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Growth and variability in production of forest produce in Gujarat state

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Abstract
The forest provides the timber and non-timber forest produce. These forest produce are important in relation to generate revenue and source of livelihood to tribal, source of revenue to government, generation of employment etc. Considering importance of forest produce in socio-economic development of the Gujarat state the present investigation has been undertaken to study growth and variability in production of forest produce in the Gujarat state. For this investigation secondary data related to production of timber and Non-Timber Forest Products (NTFPs) collected for the period 1992-93 to 2018-19 from the available reports of 'Gujarat Forest Statistics' and to study decadal growth divided in to three different periods. The compound annual growth rate and Cuddy and Della Velle Instability Index used to achieve the objectives. The results of study showed high instability in the production of timber, fuel wood and NTFPs in all the circles and Gujarat state as whole during the period-I, II, III and overall period. Production of fuel wood significantly raised during period-II and overall period where as production of timru leaves recorded positive growth during period-I in Gujarat state. Production of total NTFP, wax and gums found significantly declined during the period from 1994-95 to 2018-19. Production of gums, mhuda flowers, mhuda fruits and honey showed increasing trend with high variation during study period.

Keywords: growth, variability, CAGR, timber, NTFP, fuelwood

Introduction

Forest is one of the factor which affect on socio-economic development of the country. During the year 2019 total forest cover and tree cover of the India was 24.56% of total geographical area of the country. Gujarat state having the recorded forest area of 21647 km^2, which is 11.03% of the total geographical area of the state (Forest Survey of India 2019) [3]. It is much below the national average of 24.56%. According to National Forest Policy 1988 and 2018, there should be about one third of total land area under forest and tree cover.

The Forest provides the timber and non-timber forest produce. The sale of these forest produce form a major source of revenue. Non-Timber Forest Products (NTFPs) or the Minor Forest Products (MFPs) are the important source of livelihoods for tribal people and the other communities which are residing around forests. About 20 - 40% of annual income of tribal is contributed by the NTFPs (Planning Commission, 2011) [9]. In case of Gujarat state the contribution of NTFPs to the family income varies from 15.5% in Navsari district to 43.30% in the district of Kachchh (Yadav and Basera, 2013) [13]. Most of the forest produce form the major portion of food of these people. Forest provides the fuel wood which is the important source of energy in rural area. Apart from these forestry provide employment to the millions of people. According to the Gujarat Forest Statistics 2018-19 the employment generated by forestry sector was 244.06 lakh man days. Most of the small to large scale industries which are engaged in processing and trading of forest products depends on forest. Along with this, forest produce generate a major part of revenue to State Forest Department. About 50% of revenue and 70% of income generated from export of NTFPs in the country (Singh *et al.*, 2020) [12] Considering these points in view and the importance of forestry sector in social and economic development of state the present investigation was under taken with following objectives
1. To study the trends in production of forest produce in Gujarat state
2. To study the variability in production of forest produce in Gujarat state

Materials and Methods

The present investigation covers the production of forest produce from whole Gujarat state. The out-turn or production of forest produce divided in to two main categories *viz.* timber and

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non-timber forest produce (NTFPs). The secondary data pertaining to production of timber wood and fuel wood collected circle wise for the period from 1992-93 to 2018-19, while the data related to production of NTFPs collected for the period from 1994-95 to 2018-19 from the available reports of 'Gujarat Forest Statistics' published by Principle Chief Conservator of Forest, Government of Gujarat. Further, to study decadal growth the study period divided into three period *viz*. Period-I: 1992-93 to 1999-2000, Period-II: 2000-2001 to 2009-2010, Period-III: 2010-11 to 2018-19 and Overall period: 1992-93 to 2018-19. Analysis pertaining to growth and variability in production of timber wood and fuel wood were carried out circle wise as wel as for Gujarat state as whole.

Compound growth rate
To study the growth in respect of production of timber wood, fuel wood and NTFPs, exponential trend equation was fitted and the compound annual growth rate (CAGR) was worked out for each period.

$Y = ab^t$
Where Y = production
a = intercept,
b = regression coefficient
t = time variable in year

Compound Annual Growth Rate (CAGR) was worked by the following formulae

CAGR = (Antilog b – 1) * 100

The significance of CAGR was tested with the help of 't' test.

