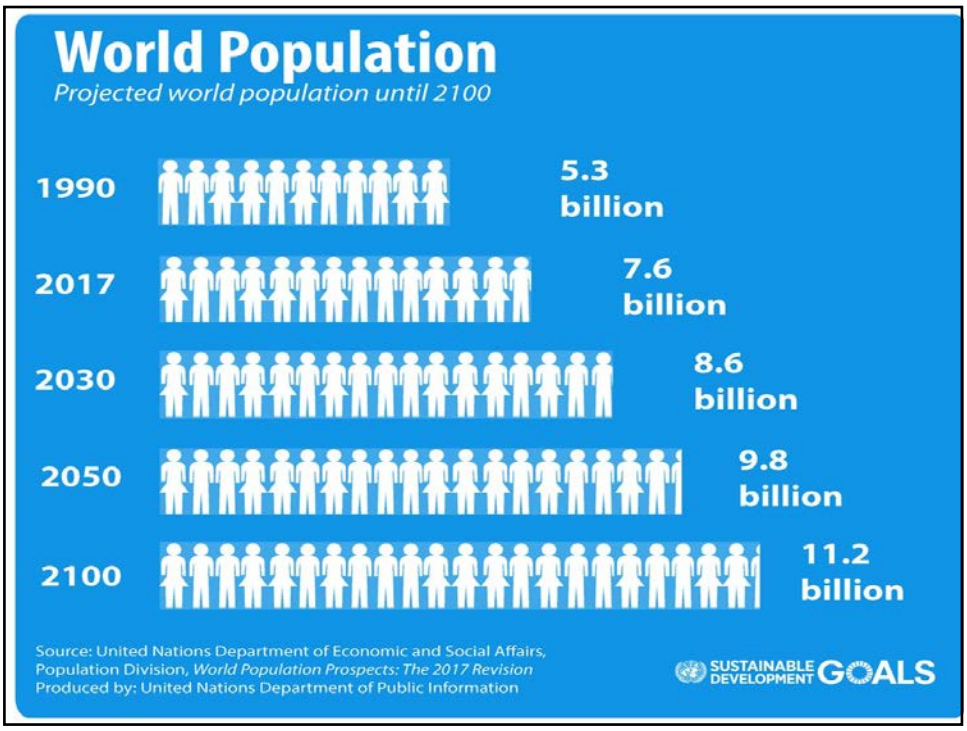
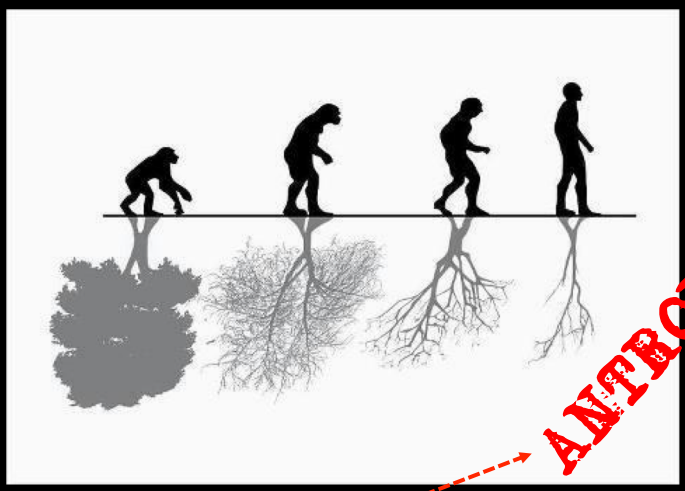
Bosques urbanos y
Servicios ecosistémicos
Madrid, 07 de Junio de 2018.
Pedro Calaza Mart nez
PhD-Eng. + PhD-L.A.


