고려대학교
KOREA UNIVERSITY

Kdata
한국데이터진흥원
Korea Data Agency

식목 기대효과 분석 및 위치기반 추천 시스템

플랜트, 플랜트!

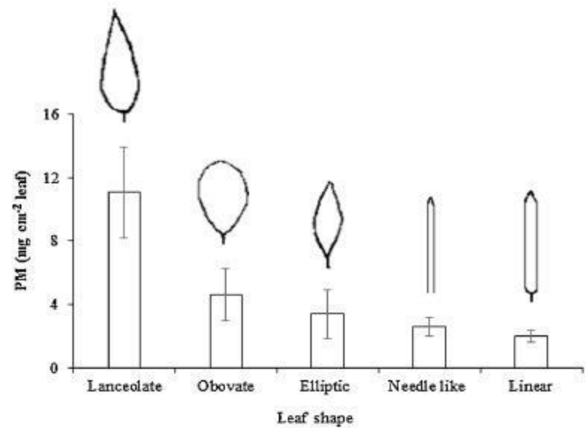
Plant, Plant!

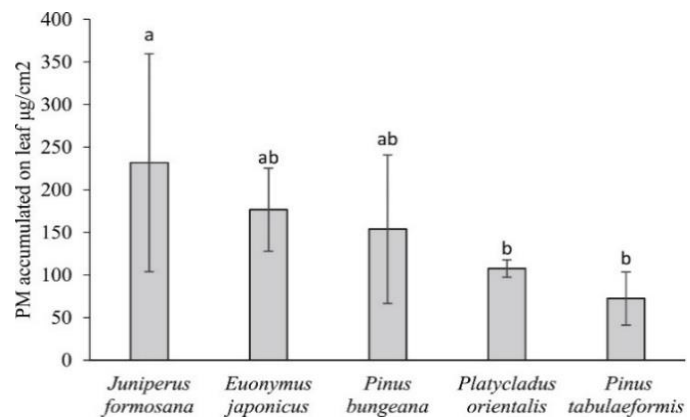
Forestry Efficiency and Benefits Assessment System


I·SEOUL·U
서울특별시
2022-3000
아낌없이 주는 나무심기 프로젝트
미세먼지는 줄이고, 도심열섬 현상은 완화하고, 보다 깨끗한 공기를 공급하기 위한
2014~2022년까지 3,000만 그루 나무심기 사업
2014
2016
2017
2018
2020
2021
2022
2,400
2,000
3,000
1,006
1,530
746
1,500만 그루를
또 심겠습니다
1,530만 그루
2022년까지 3000만 그루의 나무를 심으면?
경유차
6만 4천 대
미세먼지 줄이고 ↓
에어컨
2천 4백만 대
도심온도 낮추고 ↓
H_2O
산소공급
2천 1백만 명
산소농도 높이고 ↑

다다익선 多多益善

What
무엇을 심는가?

