GREEN AUDIT REPORT

of

ILS LAW COLLEGE,

Chiplunkar Road, Pune 411 004

Year: 2022-23

Prepared by

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795, Email: engress123@gmail.com

ENGRESS SERVICES

Yashashree, 26, Nirmal Bag Society,
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Tel: 09890444795 Email: engress123@gmail.com

Certificate No: ES/ILS/22-23/02 **Date: 30/6/2023**

GREEN AUDIT CERTIFICATE

This is to certify that we have conducted Green Audit at ILS Law College, Pune in the year 2022-23.

The College has adopted Energy Efficient & Green Practices:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Installation of Solar Thermal Water Heating System at Hostel Block
- In process Installation of 70 kWp Roof Top Solar PV Plant
- Segregation of Waste at source
- Provision of Bio Composting Machine for Conversion of Leafy Waste
- Installation of Rain Water Management Project
- Good Internal Roads
- Internal Tree Plantation
- Provision of Ramp for Divyangajan
- Creation of awareness on Energy Conservation by Display of Posters

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Green.

For Engress Services,

A Y Mehendale,
B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-8192
ASSOCHAM GEM Certified Professional: GEM: 22/788

REGISTRATION CERTIFICATES

Maharashtra Energy Development Agency

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

MEDA Registration Certificate

GEM Certificate

ASSOCHAM

ASSOCHAM hereby certifies that

Mr. A Y Mehendale

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

06 Jan, 2022

ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj B. Dhankar

GEM CP 22196

Deepak Sood

ASSOCHAM Certificate

Certificate of Registration

This is to Certify that
Quality Management System of

ENGRESS SERVICES

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

IAF

Director

Magnitude Management Services Pvt. Ltd.

ISO: 9001-2015 Certificate

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ACKNOWLEDGEMENT

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We are thankful to all Faculty & Staff members for helping us during the field study.

EXECUTIVE SUMMARY

1. ILS Law College, Pune consumes Energy in the form of **Electrical Energy;** used for various equipment.

2. Present Energy Consumption & CO_2 Emission:

No	Particulars	Value	Unit
1	Annual Energy Consumed	**385297**	kWh
2	Annual CO_2 Emissions	**346.77**	MT

3. Usage of Renewable Energy:

- Usage of Solar Thermal Water Heating System at Hostel Block
- In a process of installation of Roof Top Solar PV Plant of Capacity **75 kWp.**

4. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Organic Waste	Provision of Bio Composting Machine
3	Sanitary waste	Recommended to use Sanitary Waste Incinerator
4	E Waste	Disposed of through Authorized Agency

5. Rain Water Management:

The Rain Water from the terrace & from hill slopes is channelized and is used to recharge the bore well.

6. Green & Sustainable Practices:

- Well maintained internal Road
- Internal Tree Plantation
- Provision of Ramp for Divyangajan
- Awareness Creation on Energy Conservation by Display of Posters

7. Assumption:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

8. Reference:

1. For CO_2 Emissions: www.tatapower.com

ABBREVIATIONS

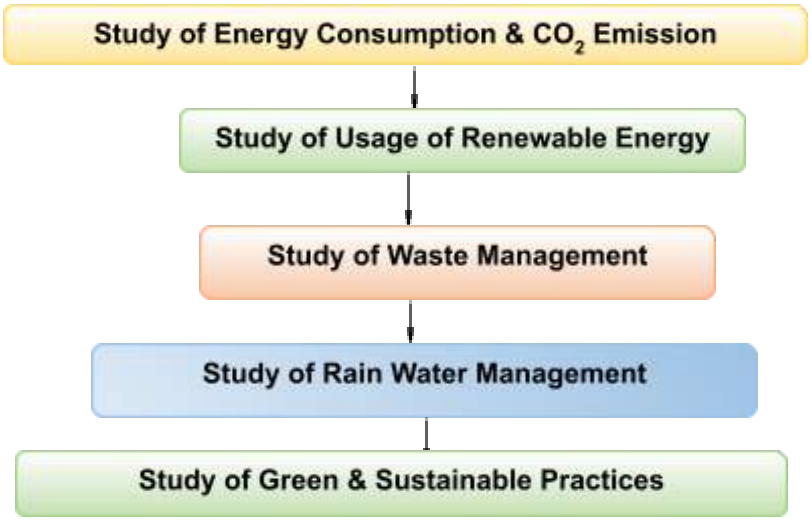
LED	:	Light Emitting Diode
ILS	:	Indian Law Society
kWh	:	kilo-Watt Hour
Qty	:	Quantity
W	:	Watt
kW	:	Kilo Watt
MT	:	Metric Ton

CHAPTER-I
INTRODUCTION

11.1 Introduction:

A Green Audit is conducted at ILS Law College, Pune.

1.2 Audit Procedural Steps:



1.3 Institute Location Image:

CHAPTER-II
STUDY OF ENERGY CONSUMPTION & CO_2 EMISSION

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the Institute for performing its day to day activities

The Institute uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the Institute due to its Day to Day operations

Table No 1: Month wise CO_2 Emissions:

No	Month	Energy Consumed, kWh	CO_2 Emissions, MT
1	Apr-22	31738	28.56
2	May-22	32181	28.96
3	Jun-22	22933	20.64
4	Jul-22	27870	25.08
5	Aug-22	30907	27.82
6	Sep-22	33320	29.99
7	Oct-22	30324	27.29
8	Nov-22	27505	24.75
9	Dec-22	33025	29.72
10	Jan-23	38333	34.50
11	Feb-23	36665	33.00
12	Mar-23	40496	36.45
13	Total	385297	346.77
14	Maximum	40496	36.45
15	Minimum	22933	20.64
16	Average	32108.08	28.90

Chart No 1: To study the variation of Month wise Energy Purchased, kWh:

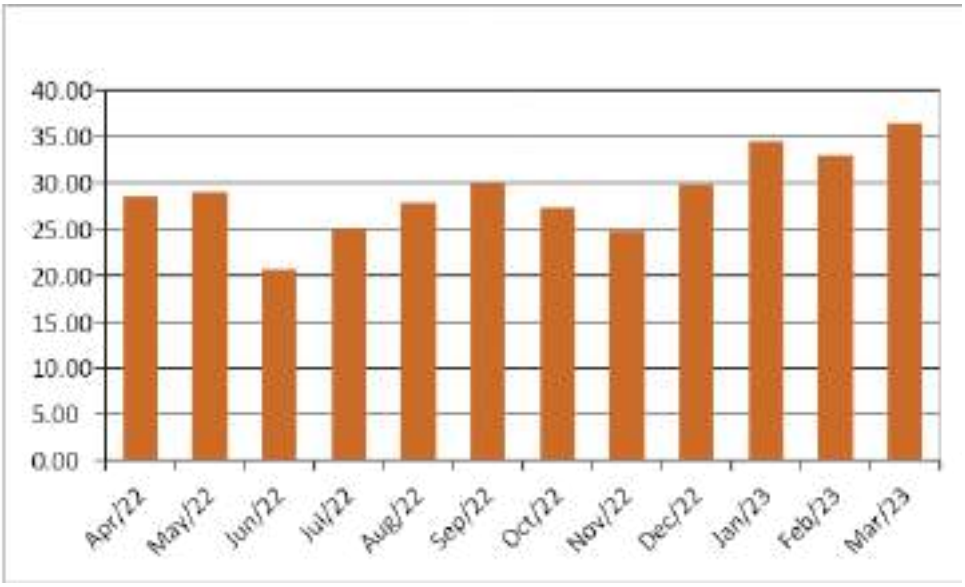


Table No 2: Key Parameters:

No	Parameter	Energy Consumed, kWh	CO_2 Emissions, MT
1	Total	385297	346.77
2	Maximum	40496	36.45
3	Minimum	22933	20.64
4	Average	32108.08	28.90

CHAPTER-III
STUDY OF USAGE OF RENEWABLE ENERGY

- The College has installed Solar Thermal Water Heating System at hostel Block
- In process of installation of Roof Top Solar PV Plant of Capacity **75 kWp.**

Photograph of Solar Thermal Water Heating System:

CHAPTER IV
STUDY OF WASTE MANAGEMENT

5.1 Segregation of Waste at Source

The Waste is segregated at source. Waste Collection Bins are placed at various locations.

Photograph of Waste Collection Bin:

5.2 Organic Waste Management:

A Bio Composting Machine is installed for conversion of Leafy Waste into Bio Compost.

Photograph of Bio Composting Machine:

5.3 Sanitary Waste Management:

It is recommended to install a Sanitary Waste Incinerator, to dispose of the Sanitary Waste.

5.4 E Waste Management:

The E Waste is disposed of through Authorized Agency.

CHAPTER-VI
STUDY OF RAIN WATER MANAGEMENT

The Rain Water from the terrace & from hill slopes is channelized and is used to recharge the bore well.

Photograph of Rain Water Carrying Pipe:

CHAPTER-VII
STUDY OF GREEN & SUSTAINABLE PRACTICES

7.1 Pedestrian Friendly Internal Road:

The College has well maintained internal road to facilitate the easy movement of the students within the campus.

Photograph of Internal Road:

7.2 Internal Tree Plantation:

The College has well maintained tree plantation in the campus.

Photograph of Tree Plantation in the campus:

7.3 Provision of Ramp for Divyangajan:

The College has made provision of Ramp for Divyangajan.

Photograph of Ramp:

7.4 Creation of Awareness about Energy Conservation:

The Institute has displayed Posters on Importance of Energy Conservation.

Photograph of Posters on Energy Conservation:

ENVIRONMENTAL AUDIT REPORT

of

ILS LAW COLLEGE,

Chiplunkar Road, Pune 411 004

Year: 2022-23

Prepared by

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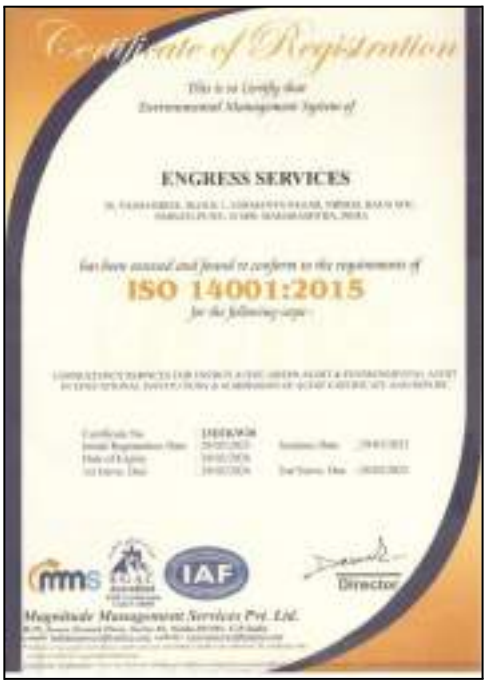

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EXECUTIVE SUMMARY

1. ILS Law College, Pune consumes Energy in the form of **Electrical Energy;** used for various equipment.

2. Pollution caused due to College Activities:

- **Air pollution:** Mainly CO_2 on account of Electricity & LPG Consumption
- **Solid Waste:** Bio degradable Garden Waste, Recyclable Waste and Human Waste
- **Liquid Waste:** Human & Laboratory Liquid waste

3. Present Energy Consumption & CO_2 Emission:

No	Particulars	Value	Unit
1	Annual Energy Consumed	**385297**	kWh
2	Annual CO_2 Emissions	**346.77**	MT

4. Various projects implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated Equipment
- In process installation of **75 kWp** Roof Top Solar PV Plant
- Installation of Rain Water Management Project

5. Usage of Renewable Energy:

- Usage of Solar Thermal Water Heating System at Hostel Block
- In a process of installation of Roof Top Solar PV Plant of Capacity **75 kWp.**

6. Indoor Air Quality:

No	Parameter/Value	AQI	PM2.5	PM10
1	Maximum	**39**	**24**	**36**
2	Minimum	**34**	**20**	**25**

7. Indoor Comfort Condition Parameters:

No	Parameter/Value	Temperature, ^0C	Humidity, %	Lux Level	Noise Level, dB
1	Maximum	**29.1**	**71**	**160**	**49**
2	Minimum	**27.9**	**7**	**109**	**39**

8. Waste Management:

No	Head	Particulars
1	Solid Waste	Segregation of Waste at source
2	Organic Waste	Provision of Bio Composting Machine
3	Sanitary waste	Recommended to use Sanitary Waste Incinerator

4	E Waste	Disposed of through Authorized Agency

9. Rain Water Management:

The Rain Water from the terrace & from hill slopes is channelized and is used to recharge the bore well.