World Population
Projected world population until 2100
1990
5.3 billion
2017
7.6 billion
2030
8.6 billion
2050
9.8 billion
2100
11.2 billion
Source: United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2017 Revision
Produced by: United Nations Department of Public Information
SUSTAINABLE DEVELOPMENT GOALS

De un mundo vac o a un mundo lleno



ANTROPOCENO

HOLOCENO

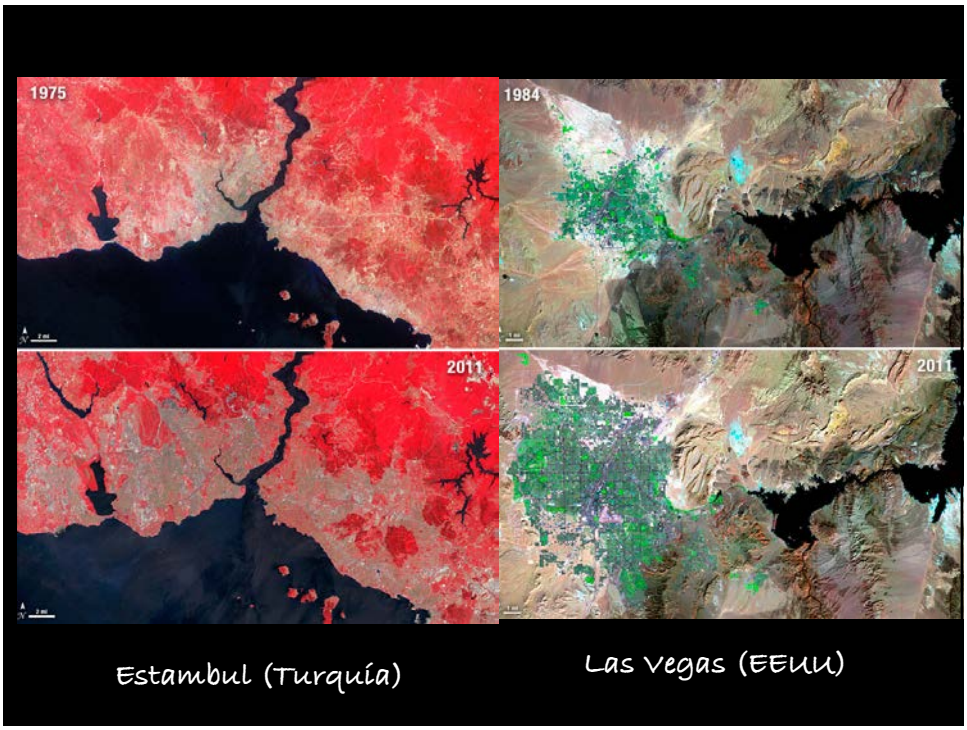
Paul Crutzen

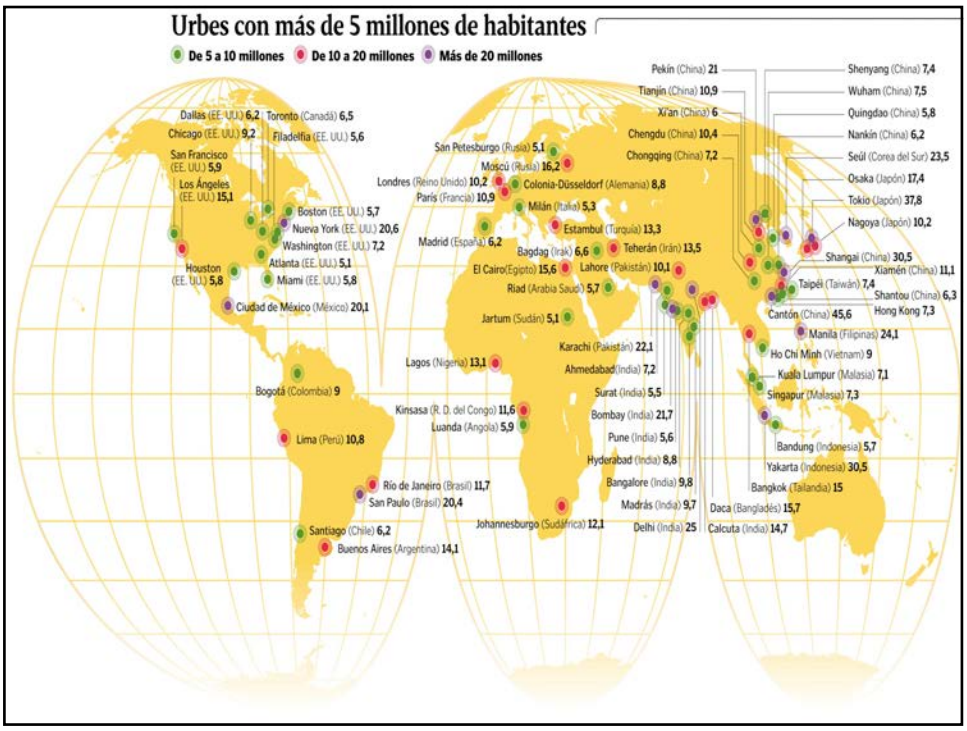
Desde 1800???