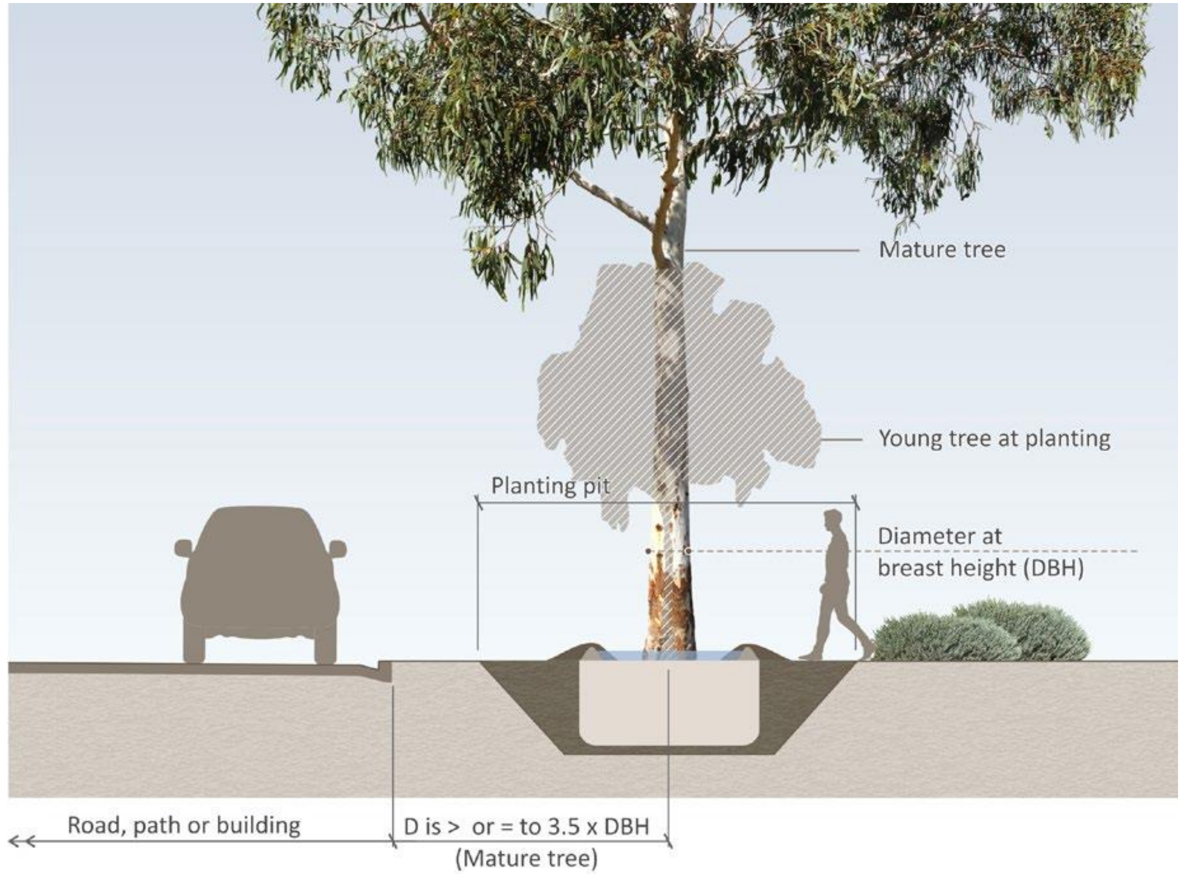




"Particulate matter deposited on leaf of five evergreen species in Beijing, China"

Where

어디에 심는가?



Determining Required Space | Image Credit: Trees Impact Group, GreenBlue Urban

Data preProcessing

국내외
식수(나무)
데이터
약 44만3천개

기타 환경
데이터
(건물 정보 / 미세먼지 /
탄소배출량 등)
약 143만개

국내외
수목 이득산출
논문 및 관련 기사
64편

한국 산림청
미국 USDA
서울열린데이터

공공데이터포털

Semanticscholar
Researchgate
국립산림과학원

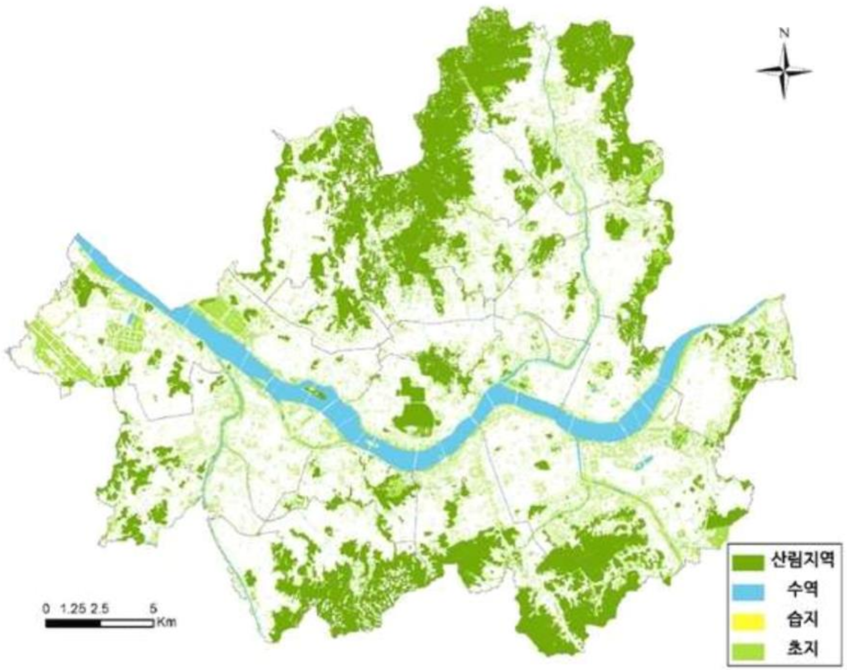
국내 분포 52수종의 흉고직경과 수관폭 상관관계 분석/식물사회학적 이론에 의한 생태모델숲 조성기법/조경수목의 수령에 따른 생장율과 탄소흡수량 변화/Consideration of Street Trees' Distribution Status in Korea/Particulate matter deposited on leaf of five evergreen species in Beijing, China/A Methodology for Calculating Cooling from Vegetation Evapotranspiration for Use in Urban Space Microclimate Simulations/Planting Noise Blockers: Best Plants For Noise Reduction In Landscapes/Trees and shrubs for noise control/ 서울시 가로수 위치정보 (좌표계_ WGS1984)/서울시 공원 및 사유지수목 위치정보 (좌표계_ WGS1984)/서울시 기간별 일평균 대기환경 정보/서울시 대기오염 (구별) 통계/임산물 DB백과/서울특별시_가로수길정보/서울시 건물 정보/서울특별시_사유지및녹림지정보/US_SpeciesList/......