Cuddy and Della Velle Instability Index (CDVI)
To study the variability in production of timber wood and NTFPs the Cuddy and Della Velle Instability Index (CDVI) was used, as it de-trend the given series of data and provide a clear direction of instability (Sihmar, 2014) [11], (Kolar *et al.* 2020) [6]. This method is modification over the coefficient of variation.

$$CDVI\,(\%) = C.V.* \sqrt{(1 - R^2)}$$

Where C.V. = Coefficient of variation
R^2 = Coefficient of determination

The range of CDVI given as below

Range of CDVI	Instability level
CDVI between 0 and 15	Low instability
CDVI > 15 and < 30	Medium instability
CDVI > 30	High instability

Results and Discussion
Growth and variability in timber wood production
Large fluctuations observed in timber wood productions in Gujarat state during the study period (Fig. 1). The production showed increasing trend during period I up to the year 1998-99, then declined to 25008 m³ during the year 1999-2000. During the period II increasing trend observed up to the year 2008-09. The highest production of timber wood obtained during the year 2016-17 (100969 m³).
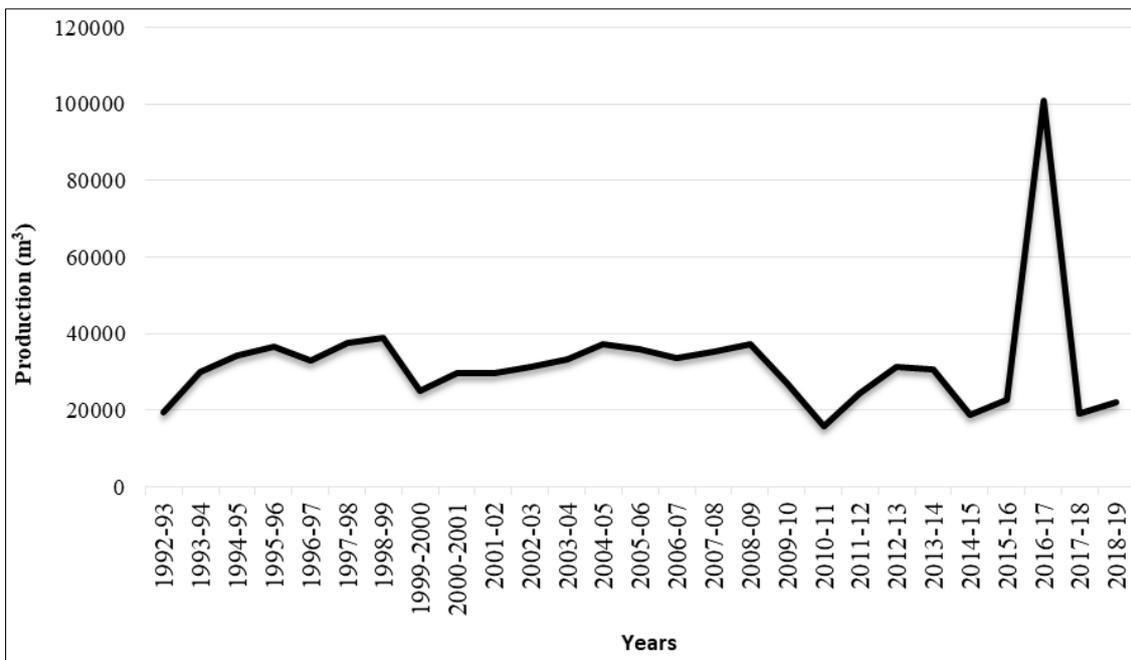

Fig 1: Trends in timber wood production in Gujarat state

Table 1 showed that during the period-I the production of timber wood raised significantly in Vadodara (28.56% per annum) and Ahmedabad (21.06% per annum) circle where as it declined significantly in Valsad circle (-9.68% per annum). The decline in production of timber wood in Valsad circle may attributed to significant decline in area under protected and unclassed forest during this period under study. During the period-II, the CAGR of production of timber wood was 22.81%, 21.21% and 19.39% in Valsad, Ahmedabad and Vadodara circle indicated that the production of timber wood raised significantly in these circle during the Period-II. The production of timber wood declined significantly in Surat (-22.35% per annum) and Mehasana (-22.05%) circle during period-II. The decline in production of timber wood in Surat circle may due to significant decline in area under protected and unclassed forest in this circle.