Steward T.A. Pickett had coined the term

first urban century

the century in which the human has begun to be a being an *urban species* numerically.

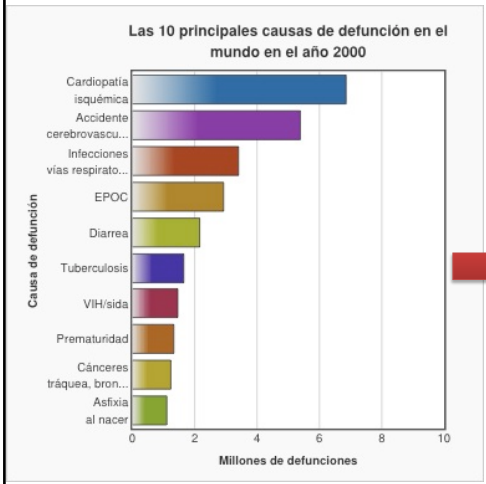

1975
1984
2011
2011
Estambul (Turquía)
Las Vegas (EEUU)

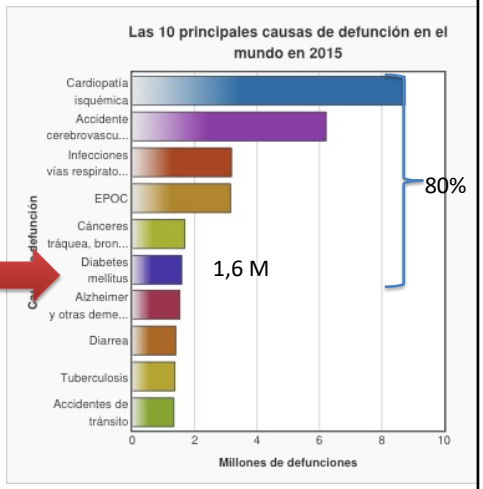

Urbes con más de 5 millones de habitantes
De 5 a 10 millones
De 10 a 20 millones
Más de 20 millones
Dallas (EE. UU.) 6,2
Toronto (Canadá) 6,5
Chicago (EE. UU.) 9,2
Filadelfia (EE. UU.) 5,6
San Francisco (EE. UU.) 5,9
Los Ángeles (EE. UU.) 15,1
Boston (EE. UU.) 5,7
Nueva York (EE. UU.) 20,6
Washington (EE. UU.) 7,2
Atlanta (EE. UU.) 5,1
Houston (EE. UU.) 5,8
Miami (EE. UU.) 5,8
Ciudad de México (México) 20,1
Bogotá (Colombia) 9
Lima (Perú) 10,8
Río de Janeiro (Brasil) 11,7
San Paulo (Brasil) 20,4
Santiago (Chile) 6,2
Buenos Aires (Argentina) 14,1
San Petesburgo (Rusia) 5,1
Moscú (Rusia) 16,2
Londres (Reino Unido) 10,2
Colonia-Düsseldorf (Alemania) 8,8
París (Francia) 10,9
Milán (Italia) 5,3
Estambul (Turquía) 13,3
Madrid (España) 6,2
Bagdag (Irak) 6,6
Teherán (Irán) 13,5
El Cairo(Egipto) 15,6
Lahore (Pakistán) 10,1
Riad (Arabia Saudí) 5,7
Jartum (Sudán) 5,1
Lagos (Nigeria) 13,1
Kinsasa (R. D. del Congo) 11,6
Luanda (Angola) 5,9
Johannesburgo (Sudáfrica) 12,1
Karachi (Pakistán) 22,1
Ahmedabad(India) 7,2
Surat (India) 5,5
Bombay (India) 21,7
Pune (India) 5,6
Hyderabad (India) 8,8
Bangalore (India) 9,8
Madrás (India) 9,7
Delhi (India) 25
Pekín (China) 21
Tianjin (China) 10,9
Xi'an (China) 6
Chengdu (China) 10,4
Chongqing (China) 7,2
Shenyang (China) 7,4
Wuham (China) 7,5
Quingdao (China) 5,8
Nankín (China) 6,2
Seúl (Corea del Sur) 23,5
Osaka (Japón) 17,4
Tokio (Japón) 37,8
Nagoya (Japón) 10,2
Shangai (China) 30,5
Xiamén (China) 11,1
Taipéi (Taiwán) 7,4
Shantou (China) 6,3
Hong Kong 7,3
Cantón (China) 45,6
Manila (Filipinas) 24,1
Ho Chi Minh (Vietnam) 9
Kuala Lumpur (Malasia) 7,1
Singapur (Malasia) 7,3
Bandung (Indonesia) 5,7
Yakarta (Indonesia) 30,5
Bangkok (Tailandia) 15
Daca (Bangladés) 15,7
Calcuta (India) 14,7