~~미완성~~

90% 달성
시스템 시연

Ok, 계획대로 되고있어

영등포구 선정 이유



[그림 2-4] 서울시 녹지 분포

자료: https://egis.me.go.kr/(환경공간정보서비스)

영등포구 녹지비율 :

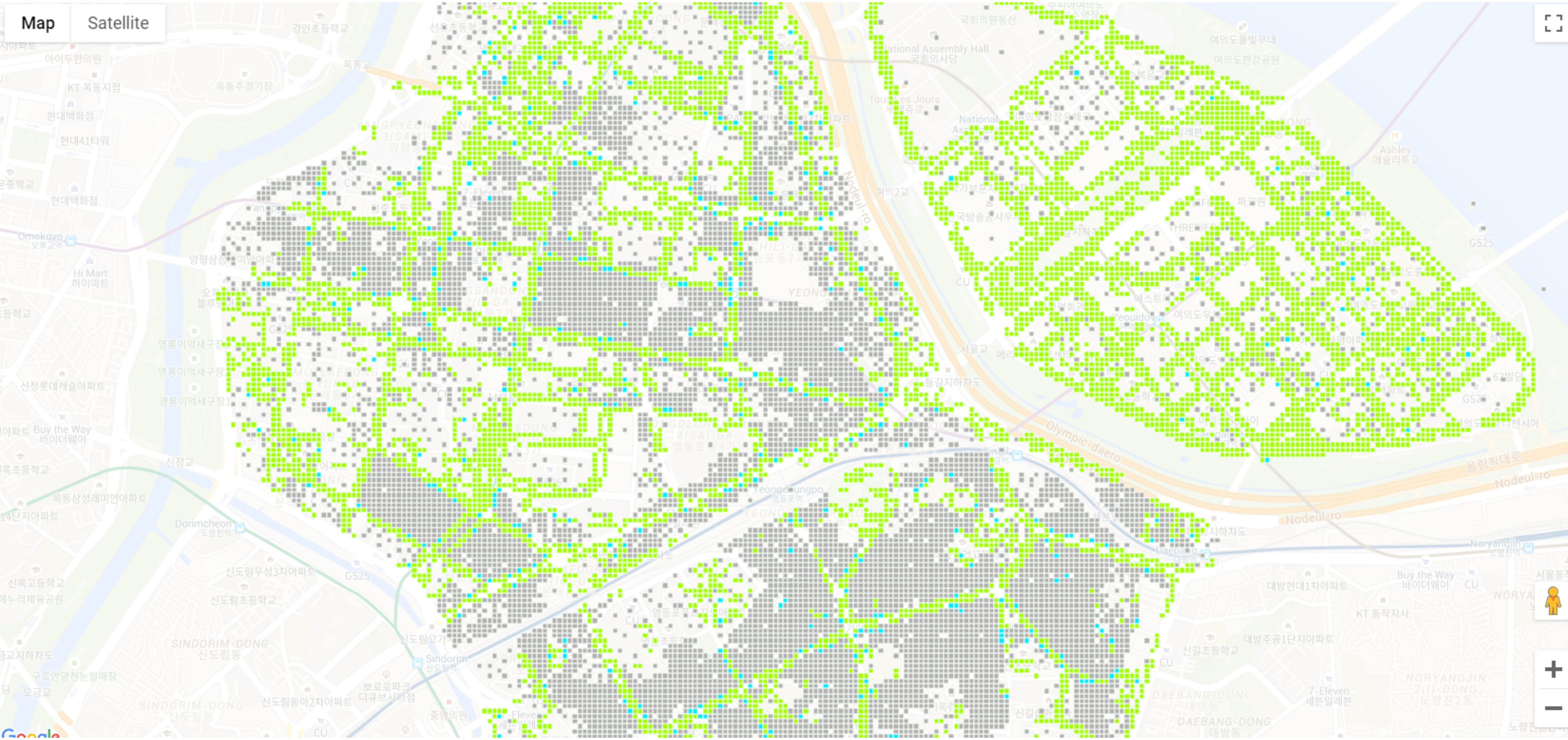
25.9%

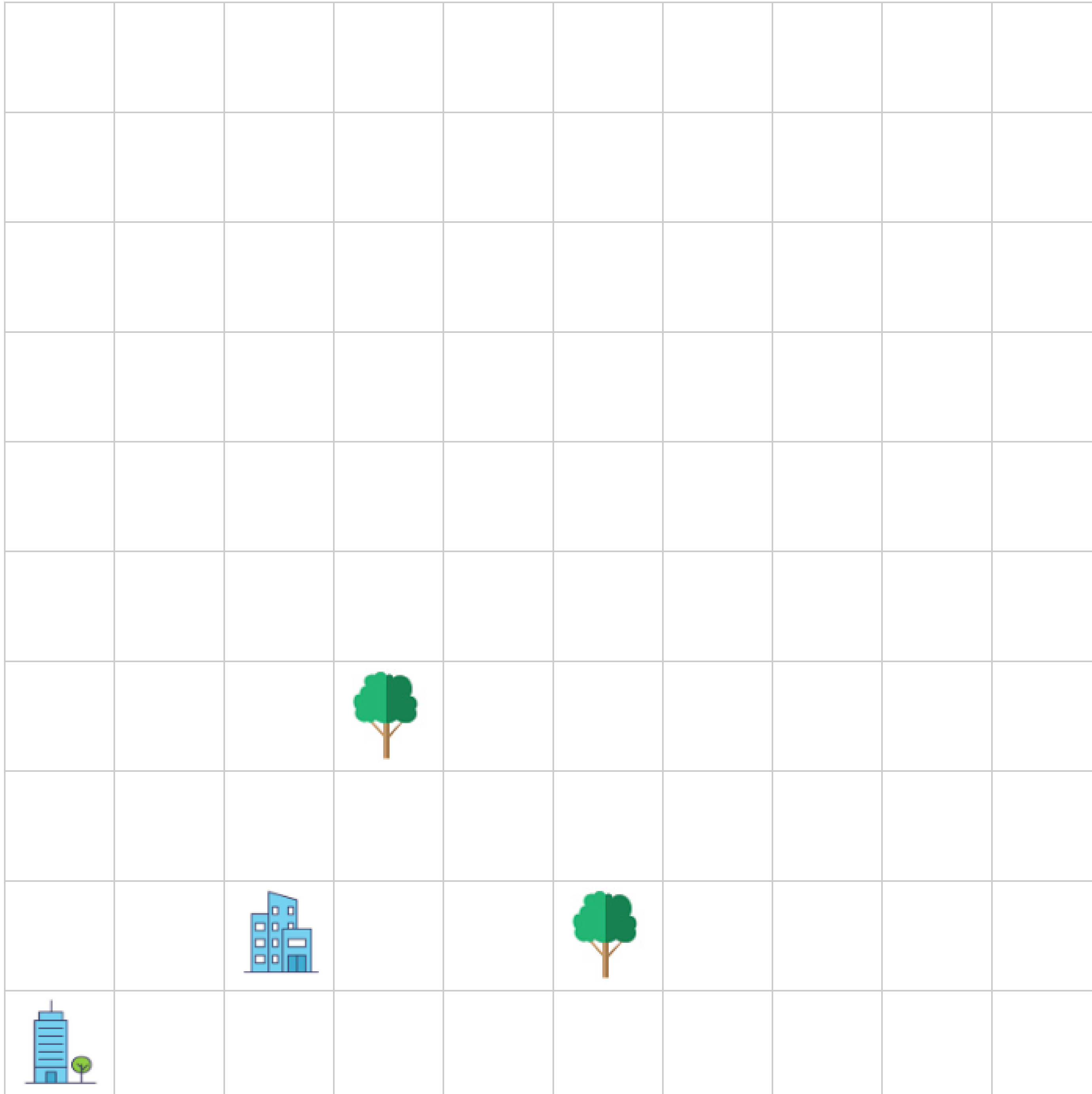
연평균 미세먼지농도 :

49.0㎍/㎥

영등포 구를 포함하는 정사각형을 만든다
위도 : (37.483523 , 37.5554687)
경도 : (126.8656244 , 126.95629) 기준
정사각형의 한 변의 길이는 8km
이것을 Division_zone 함수를 이용하여 정사각형을 가로 m개 세로 n개로 분할시킨다
Division_zone(400,400)
이 경우 작은 정사각형 한 변의 길이는 20m이다