Table 1: Growth and variability in timber wood production in Gujarat state (Values in %)

Circle	Period-I (1992-93 to 1999-2000)		Period II (2000-01 to 2009-10)		Period-III (2010-11 to 2018-19)		Overall (1992-93 to 2018-19)	
	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI
Gandhinagar	-3.21	132.29	-14.00	72.83	106.22***	70.45	-1.35	92.72
Surat	-0.61	29.97	-22.35***	31.37	-18.34**	54.84	-9.34***	42.43
Vadodara	28.56***	39.05	19.39*	73.00	-10.13	201.99	-2.28	126.13
Valsad	-9.68***	15.12	22.81**	68.07	12.99*	47.66	6.09***	76.16
Ahmedabad	21.06**	28.05	21.21*	51.49	-2.17	88.20	-0.53	64.23
Bharuch	-5.63	47.07	10.67	53.51	15.35	215.13	0.62	207.70
Mehsana	-18.35	145.63	-22.05***	42.58	-10.97	110.60	-2.78	104.14
Gujarat	3.94	20.95	0.82	10.85	4.47	86.59	-0.48	48.16

Note: ***, ** and * indicate significant at 1%, 5% and 10% level of probability, respectively
For Ahmedabad circle Period-I: 1994-95 to 1999-2000

Table 1 further depicted that the production of timber increased by 106.22% per annum and 12.99% per annum in Gandhinagar and Valsad circle, respectively, whereas it declined by -18.34% per annum in Surat circle during period-III under study. During the overall period, the significant positive CAGR found in Valsad circle (6.09%) while significant negative CAGR recorded in Surat (-9.34%) circle, indicated that the production of timber increased significantly in Valsad circle and declined significantly in Surat circle during the period from 1992-93 to 2018-19. The growth in production of timber in Valsad circle during overall period attributed to significant growth in production during the period-II and III under study. The decline in production of timber in Surat circle during overall period attributed to significant decline in production during the period-II and III under study. At state level the CAGR worked out for production of timber during the three period under study were positive and non-significant and during overall period it was negative and non-significant. According to Manoharan (2011) [7] at all India level the timber production declined from 24.50 million m^3 in 1991 to 19.30 million m^3 in 2001 which was due

to the fell in timber production from forest and forest plantations in most of the states of the country. Anonymous (2011) [1] reported that due to the increasing emphasis on forest conservation, Central Government restricted the felling of the trees in the forest, which reduced the production of timber wood.

During the period-I, the instability index worked out higher in Mehasana (145.63%), Gandhinagar (132.29%), Bharuch (47.07%) and Vadodara (39.05%) circle (Table1). For the period-II, period-III and overall period the instability index recorded higher, indicated that there was large variation in production of timber in all the circles and Gujarat state, during the period under study.

Growth and variability in Fuel wood production
The variations observed in production of fuel wood in Gujarat state during the study period. As compare to period II and Period III, less production of fuel wood found during period I (Fig.2). The highest production of fuel wood recorded during the year 2015-16 (179777 MT) whereas lowest recorded during the year 1994-95 (13900 MT).
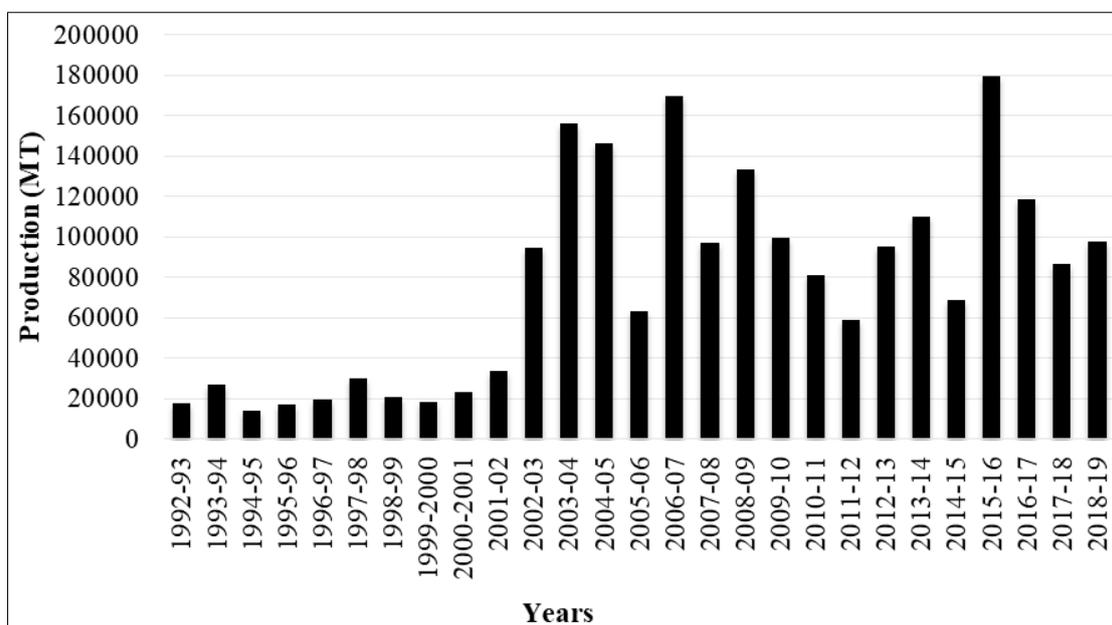