UNFPA (2011)
Población (2010): 7000 Mp
50% vive en las ciudades

Problemas Urbanos???
Vandalismo
Enfermedades de corazón
Regeneración económica
Stress
Enfermedades Respiratorias
Incohesión Social
Cambio Climático
Biodiversidad.

Causas de muerte en el mundo.





2000.

2015. M 56,4 millones de personas.

Ciudades del siglo XXI

Población >>>

Hábitos de vida, sedentarismo, alimentación, etc.

Enfermedades (ENT) (Xunta de Galicia, 2013, WHO, 2004b)

El estado de la seguridad alimentaria y la nutrici n en el mundo 2017

Significativo aumento del hambre en el mundo,
815 millones de personas (2016)
11% de la población mundial.

Incremento de 38 millones de personas.

+5,1%

Incremento continuado de otras formas de malnutrición como la obesidad, que afecta a países como España donde su prevalencia ha pasado del 21,7 al 26,8 por ciento entre 2004 y 2014.

Población >>>
Hábitos de vida sedentarios (4 causa de mortandad, 6%) (WHO, 2009)
Alimentación desequilibrada.

50% carga de morbilidad mundial

ENT

WHO (2014)
Urbanización
Envejecimiento poblacional
Globalización.

Sobrepeso, obesidad… 5% de las mortalidad mundial
Prevalencia de enfermedades (cardiovasculares, diabetes, cáncer,…
Factores de riesgo (hipertensión, sobrepeso, glucosa, etc.)
Coste económico: 7 billones de dólares

70% (40 Millones) muertes son debidas a ENT
España 92% (64,7%-2011)

El problema….

Ordenadores/Consolas/Actividades en interior/Poco tiempo

Ocasionan desconocimiento de la naturaleza… Síntoma de una desconexión total…

Nature déficit disorder

Richar Louv…

Last child in the Woods…

No hay mayor signo de demencia que **hacer la misma cosa una y otra vez** y esperar que los resultados sean distintos.

Albert Einstein

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
THE GLOBAL GOALS
For Sustainable Development
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

Meta 11.7: De aquí a 2030, proporcionar acceso universal a zonas verdes y espacios públicos seguros, inclusivos y accesibles, en particular para las mujeres y los niños, las personas de edad y las personas con discapacidad.

Habitat III: *conference on sustainable urban development*. Quito, 2016.