10. Environment Friendly Initiatives:

- Internal tree Plantation.
- Creation of Awareness on Energy Conservation by Display of Posters

11. Assumption:

1. **1 kWh** of Electrical Energy releases **0.9 Kg of CO_2** into atmosphere

12. References:

- For CO_2 Emission computation: www.tatapower.com
- For Various Indoor Air Parameters: www.ishrae.com
- For AQI &Water Quality Standards: www.cpcb.com

ABBREVIATIONS

kWh	:	kilo-Watt Hour
ILS	:	Indian Law Society
Qty	:	Quantity
MT	:	Metric Ton
CO_2	:	Carbon Di Oxide
kWp	:	Kilo Watt Peak
AQI	:	Air Quality Index
PM2.5	:	Particulate Matter of Size 2.5 microns
PM 10	:	Particulate Matter of Size 10 microns
CPCB	:	Central Pollution Control Board
ISHARE	:	The Indian Society of Heating & Refrigerating & Air Conditioning Engineers

CHAPTER-I

INTRODUCTION

1. Important Definitions:

1.1. Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment

1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.4 Audit Procedural Steps:

1.5 Institute Location Image:

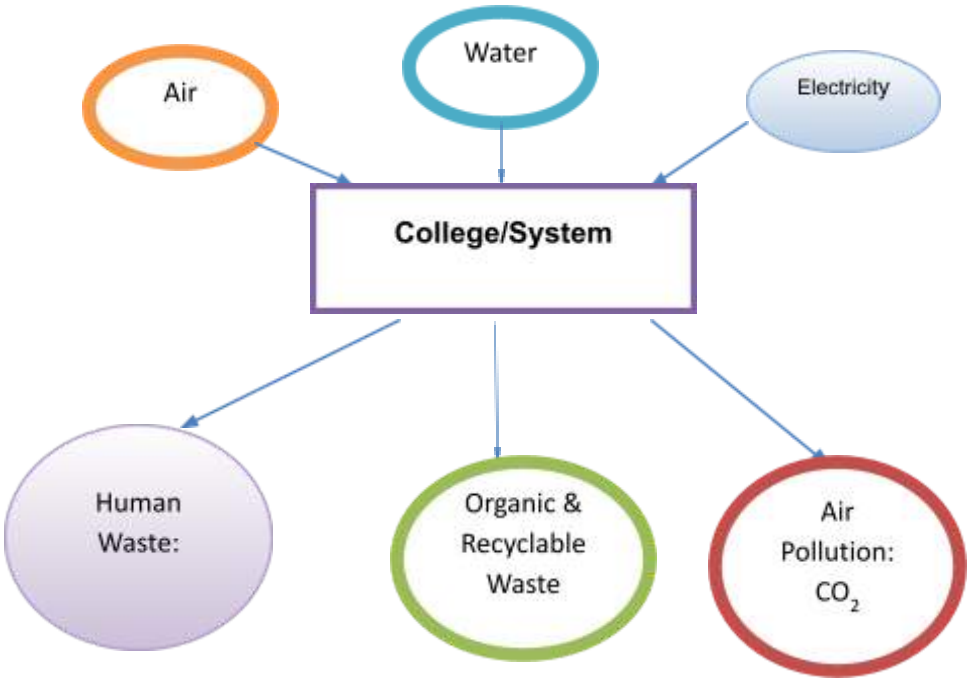
CHAPTER-II
STUDY OF RESOURCE CONSUMPTION & CO_2 EMISSION

The College consumes following Natural/derived Resources:

1. Air
2. Water
3. Electrical Energy

We try to draw a schematic diagram for the College System & Environment as under.

Chart No 1: Representation of College as System:



A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. Here we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the College for performing its day to day activities
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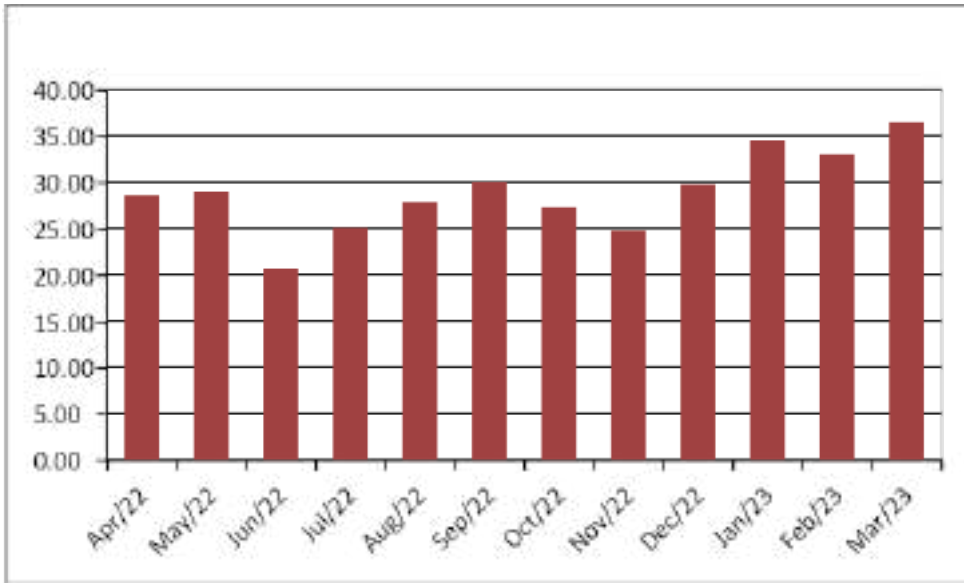
Chart No 2: Representation of Month wise CO_2 emissions:



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STUDY OF CO_2 USAGE OF RENEWABLE ENERGY

- The College has installed Solar Thermal Water Heating System at hostel Block
- In process of installation of Roof Top Solar PV Plant of Capacity **75 kWp.**

Photograph of Solar Thermal Water Heating System:

CHAPTER IV
STUDY OF INDOOR AIR QUALITY

4.1 Importance of Air Quality:

Air: The common name given to the atmospheric gases used in breathing and photosynthesis.

By volume, Dry Air contains 78.09% Nitrogen, 20.95% Oxygen, 0.93% Argon, 0.039% carbon dioxide, and small amounts of other gases.

On average, a person inhales about **14,000 liters** of air every day. Therefore, poor air quality may affect the quality of life now and for future generations by affecting the health, the environment, the economy and the city's liveability.

Rapid urbanization and industrialization has added other elements/compounds to the pure air and thus caused the increase in pollution. In order to prevent, control and abate air pollution, the Air (Prevention and Control of Pollution) Act was enacted in 1981.

Air quality is a measure of the suitability of air for breathing by people, plants and animals.

4.2 Air Quality Index:

An **Air Quality Index (AQI)** is a number used by government agencies to measure the **air pollution** levels and communicate it to the population. As the AQI increases, it means that a large percentage of the population will experience severe adverse health effects.

We present herewith following important Parameters.

1. AQI- Air Quality Index
2. PM 2.5- Particulate Matter of Size 2.5
3. PM 2.5- Particulate Matter of Size 2.5

Table No 4: Indoor Air Quality Parameters:

No	Location	AQI	PM-2.5	PM-10
1	Conference Hall	35	21	26
2	C P Law Room	36	22	27
3	Admin Block	37	23	28
4	Library	34	20	25
5	Hall-1	36	23	30
6	Faculty Room	39	24	34
7	Hostel Block	35	21	36
	Maximum	**39**	**24**	**36**
	Minimum	**34**	**20**	**25**

CHAPTER V
STUDY OF INDOOR COMFORT CONDITION PARAMETERS

In this Chapter, we present the various Indoor Comfort Parameters measured during the Audit.

The Parameters include:

1. Temperature
2. Humidity
3. Lux Level
4. Noise Level.

Table No 5: Study of Indoor Comfort Parameters:

No	Location	Temperature, ^{0}C	Humidity, %	Lux Level	Noise Level, dB
1	Conference Hall	27.9	71	109	39
2	C P Law Room	28	70	125	41
3	Admin Block	28.2	69	129	40
4	Library	28.6	69	140	43
5	Hall-1	29.1	7	160	44
6	Faculty Room	27.9	69	138	45
7	Hostel Block	28.5	69.8	136	49
	Maximum	**29.1**	**71**	**160**	**49**
	Minimum	**27.9**	**7**	**109**	**39**

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STUDY OF WASTE MANAGEMENT

6.1 Segregation of Waste at Source

The Waste is segregated at source. Waste Collection Bins are placed at various locations.

Photograph of Waste Collection Bin:

6.2 Organic Waste Management:

A Bio Composting Machine is installed for conversion of Leafy Waste into Bio Compost.

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6.3 Sanitary Waste Management:

It is recommended to install a Sanitary Waste Incinerator, to dispose of the Sanitary Waste.

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The E Waste is disposed of through Authorized Agency.

CHAPTER-VII
STUDY OF RAIN WATER MANAGEMENT

The Rain Water from the terrace & from hill slopes is channelized and is used to recharge the bore well.

Photograph of Rain Water Carrying Pipe:

CHAPTER-VIII
STUDY OF ENVIRONMENT FRIENDLY INITIATIVES

8.1 Internal Tree Plantation:

The College has well maintained tree plantation in the campus.

Photograph of Tree Plantation in the campus:

8.2 Creation of Awareness about Energy Conservation:

The Institute has displayed Posters on Importance of Energy Conservation.

Photograph of Posters on Energy Conservation:

ANNEXURE: I
AIR QUALITY, NOISE & INDOOR COMFORT STANDARDS

1. Category Wise Air Quality Index Values & Concentration of PM-2.5 & PM-10:

No	Category	AQI Value	Concentration Range, PM 2.5	Concentration Range, PM 10
1	Good	0 to 50	0 to 30	0 to 50
2	Satisfactory	51 to 100	31 to 60	51 to 100
3	Moderately Polluted	101 to 200	61 to 90	101 to 250
4	Poor	201 to 300	91 to 120	251 to 350
5	Very Poor	301 to 400	121 to 250	351 to 430
6	Severe	401 to 500	250 +	430 +

2. Recommended Noise Level Standards:

No	Location	Noise Level dB
1	Auditoriums	20-25
2	Outdoor Playground	55
3	Occupied Class Room	40-45
4	Un occupied Class Room	35

5	Apartment, Homes	35-40
6	Offices	45-50
7	Libraries	35-40
8	Restaurants	50-55

4. Thermal Comfort Conditions: For Non-conditioned Buildings:

No	Parameter	Value
1	Temperature	Less Than 33^0C
2	Humidity	Less Than 70%

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- Maximum usage of Day Lighting
- Installation of Solar Thermal Water Heating System at Hostel Block
- In process installation of 75 kWp Roof Top Solar PV Plant.
- Sensor based operation of Water Pumping at Hostel Block

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For Engress Services,

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B E-Mechanical, M Tech- Energy
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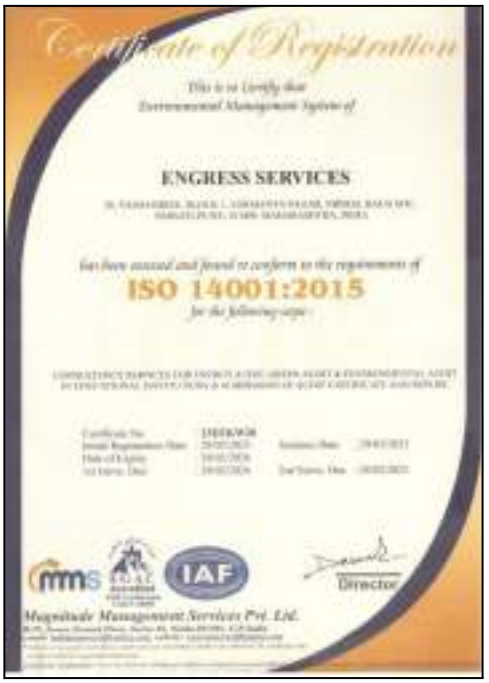

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2. Present Connected Load & Annual Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	**201**	kW
2	Annual Energy Consumption	**385297**	kWh

3. Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	**385297**	kWh
2	Total Built up area of College	**17415**	m^2
3	Energy Performance Index **=(1) / (2)**	**22.12**	kWh/m^2

4. Study of Lighting:

No	Particulars	Value	Unit
2	% of Usage of LED Lighting to Total Lighting Load	**17.57**	%

5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Installation of Solar Thermal Water Heating System at Hostel Block
- In process Installation of **75 kWp Roof Top** Solar PV Plant
- Sensor based operation of Water pumping Operation

6. Assumption:

1. **1 kWh** of Electrical Energy releases **0.9 Kg** of **CO_2** into atmosphere

7. References:

- Audit Methodology: www.mahaurja.com
- Energy Conservation Building Code: ECBC-2017: www.beeindia.gov.in
- For CO_2 Emissions: www.tatapower.com

ABBREVIATIONS

ILS	:	Indian Law Society
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LED	:	Light Emitting Diode
kWh	:	kilo-Watt Hour
Qty	:	Quantity
W	:	Watt
kW	:	Kilo Watt
PC	:	Personal Computer
MT	:	Metric Ton

CHAPTER-I

INTRODUCTION

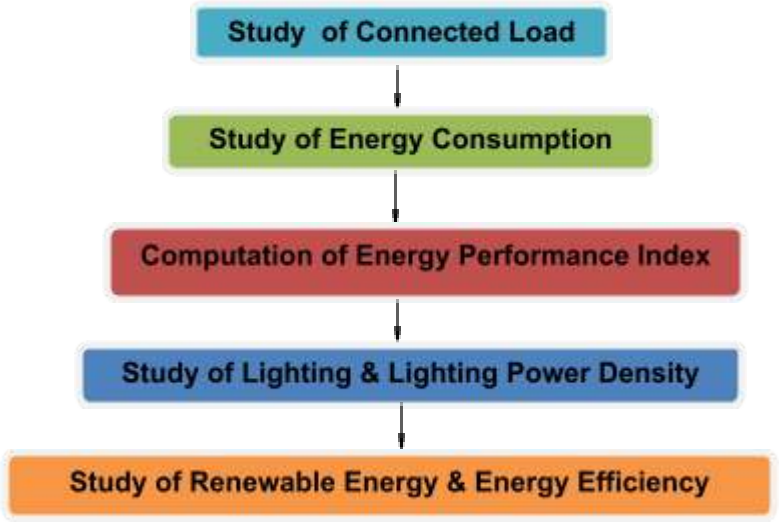
1.1 Introduction:

An Energy Audit is conducted at ILS Law College, Pune.