DF = pd.DataFrame(columns=["first_log", "first_lat", "last_log", "first_lat", "last_log", "last_lat", "first_log", "last_lat", "first_log", "first_log"])
이와 같이 DataFrame을 만든 이유는 네모를 그리는 UI에 이용하기 위해서이다
[위도, 경도] 꼴로 정사각형의 꼭지점 1, 2, 3, 4, 1 으로 주면 네모를 그려준다


Map
Satellite
National Assembly Hall
국회의사당
Nodeul-ro
Olympic-daero
올림픽대로
Yeouido
Yeongdeungpo
Omokgyo
Dorimcheon
Sindorim
Noryangjin
SINDORIM-DONG
신도림동
DAEBANG-DONG
대방동
Buy the Way
바이더웨이
GS25
CU
7-Eleven



Project Report - i-Tree Planting Calculator v1.2.0

Location: Forest Meadows, California 95247
Electricity Emissions Factor: 252.40 kilograms CO2 equivalent/MWh
Fuel Emissions Factor: 52.00 kilograms CO2 equivalent/MMBtu
Lifetime: 40 years
Tree Mortality: 10%

All amounts in the tables are for the full lifetime of the project.

Units

- (•) English (pounds & tons; kWh & MMBtu; gallons)
- ( ) Metric (kilograms & metric tons; kWh & MMBtu; cubic meters)

Copy | Export | CO_2 | Energy | Eco | Air Pollution

Search:

Location		CO_2 Benefits			
Group Identifier	Tree Group Characteristics	CO_2 Avoided (pounds)	CO_2 Avoided ($)	CO_2 Sequestered (pounds)	CO_2 Sequestered ($)
1	• (2) Ginkgo (Ginkgo biloba) at 1.5 inches DBH. • Planted 0-19 feet and northeast (45°) of buildings that were built post-1980 with heat and A/C. • Trees are in excellent condition and planted in full sun.	3,403.9	$79.16	964.6	$22.43
2	• (1) Acacia (Acacia species) at 0.9 inch DBH. • Planted 20-39 feet and southwest (225°) of buildings that were built post-1980 with heat and A/C. • Trees are in critical condition and planted in full sun.	89.8	$2.09	464.3	$10.80
3	• (1) Ash, Green (Fraxinus pennsylvanica) at 1.3 inches DBH. • Planted 0-19 feet and east (90°) of buildings that were built post-1980 with heat and A/C. • Trees are in fair condition and planted in full sun.	3,199.3	$74.41	2,965.8	$68.98

how to calculate tree benefit

Moderators: mbinkley, i-Tree Team

how to calculate tree benefit

by **brandoncha** » Sun Jul 28, 2019 2:17 am

brandoncha
Posts: 1
Joined: Sun Jul 28, 2019 2:05 am

hello,

I'm teaching kids at elementary school in South Korea.

I demonstrated I-tree tool to explain benefit of tree to my students.

At the end of class, one of students asked me this questions.

" How to calculate tree benefit zone area? which equation (algorithm) they use to find that? "

Unfortunately, I had no idea about that. I promised that I will tell him next time...

I'm searching for the answer, but I can't...

I wish somebody can help me to answer this..

Re: how to calculate tree benefit

by **Jason.Henning** » Tue Jul 30, 2019 10:28 am

Jason.Henning
i-Tree Team
Posts: 167
Joined: Fri Dec 21, 2012 7:45 am

Thanks for your question.
The i-Tree energy methods drive most of those benefits zone maps and are explained in broad strokes here, http://www.itreetools.org/streets/resou ... st_CTG.pdf (see around page 5 for the energy overview) and this is one of the more specific papers that work draws on, https://www.nrs.fs.fed.us/pubs/jrnl/198 ... er_002.pdf.
The energy models differ for different regions of the US. Things like predominant wind direction, seasonal sun angle, relative local heating and cooling costs, typical energy sources, etc. all impact the regional calculations. For example, if the wind is predominantly from the northwest in the winter then planting evergreen trees there can act as a windbreak, decreasing winter heating costs in cooler regions. The same tree planted southwest of the house may actually increase heating costs by blocking winter sun. This map shows the different climate regions https://static.itreetools.org/media/ima ... iginal.jpg. It may be useful to talk to your students about how choosing a different location, e.g. the desert southwest US versus the temperate northeast US (more comparable to your location I think) would impact those benefit zone maps.
Hope those resources are helpful.
Thanks,
Jason

