-16		300	White sandal	-	-	-

**Table 8. Details of Red sander plantations by Farmers in Ahmedabad district, (Division: Ahmedabad, Circle: Ahmedabad).**

Sl No.	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual no. of plant	Area in ha	Av. Height (M)	Av. Girth (cm)
1	Himmatsinh Bhimsinh Vaghela	Kaneti	2016-17	7	28	21	0.01	6.24	42.79

**Table 9. Details of Red sander plantations by Farmers in Anand district, (Division: Anand, Circle: Ahmedabad)**

Sl No.	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual no. of plant	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Ashokbhai Dahiyabhai Rami	Ankalav	2001-02	22	230	<i>Adenanthera pavonina</i> Not redsanders ( <i>Ratangunja</i> (Hindi: रतनगुंज Gujarati badigumchi)	-	-	-

**Table 10. Details of Red sander plantations by Farmers in Bhavnagar district, (Division: Botad, Circle: Rajkot) .**

Sl No.	Farmers Name	Village	Plantation Year	Age (years)	No. of Plants	Actual no. of plant	Area in ha	Av. Height (M)	Av. Girth (cm)
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1.	Dhandhaliya Gaurisankar Revasankar	Agiyari	2018-19	5	725	675	2.0	5.92	27.35
2.	Shree Nanjibhai Parashottambhai Sutariya	Kobadi	2018-19	5	100	100	0.5	6.01	27.72
3.	Mr. Nareshbhai K. Patel	Sidsar (Khodiyar)	1985-86	38	46	46	0.1	12.19	89.26

**Table 11. Details of Red sander plantations by Farmers in Aravalli district, (Division: Sabarkantha, Circle: Mehsana) .**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants as per report	Actual no. of plant	Area in ha	Av. Height (M)	Av. Girth (cm)
1	Kharadi Firojkumar Eliyabhai	Kheradi	2007-08	15/10	3	12	0.001	10.88	59.92
2	Kharadi Firojkumar Eliyabhai	Kheradi	2008-09	15	2				
3	Kharadi Firojkumar Eliyabhai	Kheradi	2012-13	16	5				
4	Patel Rameshbhai Hirabhai	Umedpur	2003-04	19	34	35	0.1	7.39	43.49
5	Patel Rameshbhai Karshanbhai	Umedpur	2019-20		17	17	0.001	2.32	13.7
6	Kanabhai Hirabhai Patel	Umedpur	2003-4	20	3	3	-	8.13	52.90
7a	Fera Remabhai Somabhei	Vanta	2018-9	14	500	226	0.75	5.00	17.27
7b	-do-		2012-13	10	300	226	0.75	10.94	50.20
7c	-do-		2016-17	6	26	26	0.01	4.72	11.77
10	Kharadi Kevajibhai Somabhai	Itava	2010-16	13/7	133	2	-	5.49	28.0

**Table 12. Details of Red sander plantations by Farmers in Bharuch district, (Division: Division: Bharuch, Circle Bruch) .**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants reported	Actual No of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.a	Vasava chhotubhai Amarsangbhai	Vasana	2017-2018	7	9975	2000	3	1.91	14.78
b	Vasava chhotubhai Amarsangbhai	Dharoli	2019-20	4	8000	8000	2.5	1.4	12.66
2.	Vasava Sarlaben Chhotubhai	Vasana	2017-2018	6	1394	1254	5	5.31	18.70
3.	Mr. Jayeshbhai Patel	Bharadiya	2015	8	10000	10000	8	3.44	23.05

**Table 13. Details of Red sander plantations by Farmers in Surat district, (Division: Surat, Circle: Bharuch) .**

Sl No.	Farmers Name	Village	Plantation Year	Age of plantation	No. of Plants	Actual no of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Shri Vallabhbhai Patel	Aamboli	2007	16	10,000	10000	7.5	9.43	47.77
2.	Shri Girish Tekkar	Dhamdod	2013	10	4000	1800	2.5	8.4	56.38