New Urban Agenda:

referencias *explícitas* a la salud mental y física, construcción de la comunidad realizando tareas ecológicas urgentes…

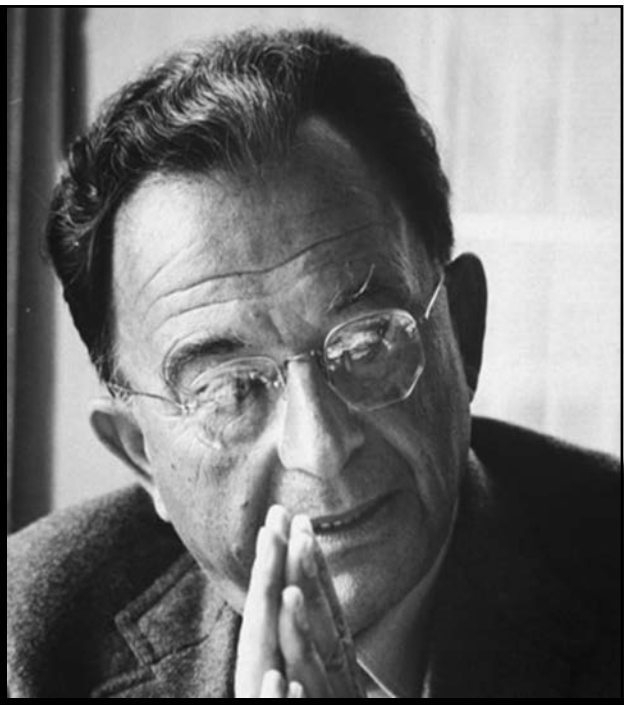
Los políticos, planificadores y desarrolladores urbanos deben implicarse con el uso del arbolado.

Biofilia

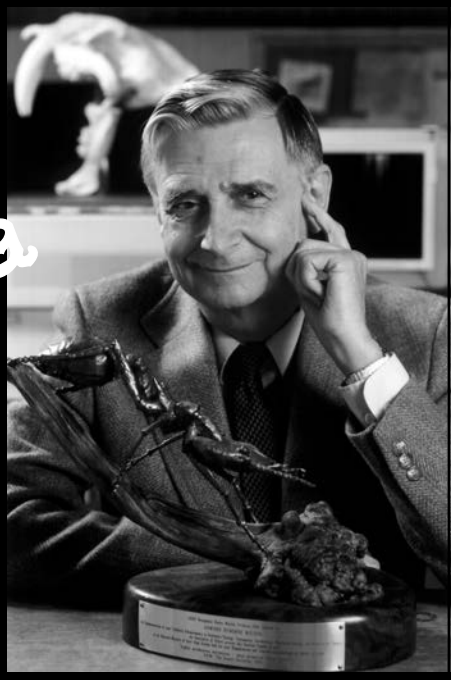
El corazón del hombre (Fromm, 1964),

The anatomy of Human Destructiveness (Fromm, 1973).

Biophilia is the passionate love of life and of all that is alive; it is the wish to further growth, whether in a person, a plant, an idea, or a social group (Fromm, 1973).



Biofilia



Biofilia (Edward Wilson, 1984)

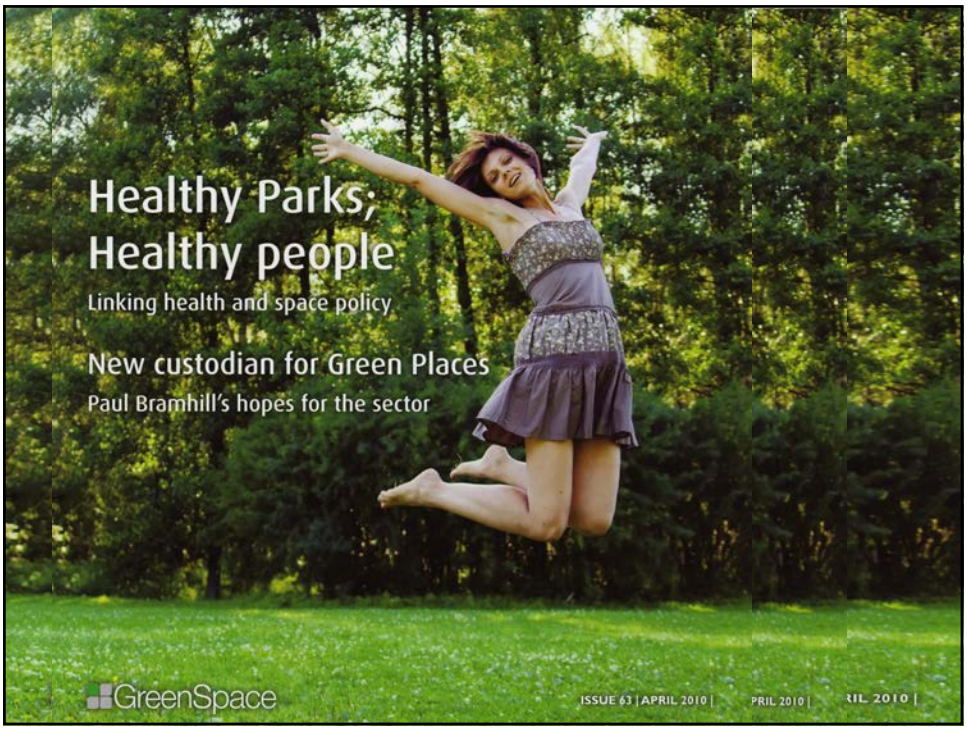
tendencia innata a centrarse
en la vida y procesos
naturales
(Wilson, 1984, p. 1).