A member of the i-Tree Team

JOURNAL OF
ARBORICULTURE

May 1986
Vol. 12, No. 5

ENERGY SAVINGS WITH TREES[1]

by Gordon M. Heisler

Abstract. In conventional buildings, trees increase, decrease, or have little effect on energy use depending on general climate, building type, tree species, and tree location. Tree arrangements that save energy provide shade primarily for east and west walls and roofs and wind protection from the direction of prevailing winter winds. Particularly for buildings specially designed to use solar energy and those with solar collectors, it is important to place tree crowns so they do not block sun from collectors and south walls. But conventional houses also benefit from winter sun. Deciduous trees provide better year-round shade than conifers, but do reduce solar energy significantly even without leaves. In winter, reductions in solar energy on south walls by a deciduous tree may be greater than reductions by the same tree in summer. Hence, growth rate and crown shape are important criteria in selecting shade trees, and the placement of trees around the house is important. A summary of research data suggests that the maximum potential annual effect of trees on energy use in conventional houses is about 20 to 25% compared to the same house in the open.

Both increased energy costs and our growing awareness that trees modify our environment have created interest in potential energy savings with trees. Trees may increase, decrease, or have little effect on energy use depending on species and location, climate, building design, and other factors (10, 13, 21, 27, 48, 54). Members of ISA have had an opportunity to become familiar with several aspects of tree influence on energy use for heating and cooling buildings; the Journal has included at least a half dozen relevant articles (14, 21, 44, 48, 54, 56).

Although many extension bulletins and even entire books have been written for the homeowner (16, 37), most homeowners probably have not used this information and know little about managing trees for energy saving. In their daily work, arborists can pass on information about tree effects on energy use and sometimes make decisions that influence energy use, such as where to plant or remove trees or how to prune them.

Urban planners and managers also have a stake in the effects of trees on energy use because trees interfere with solar access (48). Concerns about solar access will lead to demands for changes in street-tree management in many cities, including the use of trees with low winter density and short mature heights.

At the national level, energy use figures provide a perspective on the potential importance of trees. The greatest impact of trees on energy use is in small buildings, particularly detached single-family houses and mobile homes. In 1982, the nearly 58 million single-family detached dwellings in the United States used more than $63 billion worth of energy; this does not account for wood that is burned for heat (50). About 53% of the total energy use in houses in the nation is for space heating and 12% is for space cooling. Hence, we spend about $40 billion per year to heat and cool detached housing units—about 8% of all U.S. energy use. A 1% saving of this energy would amount to $400 million annually.

Some general recommendations can be made for managing trees to save energy. However, tree effects differ with the many differences among local climates, building structures, and existing vegetation. Needs and desires of homeowners also differ. Therefore, better tree management for energy saving will result from knowing 1) how heat moves in and out of buildings in response to

1. Presented at the annual conference of the International Society of Arboriculture in Milwaukee in August 1985.

(45).

Another indication of the value of sun for winter heating is a recent report (34) which suggested that on average, ordinary single-family detached houses in Portland, Oregon, use between 21 and 25% less energy now than they would if all were in complete shade. The sun's energy now falling on building surfaces and entering windows is worth $100 to $300 per house annually, depending on house size and design. Citywide, this total exceeds $14 million. This does not include houses specially designed for use of solar energy.

Solar radiation is more important when the sun is low in the sky and strikes windows and walls almost perpendicularly, as for south-facing surfaces in winter, and for east- and west-facing windows in early morning or late afternoon in summer (Table 1). Relatively little heat comes through south windows in summer because the sun is so high during the time it is in the southern sky and its rays make a small oblique angle with south windows. At 32° latitude, on July 21, south windows receive only a little more solar radiation than north windows.

Solar path diagrams (Fig. 1) are one means of visualizing the sun's path through the year and they help explain values of solar radiation in Table 1. The bottom of each diagram represents the horizon (elevation angle = 0°), and the top center is directly overhead (elevation angle = 90°). The solid curved lines represent the position of the sun in the sky by month and hour of the day—for example, it is easily seen that from April through August, the sun rises north of east and sets north of west, rising high in the sky at noon. From October through February, the solar path begins and ends south of east and west and is lower in the sky.

Table 1. Approximate number of Btu through 1 square foot of single-pane window on a clear day for windows facing different directions at three latitudes (January 21 and July 21 are representative of winter and summer).