**Table 14. Details of Red sander plantations by Farmers in Dang district, (Division: Dang North Circle: Valsad) .**

Sl No.	Farmers Name	Village	Plantation Year	Age	No. of Plants	Actual Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1	Mr. Revubhai Motryabhai Pawar	Subir	2016-17	7	55	55	0.25	9.07	18.45
2	Mr. Mirubhai	Subir	2007-08	15	61	15	0.5	6.77	37.92

	Madanbhai Pawar								
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### 3.1 Age classes of Red Sanders Plantations in Gujarat

The Tables 15 to 18 provide details of farmers who have red sanders plantations of above 25 years age, 15-25 years age, 5-15 years age and below 5 years age.

The Table 15 provides details of red sanders plantations of above 25 years age. One farmer in Panchmahal district found to have 44 plants of red sanders of about 27 years which have recorded average height of 13.19 meters and average girth of 124 cm. The plants are found to be in line on boundaries and the growth rate is high compared to growth rates reported in natural stands (IFGTB,2011, Hegde, et al 2012). The total area of above 25 years age estimated to be 0.21 ha. One farmer in Bhavnagar district found to have 50 red sanders plants of 38 years age. The average height found to be 12.19 meters and average girth found to be 89.26 cm.

**Table 15. Details of Red Sanders Plantation of 25 above Years age in Gujarat State**

Sl No.	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual No of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Shri Chandrsinh Kanaksinh Raulji	Panchmahal	1996-97	27	55	44	0.20	13.19	123.98
2	Mr. Nareshbhai K. Patel	Bhavnagar	1985-86	38	46	50	0.01	12.19	89.26
					<b>Total</b>	<b>94</b>	<b>0.21</b>		

The Table 16 provides details of red sanders plantations aged between 15 to 25 years. Around 10,000 plants found be between 15 to 25 years age, planted in area of 8 hectares by 5 farmers in Aravalli, Dang and Surat districts.

**Table 16. Details of Red Sanders Plantation of 15 to 25 Years age in Gujarat State**

Sl No.	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual No of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
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1.	Kharadi Firojkumar Eliyabhai	Aravalli	2007- 08/2008- 09/2012- 13	15/16	10	12	0.001	10.88	123.98
2.	Patel Rameshbhai Hirabhai	Aravalli	2003-04	19	34	34	0.1	7.39	43.49
3.	Kanhabhai Hirabhai patel	Aravalli	2003-04	20	3	3	—	8.13	52.90
4.	Mr. Mirubhai Madanbhai Pawar	Dang	2007-08	15	61	15	0.5	6.77	37.92
5.	Shri Vallabhbhai Patel	Surat	2007	16	10,000	10,000	7.5	9.43	47.77
				<b>Total</b>		<b>10,064</b>	<b>8.01</b>		

The Table 17 provides details of red sanders plantations between 5 to 15 years age. Around 19,000 plants have been planted in 30.28 hectares covering several districts which are of 5 to 15 years age.

**Table 17. Details of Red Sanders Plantation of 5 to 15 Years age in Gujarat State**

Sl No .	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual No of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Himmatsinh Bhimsinh Vaghela	Ahmedabad	2016-17	6	28	21	0.01	6.24	42.79
2.	Fera Remabhai Somabhei	Aravalli	2008-09	14	500	226	0.75	5.00	17.27
3.	Fera Remabhai Somabhei	Aravalli	2012-13	10	300	226	0.75	10.94	50.2