T de la reducci n de stress
Dr. Roger Ulrich

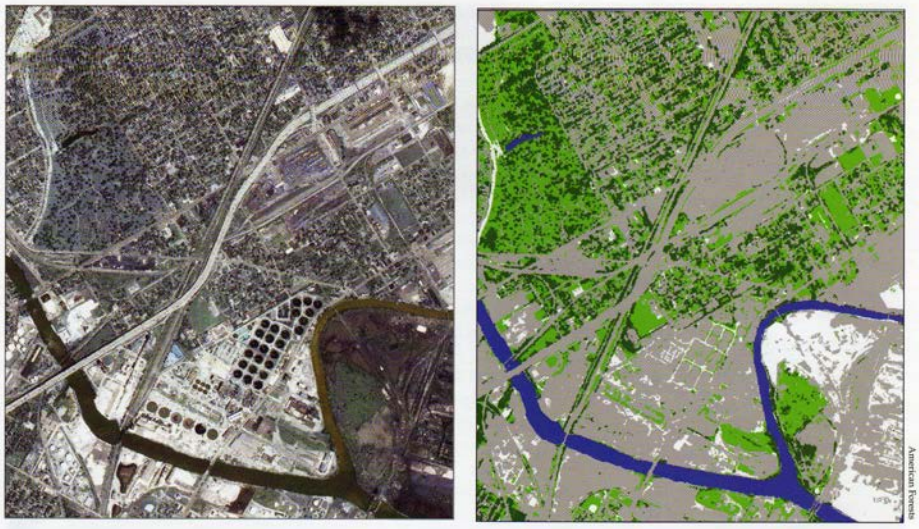
T ART
Drs. Kaplan Y Kaplan

Ciudades biofílicas

Biofilia representa el hilo conductor conceptual de un diseño y la gestión de ciudades que potencia la *gobernanza, la información y formación, los estilos de vida sanos, y sobre todo la naturación de las ciudades, a diferentes escalas y morfologías* (Beatley, 2010).


Healthy Parks;
Healthy people
Linking health and space policy
New custodian for Green Places
Paul Bramhill's hopes for the sector
GreenSpace
ISSUE 63 | APRIL 2010 |

Infraestructura verde



This high-resolution, satellite imagery is more than just a pretty picture. Its multispectral qualities provide the basis for classifying imagery into land cover and calculating the land cover's ecosystem services.

Schwab et al. (2009)

oximoron

Es hielo abrasador, es fuego helado,
es herida, que duele y no se siente,
Francisco de Quevedo