The guidelines followed for conducting the Energy Audit are:

- BEE India's Energy Conservation Building Code: ECBC-2017
- Maharashtra Energy Development Agency (www.mahaurja.com)
- Tata Power: www.tatapower.com

1.2 Audit Procedural Steps:



1.3 Institute Location Image:

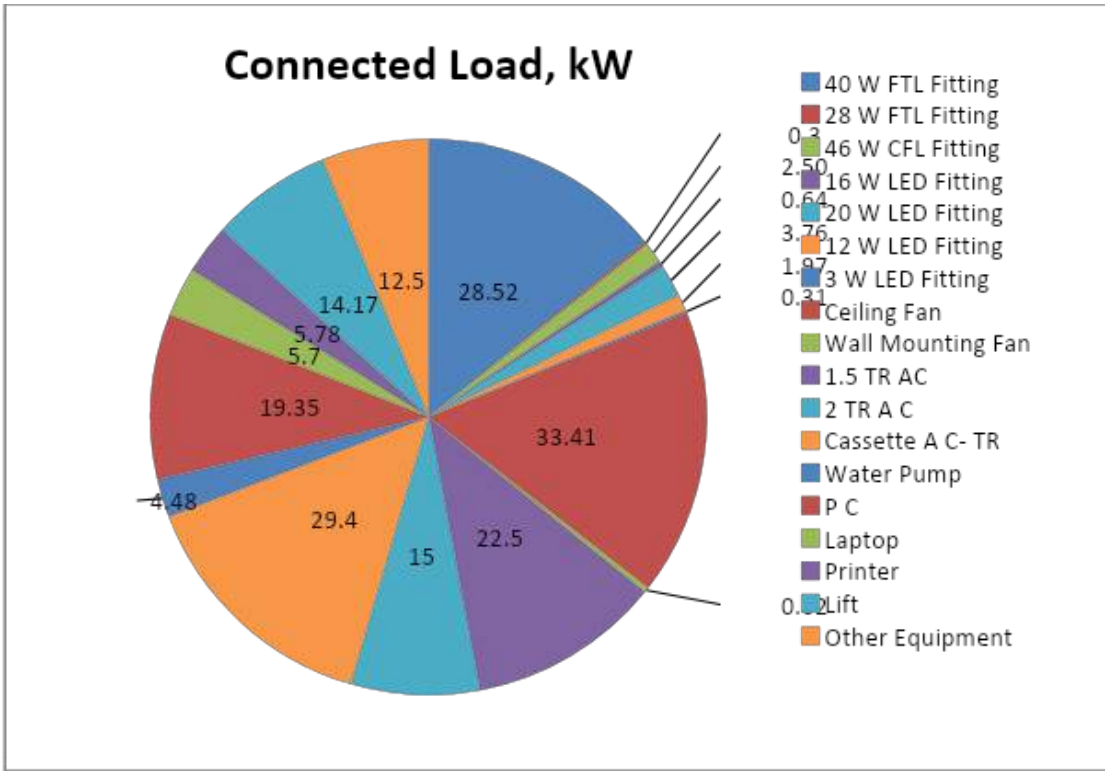
CHAPTER-II
STUDY OF CONNECTED LOAD

In this chapter, we present the details of various Electrical loads in the College as under.

Table No 1: Study of Equipment wise Connected Load:

No	Equipment	Qty	Load, W/unit	Load, kW
1	40 W FTL Fitting	713	40	28.52
2	28 W FTL Fitting	10	30	0.3
3	46 W CFL Fitting	52	48	2.50
4	16 W LED Fitting	40	16	0.64
5	20 W LED Fitting	188	20	3.76
6	12 W LED Fitting	164	12	1.97
7	3 W LED Fitting	103	3	0.31
8	Ceiling Fan	514	65	33.41
9	Wall Mounting Fan	12	52	0.62
10	1.5 TR AC	12	1875	22.5
11	2 TR A C	6	2500	15
12	Cassette A C- TR	28	1050	29.4
13	Water Pump	4	1119	4.48
14	P C	129	150	19.35
15	Laptop	57	100	5.7
16	Printer	33	175	5.78
17	Lift	2	7087	14.17
18	Other Equipment	50	250	12.5
19	**Total**			**201**

Chart No 1: Details of Connected Load:



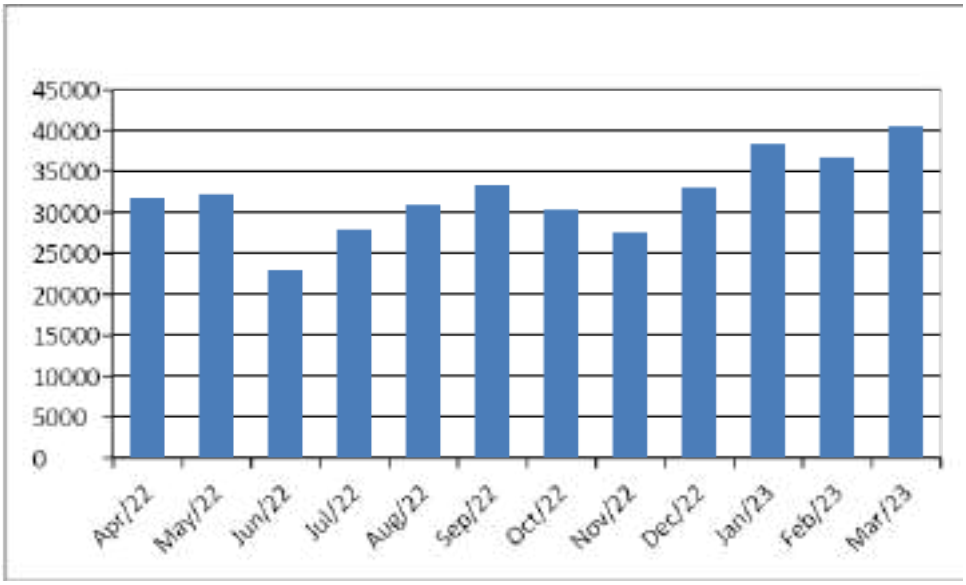
CHAPTER-III
STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of last year Electricity Energy.

Table No 2: Electrical Energy Consumption Analysis: 2022-23:

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Apr-22	31738	28.56
2	May-22	32181	28.96
3	Jun-22	22933	20.64
4	Jul-22	27870	25.08
5	Aug-22	30907	27.82
6	Sep-22	33320	29.99
7	Oct-22	30324	27.29
8	Nov-22	27505	24.75
9	Dec-22	33025	29.72
10	Jan-23	38333	34.50
11	Feb-23	36665	33.00
12	Mar-23	40496	36.45
13	Total	385297	346.77
14	Maximum	40496	36.45
15	Minimum	22933	20.64
16	Average	32108.08	28.90

Chart No 2: To study the variation of Month wise Energy Consumed, kWh:



CHAPTER-IV
STUDY OF ENERGY PERFORMANCE INDEX

Energy Performance Index: Energy Performance Index of a Building is its Annual Energy Consumption in Kilo Watt Hours per square meter of the Building

It is determined by:

$$\text{EPI} = \frac{\text{(Annual Energy Consumption in kWh)}}{\text{(Total Built-up area in m}^2\text{)}}$$

Now we compute the EPI for the Institute as under:

Table No 3: Computation of Energy Performance Index:

No	Particulars	Value	Unit
1	Total Annual Energy Consumed	385297	kWh
2	Total Built up area of Institute	**17415**	m^2
3	Energy Performance Index **=(1) / (2)**	**22.12**	kWh/m^2

CHAPTER V
STUDY OF LIGHTING

Terminology:

1. Lumen is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.

2. Lux is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.

3. Circuit Watts is the total power drawn by lamps and ballasts in a lighting circuit under assessment.

4. Installed Load Efficacy is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre (lux/W/m²)

5. Lamp Circuit Efficacy is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt (lm/W)

6. Installed Power Density. The installed power density per 100 lux is the power needed per square metre of floor area to achieve 100 lux of average maintained illuminance on a horizontal working plane with general lighting of an interior
Unit: watts per square metre per 100 lux (W/m²/100 lux) 100 Installed power density (W/m²/100 lux)

7. Lighting Power Density: It is defined as Total Lighting Load in a room divided by the Area of that Room in square meters.

In this Chapter we compute the percentage usage of LED Lighting to total Lighting Load of the Institute.

Table No 4: Percentage Usage of LEDs to Total Lighting Load:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	713	Nos
2	Load/unit of 40 W FTL Fitting	40	W
3	Total Load of 40 W FTL Fittings	**28.52**	kW
4	No of 28 W FTL Fittings	10	Nos
5	Load/unit of 28 W FTL Fitting	30	W
6	Total Load of 28 W FTL Fittings	**0.3**	kW
7	No of 46 W CFL Fittings	52	Nos
8	Load per unit of 46 W CFL Fitting	48	W
9	Total Load of 46 W CFL Fittings	**2.496**	kW
10	No of 16 W LED Fittings	40	Nos
11	Load per unit of 16 W LED Fitting	16	W
12	Total Load of 16 W LED Fittings	**0.64**	kW
13	No of 20 W LED Fittings	188	Nos
14	Load per unit of 20 W LED Fitting	20	W
15	Total Load of 20 W LED Fittings	**3.76**	kW
16	No of 12 W LED Fittings	164	Nos
17	Load per unit of 12 W LED Fitting	12	W
18	Total Load of 12 W LED Fittings	**1.968**	kW
19	No of 3 W LED Fittings	103	Nos
20	Load per unit of 3 W LED Fitting	3	W
21	Total Load of 3 W LED Fittings	**0.309**	kW
22	Total LED Lighting Load=12+15+18+21	**6.677**	kW
23	Total Lighting Load = 3+6+9+12+15+18+21	**37.99**	kW
24	% of Usage of LED to Total Lighting Load = **22*100/23**	**17.57**	%

CHAPTER-VI
STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

6.1 Usage of Renewable Energy:

- The College has installed Solar Thermal Water Heating System at hostel Block
- In process of installation of Roof Top Solar PV Plant of Capacity **75 kWp.**

Photograph of Solar Thermal Water Heating System:

6.2 Energy Efficiency Projects Implemented:

1. Usage of Energy Efficient LED Light Fittings
2. Usage of BEE STAR Rated Equipment
3. Sensor based operation of Water Pumping Operation in Hostel Blocks

A RAPID IMPACT ASSESSMENT OF THE PROPOSED ROAD ON THE AVIFAUNA OF THE LAW COLLEGE HILL COMPLEX, PUNE

KAUSTUBH MOGHE
SANJAY THAKUR

OCTOBER 2000

ECOLOGICAL SOCIETY
PUNE 8

A RAPID ASSESSMENT OF THE IMPACT OF THE PROPOSED ROAD ON THE AVIFAUNA OF THE LAW COLLEGE HILL COMPLEX, PUNE CITY.

Introduction

Pune or Poona is one of the major cities in India, with an area of about 700 sq. km. It is located on the Deccan Plateau at a height of 560 m above mean sea level. The city of Pune has spread in the flood plains of rivers the Mula and the Mutha. These flood plains also known as Pune Plains are surrounded by low hill ranges in all directions except the eastern side which is comparatively flat and open. During the British colonial rule Pune rose to importance as an important military and administrative station thanks to its pleasant climate. The moderate yearly rainfall of 700mm made the city monsoon capital of the then Bombay Presidency

The city still appears green when seen from an elevation but its green surroundings are no longer there. Now there are very few green patches left outside and within the city limits. Noteworthy of these are Katraj valley and Sinhgad Valley on its outskirts and Pachgaon Parvati, Law College Hill complex and *Khandoba hill* within city limits.

These patches are threatened due to growing population and development pressures. These hill tops and hill slopes are important because they provide necessary habitats for the remaining flora and fauna in and around the city of Pune. Some of these hills are also declared as Forest Parks (*Van Vihar*) viz. Pachgaon Parvati *Van Vihar and* Bhambhurda *Van Vihar* (Part of Law College Hill and Vetal Hill) Many citizens of Pune from all age groups use these hills for exercise and for morning and evening walks Moreover, the Law College hill complex is extensively used by bird watchers and students of Ecological Society for their field practicals. These open spaces are very important for they are the sources of clean and fresh air and can be called lungs of the city.

The forests on Pachgaon Parvati and Law College hill complex are man-made but in the last few years natural regeneration of indigenous plants has taken place on a good scale Now one could see mixed forest patches on these hill tops and hill slopes. *Khandoba hill* near Chandani Chowk on the way to National Defence Academy still has better forest cover than all the existing forest patches within the city limits and it harbours a great deal of plant diversity and biodiversity in general.

The Law College Hill Complex

Among the green areas of Pune the Law College hill and surrounds are prominent as a large green belt. This green belt extends to the Vetal hill to its North-west and Maharashtra Institute of Technology (MIT) and Automobile Research Institute of India (ARAI) to its west. This hill complex with a general North - South direction is clothed with dry deciduous vegetation in various stages of use and protection.

The history of afforestation programmes of this area goes to back to 1930s Afforestation programme on the Vetal and Law College hill was undertaken by many workers. The most prominent amongst them were Late Prin J.R Gharpure of Law College and well known botanist Shri. H.P. Paranjapye. Due to their untiring efforts this hill complex today remains substantially green. This work was carried out in the 1930s and 1940s of the last century Land development, soil cover development, watering of trees, selection of suitable species and their cultivation etc. were meticulously undertaken. Most importantly the entire landscape was protected from cattle, trespassers etc. Subsequently in the 1980s and 90s the Maharashtra State Forest Department's Social Forestry wing carried out plantation programmes for some years. In this manner a large part of the hills was planted with various trees. As a result today one can see extensive green tree cover on the hill top and hill slopes. This green cover prevents soil erosion and helps soil to absorb more water. It maintains the balance of the ecosystem and forms very good refuge for birds and small wildlife This area is significant as it is one of the important constituents of Bhambhurda *Van Vihar*.

In the past the vegetation of this hill complex appears to consist of shrubs, such as *Fluggea, Carissa, Lantana, ziziphus* etc. The tree cover consists of species of *Accacia, Annogeissus, Dalbergia, Butea, Cochlospermun, Boswellia, Madhuca indica*, etc The Forest Department had carried out an extensive plantation of *Glirisidia sepium*.

There are mainly seven different habitats that cover the Law College hill complex. These are as follows:

1. Open woodland - Eastern slopes of the hill
2. Closed woodland - Eastern slope of the hill.
3. Scrub Plateau between MIT side and North of Maruti temple and Vetal temple.
4. Plantation - Slopes behind the Law College and between two Maruti Temples
5. Moist Deciduous Forest - behind Patrakar Nagar side and the Sheep farm
6. Dry grass land - Plateau on North side and
7. Quarry -to the north-west of Law College hill.