Fig 2: Trends in fuel wood production in Gujarat state

Table 2 showed that the production of fuel wood declined significantly in Kachchh (-32.10% per annum), Junagadh (-29.52% per annum) and Surat (-22.03% per annum) during period-I whereas it declined in Junagadh WL (-31.63% per annum), Junagadh (-26.62% per annum) and Rajkot (-25.17% per annum) circle during period-II. The decline in production

of fuel wood in Junagadh circle during period-I and period-II and in Junagadh WL circle during period-II attributed to significant decline in area under unclassed forest during the study period. The production of fuel wood reported positive and significant CAGR in Mehasana (49.00%) and Ahmedabad (21.61%) circle during period-I, in Valsad

(48.64%) and Ahmedabad circle (37.14%) during period-II and in Gandhinagar circle (155.25%) during period-III implied that the production of fuel wood increased in these circles during the study period. The significant rise in production of fuel wood in Valsad circle attributed to significant raise in area under protected and unclassed forest during the period-II.

Table 2: Growth and variability in Fuel wood production in Gujarat state (Values in %)

Circle	Period-I (1992-93 to 1999-2000)		Period II (2000-01 to 2009-10)		Period-III (2010-11 to 2018-19)		Overall (1992-93 to 2018-19)	
	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI
Gandhinagar	0.37	27.32	21.20	101.15	155.25*	144.68	-3.14	138.33
Junagadh	-29.52**	66.40	-26.62*	104.22	15.95	96.58	-8.66**	100.80
Junagadh WL	-5.14	42.61	-31.63***	34.13	-26.96	137.90	-13.06***	68.31
Kachchh	-32.10**	27.58	-8.56	65.07	-2.49	124.23	9.05*	205.17
Surat	-22.03**	47.60	-18.15	139.08	-5.12	70.62	0.74	94.27
Vadodara	-0.87	87.16	9.35	136.03	-20.76	122.47	-2.67	120.01
Valsad	--	--	48.64**	131.64	4.97	92.02	20.51***	128.79
Ahmedabad	21.61**	32.69	37.14***	36.45	-2.88	62.73	8.94***	92.21
Bharuch	-2.52	33.97	-15.76	54.20	20.85	85.92	3.91	111.02
Mehasana	49.00**	71.82	7.83	90.66	20.75	86.18	13.31***	100.14
Rajkot	8.11	67.00	-25.17***	50.98	-8.24	231.05	3.95	286.42
Gujarat	1.91	27.81	14.50*	45.81	4.87	35.58	8.50***	51.80

Note: ***, ** and * indicate significant at 1%, 5% and 10% level of probability, respectively
Overall period for Valsad circle: 1997-98 to 2018-19

It was observed that during the overall period the highest positive and significant CAGR reported in Valsad (20.51%) followed by Mehasana (13.31%), Kachchh (9.05%) and Ahmedabad (8.94%) circle indicated that the production of fuel wood increased in these circles during the period 1992-93 to 2018-19. The raise in production of fuel wood in Valsad and Kachchh circle attributed to significant increase in area under protected and unclassed forest, where as in Ahmedabad circle it may due to raise in area under unclassed forest during study period. At state level the production of fuel wood increased by 8.50% per annum during the overall period under study which may attributed to significant raise in area under protected forest in the state as whole. Pandey (2002) [8] reported that the area of fuel wood production shifted from forest to non-forest areas. Most of the fuel wood produced from the trees planted outside the forests like roads, canals, farmland etc. During the same period the production of fuel wood reported significant decline in Junagadh WL (-13.06% per annum) and Junagadh (-8.66% per annum) circle which may attributed to significant decline in area under protected and unclassed forest in Junagadh circle and period-I in Junagadh WL circle during the study period.

Table 2 further revealed that, there was high variability in production of fuel wood in Gujarat state during study period. The value of CDVI recorded around 30% in all the circles and Gujarat state during the period-I, period-II, period-III and overall period, implied that there was large fluctuations in fuel wood production in all the circles and Gujarat state.