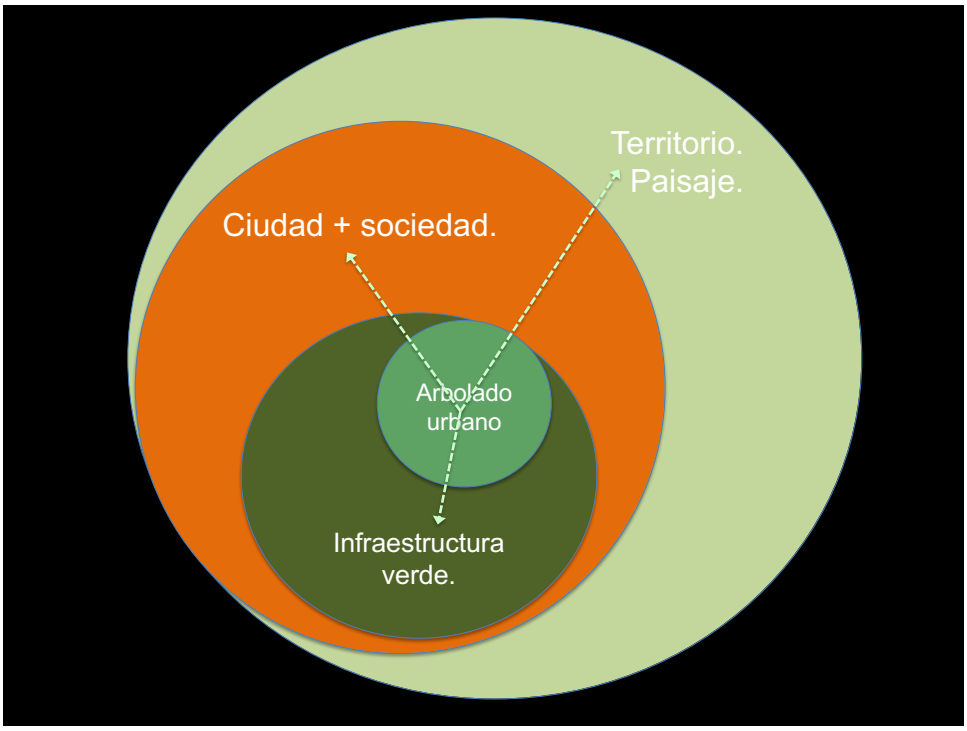
TR

Unión europea, 2014:

"La infraestructura verde puede definirse, en términos generales, como una red estratégicamente planificada de zonas naturales y seminaturales de alta calidad con otros elementos medioambientales, diseñada y gestionada para proporcionar un amplio abanico de servicios ecosistémicos y proteger la biodiversidad tanto de los asentamientos rurales como urbanos
(UE, 2014)..."

Multi

- Sémica
- Escalar
- Funcional
- Objetivo
- Temporal
- Disciplinar


Territorio.
Paisaje.
Ciudad + sociedad.
Arbolado
urbano
Infraestructura
verde.

Arboricultura urbana

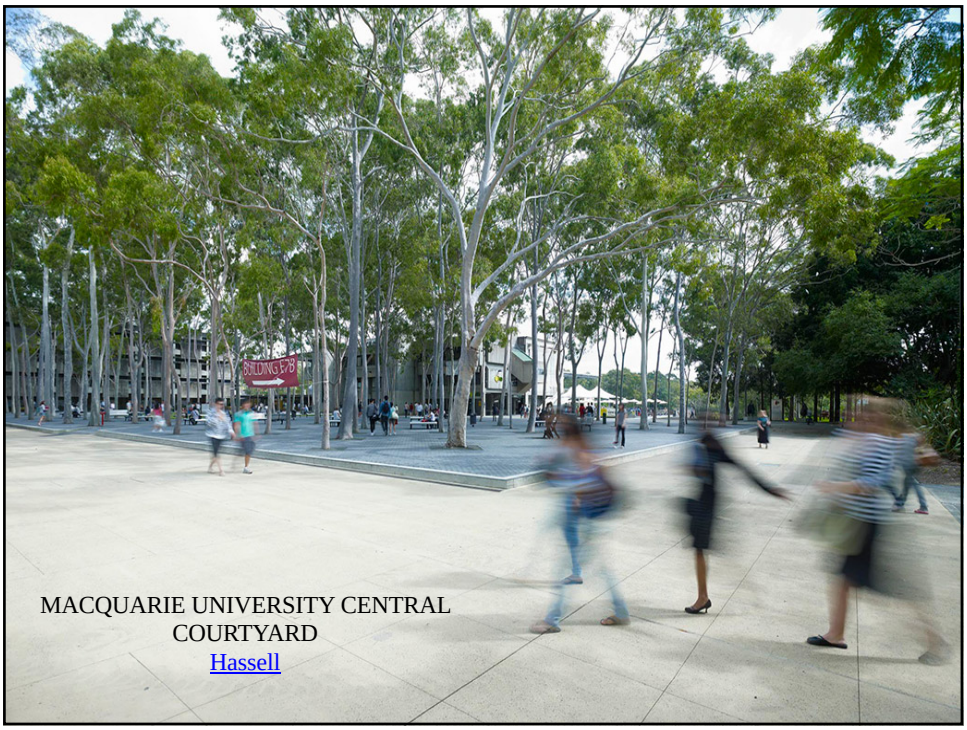
El arte, ciencia y tecnología de gestionar árboles y recursos forestales en y alrededor de ecosistemas urbanos comunitarios para los beneficios psicológicos, sociológicos, económicos y estéticos que los árboles proporcionan a la sociedad.