4.	Fera Remabhai Somabhei	Aravalli	2016-017	6	26	26	0.01	4.72	11.77
5.	Kharadi Kevajibhai Somabhai	Aravalli	2010-2016	13 /7	133	2	0.10	5.49	28
6.	Dhandhaliya Gaurisankar Revasankar	Bhavnagar	2018-19	5	725	675	2.0	5.92	27.35
7.	Shree Nanjibhai Parashottambhai Sutariya	Bhavnagar	2018-19	5	150	100	0.5	6.01	27.72
8.	Desai Dineshbhai Muljibhai	Banaskantha	2016-17	7	2000	1000	2.0	3.79	23.55
9.	Shri Mangaisinh Zavrabhai Pateliya	Panchmahal	2017-18	5	160	160	0.25	5.56	37.73
10.	Shri Natvarsinh Ramajibhai Bariya	Panchmahal	2017-18	5	325	200	0.25	3.42	11.5
11.	Shri, Harishbhai Karansinh Patel	Dahod	2018	5	25	34	0.25	3.3	27.4
12.	Shri, Nareshbhai Chamanbhai	Dahod	2018	5	20	55	0.30	—	—
13.	Shri, Babubhai Chhaganbhai	Dahod	2018	5	30	70	0.10	3.44	24.04
14.	Shri, Keshrsinh Chhaganbhai Patel	Dahod	2014	9	123	120	0.75	5.57	44.6
15.	Shri, Narpatbhai Ranchhodbhai	Dahod	2018	5	80	20	0.01	4.46	31.2

16.	Shri, Gulabbhai Somabhai	Dahod	2015	8	170	40	0.2	5.82	45.5
17.	Shri, Ramsubhai Dalabhai Hathila	Dahod	2017	6	200	194	0.5	5.54	27.4
18.	Shri, Alkeshbhai Manjibhai Hathila	Dahod	2017	6	113	41	0.25	2.83	23.2
19.	Shri, Navinbhai Palas	Dahod	2015-18	8/ 5	200	200	0.5	3.07	21
20.	Shri, Bhopatbhai Varsingbhai Ravat	Dahod	2018	5	30	30	0.10	4.34	18.93
21.	Shri, Sursintgbhai Jalabhai Bhedi	Dahod	2018	8	20	20	0.10	3.11	21.22
22.	Shri, Pravinsinh Sursingbhai	Dahod	2018	5	90	75	0.20	3.15	27.23
23.	Shri, Bachubhai Saybabhai	Dahod	2013	10	3	1	0.001	6	43
24.	Shri, Himmatbhai Vajesingbhai	Dahod	2018	5	150	150	0.25	3.15	17.1
25.	Shri, Narusungbhai Dinabhai Palas	Dahod	2018/202 0	5/ 3	1050	400	1.25	4.8	12.63
26.	Shri, Bharatbhai Mansingbhai Bhura	Dahod	2018	5	2	3	-	4.2	14.20
27.	Shri, Shankarbhai Zujarbhai Parmar	Dahod	2018	5	270	90	0.25	Seedl ings	

28.	Shri, Sardarbhai Kaliyabhai Parmar	Dahod	2018	5	7	7	—	3.01	10.14
29.	Vasava chhotubhai Amarsangbhai	Bharuch	2017- 2018	7	9975	2000	3.0	6.12	1.91
30.	Vasava Sarlaben Chhotubhai	Bharuch	2017- 2018	6	1394	1254	5.0	5.31	18.7
31.	Mr. Jayeshbhai Patel	Bharuch	2014- 2015	8	10000	10000	8.0	3.44	23.05
32.	Mr. Revubhai Motryabhai Pawar	Dang	2016- 2017	7	55	55	0.25	9.07	18.45
33.	Shri Giresh Takkar	Surat	2013	10	4000	1800	2.5	8.48	56.38
					<b>Total</b>	<b>19,295</b>	<b>30.38</b>		

Table 18 provides details of red sanders plantation below 5 years age in Gujarat state. Twenty farmers are found have planted red sanders in 7.8 hectares which are aged below 5 years. Many plants are in seedling stage.