Therefore, based on the existing habitat pattern the hill complex was divided into five parts for observation purposes Following are the parts in which observations were carried out:

a The undulating land behind Law College through which the proposed road will pass.
b. The steeper hill slope above the alignment of the proposed road
c. Plateau between two Maruti temples - one towards the south and another towards the north.
d. Slopes overlooking the MIT campus.
e Slopes behind Patrakarnagar and the Sheep farm

Detailed Description of various Habitats Types of the Law College Hill Complex

1. *Open Woodland*

Eastern slopes of the Law College Hill are covered by open woodland. Glirisidia, *Lannea coromandelica* (Moi). *Morinda tomentosa* (Bartondi), *Azadirachta indica, Gmelina arborea* and *Santalum album* (Sandalwood tree) trees are some of the characteristic species of this habitat This vegetation is a mixture of original floristic elements such as *A. catechu* (Khair). *A leucophloea* (Hivar), *A. nilotica* (Babhul). *Azadirachta indica* (Neem), *Morinda tomentosa* (Bartondi). etc and introduced species such as *Glirisidia sepium* and *Leucaena leucochloea* (Subabhul)

2. *Closed Woodland*

Adjacent to open woodland area is the closed woodland. Commonly recorded tree species are *A. catechu* (Khair). *A. leucophloea* (Hivar), *Santalum album* (Sandalwood tree), *Tecoma undulata, Azadirachta indica* (Neem), *Boswellia serrata* etc. along with the introduced *Glirisidia Sepium* and *L. leucophloea* (Subabhul). *Acacia spp.* and *Ziziphus spp., Lantana* etc. are the shrubs found in this habitat This area also has good natural regeneration

The proposed road which passes through the Law College campus cuts through these two habitats. As such the proposed road will affect these habitats the most

3. *Dry Deciduous Forest*

The slopes overlooking MIT campus and ARAI building has dry deciduous forest At places this forest is interspersed with plantations. *A. catechu, A. leucophloea. A. nilotica, Dolchandrone falcata* (Medshingi) *Grewia tiliifolia*

(Dhaman), *Ziziphus spp*., *Albezia procera* etc are the common trees in this habitat. *Asparagus spp., Lantana, Fluggia*, and at places saplings of *Accacia spp.* form the ground cover in this habitat.

Most of the area except the plantation area has good natural regeneration. In plantation area there is occasional presence of *M. tomentosa* (Barlondi), *A. catechu* (Khair), *A. leucophlcea* (Hivar) *Dolchandrone falcata* (Medshingi) etc

4. Scrub

A major part of the Law College Hill complex is constituted by the huge plateau that extends from Maruti temple on the southern side of the hill to Maruti temple on the northern side. This plateau is an important habitat type as it has seasonal grassland and scrub kind of vegetation. This area has mainly thorny bushes such as *Ziziphus spp., Carissa, Fluggia, Accacia spp.* etc. *Butea monosperma. Dolchandrone falcata* (Medshingi), *A leucophloea* etc. are also present occasionally. Some of the part of the plateau is also covered with plantations of *G. sepium*.

5. Moist Deciduous Forest

The slopes behind Patrakar Nagar and the Sheep Farm side of the Law College hill complex are covered with a moist deciduous forest. The assemblage of tree species here is therefore, different from that of the other habitats. Trees such as *Tectona grandis, Anogeissus latifolia, T. tomentosa, Bombax ceiba, Madhuca indica* represent the moist elements. Apart from these trees there is presence of *D. melanoxylon, G. sepium* etc which are introduced species.

6. Plantations

Afforestation and plantation programmes on the Law College hill complex were conducted by many government, non government organisations and individuals for the last 20 years. In 1980s and 90s the Social Forestry wing of the Maharashtra State Forest Department undertook plantation programme in which they planted *G sepium, L. leucochloea, Eucalyptus spp.* etc. The recent plantation programme includes indigenous species such as *T. grandis, Shiwan, P. pinnata, D. sisoo, C. fistula, Bauhunia spp., Phylanthus emblica* etc These plantations give the Law College hill a green appearance. In this hill complex plantations form a part of each of these habitats.
In some areas even in plantations the natural regeneration has been noteworthy. Such areas has a good vegetation diversity.

7. Quarry

Northernmost of the hill complex has a stone quarry. Because of quarrying activity there are lot of uneven places These places has given rise to lot of puddles and ponds by collection of rainwater. These ponds and puddles attract lot of aquatic birds.

The quarry is devoid of any woody plants but has lot of herbaceous cover. This entire quarried area is in early stage of succession. There is occasional presence of ground orchids such as *Habenarium spp.* in this area In the surrounding area of the quarry there is plantation of *G. sepium* and at places *L. leucophloea*.

The Impacts of the Proposed Road on the Law College Hill Complex

The road construction projects have many impacts in a number of areas. the most noteworthy of which are aesthetic, air quality, circulation. traffic patterns, noise, socio-economics and wildlife to name a few The road construction may stimulate or induce other actions (secondary impacts, such as more rapid land development or changed land-use pattern or changed pattern of social and economic activities. The impacts associated with secondary actions and due to these secondary actions are more substantial than the primary impacts, e.g. the impacts of road construction may be less than that of the impacts due to infrastructure created for the road construction.

Air quality impacts. Air quality impacts include 1. Dust or particulate matter on vegetation and on the structures around the construction site. 2. Vehicular exhaust coating vegetation and other structures and pollution of air in an unpolluted area due to increased exhaust emissions. fumes etc.

Noise Impact. Noise impact generally involves the area within sound of traffic It affects most when places are sensitive to any noise Such places include educational or cultural institutions. In this case the proposed road site is very close to the teaching area and hostels of the Law College.

Socio-economic Impacts. Socio-economic impacts include removal of residential areas, loss of unique sites of cultural and social importance and loss of recreational lands.

Impact on Biodiversity. The impact of road construction on biodiversity is of great concern Such projects always come up at the cost of biodiversity. The impacts generally include loss of unique green areas, loss of wildlife habitat or division of wildlife habitat/ range Many times roads through wilderness areas affect migration patterns of animals, both small and big. The roadkills of smaller

animals mainly snakes, frogs etc. is also another issue associated with the roads in wilderness areas.

Aesthetic Impacts. Impact on aesthetics include, (i) blocking of landmarks from community areas; (ii) blocking of viewline, visual distraction in recreational and residential areas and (iii) unattractive contrast between existing vegetation, natural landscape and engineering features of the road.

The Law College hill complex is a unique area in many ways. It is one of the last remaining green belts in the city of Pune. Moreover, citizens of all age groups use this area for exercise, morning walk, and other recreational activities. This is their only escape from stressed city life. So the Law College hill complex is not only important from the conservation point of view but also it is a social need of the citizens of Pune city. Therefore, in this urban context conserving such areas is of utmost importance. The proposed road will disturb the present flora and fauna of the hill complex. Joshi, et. al. (1992) has reported loss of over 30 plant species from this area in the last 70 years. The rate of loss of species may accelerate due to the proposed road as there will be increased biotic interference in this area.

THE IMPACT OF THE PROPOSED ROAD ON BIRDLIFE

As mentioned earlier, there are seven different habitat types present on Law College Hill Complex. Based on existing habitat pattern the hill complex was divided into five different parts. The following table shows the various parts of the hill covering different habitats and number of species present in each part.

No.	Description of various Parts of the hill complex.	Habitats covered	No. of Bird species
1.	Undulating land behind law Coll. (Proposed road site)	Open woodland and Closed woodland	39
2.	Steeper slopes above the site of proposed road.	Plantation, Closed wood land.	34
3	The plateau	Scrub, Plantation	36
4	Slopes overlooking MIT/ ARAI	Dry deciduous forest, Plantation	25
5	Slopes behind Patrakar Nagar and Sheep Farm	Moist deciduous Forest	32

A survey was conducted to record the diversity of the avifauna in different parts of the hill complex covering various habitats. The results are discussed below. It gives an idea of the birdlife and the species diversity recorded in each part

Part 1. Part 1 of the Law College Hill complex covers two habitats viz. Open woodland and Closed woodland and some part of plantations. The typical birds of these habitats are Coppersmith Barbet, Greater Coucal, Spotted Owlet, Jungle Crow, Great Tit, Common Iora, Plain Prinia and Common Tailor Bird. 39 bird species were recorded in these habitats.

Part 2. Part 2 of the Law College Hill complex covers plantation and dry deciduous vegetation on the slopes. 34 different species of birds were recorded here. Common Hawk Cuckoo, Shikra, Tickel's Blue Flycatcher, Dusky Crag Martin, Red-vented Bulbul, Plain Prinia, Thick-billed Flower-pecker, Purple Sunbird Common Wood Shrike are some of the birds that represent this habitat.

Part 3. Part 3 is the plateau which covers an area between two Maruti Temples, one on the Southern side and one on the Northern side. It covers scrub - thorny bushy vegetation and plantation on one side. The second largest diversity of the bird species was recorded in this area. Painted Francolin, Grey Francolin, House swift, Laughing Dove, Indian Robin, Common Myna, Large Grey Babbler, Ashy Crowned Sparrow Lark, Streak-throated Swallow were recorded in this part.

Part 4. Part 4 of the Law College hill complex covers the slopes overlooking the MIT and ARAI campuses. It is largely dry deciduous forest and plantation on one side. The number of birds recorded here are 25 The important species among these are Indian Pea Fowl, Black Kite, Grey Breasted Prinia, Green Bee eater. Some common species are House Sparrow, House Crow, Purple-rumped Sunbird, Red vented Bulbul etc

Part 5. Part 5 is the area covering slopes behind Patrakar Nagar and Sheep Farm. This area has moist deciduous forest 32 different bird species were recorded in this habitat Some of the important birds found here are Indian Pea Fowl, Common Hawk Cuckoo, Rose ringed Parakeet, Jungle Prinia, Pale- billed Flower pecker, Oriental White-eye.

Also see annex for the complete checklist and partwise birdlist.

The number of recorded birds show that the part through which the road will pass harbours the highest number of species. Most of them will disappear if the road becomes a reality The next highest diversity was recorded on the hill slopes adjacent to the part through which the road will pass The road construction involving excavation, removal of rocks and soil from the hill slope will result in great disturbance to the existing forest on these slopes. The consequence will be disappearance of most of the species of the birds including India's national bird, Peacock or Pea Fowl.

The proposed road will therefore, involve a substantial removal of a vital green part of the city, destruction of biodiversity and reduction in public amenities that help to improve the quality of our urban life.

ACKNOWLEDGEMENT

We wish to express our gratitude to the management of the ILS Law College for sponsoring this investigation and for giving us all the facilities in their campus for carrying it out. Thanks are also due to Kalpavriksha for their advice.

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APPENDIX I

LISTS OF BIRDS OBSERVED IN DIFFERENT PARTS OF THE HILLCOMPLEX

Part I : Part through which the proposed road will pass

Painted francolin(Francolinus pictus) Rock bush quail(Perdicula argoondah)
Coppersmith barbet(Megalaima haemacephala)
Indian grey hornbill(Ocyceres birostris)
White-throated kingfisher(Halcyon smyrnensis) Green bee-eater(Merops orientalis)
Asian koel(eudynamys scolopacea) Greater coucal(Centropus sinensis)
Rose-ringed parakeet(Psittacula krameri) Spotted owlet(Athene brama)
Rock pigeon(Columba livia) Laughing dove(Streptopelia senegalensis)
Black kite(Milvus migrans) Shikra(Accipiter badius)
Long-tailed shrike(Lanius schach) House crow(Corvus splendens)
Large-billed crow(Corvus macrorhynchos) Small minivet(Pericrocotus cinnamomeus)
White-throated fantail(Rhipidura albicollis) Common iora(Aegithina tiphia)
Oriental magpie robin(Copsychus saularis) Indian robin(Saxicoloides fulicata)
Brahminy starling(Sturnus pagodarum) Common Myna(Acridotheres tristis)
Great tit(Parus major) Red-vented bulbul(Pycnonotus cafer)
Plain prinia(Prinia inornata) Ashy prinia(Prinia socialis)
Common tailor bird(Orthotmus sutorius) Yellow-eyed babbler(Chrysomma sinense)
Large grey babbler(Turdoides malcolmi)
Pale-billed flowerpecker(dicaeum erythrorhynchos)
Purple-rumped sunbird(Nectarinia zeylonica) Purple sunbird(Nectarinia asiatica)
House sparrow(Passer domesticus) Scaly-breasted munia(Lonchura punctulata)
Oriental white-eye(Zosterops palpebrosa) Black drongo(Dicrurus macrocercus)
Grey-breasted prinia(Prinia hodgsonii)
Greenish warbler(Phylloscopus trochiloides)
Common chiffchaff(Phylloscopus collybita)

Part II : Hill Slope behind Law College

Painted francolin(Francolinus pictus) Rock bush quail(Perdicula argoondah)
Coppersmith barbet(Megalaima haemacephala)
Green bee-eater(Merops orientalis) Common hawk-cuckoo(Hierococcyx varius)
Plaintive cuckoo(Cacomantis merulinus) Asian koel(Eudynamys scolopacea)
Greater coucal(Centropus sinensis) House swift(Apus affinis)
Laughing dove(Streptopelia senegalensis) Spotted dove(Streptopelia chinensis)
Shikra(Accipiter badius) Large-billed crow(Corvus macrorhynchos)
Small minivet(Pericrocotus cinnamomeus)
Tickell's blue flycatcher(Cyornis tickelliae) Indian robin(Saxicoloides fulicata)
Brahminy starling(Sturnus pagodarum) Common myna(acridotheres tristis)
Jungle myna(Acridotheres fuscus) Great tit(Parus major)
Dusky crag martin(Hirundo concolor) Red-vented bulbul(Pycnonotus cafer)
Grey-breasted prinia(Prinia hodgsonii) Jungle prinia(Prinia sylvatica)
Ashy prinia(Prinia socialis) Plain prinia(Prinia inornata)

Common tailor bird(Orthotomus sutorius) Large grey babbler(Turdoides malcolmi)
Thick-billed flowerpecker(Dicaeum agile)
Pale-billed flowerpecker(Dicaeum erythrorhynchos)
Plain flowerpecker(dicaeum concolor) Purple sunbird(Nectarinia asiatica)
Oriental white-eye(Zosterops palpebrosa)
Common wood shrike(Tephrodornis pondicerianus)
Asian Paradise Flycatcher(Terpsiphone paradisi)