Direction window faces	32° Latitude (e.g., El Paxo, TX)		40° Latitude (e.g., Columbus, OH)		48° Latitude (e.g., Spokane, WA)	
	Jan. 21	July 21	Jan. 21	July 21	Jan. 21	July 21
North	160	460	120	450	90	450
East/west	650	1,150	510	1,190	360	1,230
South	1,710	500	1,630	700	1,400	950

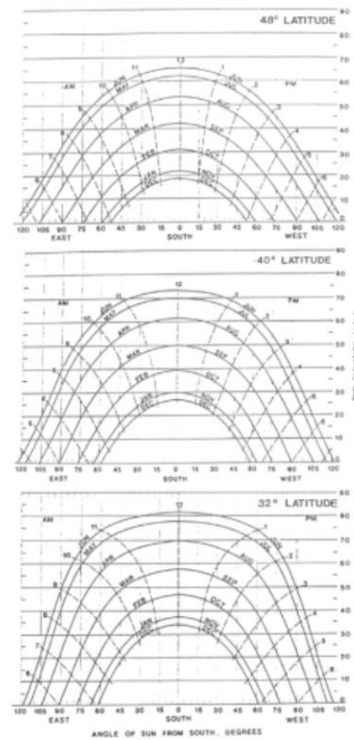


Figure 1. Solar path diagrams for three latitudes that range from southern United States and northern Mexico (32°) to northern United States and southern Canada (48°). The horizontal axis shows true azimuth angles measured from south. Solar paths are plotted on the 21st of each month. (Adapted from Mazria and Winitsky (32)).