**Table 18. Details of Red Sanders Plantation of Below to 5 Years age in Gujarat State**

Sl No.	Farmers Name	Address	Plantation Year	Age	No. of Plants as per report	Actual No of Plants	Area in ha	Av. Height (M)	Av. Girth (cm)
1.	Patel Rameshbhai Karshanbhai	Arvalli	2019-20	4	17	17	0.001	2.32	13.7
2.	Patel Bhailabhai Manilal	Mehsana	2019-20	4	39	39	0.1	2.02	7.92
3.	Patel Hasmukhbhai Manubhai	Gandhinagar	2019-20	4	200	70	0.1	2.32	15.65

4.	Shri Parsottambhai Shivabhai Patel	Mahisagar	2019-20	4	400	200	1.5	1.98	9.6
5.	Shri, Subhashbhai Mangabhai Patel	Dahod	2022	1	80	66	0.25	–	–
6.	Shri, Pratapbhai Vechatbhai	Dahod	2021	2	20	3	0.01	–	–
7.	Shri, Haribhai Gulabbhai	Dahod	2021	2	70	70	0.20	–	–
8.	Shri, Atulbhai Anopbhai Bamaniya	Dahod	2020	3	150	145	0.25	Seedling	–
9.	Shri, Shaileshbhai Makanbhai Bhagora	Dahod	2020	2	4	12	0.01	6.5	71.5
10.	Shri, Babubhai Gulabbhai Bariya	Dahod	2020	3	100	100	0.25	Seedlings	
11.	Shri, Mangabhai Narsubhai Bariya	Dahod	2022	1	80	47	0.25	Seedlings	
12.	Shri, Babubhai Valabhai Palas	Dahod	2020	3	120	140	0.25	4.23	12.3
13.	Shri, Sapubahi Valabhai Palas	Dahod	2021	2	120	130	0.25	Seedlings	
14.	Shri, Titarbhai Valabhai Palas	Dahod	2022	1	120	115	0.25	seedlings	
15.	Shri, Dineshbhai Khaparbhai	Dahod	2023	0	120	100	0.2	Seedling	–

	Palas								
16.	Shri, Saniyabhai Manabhai Palas	Dahod	2021	2	220	120	0.5	seedlings	
17.	Shri, Bhamsing Gulabhai Palas	Dahod	2022	1	300	25	0.5	seedlings	
18.	Shri, Gulabbhai Saklabhai Psaya	Dahod	2022	1	260	40	0.25	Grazed	—
19.	Shri, Narvatbhai Juvansing Maida	Dahod	2019	4	14	20	0.25	3.56	10.6
20.	Vasava chhotubhai Amarsangbhai	Bharuch	2019-20	4	8000	8000	2.5	1.4	12.66
					<b>Total</b>	<b>9459</b>	<b>7.87</b>		

### 3.3 Estimation of Growing Stocks of Plantations of Various Age –Classes

Table 19 gives growing stocks of various age classes. The growing stock estimation and estimation of heartwood yield were made as per previous study undertaken in natural populations of red sanders in Andhra Pradesh (Hegde, M, 2011). The heartwood formation starts at the age of 15 years in red sanders (ICFRE,1992; Hegde et al., 2017; Suresh et al., 2017). Therefore, the heartwood estimation has been done from plantations of above 15 years only in the present study. Above 25 years plantations recorded growing stock of 68.61 cubic meters (Cu. M) and heartwood yield of 14.41 Cu. M. The plantations of 15-25 years recorded growing stock of 1851 cu. M and heartwood of 388.68 cu. M. The total growing stock estimated to be 2120 Cu. M and the total heartwood yield estimated from these growing stocks is 403.1 Cu. M. The growing stocks of lower age class (below 15 years) is around 200 cu. M.