Part II : Hill Top between two Maruti Temples including the quarry

Painted francolin(Francolinus pictus) Grey francolin(Francolinus pondicerianus)
Yellow-crowned woodpecker(Dendrocopos mahrattensis)
White-throated kingfisher(Halcyon smyrnensis)
Asian koel(Eydynamys scolopacea) House swift(Apus affinis)
Rock pigeon(Columba livia) Laughing dove(Streptopelia senegalensis)
Spot-billed duck(Anas poecilorhyncha) Indian peafowl(Pavo cristatus)
Common hawk-cuckoo(Hierococcyx varius)
Common sandpiper(Tringa hypoleucos) Red-wattled lapwing(Vanellus indicus)
River tern(Sterna aurantia) Black kite(Milvus migrans)
Shikra(Accipiter badius) Large-billed crow(Corvus macrorhynchos)
Small minivet(Pericrocotus cinnamomeus) Indian robin(Saxicoloides fulicata)
Common myna(Acridotheres tristis) Great tit(Parus major)
Dusky crag martin(Hirundo concolor) Red-vented bulbul(Pycnonotus cafer)
Plain prinia(Prinia inornata) Ashy prinia(Prinia socialis)
Large grey babbler(Turdoides malcolmi) Indian bush lark(Mirafra erythroptera)
Ashy-crowned sparrow lark(Eremopterix grisea)
Thick-billed flowerpecker(Dicaeum agile)
Purple-rumped sunbird(Nectarinia zeylonica) Purple sunbird(Nectarinia asiatica)
House sparrow(Passer domesticus)
White-browed wagtail(Motacilla maderaspatensis)
Oriental white-eye(Zosterops palpebrosa) Red-rumped swallow(Hirundo daurica)
Black drongo(Dicrurus macrocercus)

Part IV : Hill-slope towards MIT

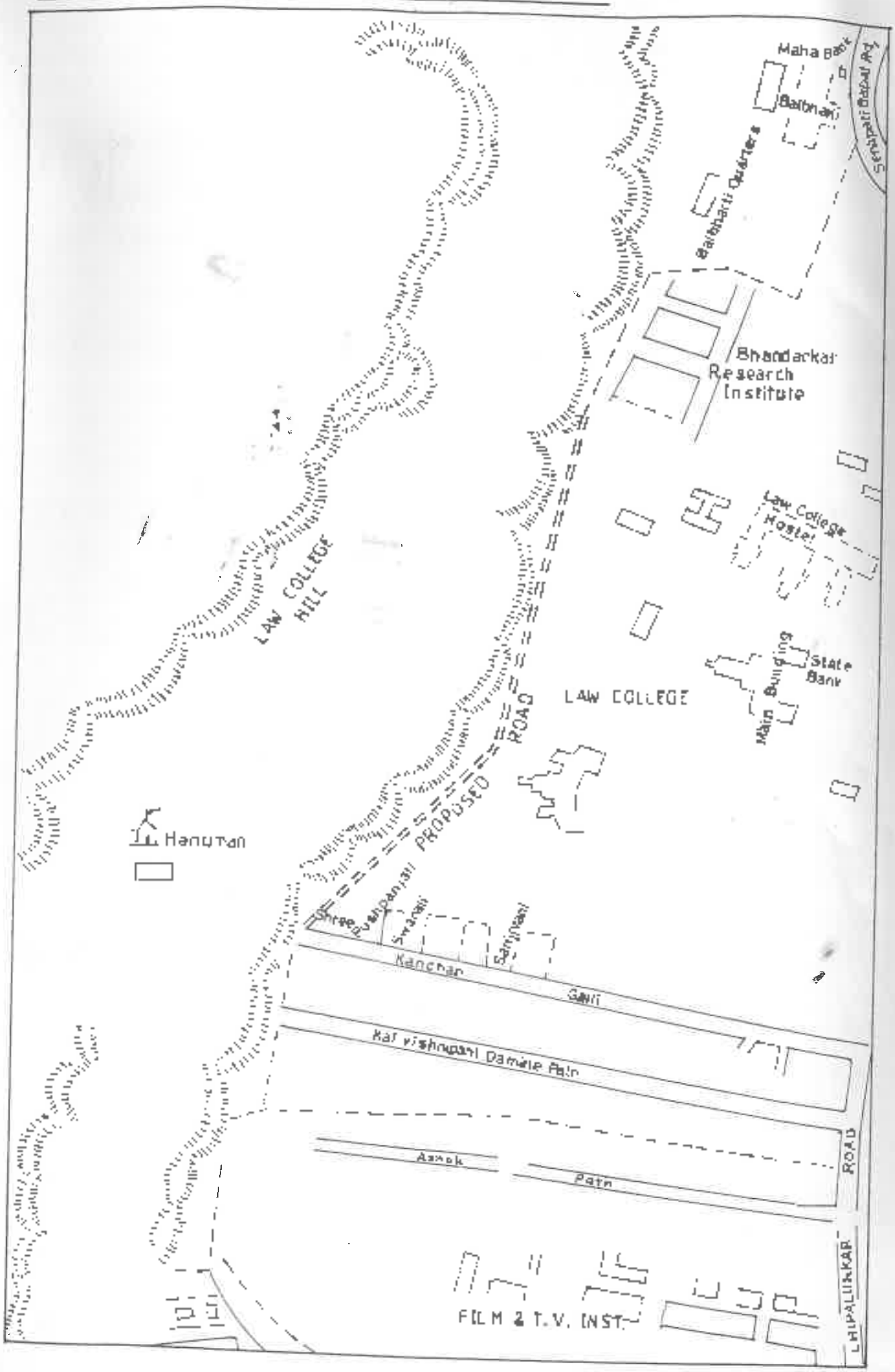
Painted francolin(Francolinus pictus) Grey francolin(Francolinus pondicerianus)
Indian peafowl(Pavo cristatus) Green bee-eater(Merops orientalis)
Common hawk-cuckoo(Hierococcyx varius)
Plaintive cuckoo(Cacomantis merulinus) House swift(Apus affinis)
Rock pigeon(Columba livia) Laughing dove(Streptopelia senegalensis)
Black kite(Milvus migrans) Long-tailed shrike(Lanius schach)
House crow(Corvus splendens) Long-billed crow(Corvus macrorhynchos)
Indian robin(Saxicoloides fulicata) Common myna(Acridotheres tristis)
Great tit(Parus major) Dusky crag martin(Hirundo concolor)
Red-vented bulbul(Pycnonotus cafer) Grey-breasted prinia(Prinia hodgsonii)
Ashy prinia(Prinia socialis) Large grey babbler(Turdoides malcolmii)
Thick-billed flowerpecker(Dicaeum agile)

Plain flowerpecker(Dicaeum concolor)
Purple-rumped sunbird(Nectarinia zeylonica)
House sparrow(Passer domesticus)
Common kestrel(Falco tinnunculus)
Green sandpiper(Tringa ochropus)
Common sandpiper(Actitis hypoleucos)
Little grebe(Tachybaptus ruficollis) Indian pond heron(Ardeola grayii)
Blue rock thrush(Monticola solitarius)

Part V . Hill-slopes behind Patrakar Bhavan

Painted francolin(Francolinus pictus) Grey francolin(Francolinus pondicerianus)
Indian peafowl(Pavo cristatus) Coppersmith barbet(Megalaima haemacephala)
Common hawk-cuckoo(Hierococcyx varius) Asian koel(Eudynamys scolopacea)
Greater coucal(Centropus sinensis) Rose-ringed parakeet(Psittacula krameri)
Rock pigeon(Columba livia) Laughing dove(Streptopelia senegalensis)
Black kite(Milvus migrans) Long-tailed shrike(Lanius schach)
Large-billed crow(Corvus macrorhynchos)
Small minivet(Pericrocotus cinnamomeus) Indian robin(Saxicoloides fulicata)
Common myna(Acridotheres tristis) Jungle myna(Acridotheres fuscus)
Great tit(Parus major) Dusky crag martin(Hirundo concolor)
Red-vented bulbul(Pycnonotus cafer) Grey-breasted prinia(Prinia hodgsoni)
Jungle prinia(Prinia sylvatica) Plain prinia(Prinia inornata)
Ashy prinia(Prinia socialis) Common tailor bird(Orthotomus sutorius)
Large grey babbler(Turdoides malcolmii)
Pale-billed flowerpecker(Dicaeum erythrorhynchos)
Purple-rumped sunbird(Nectarinia zeylonica)
Purple sunbird(Nectarinia asiatica) House sparrow(Passer domesticus)
Oriental white-eye(Zosterops palpebrosa)

Sketch Map of the Location of Proposed Road



SURVEY OF FLOWERING PLANT DIVERSITY OF ILS LAW COLLEGE HILL AND CAMPUS

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SURVEY OF FLOWERING PLANT DIVERSITY OF ILS LAW COLLEGE HILL AND CAMPUS

INTRODUCTION

Pune is located at 560 m above sea level on the western margin of the Deccan plateau. On the western side of the city, lies the mountain chain of Western Ghats, one of the global 35 biodiversity hot spots. Sinhagad- Katraj- Dive Ghat- Bhuleshwar hill range is western spur of Western Ghats, towards the north of which Pune city is located. There are many hills and hillocks in and around the city. Vetal hill, which is named after a temple of *Vetal* located at the top, includes Chatushringi hill and Fergusson college hill. The highest point within the city limits lies on Vetal hill with an elevation of 790 meter.

Pune has a semi- arid climate with average temperatures ranging between 19 to 33 °C. It has marked three seasons namely summer, winter and rains. The rains are mostly concentrated during June to October. The rest of the year is a dry period with few pre monsoon showers in April and May. The climate of the city is conducive for growth of dry deciduous type. Since the area is located on transit or zone between semi evergreen-evergreen forests of Western Ghats and thorny scrub forests of Deccan plateau, the region shows mix of evergreen and thorny species in addition to its original dry deciduous elements. The Law college hill which is a part of Vetal hill complex also shelters typical dry deciduous forests, with a few mixed elements. The law college hill and campus was surveyed on request of authorities of Law College with major objective to document present floristic diversity of the area including native and non-native diversity growing in all life forms.

LOCATION

Law college campus is located at the base Vetal Hill. The hill under jurisdiction of ILS law college (refereed hereafter as Law college hill) and campus together are placed in between 18.514475 and 18.523255 north latitude and 73.817032 and 73.829380 East longitude. A good vegetation patch is located between the hill and the campus which has mainly introduced and planted species with some indigenous elements. The reforestation of Law College was systematically planned and executed under the leadership of JR Gharpure, then Principal, ILS Law college and botanist Haribhau Paranjape six to seven decades back. The plantation program underwent for almost 8 years. The plantation, which was protected from grazing and trace passers, has flourished well in subsequent years. In the present condition, the vegetation is thriving well. Under the program of greening of law college campus, many species of indigenous and exotic trees were introduced.

EARLIER SURVEY BY ARI

Agharkar Research Institute undertook the work on study of vegetation of Law college hill and campus in the year 2000 at the instance of ILS Law college authorities. The report gives list of 399 species belonging to 290 genera and 80 families. That report was based on observations done in February 2000. However, the report also includes species growing in all seasons based on published literature like Joshi et al. (1992) and Joshi & Kumaho kar (1997).

METHODS FOR THE PRESENT WORK

The present survey was conducted in July 2017. For the sake of convenience, the total area was broadly divided into four zones viz. Eastern slope, western slope, Hill top and base of the hill. The details of each zone are as follows

- **Base of the hill** (referred as **BS** in appendix 1) There is good patch of vegetation located between the hill and law college campus. The northern boundary for this forest patch is Bhandarkar Institute campus and southern boundary is Kanchan lane.
- **Eastern slope (ES)**: Eastern slope has typical dry deciduous vegetation which is characteristic of vegetation of hills around Pune city. Small open patches shelter good monsoon ephemerals and other annual plants
- **Hill top (HT)** Hill top has many indigenous deciduous tall growing trees. There are two to three major open areas which shelter growth of grasses and other herbs.
- **Western slope (WS)**: This slope is slightly disturbed as compared to eastern slopes. It is located between ARAI approach road and M Y college campus.

During the survey in each of these zones, efforts were made to cover maximum possible area. A checklist of plants was recorded in field based on observation of plants. Plants were identified in the field following Cooke (1903–1908), Lakshminarasimhan (1996) Singh & Karthikeyan (2000), Singh et al. (2001). Unidentified specimens were collected for identification and were confirmed in the lab by comparison with authentic specimens deposited in Agharkar Research Institute herbarium (AHMA). Comprehensive lists of plants were prepared based on these surveys, which are provided in Appendix 1 (list of plants from the hill) and Appendix 2 (list of plants from the campus). The plant names are as per The plant list (www.theplantlist.org, 2014).

DISCUSSION

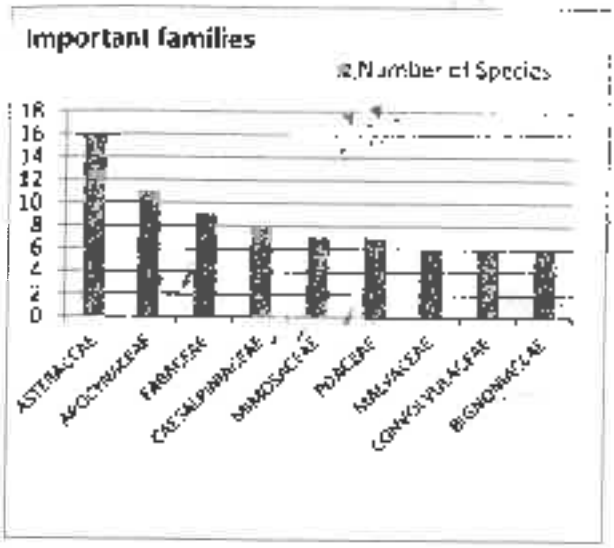
A. Vegetation

The major vegetation on ILS law college hill is dry deciduous type with dominance of *Boswellia serrata*, *Lannea coromandelica* and *Cochlospermum religiosum*, which are peculiarity of forests in Pune and surroundings. Tree species like *Gliricidia sepium* and *Eucalyptus globulus*

are introduced by forest department for the purpose of greening of hill's Species like *Dalbergia melanoxylon* which were introduced by British people in Pune university campus which was the governor bungalow that time, has ran as escape and now surviving well on law college hill.

