Evaluation of squared timber and log products in the Hyrcanian Forests of Iran

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ABSTRACT: The forests located in the northern areas of Iran are known as Hyrcanian Forests and are distributed across three provinces, namely Gilan, Maznadarn and Golestan. These provinces are situated in the north of Iran near the Caspian Sea. Timber products in the said forests during the last two decades were markedly different so that the total timber harvested in the first decade was 1.6 million m^3 on average, however, in the second decade it nearly amounted to 1 million m^3. Two major timber products of Iran are studied and compared in this research, namely logs and squared timber. Squared timber products averaged 10.7% during the first decade, but they fell to 7.3% over the second decade. Apropos of log products, they reached 20.9% and 29.2% over the first and the second decade, respectively. Analyses of the data indicate the following converse linear equation between squared timber products and log products during the 20 years of study: $Y = -0.359X + 18.065$ (Y = log products, X = squared timber, $R^2 = 0.768$). Accordingly, any increase in log products at a time caused the squared timber products to decrease at the same time.

Keywords: Hyrcanian Forests; logs; mechanized harvesting system; squared timber

The Hyrcanian Forests of Iran are natural broad-leaved forests located in the north of Iran near the Caspian Sea (Fig. 1). They have uneven topography and very steep slopes so that these regions with slopes larger than 100% have been designated as the protected areas, where harvesting operations are banned. Due to the ecosystemic and environmental aspects, biodiversity, ecology and eco-tourism values and their historical background, these forests are one of the important ecological resources in the world. The average standing timber volume is about 210 $m^3 \cdot ha^{-1}$, an average of 201 trees per hectare canopies are shown in Table 1.

For many different reasons such as socio-economic situation, export and import of wood and timber market, the trend of timber products in these forestlands has not been so regular during the last 20 years. The main types of timber products in these forests are logs, squared timber, sawlogs, fuel wood and charcoal (Table 2).

Fig. 1. Study site location

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Table 1. Canopies of trees in the Northern Forests of Iran

Situation	Close forests	Semi closed forests	Open forests
Canopy cover (%)	51	32	17

Harvesting operations in these forest zones are divided into two categories: non- mechanized and mechanized logging systems. In non-mechanized logging systems, after cutting, felling and delimbing, the logs are cut using manual chainsaws into smaller products such as squared timber, sawlogs and so on in forest stands. Then these smaller products are dragged by animals like horses, donkeys and mules (Fig. 2). In mechanized systems, cutting and bucking operations are carried out by manual chainsaws; however, logs are extracted by skidders from forest stands to a yard near the main road (Fig. 3). As Koshki (2007) indicated, from 1997 to 2002 the importation of timber to Iran increased and its exportation decreased during the same period. Shahnazi (2000) showed that the amounts of squared timber importation to Iran increased during the last 10 years. Hosseini et al (2008) reported that the importation of squared timber to Iran experienced an increase of over 100% from 2000 to 2008 in comparison with the years between 1989 and 1999. The total log volume imported to Iran since 1989 has been less than 1% in total. This information, together with other references, showed that other factors also influenced the production of logs and squared timber in these forestlands (Shafiefar 1990; Abdollahpor 2005; Anonymous 2006). For instance, over the first decade under study, only 30% of harvesting operations were carried out using mechanized systems, while during the second decade, their use increased to 70% (Hosseini et al. 2009). The unit cost per cubic meter of squared timber compared with skidding systems was exorbitantly high; therefore, the local contractors and timber sellers were encouraged to produce logs instead of squared timber (Sarikhani 1990).

This paper is aimed at shedding light on the processes and trends of squared timber and log production and the relations between them in the Hyrcanian Forests of Iran during the last 20 years.