**Table 19. Details of Various Age-Class Plantations of Red Sanders in Gujarat State**

Sl. No.	Age class	No. of plants	Area (in ha)	Av. Height (M)	Av. Girth (cm)	Estimated Total Growing stock	Estimated Heartwood (Cu. M)*
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						(Cu.M)*	
1	Above 25 years	94	0.21	12.69	106.62	68.61	14.41
2	15-25 years	10,064	8.01	8.52	61.21	1,850.84	388.68
3	5- 15 years	19,295	30.38	5.01	25.97	188.18	-
4	0- 5 years	9,459	7.87	3.04	19.24	12.07	-
	<b>Total</b>	<b>38,912</b>	<b>46.47</b>			<b>2119.7</b>	<b>403.09</b>

#### 4. Conclusions and Recommendation

a). The red sanders is native and endemic only to Seshachalam, Veligonda, Lankamalla and Palkonda hill ranges in southern Eastern Ghats of Andhra Pradesh (IFGTB, 2011). It is not found naturally in Gujarat state. However, large numbers of enthusiastic and progressive farmers have taken up cultivation of this endangered species in several districts of Gujarat owing to high values of heartwood in international market. There is no local market for red sanders wood and the farmers have to sell the wood to buyers from international market only. Therefore, there is a need to create export opportunities for cultivated red sanders wood of farm origin.

(b) Presently, very small proportion of plantations (0.21 ha) of farm grown red sanders have reached harvestable girth and harvestable age in Gujarat. Generally harvestable age for red sanders in plantations considered to be 30 years and above under plantation conditions (Hegde et al., 2017; Suresh et al., 2017) which may also be dependent on extent of heartwood formation and also location factors. In the present study, the 27 years aged plantation was found to have good girth (124 cm) which is excellent compared to red sanders growth rate in natural populations which take 70 to 80 years to reach 70 cm girth at breast height (Hegde et al., 2012; ICFRE, 1992). For natural red sanders the harvestable girth considered to be above 70 cm.

(C) Presently, the estimated heartwood yield from farm grown red sanders is about 400 Cu. M. in Gujarat state. Therefore, **100 Cu. M** of export quota may be fixed (on volume basis) **annually** for four years for the state of Gujarat. The specific gravity of air dried wood of red sanders has been reported to vary from 0.87 to 1.20 (Arunkumar and Joshi, 2014; Anonymous, 1969), and the average specific gravity of air dried red sanders wood is about 1.0. **Therefore, it is recommended that the export quota may be fixed as 100 MT annually (on weight basis), for four years for the state of Gujarat.** Later this annual quota may be reviewed based on actual usage by the state. This annual quota is subjected to the terms and conditions laid out by MoEF

&CC and DGFT from time to time. This will encourage more farmers in Gujarat to come forward and plant the red sanders in their farm land.

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Plate 1. A 38 year old plantation of Red Sanders at Bhav Nagar (Sh. Nareshbhai Patel)



Plate 2. Heartwood from felled tree and excellent growth red sanders at Bhavnagar





Plate3. Boundary (line) plantation of Red Sanders (38 years of age) at Bhavnagar, Gujarat



Plate 4. 8 Years old Red sanders at Bharuch planted along with Gauva as well as pure crop in block plantation.





Plate 5 The AFRI and IFGTB team taking field data in Surat, Poona Khumbariya



Plate 6 Red sanders plantations (15 and 10 years) in Surat district Dhamdod village





Plate 7. Farmers have planted Bijasal (*Pterocarpus marsupium*) at Valsad and Navsari



Plate 8. Excellent growth of Red Sanders trees (>27 years) reaching harvestable girth at Panchamal





Plate 9. Farmer at Anand has planted Ratangunj (*Adenanthera pavonina*) by mistaking with red sanders.



Plate 10. Farmers in Dang district have planted white sandalwood (*Santalum album*) but listed as red sanders farmers.





Plate 11 NDF interaction meeting between AFRI and IFGTB at AFRI Jodhpur on 12-6-2023



Plate 12 NDF interaction meeting between AFRI and IFGTB at IFGTB Coimbatore on 02-9-2023



Plate 13. The AFRI and IFGTB team met senior Forest Officials at Gandhinagar during first week of June 2023.



Plate 14. AFRI teams interacting with farmers during field visits.





Plate 15. AFRI teams meeting Gujarat Forest Department staff during field visits