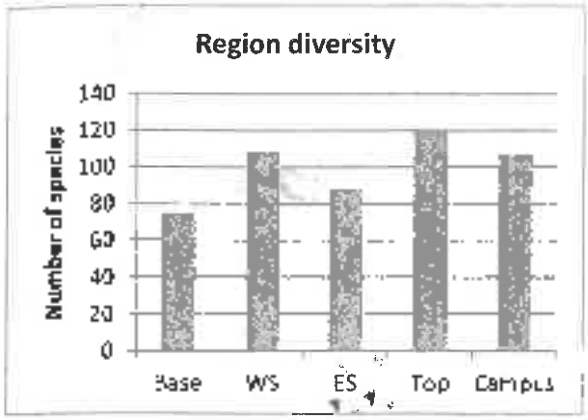
B. Floristic analysis

Since the present survey was conducted in early monsoon, **only trees, shrubs and some early flowering herbs were only documented** The late monsoon flowering species including grasses and sedges are missing from the list.

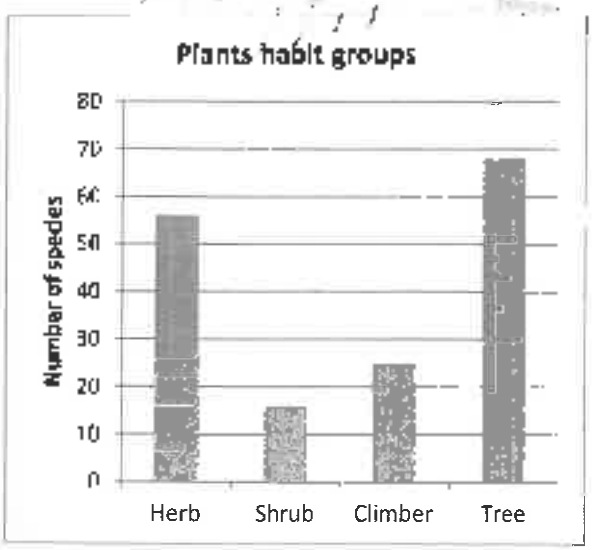


Graph 1: Dominant plant families in ILS Law college hill

The present survey documents 165 species of flowering plants. Asteraceae is dominant family followed by Apocyanceae and Fabaceae (Graph 1) Since the plants were documented in early monsoon, the trees dominate the list followed by herbs, climbers and shrubs (Graph 3). Tree blooming is characteristic of summer hence many trees recorded during the surveys were based on vegetative identification. However late blooming species like *Dalichandrone falcate* (Medshing) was in bloom and monsoon blooming *Tectona grandis* was also seen in flowering condition All the herbs documented during the survey were wither early blooming annual herbs or monsoon ephemerals.



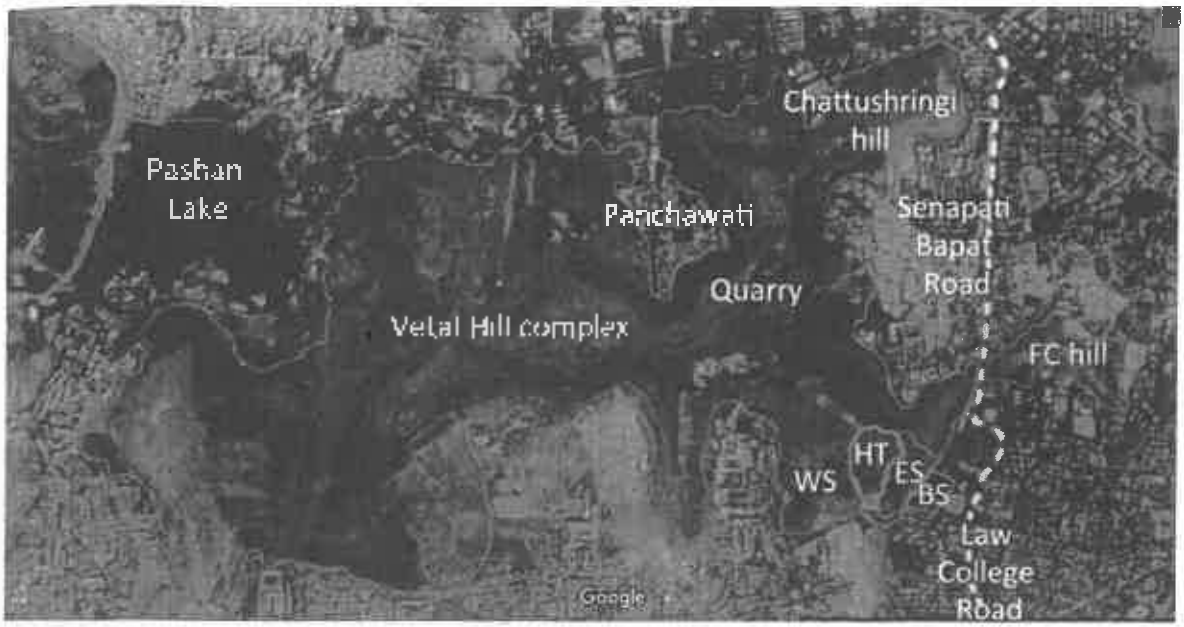
Graph 2: Plant species distribution in various zones in ILS law college campus and law college hill.



Graph 3: Plants as per various habit groups on law college hill.

Hill top region has more species comparted to western and eastern slopes and base (Graph 2). Species recorded in the campus are trees in majority and includes many introduced exotic elements. A tree named *Schleichera oleosa* is uniqueness of the campus. This tree species though common in and around Pune, not frequently seen in city area.

C. Importance of the area



Map 1: Vetal hill complex and area under survey. WS, HT, ES and BS refer to western slope, hill top, Eastern slope and base of the hill respectively.

The presently surveyed Law college hill is one of the fragment of vegetation that exists in and around Pune. Region surrounding Pune shelters dry deciduous type of vegetation. The city area is surrounded by many hills like Parvati, Vetal-Hanuman hill chain, Pachgaon- Parvati, Range hills, NDA hills which act as the green corridors of the city (Joshi *et al.*, 1994). They contain variety of habitats like open scrublands, rocky, marshy, aquatic supporting various species. Floristic explorations on Vetal hill by Joshi & Kumbhijkar (1997), Joshi *et al.* (1992) have reported occurrence of 416 species belonging to 101 families. Species like *Anogeissus latifolia, Gliricidia sepium, Dalbergia lanceolaria, Dalichandrone falcata* are common there with many ephemeral plants occurring during the monsoon. Four hundred nine species of plants have been reported from Pachgaon Parvati hills along with many animal species. On the southern boundary lies the Katraj Ghat which is floristically well studied by earlier (Datar & Ghate, 2006). Around 645 plant species have been reported from this area. The dominant tree community is *Boswellia- Sterculia-Lannea- Cochlospermum* (Datar & Ghate, 2006). There are many forts around the city, Sinhagad being the nearest one. The valleys of the forts contains a typical moist deciduous type of vegetation with species like *Tectona grandis, Anogeissus latifolia, Kydia calycina, Terminalia chebula* etc. with some evergreen elements. The western boundary of the city (Taluka- Mulshi) is a newly declared sanctuary containing moist deciduous forests with some evergreen elements. All these forest patches are presently disconnected with each other and there is no corridor

existing between them for migration of animals. Amongst all these only vetal hill complex is one such area which is spread widely and various hills in this complex are connected to each other There is proposed road which will pass between hill and ILS Law college campus. Fragmentation of such area by activities like road construction will not only hamper the vegetation form the region where the road is proposed but also affect the overall ecosystem of the entire hill complex. Disturbance of the flora will ultimately affect the fauna of the area. The road will also affect the corridor for species migration.

D. **Rare and threatened elements of the area**

The Law college hill has one rare and endangered species named ***Jatropha nana* Dalzell & A. Gibson**. The species is named as nana due to its stunted habit. The species is rare and threatened and only known from India. The species is included in International Union of Conservation of Nature's (IUCN) list of threatened plants across the globe. (http://www.iucnredlist.org/details/88425992/0)

Endemic and threatened *Jatropha nana* Dalzell & A. Gibson from Law College hill.

This species was assessed regionally as Near Threatened (Tetali *et al.* 1998) and later as Endangered (Mishra and Singh 2001) when it was considered endemic to Maharashtra state. In Maharashtra the species is only restricted to hills around Pune city. The known locations of the species are Bowdhan, Chatushringi hill, Ghodnadi, Katraj, Parvati and Pethghat. Recently the species has been collected from West Bengal, Bihar and Jharkhand extending its range of distribution. However the species population are still under threat and IUCN recommends its conservation. In Pune and surroundings the distribution of the species is sporadic and is under severe threat. **A population of few individuals of this species was found on the top plateau of Law college hill.** Even IUCN threat assessment page of the species mentions its occurrence from Law college hill. This is based on studied done by Nerlekar (2015).

IUCN's comments on the species are as below

"*Jatropha nana* is threatened primarily due to plantation/afforestation activities at the largest subpopulation (around Pune), invasive species and habitat degradation due to various factors. The inability of the citizens, planters and managers to view plantation and allied activities as a threat is itself the greatest challenge for conservation of this species. Thus, *J. nana* is assessed as vulnerable at present because of its limited area of occupancy (AOO) of 96 km^2, occurrence at eight locations, and the continuing decline in the area, extent and quality of habitat and number of mature individuals"

As per IUCN the total estimated population within Pune city is 650-700 mature individuals which is the largest subpopulation recorded to date for this species. Estimates of other localities apart from the ones provided above, are not available but are speculated to be smaller than the Pune subpopulation. Thus it is unknown if the population is severely fragmented or not.

It can be summarized that conservation of this species is highly essential in light of increased human interference on hill around Pune. Strict protection of the hill will conserve the species.

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APPENDIX 1: LIST OF SPECIES

Sr. No	Family	Species Name	Local Name	Habit	Distribution in various zone #
1	ANNONACEAE	**Annona squamosa** L.	सीताफळ	Tree	BS, WS
2		**Miliusa tomentosa** (Roxb.) J.Sinclair		Tree	BS
3		**Polyalthia longifolia** (Sonn.) Thwaites	खोटा अशोक	Tree	WS, HT
4	MENISPERMACEAE	**Cocculus hirsutus** (L.) Diels	वासन वेल	Climber	WS, ES, HT
5		**Tinospora cordifolia** (Willd.) Hook.f. & Thoms.	गुळवेल	Climber	BS, WS, ES, HT
6	CLEOMACEAE	**Cleome simplicifolia** Hook.f. & Thoms	गुलबी तीलवण	Herb	ES
7	CAPPARACEAE	**Capparis grandis** L.f.	पाचुंदा	Tree	WS, ES, HT
8	COCHLOSPERMACEAE	**Cochlospermum religiosum** (L.) Alst.	गणेर	Tree	ES, HT
9	FLACOURTIACEAE	**Flacourtia indica** (Burm.f.) Merr.		Tree	WS, ES, HT
10	POLYGALACEAE	**Polygala arvensis** Willd.		Herb	ES
11	PORTULACACEAE	**Portulaca oleracea** L.		Herb	BS, HT
12	MALVACEAE	**Bombax ceiba** L.	काटे सावर	Tree	BS, HT
13		**Grewia tiliifolia** Vah	धामण	Tree	WS, ES, HT
14		**Grewia flavescens** Juss.	खरखरी	Shrub	BS, WS, ES, HT
15		**Sida acuta** Burm.f.		Herb	WS, ES, HT
16		**Thespesia populnea** (L.) Soland	भेंड	Tree	BS
17		**Triumfetta rotundifolia** Lamk.		Herb	BS, WS, ES, HT
18	BIGNONIACEAE	**Muntingia calabura** L.	सिंगापूर चेरी	Tree	ES
19	OXALIDACEAE	**Oxalis corniculata** L.	अंबूशी	Herb	BS, ES
20	BALSAMINACEAE	**Impatiens balsamina** L	तेरड	Herb	HT
21	RUTACEAE	**Aegle marmelos** (L.) Corr.	बेल	Tree	HT

22		**Murraya koenigii** (L.) Spreng.	कढीपत्ता	Shrub	BS
23	BURSERACEAE	**Boswellia serrata** Roxb. ex Colebr.	सालई	Tree	WS, ES, HT
24	MELIACEAE	**Aphanamixis polystachya** (Wall.) R.Parker		Tree	BS
25		**Azadirachta indica** A. Juss.	कडूनिंब	Tree	WS, ES, HT
26		**Gymnosporia senegalensis** (Lam.) Loes.	हिंकळ	Shrub	WS,ES, HT
27	RHAMNACEAE	**Zizyphus mauritiana** Lamk.	बोर	Tree	BS, WS, ES, HT
28		**Zizyphus oenoplia** (L.) Mill		Shrub	ES, HT
29		**Zizyphus xylopyrus** (Retz.) Willd.	घाटबोर	Tree	BS, WS
30	VITACEAE	**Ampelocissus latifolia** (Roxb.) Planch.		Climber	WS HT
31		**Cayratia trifolia** (L.) Domin.		Climber	ES,
32		**Cissus woodrowii** (Stapf. ex Cooke) Sant	हिरनुल	Shrub	WS, ES, HT
33	ANACARDIACEAE	**Schleichera oleosa** (Lour.) Merr.	कोशिंब	Tree	BS,
34		**Lannea coromandelica** (Houtt.) Merr.	मोई	Tree	BS, WS, ES, HT
35		**Mangifera indica** L.	आंबा	Tree	BS
36	FABACEAE	**Butea monosperma** (Lamk.) Taub.	पळस	Tree	WS, ES, HT
37		**Dalbergia lanceolaria** L.f.	पाणशी	Tree	BS, WS, HT
38		**Dalbergia melanoxylon** Guill. & Perr.	पतगी	Tree	BS, WS, ES, HT
39		**Dalbergia sissoo** DC.	शिसव	Tree	HT
40		**Desmodium laxiflorum** DC.		Herb	WS, ES, HT
41		**Erythrina suberosa** Roxb.	पांगारा	Tree	ES
42		**Gliricidia sepium** (Jacq.) Kunth. ex Steud.	उंटीरनारे	Tree	BS, WS, ES, HT
43		**Pongamia pinnata** (L.) Pierre	करंज	Tree	WS, HT
44		**Vigna radiata** (L.) Wilczek	जंगली मूग	Climber	WS, ES