Fig. 2. Extracting squared timbers by animals

MATERIALS AND METHODS

Areas under Study

Located in the northern part of Iran, the study areas are known as the Northern Forests or Hyrcanian Forests and are distributed across three provinces: Golestan, Mazandaran, and Gilan. The majority of these forests are located in Mazandaran Province with 967,790 ha (51%), Gilan with 511,306 ha (27%) and Golestan with 421,905 (22%). These forests form rather a narrow green belt bordering the northern part of the Alborz Mountains and extend from Astara in the west of Gilan Province to Giledarreh in the east of Golestan province, and are about 800 km in length and 20 to 70 km in width (Fig. 1).

Methodology

In this study, all documents of trees cut during the last 20 years in the three provinces under study have been examined, summarized, and cat-

Table 2. Total volume and percentage of timber products in the Hyrcanian Forests of Iran

	Log		Squared Timber		Sawlog		Fuel Wood		Charcoal	
	1989	2008	1989	2008	1989	2008	1989	2008	1989	2008
Volume	97,392	34,058	119,531	53,437	224,893	231,350	673,011	309,530	271,566	4,884
Percentage	15.2	34.8	7.5	5.8	14.2	25.1	42.6	33.6	17.2	0.5

Fig. 3. Extracting logs by skidders

egorized based on the type of timber products. The production processes of two major categories, i.e. squared timber and logs, were studied per province separately.

The volume of squared timber was calculated through measuring the length, width and height. Such timbers were extracted out of forest stands using the animals like horses and mules in such a way that each animal carried two logs per load and one end of timbers was dragged along the ground (Fig. 2). The volume of logs was gauged based on the Huber formula and measuring the lengths and middle diameters of logs and the logs were extracted by skidders (Fig. 3). Furthermore, the processes of forest harvesting systems progress in the study areas were monitored at the same time. The relationships between squared timber and log products during the last 20 years (1989–2008) were evaluated using statistical software such as SPSS (Statistical Package for Social Sciences) and so on.

RESULTS

The total squared timber volume produced from 1989 to 2008 in the three northern provinces of Iran, namely Golestan, Mazandaran and Gilan, was 439,715 m^3, 1,709,655 m^3 and 363,101 m^3, respectively (Table 3). The maximum volume of 76,959 m^3 was produced in Golesan forests in 1991, in Mazandaran forests it was 139,217 m^3 in 1990 and in Gilan forests it was 29,360 m^3 in 2002. This table also shows that the squared timber products at all three forest sites had a downward trend during the last two decades; however, this trend was is not quite regular on a year-by-year basis.

Table 3. Total squared timber and log products in the study areas in zears 1989–2008

	Squared timber (m^3)			Logs (m^3)		
Provinces	Golestan	Mazandaran	Gilan	Golestan	Mazandaran	Gilan
1989	35,204	124,450	8,872	13,269	131,168	96,178
1990	40,235	139,217	9,873	17,561	154,258	94,731
1991	76,959	125,199	13,985	13,501	155,934	111,634
1992	31,663	123,956	16,072	13,298	183,439	123,240
1993	28,692	138,238	15,918	15,277	196,770	111,853
1994	22,848	131,489	15,867	43,611	218,441	149,808
1995	19,187	137,121	20,351	39,666	214,485	141,560
1996	25,461	105,331	28,365	36,662	201,299	138,444
1997	20,485	97,188	26,503	46,412	208,135	116,561
1998	18,758	99,097	23,126	45,874	231,774	131,469
1999	20,115	94,415	14,436	60,162	194,328	86,486
2000	20,046	61,710	14,806	32,399	170,747	90,935
2001	18,162	57,243	27,009	22,309	189,649	107,158
2002	13,974	43,494	29,360	24,973	201,807	99,019
2003	5,169	41,691	18,956	15,773	213,414	86,758
2004	11,581	45,384	22,338	9,067	214,814	76,572
2005	9,530	41,265	17,142	12,618	204,319	56,694
2006	9,287	35,729	16,791	11,233	193,641	53,559
2007	6,071	31,172	12,448	13,232	205,233	66,922
2008	6,288	36,266	10,883	18,212	228,033	74,104
Total	439,715	1,709,655	363,101	505,109	3,911,688	2,013,685

The maximum of log products in Golestan, Mazandaran and Gilan forestlands was 60,162 m^3 (1999), 231,774 m^3 (1998) and 149,808 m^3 (1994), respectively. The log products in the three forestlands vis-à-vis the squared products had an upward trend, and such a trend increased several times in comparison with the early years of the studied period.