수종 별 역량 및 경제효과 산출

수목명	흉고지름	Condition	Value	CO2 Avoi	CO2 Avoi	CO2 Sequ	CO2 Sequ	Electricity	Electricity	Fuel Save	Fuel Save	Tree Biom	Rainfall In	Avoided F	Avoided F	O3 Remov	NO2 Avoi	NO2 Rem	SO2 Avoi	SO2 Remo	VOC Avoi	PM2.5 Av	PM2.5 Re
회화나무	15	Fair	SOJA	3170.9	73.74	2150	50	2518.3	284.29	2.4	37.83	1.5	42133.8	266.5	2.38	13.8	0.5	0.5	12	1	0.1	0.9	0.7
회화나무	26	Excellent	SOJA	3432.4	79.83	9.9	0.23	2757.9	311.34	2.4	37.83	4.5	71165.3	450.1	4.02	23.2	0.5	0.9	13	1.7	0.1	0.9	1.1
회화나무	30	Excellent	SOJA	3432.4	79.83	12.6	0.29	2757.9	311.34	2.4	37.83	6.7	72785.1	460.4	4.11	23.7	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	24	Excellent	SOJA	3432.4	79.83	8.6	0.2	2757.9	311.34	2.4	37.83	3.6	68754.3	434.9	3.89	22.7	0.5	0.8	13	1.7	0.1	0.9	1.1
회화나무	21	Excellent	SOJA	3432.4	79.83	6.8	0.16	2757.9	311.34	2.4	37.83	2.5	63280.4	400.3	3.58	21.4	0.5	0.8	13	1.6	0.1	0.9	1.1
회화나무	22	Excellent	SOJA	3432.4	79.83	7.4	0.17	2757.9	311.34	2.4	37.83	2.9	65339.8	413.3	3.69	21.9	0.5	0.8	13	1.6	0.1	0.9	1.1
회화나무	32	Excellent	SOJA	3432.4	79.83	14.1	0.33	2757.9	311.34	2.4	37.83	8	72785.1	460.4	4.11	23.8	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	31	Excellent	SOJA	3432.4	79.83	13.4	0.31	2757.9	311.34	2.4	37.83	7.3	72785.1	460.4	4.11	23.7	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	23	Excellent	SOJA	3432.4	79.83	8	0.19	2757.9	311.34	2.4	37.83	3.2	67168	424.8	3.8	22.3	0.5	0.8	13	1.7	0.1	0.9	1.1
회화나무	27	Excellent	SOJA	3432.4	79.83	10.5	0.24	2757.9	311.34	2.4	37.83	5	71976.2	455.3	4.07	23.4	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	38	Excellent	SOJA	3432.4	79.83	19	0.44	2757.9	311.34	2.4	37.83	12.8	72785.1	460.4	4.11	23.9	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	36	Excellent	SOJA	3432.4	79.83	17.3	0.4	2757.9	311.34	2.4	37.83	11	72785.1	460.4	4.11	23.9	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	33	Excellent	SOJA	3432.4	79.83	14.9	0.35	2757.9	311.34	2.4	37.83	8.7	72785.1	460.4	4.11	23.8	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	29	Excellent	SOJA	3432.4	79.83	11.9	0.28	2757.9	311.34	2.4	37.83	6.1	72785.1	460.4	4.11	23.6	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	28	Excellent	SOJA	3432.4	79.83	11.2	0.26	2757.9	311.34	2.4	37.83	5.6	72517.2	458.7	4.1	23.5	0.5	0.9	13	1.8	0.1	0.9	1.1
회화나무	55	Excellent	SOJA	3432.4	79.83	36.1	0.84	2757.9	311.34	2.4	37.83	35.1	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	25	Excellent	SOJA	3432.4	79.83	9.2	0.21	2757.9	311.34	2.4	37.83	4.1	70089.3	443.3	3.96	23	0.5	0.8	13	1.7	0.1	0.9	1.1
회화나무	34	Excellent	SOJA	3432.4	79.83	15.7	0.36	2757.9	311.34	2.4	37.83	9.4	72785.1	460.4	4.11	23.8	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	42	Excellent	SOJA	3432.4	79.83	22.6	0.53	2757.9	311.34	2.4	37.83	16.8	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	40	Excellent	SOJA	3432.4	79.83	20.8	0.48	2757.9	311.34	2.4	37.83	14.7	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	45	Excellent	SOJA	3432.4	79.83	25.5	0.59	2757.9	311.34	2.4	37.83	20.3	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	48	Excellent	SOJA	3432.4	79.83	28.5	0.66	2757.9	311.34	2.4	37.83	24.2	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	35	Excellent	SOJA	3432.4	79.83	16.5	0.38	2757.9	311.34	2.4	37.83	10.2	72785.1	460.4	4.11	23.9	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	41	Excellent	SOJA	3432.4	79.83	21.7	0.5	2757.9	311.34	2.4	37.83	15.7	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	44	Excellent	SOJA	3432.4	79.83	24.5	0.57	2757.9	311.34	2.4	37.83	19.1	72785.1	460.4	4.11	24	0.5	0.9	13	1.8	0.1	0.9	1.2
회화나무	24	Fair	SOJA	3170.9	73.74	7	0.16	2518.3	284.29	2.4	37.83	3.6	56378	356.6	3.19	18.3	0.5	0.7	12	1.4	0.1	0.9	0.9
회화나무	12	Fair	SOJA	3170.4	73.73	3604.8	83.84	2517.8	284.24	2.4	37.83	1.4	38396.8	242.9	2.17	12.5	0.5	0.5	12	0.9	0.1	0.9	0.6
회화나무	18	Fair	SOJA	3170.9	73.74	4.3	0.1	2518.3	284.29	2.4	37.83	1.7	45794	289.7	2.59	15	0.5	0.6	12	1.1	0.1	0.9	0.7
회화나무	26	Fair	SOJA	3170.9	73.74	8.1	0.19	2518.3	284.29	2.4	37.83	4.5	58355.2	369.1	3.3	18.9	0.5	0.7	12	1.4	0.1	0.9	0.9
회화나무	17	Fair	SOJA	3170.9	73.74	764.9	17.79	2518.3	284.29	2.4	37.83	1.6	44542.2	281.7	2.52	14.6	0.5	0.5	12	1.1	0.1	0.9	0.7
회화나무	22	Fair	SOJA	3170.9	73.74	6.1	0.14	2518.3	284.29	2.4	37.83	2.9	53578	338.9	3.03	17.4	0.5	0.6	12	1.3	0.1	0.9	0.8
회화나무	10	Fair	SOJA	2946.8	68.53	4211.7	97.95	2346.1	264.85	2.2	34.6	1.3	35885.9	227	2.03	11.6	0.4	0.4	11.2	0.9	0.1	0.8	0.6
회화나무	16	Fair	SOJA	3170.9	73.74	1501.9	34.93	2518.3	284.29	2.4	37.83	1.6	43349.7	274.2	2.45	14.2	0.5	0.5	12	1.1	0.1	0.9	0.7
회화나무	11	Fair	SOJA	3061.4	71.2	3941.4	91.67	2434.7	274.86	2.3	36.2	1.3	37139.5	234.9	2.1	12	0.4	0.4	11.6	0.9	0.1	0.8	0.6
회화나무	19	Fair	SOJA	3170.9	73.74	4.7	0.11	2518.3	284.29	2.4	37.83	1.9	47985.1	303.5	2.71	15.7	0.5	0.6	12	1.2	0.1	0.9	0.8

Sector 내부 (10x10) 예시

	0	1	2	3	4	5	6	7	8	9	...	90	91	92	93	94	95	96	97	98	99
0											...										
1											...										
2											...										버즘나무
3											...										
4											...										
5											...										
6											...										
7											...										
8											...										
9											...										
10				건물			은행나무				...										
11											...										
12											...										
13							버즘나무				...										
14											...										
15											...										살구나무
16											...										
17											...										
18											...										
19											...										
20										은행나무	...										