45	CAESALPINIACEAE	Bauhinia racemosa Lamk.	आपटा	Tree	WS, ES, HT
46		Bauhinia variegata L.	कांचन	Tree	WS, ES, HT
47		Cassia fistula L.	बहावा	Tree	BS, WS, ES, HT
48		Delonix regia (Boj ex Hook.) Raf.	गुलमोहोर	Tree	BS, WS, HT
49		Peltophorum pterocarpum (DC.) K.Heyne	सोनमोहोर	Tree	BS, WS, ES, HT
50		Senna tora (L.) Roxb.	टाकळा	Herb	WS
51		Senna uniflora (Mill.) H.S.Irwin & Barneby	विलायती टाकळा	Herb	BS, WS, FS, HT
52		Tamarindus indicus L.	चिंच	Tree	BS, WS, HT
53	MIMOSACEAE	Acacia chundra (Rottler) Willd.	खैर	Tree	BS, WS, ES, HT
54		Acacia leucophloea (Roxb.) Willd	हिवर	Tree	BS, WS, ES, HT
55		Acacia nilotica (L.) Willd	बाभूळ	Tree	BS
56		Albizia lebbeck (L.) Willd.	शिरीष	Tree	BS, HT
57		Dichrostachys cinerea (L.) Wt. & Arn.	दुरंगी बाभूळ	Shrub	BS, WS
58		Leucaena leucocephala (Lamk.) de Wit.	सुबाभूळ	Tree	BS, WS, FS, HT
59		Samanea saman (Jacq.) Merr.	रेन ट्री	Tree	HT
60	COMBRETACEAE	Anogeissus latifolia (Roxb. ex DC.) Wall	धावडा	Tree	WS, ES, HT
61		Combretum ovalifolium Roxb.		Climber	ES, HT
62	MYRTACEAE	Eucalyptus globulus Labill.	निलगिरी	Tree	WS
63		Psidium guajava L.	पेरू	Tree	WS, HT
64		Syzygium cumini (L.) Skeels	जांभूळ	Tree	HT
65	LYTHRACEAE	Lagerstroemia parviflora Roxb.		Tree	WS, HT
66	PASSIFLORACEAE	Passiflora foetida L.		Climber	BS, ES
67	CUCURBITACEAE	Mukia maderaspatana (L.) Roem.		Climber	WS

68		Solena amplexicaulis (Lamk.) Gandhi	गोमटी	Climber	ES
69	RUBIACEAE	Cerlscoides turgida (Roxb.) Tirveng.	कैंदरी	Tree	HT
70		Morinda pubescens J. E. Smith	बारतोंडी	Tree	BS, WS, ES, HT
71		Neolamarckia cadamba (Roxb.) Bosser	कदंब	Tree	HT
72	ASTERACEAE	Acanthospermum hispidum DC.		Herb	BS, HT
73		Ageratum conyzoides L.	गंधदेवी	Herb	BS
74		Bidens biternata Lour.		Herb	BS, ES
75		Blanvillea acmella L		Herb	BS, WS, ES, HT
76		Blumea lacera (Burm.f.) DC.	दुरांडी	Herb	ES, HT
77		Cosmos bipinnatus Cav	कॉसमॉस	Herb	BS, WS, ES, HT
78		Eclipta prostrata (L) L.	माका	Herb	WS, HT
79		Launaea intybacea (Jacq.) Beauverd	पाथरी	Herb	HT
80		Lagascea mollis Cav.	हारवड	Herb	HT
81		Parthenium hysterophorus L.	गाजरगवत	Herb	BS, WS, HT
82		Sonchus oleraceus L.		Herb	HT
83		Synedrella vialis (Less.) A. Gray		Herb	BS, WS, ES, HT
84		Tridax procumbens L.	एकदांडी	Herb	BS, WS, ES, HT
85		Xanthium indicum Koen	तारगा	Herb	HT
86	EBENACEAE	Diospyros malabarica (Desr.) Kostel.	गोविंदा	Tree	ES, HT
87		Diospyros melanoxylon Roxb.	टेमरुणी	Tree	WS, ES, HT
88	OLEACEAE	Jasminum malabaricum Wt.	कुसर	Shrub	ES, HT
89		Nyctanthes arbor-tristis L.	पारिजातक	Tree	BS, WS, ES, HT
90	APOCYNACEAE	Alstonia scholaris (L.) R. Br	सप्तविण	Tree	ES, HT

91		**Calotropis gigantea** (L.) R. Br.	रुई	Shrub	HT
92		**Carissa congesta** Wahl var.	करवंद	Shrub	WS HT
93		**Cascabela thevetia** (...) Lippold	बिट्टी	Tree	WS HT
94		**Ceropegia bulbosa** Roxb var. **bulbosa**		Climber	ES
95		**Ceropegia hirsuta** Wt. & Arn.	हमाण	Climber	ES
96		**Cryptolepis dubia** (Burm.f.) M.R.Almeida	कावळी	Climber	WS, ES, HT
97		**Dregea volubilis** (L.f.) Benth. ex Hook.f.	हरणडोळी	Climber	BS, WS, ES, HT
98		**Hemidesmus indicus** (...) Schult. var. **indicus**	अनंतमूळ	Climber	BS, WS, ES, HT
99		**Tylophora dalzellii** Hook.f.		Climber	BS, HT
100		**Wrightia tinctoria** R.Br.	कुडा	Tree	ES
101	BORAGINACEAE	**Cordia dichotoma** Forst	भोकर	Tree	HT
102		**Ehretia laevis** Roxb.	दलदम	Tree	BS, WS, ES, HT
103		**Trichodesma indicum** (L.) Lehm.	छोटा कल्प	Herb	BS, WS, ES, HT
104	CONVOLVULACEAE	**Argyreia cuneata** (Wild.) Ker-Gwol.	महाळुंगी	Climber	WS, HT
105		**Evolvulus alsinoides** L.	दिष्णुक्रांत	Herb	WS, HT
106		**Ipomoea eriocarpa** R. Br.		Climber	BS, WS, ES, HT
107		**Ipomoea nil** (L.) Roth.		Climber	BS
108		**Ipomoea muricata** (L.) Jacq.		Climber	BS, WS, ES, HT
109		**Rivea hypocrateriformis** Choisy	खासबेल	Climber	WS
110	BIGNONIACEAE	**Dolichandrone falcata** (Wall. ex DC.) Seem.	मेडशिंगे	Tree	WS, ES, HT
111		**Heterophragma quadriloculare** (Roxb.) K. Schum.	दारस	Tree	ES
112		**Jacaranda acutifolia** Humb. & Bonpl.	नीलमोहोर	Tree	HT

113		**Tecoma stans** (L.) Kunth.	फुटाणी	Shrub	WS, HT
114	ACANTHACEAE	**Dipteracanthus patulus** (Jacq.) Nees		Herb	WS
115		**Rostellularia diffusa** (Willd.) Nees		Herb	ES, HT
116	VERBENACEAE	**Duranta erecta** L.		Shrub	HT
117	LAMIACEAE	**Gmelina arborea** Roxb.	शिवण	Tree	BS, WS, HT
118		**Hyptis suaveolens** Poit.		Herb	WS, ES, HT
119		**Lantana camara** L. var. aculeata (L.) Mold.	घाणेरी	Shrub	BS, WS, ES, HT
120		**Lavandula bipinnata** (Roth.) O. Ktze.	पोडेन्ज	Herb	WS, ES, HT
121		**Tectona grandis** L.	साग	Tree	BS, WS, ES, HT
122	NYCTAGINACEAE	**Boerhavia diffusa** L.	पुनर्नवा	Herb	BS, WS, ES, HT
123		**Bougainvillaea spectabilis** Willd.	बोगनवेल	Shrub	WS, HT
124	AMARANTHACEAE	**Achyranthes aspera** L.	अंघाडा	Herb	BS, WS, ES, HT
125		**Alternanthera sessilis** (L.) R. Br.		Herb	BS, WS, ES, HT
126		**Chenopodium album** L.		Herb	WS, HT
127	LORANTHACEAE	**Dendrophthoe falcata** (L. f.) Ettingsh.	बांडगुळ	Parasite	HT
128	SANTALACEAE	**Osyris quadripartita** Salz. ex Decne.	वदनी	Shrub	WS, HT
129		**Santalum album** L.	चंदन	Tree	BS, WS, HT
130	PUTRANJIVACEAE	**Putranjiva roxburghii** Wall.	पुत्रंजीवा	Tree	HT
131	EUPHORBIACEAE	**Acalypha ciliata** Forssk.		Herb	BS, WS, ES, HT
132		**Euphorbia geniculata** Ortega	दुधाणी	Herb	BS, WS, ES, HT
133		**Euphorbia hirta** L.		Herb	BS, WS, ES, HT
134		**Jatropha curcas** L.	मोगली एरंड	Tree	WS
135		**Jatropha nana** Dalz.		Shrub	HT

136		**Ricinus communis** L.	एरंड	Shrub	WS, HT
137	PHYLLANTHACEAE	**Phyllanthus emblica** L.	आंवळा	Tree	WS, HT
138		**Flueggea leucopyrus** Willd	पांढरफळी	Shrub	BS, WS, ES, HT
139		**Phyllanthus maderaspatensis** ..		Herb	BS, WS, ES
140	ULMACLAE	**Holoptelea integrifolia** Planch.	वावळ	Tree	WS, HT
141		**Trema orientalis** Blume	घोळ	Tree	BS, WS
142	MORACEAE	**Ficus bengalensis** L	वड	Tree	WS, HT
143		**Ficus racemosa** L.	उंबर	Tree	BS, WS
144		**Ficus religiosa** L.	पिंपळ	Tree	WS, HT
145	HYPOXIDACEAE	**Curculigo orchioides** Gaertn.	काळी मुसळी	Herb	HT
146	AGAVACLAE	**Agave americana** L. var.	घायपात	Shrub	WS, HT
147	DIOSCORIACEAE	**Dioscorea bulbifera** L.	कारंदा	Climber	BS, WS, ES, HT
148		**Dioscorea oppositifolia** L.		Climber	WS
149		**Dioscorea pentaphylla** L.		Climber	WS
150	COLCHICACEAE	**Iphigenia indica** A. Gray		Herb	ES
151	ASPARAGACEAE	**Asparagus racemosus** Willd.	शतावरी	Climber	BS, WS, ES, HT
152		**Chlorophytum laxum** R. Br.		Herb	BS, WS, ES
153		**Drimia indica** Jessop	रानकांदा	Herb	BS, ES
154		**Ledebouria revoluta** (L.f.) Jessop	खाजकांदा	Herb	BS, WS, ES, HT
155	COMMELINACEAE	**Commelina benghalensis** L.	कैलैनी	Herb	BS, WS, ES, HT
156		**Cyanotis cristata** (L.) D.Don		Herb	BS, WS, ES, HT
157		**Cyanotis tuberosa** (Roxb.) Schult & Schult.f.		Herb	BS, WS
158	CYPERACEAE	**Kyllinga brevifolia** Rottb.		Herb	BS, WS, ES, HT
159	POACEAE	**Apluda mutica** L	पोन्ड्या	Herb	WS, HT
160		**Chloris barbata** Swartz	कोंडवेल	Herb	BS, WS, ES,

162		Cymbopogon martinii Wats.		Herb	WS, HT
152		Cynodon dactylon Pers	दूर्वा	Herb	BS, WS, ES, HT
163		Dactyloctenium aegyptium Willd.	व्हाल लोरवेल	Herb	BS, WS
164		Echinochloa colona (L.) Link		Herb	WS
165		Heteropogon contortus (L.) P. Beauv.	कुसळी	Herb	WS, ES, HT

Details of the zones: WS: western slopes; ES: Eastern slopes; BS: Base of the hill; HT: Hill top.

APPENDIX 2: LIST OF PLANT SPECIES FROM ILS LAW COLLEGE CAMPUS.

Sr.no	Family	Species Name	Local Name	Habit
1	ANNONACEAE	Annona squamosa L.	सीताफळ	Tree
2		Annona reticulata L.	रामफळ	Tree
3		Polyalthia longifolia (Sonn.) Thwaites	खोटा अशोक	Tree
4	MENISPERMACEAE	Cocculus hirsutus (L.) Diels	हारण्ड वेल	Climber
5		Tinospora cordifolia (Willd.) Hook.f. & Thoms.	गुळवेल	Climber
6	PORTULACACEAE	Portulaca oleracea L.		Herb
7	MALVACEAE	Bombax ceiba L.	काटे सावर	Tree
8		Ceiba pentandra (L.) Gaertn.	पांढरी सावर	Tree
9		Hibiscus rosa-sinensis L.	जास्वंद	Shrub
10		Thespesia populnea (L.) Soland	भेंडी	Tree
11	OXALIDACEAE	Oxalis corniculata L.	अंबुशी	Herb
12	RUTACEAE	Aegle marmelos (L.) Corr.	बेल	Tree
13		Limonia acidissima L.	कवठ	Tree