The data collected from the total timber products at the three sites under study during the last 20 years shows that in the first decade (1989–1998) there was not a large difference in the volumes of products, however, during the second period (1999–2008) it gradually decreased so that in 1998 it was 1.7 million m^3 and in 2008 it reached 0.9 m^3 (Fig. 4). As all these forestlands are state forests, the government tries to reduce logging operations and preserve them for future generations. At the moment, the most frequently used types of machines are skidders which are generally imported from abroad.

The average share of squared timber products in the first decade was 10.7% and in the second decade it was 7.3%; meanwhile the share of log products was 20.9% and 29.2% in the first and second decade, respectively.

Data analysis indicated that simultaneously with the increase in the total timber production during the studied period, the squared timber production in percentage declined (Fig. 5a), but the percentage of log products increased at the same time (Fig. 5b). In other words, with the reduction of total timber products in these forests the quality of products also changed to positive improvements such as log products. Furthermore, it should be noted that other contributory factors probably affected this process and trend, for example the wood market, introduction of new mechanized harvesting systems, new wood technology and industries, imports and exports of timbers and so on (Hosseini et al. 2008).

Data analysis shows that there is a significant correlation between log products and squared timbers and this is a converse linear relationship. The mathematical equation between the two mentioned factors is as follows:

$Y = -0.359X + 18.065$

$R^2 = 0.768$

Y = log products

X = squared timber

Table 4. Summary of nonparametric output test for logs and squared timber products during last 20 years

Situation	No. of samples	Kendall's tau_b	*P*-value
Logs	20	–779	0/000
Squared timber	20	–919	0/000

P – Probability

The results of nonparametric tests, which were obtained using SPSS software, confirmed a significant correlation between the log products and squared timber on both statistical levels of 1% and 5% (Table 4).

CONCLUSION

As the acquired data showed, total timber products in the three provinces of study for the first 10 years of study were approximately close to each other while in the second 10 years of study they were quite different from the first period. Data analysis indicates that the percentages of squared timber and log products are completely different from each other so that the scooter plots of log products are an ascending curve and for squared timber it is a descending curve (Fig. 5c). In other words, although the total timber harvested decreased (Fig. 4), the amounts of log products increased and the amounts of squared timber declined at the same time.

As a result, this study shows that the amounts of squared timber products in the Hyrcanian Forests