Growth and variability in NTFP production
The major NTFPs produced in Gujarat state are the grasses, gums, mahuda fruits, mahuda flowers, honey, wax and timru leaves. The declining trend observed in the production of total NTFPs and timru leaves in the Gujarat state during the study period (Fig. 3).
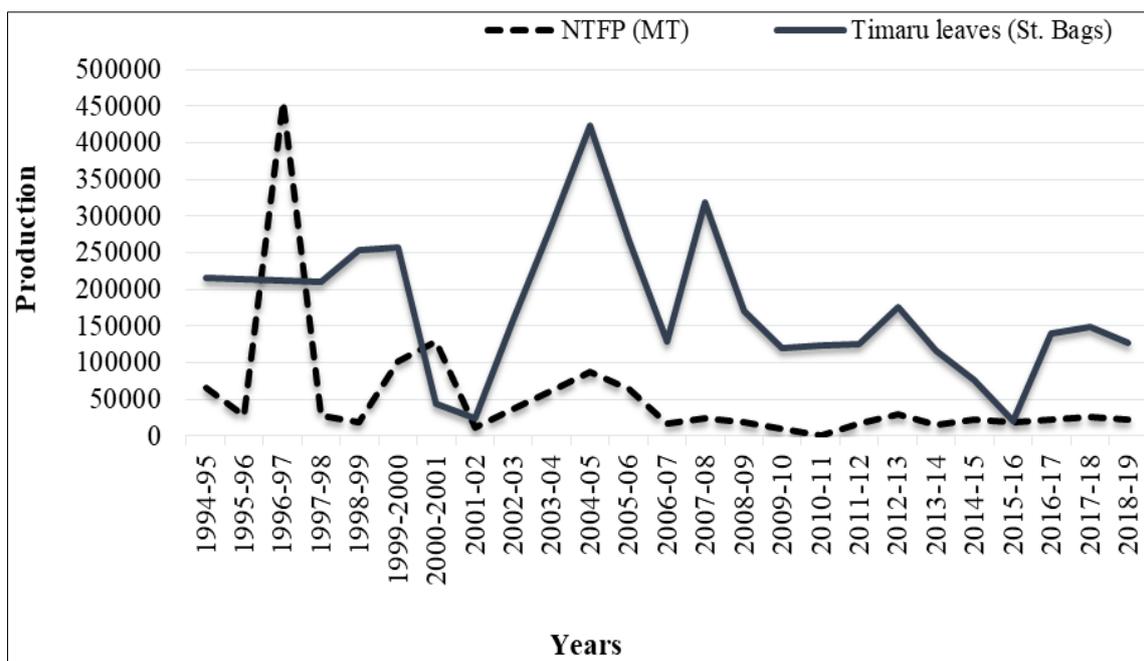

Fig 3: Trends in production of NTFPs and Timru leaves in Gujarat state

From Table 3, it was observed that during the period-I the production of Timru leaves raised significantly by 4.02% per annum, during period –II the production of gums, mahuda flowers, mahuda fruits and honey raised significantly by 61.13% per annum, 59.34% per annum, 48.13% per annum and 32.01% per annum, respectively, whereas during period-III the production of grasses, total NTFP and other NTFP increased by 89.01% per annum, 22.58% per annum and 15.65% per annum, respectively. During the overall period the production of gums, wax and total NTFP recorded negative and significant CAGR which was worked out to -9.40%, -8.97% and -6.60%, respectively, indicted that the production of gums, wax and total NTFP declined during the period from 1994-95 to 2018-19.

High variability observed in production of non-timber forest products in Gujarat state during study period (Table 3). The value of CDVI recorded higher than 30% for grasses, gums, mahuda fruits and flowers, honey, wax, timru leaves, other NTFP and Total NTFP during the period-I, period-II, period-III and overall period, implied that the stability in production of all these NTFPs in the Gujarat state was not achieved over the period of time. Bhat *et al.* (2018) [2] found that there is year to year variation and cyclical pattern in the yield of several NTFP species of Western Ghats. This may leads to variation in the production of NTFPs.