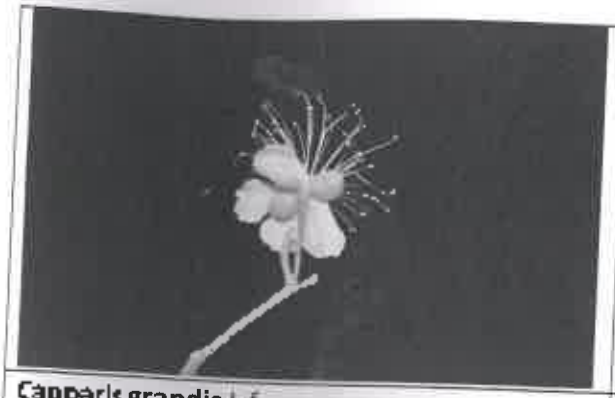
14		Murraya koenigii (L.) Spreng.	कढीपत्ता	Shrub
15	SIMAROUBACLAE	Ailanthus excelsa Roxb.	माइरुख	Tree
16	MELIACEAE	Aphanamixis polystachya (Wall.) R.Parker		Tree
17		Azadirachta indica A. Juss.	कडूनिंब	Tree
18		Swietenia mahagoni (L.) Jacc.	महोगनी	Tree
19	CELASTRACEAE	Cassine glauca (Rottb.) Kuntze	भुरका	Tree
20	RHAMNACEAE	Zizyphus mauritiana Lamk.	बोर	Tree
21	SAPINDACLAE	Sapindus laurifolius Vah	रिठा	Tree
22	ANACARDIACEAE	Schleichera oleosa (Lour.) Merr.	कोशिंब	Tree
23		Lannea coromandellica (Houtt.) Merr.	मोई	Tree
24		Mangifera indica L.	आंबा	Tree
25	MORINGACEAE	Moringa oleifera Lamk.	शेवगा	Tree
26	FABACEAE	Butea monosperma (Lamk.) Taub.	पळस	Tree
27		Dalbergia lanceolaria L.f.	फणशी	Tree
28		Dalbergia melanoxylon Guill. & Perr.	पतंगी	Tree
29		Dalbergia sissoo DC.	शिसव	Tree
30		Gliricidia sepium (Jacq.) Kunth. ex Steud.	गिरीपुष्प	Tree
31		Pongamia pinnata (L.) Pierre	करंज	Tree
32	CAESALPINIACEAE	Bauhinia racemosa Lamk	आपटा	Tree
33		Bauhinia variegata L.	कांचन	Tree
34		Cassia fistula L.	बहावा	Tree
35		Cassia renigera Benth	गुलाबी बहावा	Tree
36		Delonix regia (Bo. ex Hook.) Raf.	गुलमोहर	Tree
37		Peltophorum pterocarpum (DC.) K.Heyne	सोनमोहोर	Tree
38		Senna tora (L.) Roxb.	टाकळा	Herb
39		Senna uniflora (Mill.) H.S Irwin & Barneby	पेरुवाची टाकळा	Herb
40		Tamarindus indicus L.	चिंच	Tree

41	MIMOSACEAE	Acacia leucophloea (Roxb.) Willd.	हिवर	Tree
42		Albizia lebbeck (L.) Willd.	शिरीष	Tree
43		Albizia procera (Roxb.) Benth.	किन्हई	Tree
44		Leucaena leucocephala (Lamk.) de Wit.	सुबाभूल	Tree
45		Samanea saman (Jacq.) Merr.	पर्जन्य वृक्ष	Tree
46	COMBRETACEAE	Quisqualis indica L.	मधुमालती	Climber
47	MYRTACEAE	Eucalyptus globulus Labill.	निलगिरी	Tree
48		Psidium guajava L.	पेरु	Tree
49		Syzygium cumini (L.) Skeels	जांभूळ	Tree
50	CACTACEAE	Opuntia stricta (Haw.) Haw.	फडया निवडुंग	Shrub
51	RUBIACEAE	Morinda pubescens J. E. Smith	बरतोंडी	Tree
52	ASTERACEAE	Blanvillea acmella L.		Herb
53		Cosmos bipinnatus Cav.	कॉसमॉस	Herb
54		Parthenium hysterophorus L.	गाजरगवत	Herb
55		Sphagneticola trilobata (L.) Pruski		Herb
56		Synedrella vialis (Less.) A. Gray		Herb
57		Tridax procumbens L.	एकदांडी	Herb
58	PLUMBAGINACEAE	Plumbago zeylanica L.	चित्रक	Herb
59	SAPOTACEAE	Madhuca longifolia (Koen.) McBride var. longifolia	मोह	Tree
60		Manilkara hexandra (Roxb.) Dubard	खिरणी	Tree
61		Manilkara zapota (L.) Van Royen	चिक्कू	Tree
62	EBENACEAE	Diospyros cordifolia Roxb. (Different than D. montana Roxb.		Tree
63		Diospyros malabarica (Desr.) Kostel.	टेंभुरणी	Tree
64	OLEACEAE	Jasminum officinale L.	जाई	Climber
65		Nyctanthes arbor-tristis L.	पारिजातक	Tree
66	APOCYNACEAE	Alstonia scholaris (L.) R. Br.	सप्तपर्णी	Tree
67		Cascabela thevetia (L.) Lippold	बिट्टी	Tree
68		Catharanthus roseus (L.) G. Don	सदाफुली	Herb

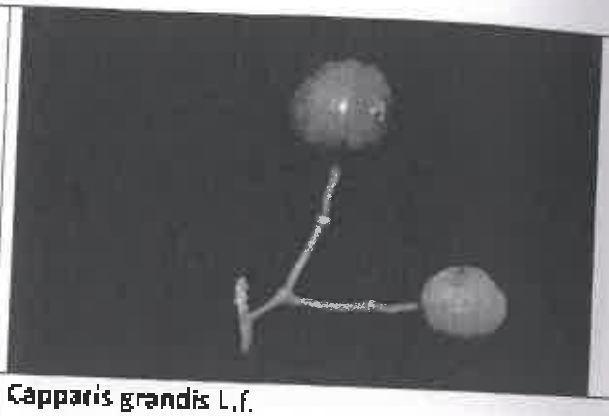
69		Dregea volubilis (L.f.) Benth. ex Hook f.	हरण डोडी	Climber
70		Plumeria alba L.	चाफा	Tree
71	BORAGINACLAE	Cordia myxa L.	भोकर	Tree
72		Ehretia laevis Roxb.	पेत्रंग	Tree
73	CONVOLVULACEAE	Ipomoea muricata (L.) Jacq.		Climber
74	BIGNONIACEAE	Millingtonia hortensis L.	बेद	Tree
75	BIGNONIACEAE	Tecoma stans (L.) Kunth.	पेटाणी	Shrub
76	ACANTHACEAE	Barleria prionitis L.		Shrub
77	VERBENACEAE	Duranta erecta L		Shrub
78	LAMIACEAE	Gmelina arborea Roxb.	शिवण	Tree
79		Holmskioldia sanguinea Retz.		Shrub
80		Lantana camara L. var. aculeata (L.) Mold.	घाणेरी	Shrub
81	NYCTAGINACEAE	Bougainvillaea spectabilis Willd.	बोगनवेल	Shrub
82	AMARANTHACEAE	Achyranthes aspera L.	अंधाडा	Herb
83		Alternanthera sessilis (L.) R. Br.		Herb
84	LORANTHACEAE	Dendrophthoe falcata (L.f.) Ettingsh.	बांडगूळ	Parasite
85	SANTALACEAE	Santalum album L	चंदन	Tree
86	PUTRANJIVACEAE	Putranjiva roxburghii Wall.	पुत्रंजीवा	Tree
87	EUPHORBIACEAE	Euphorbia geniculata Orteg	दुधणी	Herb
88		Euphorbia hirta L	दुधणी	Herb
89	PHYLLANTHACEAE	Phyllanthus emblica L.	आवळा	Tree
90	ULMACEAE	Holoptelea integrifolia Planch.	वावळ	Tree
91	MORACEAE	Artocarpus heterophyllus Lamk.	फणस	Tree
92		Ficus bengalensis L.	वड	Tree
93		Ficus hispida L.f.	लाल उंबर	Tree
94		Ficus racemosa L.	उंबर	Tree
95		Ficus religiosa L	पिंपळ	Tree
96	CASUARINACEAE	Casuarina equisetifolia L. Amoen.	सुरु	Tree
97	AGAVACEAE	Cordyline fruticosa (L.) A.Chev.		Shrub
98	COMMELINACEAE	Commelina benghalensis L.	केणी	Herb
99		Tradescantia sp.		Herb

100	ARACACEAE	Dypsis lutescens (H.Wendl.) Beentje & J.Dransf.		Tree
101		Phoenix sylvestris (L.) Roxb	शिंदी	Tree
102		Roystonea regia (Kunth) O.F.Cook	बॉटल पाम	Tree
103	CYPERACEAE	Kyllinga brevifolia Rottb.		Herb
104	POACEAE	Bambusa arundinacea Willd		Herb
105	POACEAE	Chloris barbata Sw.	गोंड वेळ	Herb
106	POACEAE	Cynodon dactylon Pers.	दूर्वा	Herb
107	POACEAE	Dactyloctenium aegyptium Willd.	लहान मारवेल	Herb
109	CUPRESSACEAE	Thuja Sp.	मोरपंखी	Tree

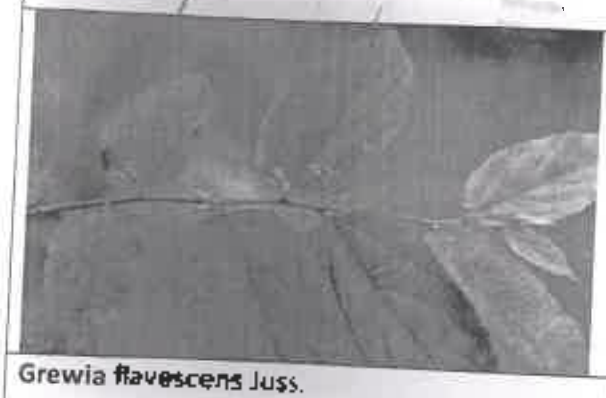
PLATE 1



Capparis grandis L.f.
Flowers

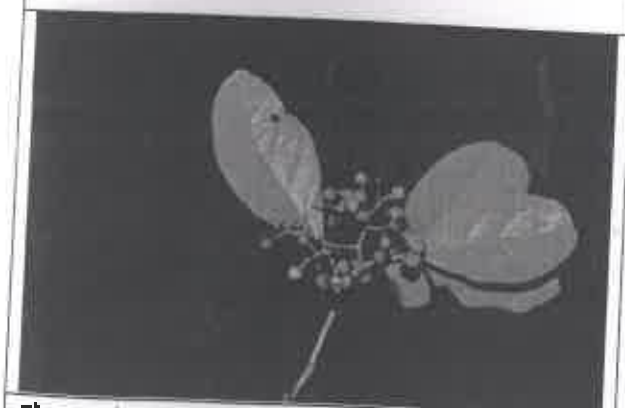


Capparis grandis L.f.
Fruits

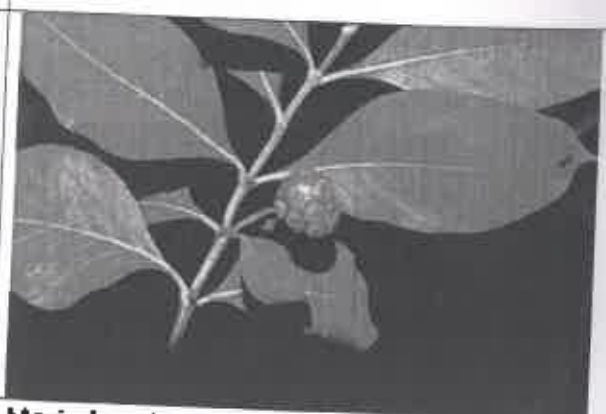


Grewia **flavescens** Juss.
A common climbing shrub on Eastern slopes

Dregea volubilis (L.f.) Benth. ex Hook.f.



Ehretia laevis Roxb.

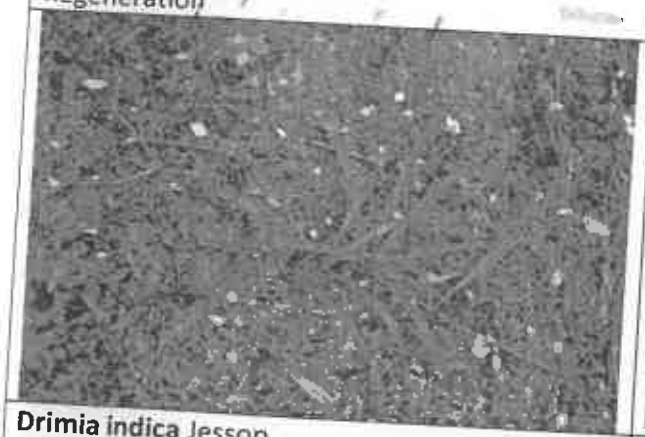


Morinda pubescens J. E. Smith
Common tree

PLATE 2

Ipomoea muricata (L.) Jacq.
Regeneration

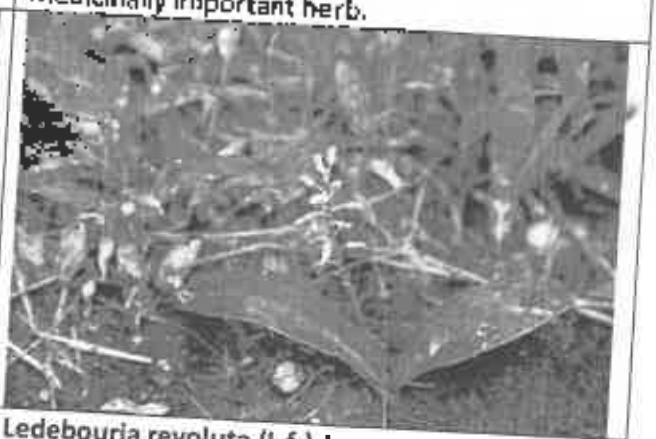
Cleome simplicifolia Hook.f. & Thoms.
Early flowering monsoon herb.



Drimia indica Jessop.

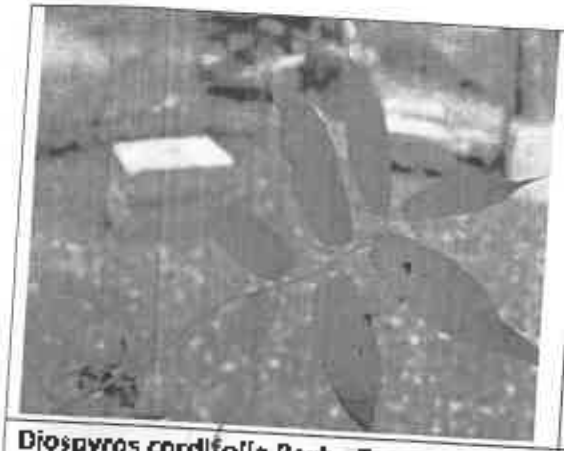
Curculigo orchioides Gaertn.
Medicinally important herb.

Asparagus racemosus Willd.



Ledebouria revoluta (L.f.) Jessop

PLATE 3



Diospyros cordifolia Roxb. : Tree rare in Pune growing in ILS Law college campus

Cissus woodrowii (Stapf ex Cooke) Sant.

Grewia tiliifolia Vahl

Boswellia serrata Roxb. ex Colebr
A common tree on hills around Pune

Cyanotis tuberosa (Roxb.) Schult. & Schult.f.

Cassia renigera Benth.
Tree planted in Law college campus