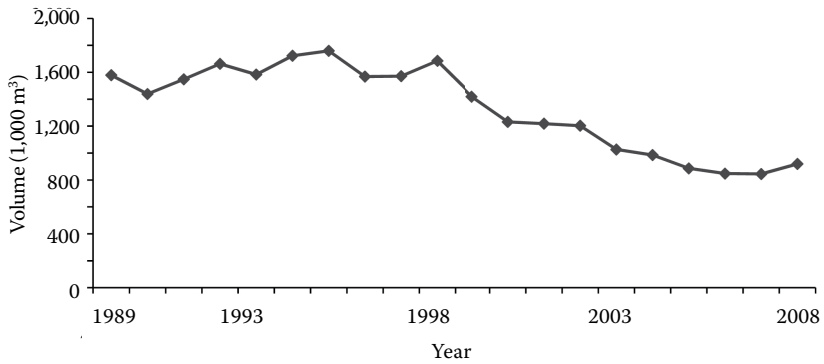

Fig. 4. Total timber products in the three forest sites under study

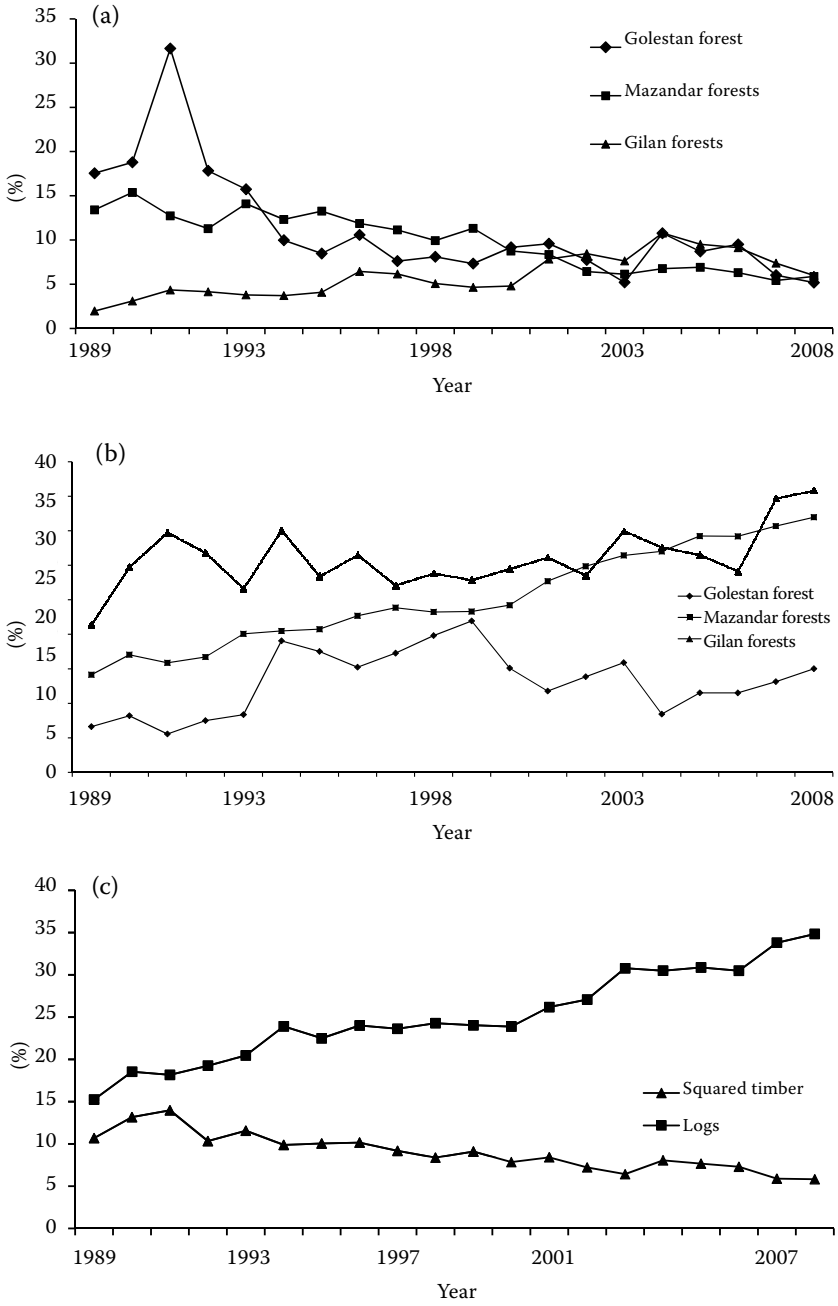

Fig. 5. Percentages of (a) squared timber (b) logs products and (c) log products and squared timber in three site study location during last 20 years

of Iran during the last 20 years were dependent on log products. One of the main effective factors in this relationship was harvesting operations changing from non-mechanized logging systems to mechanized logging systems in the said forestlands. Therefore, by improving the mechanized logging operations, the log products increased and squared timber decreased.

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