Table 3: Growth and variability in NTFP production in Gujarat state (Values in %)

Produce	Period-I (1994-95 to 1999-2000)		Period II (2000-01 to 2009-10)		Period-III (2010-11 to 2018-19)		Overall (1994-95 to 2018-19)	
	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI	CAGR	CDVI
Grasses	-10.80	226.61	-30.13*	53.33	89.01*	42.33	-5.09	284.23
Gums	4.23	37.43	61.13**	58.61	-34.77	94.02	-9.40*	82.73
Mahuda fruit	-14.28	63.78	48.13***	73.58	-13.87	123.80	1.59	106.44
Mahuda flower	-7.13	107.98	59.34***	150.46	9.11	63.17	1.72	147.77
Honey	8.03	46.96	32.01*	82.39	-18.38*	90.78	0.45	155.16
Wax	24.76	41.45	-8.38	33.89	-30.07***	63.30	-8.97***	50.66
Other NTFP	-4.88	103.48	23.86	120.02	15.65*	54.67	2.12	154.04
Total NTFP	-5.14	162.08	-14.13	74.31	22.58*	36.31	-6.60**	156.65
Timru leaves	4.02*	6.73	15.08	66.76	-2.60	40.87	-3.00	51.09

Note: ***, ** and * indicate significant at 1%, 5% and 10% level of probability, respectively

Conclusions
The present study showed the non-significant growth in production of timber wood in all the circles and Gujarat state as whole, except Valsad circle which recorded significant positive growth during the period from 1992-93 to 2018-19. High instability found in the production of timber, fuel wood and NTFP in all the circles and Gujarat state as whole during the period-I, II, III and overall period. Production of fuel wood significantly raised during period-II and overall period where as production of timru leaves recorded positive growth during period-I in Gujarat state. Fuel wood production raised significantly in Valsad, Mehasana, Kachchh and Ahmedabad circle whereas it declined significantly in Junagadh WL and Junagadh circle during the period from 1992-93 to 2018-19. Production of total NTFP, wax and gums found significantly declined during the period from 1994-95 to 2018-19. Production of Gums, mhuda flowers, mhuda fruits and honey recorded high growth rate with high instability during period-II indicated that the production of these NTFPs raised with high variation during study period. To cope up the increasing demand of these forest produce different strategies should be adopted to increase the production.

References
1. Anonymous. Production of wood and non-wood forest product Section-III, Forestry Statistics India 2011, 35. https://agritech.tnau.ac.in/forestry/stat/Production of wood and NTFPs.pdf
2. Bhat PR, Hegde GT, Shastri CM, Deepak Shetti, Indu Murthy K, Murali KS *et al*. Trends in yield of selected Non-Timber Forest Product yielding species in the Western Ghats, India: Implications for sustainability. International Journal of Advanced Earth Science and Engineering 2018;7(1):622-634.
3. Forest Survey of India. India State of Forest Report. Ministry of Environment, Forest and Climate Change, Government of India 2019.
4. Government of India. National Forest Policy. Ministry of Environment and Forest, Department of Environment, Forests & Wildlife 1988, 4.
5. Government of India. Draft National Forest Policy. Ministry of Environment and Forest and Climate Change, Forest Policy Division 2018, 1.
6. Kolar P, Awasthi PK, Sahu A. Growth performance of oilseeds among leading states in India. Economic Affairs 2020;65(2):219-224.
7. Manoharan TR. Supply determinants of timber trade in India. A study supported by planning Commission, Government of India 2011. Web link https://niti.gov.in/planningcommission.gov.in/docs/reports/sereport/ser/ser_timber300511.pdf.
8. Pandey D. Fuelwood studies in India: Myth and reality. Centre for International Forest Research, Jakarta, Indonesia 2002. Web link https://www.cifor.org/publications/pdf_files/Books/Fuelwood.pdf.
9. Planning Commission. Report of the Sub-Group-II on NTFP and their sustainable management in the 12th 5-year plan. Submitted under: Planning Commission's Working Group on Forests & Natural Resource Management 2011. Web link https://niti.gov.in/planningcommission.gov.in/docs/aboutus/committee/wrkgrp12/enf/wg_subntfp.pdf.
10. Principle Chief Conservator of Forest. Government of Gujarat. Gujarat Forest Statistics 1990-91 to 2018-19.
11. Sihmar R. Growth and instability in agricultural production in Haryana: A district level analysis. International Journal of Scientific and Research Publications 2014;4(7):1-12.
12. Singh S, Chaudhary N, Bhatia AK. Role of Non-Timber Forest Products in Rural Economy of Farmers. International Journal of Economic Plants 2020;7(4):165-

169.
13. Yadav M, Basera K. Status of Forest Products Production and Trade. Working Paper Series, Indian Institute of Forest Management, Bhopal 2013/1.