(Helms 1998, después de Miller 1997)

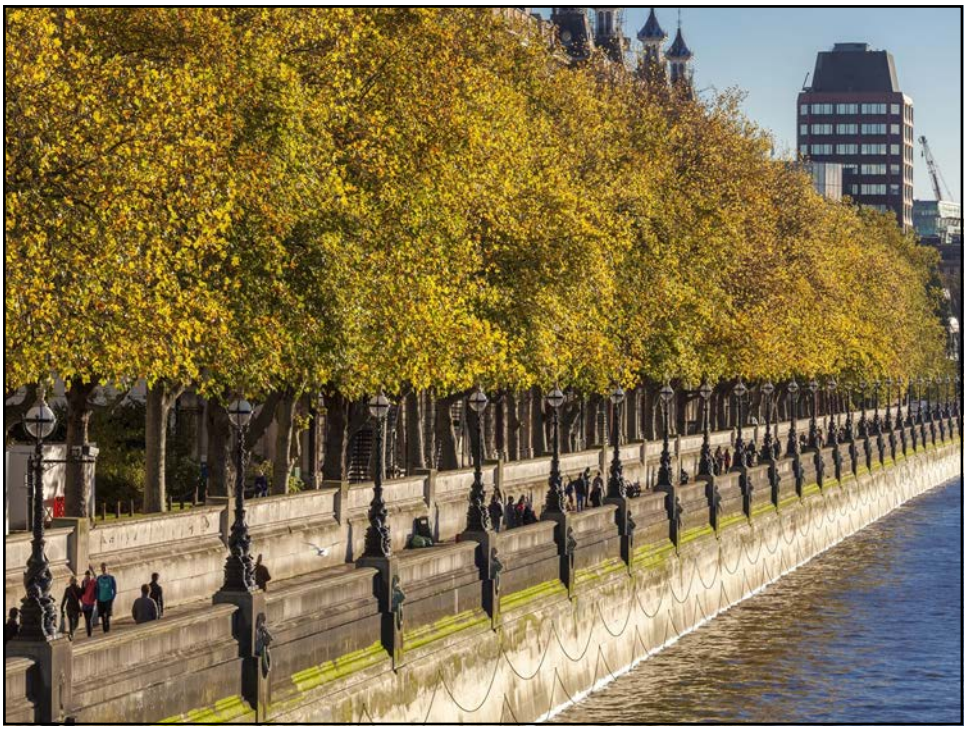
Urban forests:

Redes o sistemas que comprenden todos los bosques, grupos de árboles y árboles individuales localizados en áreas urbanas y periurbanas, incluyen, entre otros, bosques, árboles de calle, en parques y jardines y árboles en áreas abandonadas.

(FAO, 2016)



MACQUARIE UNIVERSITY CENTRAL COURTYARD
Hassell



Bosques urbanos e Infraestructura verde

Table 1 Matrix of the relationship between urban forest components and green infrastructure types.

Green infrastructure typology*	Urban forest components			
	Single tree	Line of trees	Tree cluster	Woodland
Street trees and verges				
Green roofs and walls				
Amenity spaces				
Derelict lands				
Water management spaces				
Parks and gardens				
Land used for urban agriculture				
Civic spaces				
Institutional grounds				
Outdoor sports facilities				
Green corridors				
Natural and semi-natural spaces				
Agricultural land				

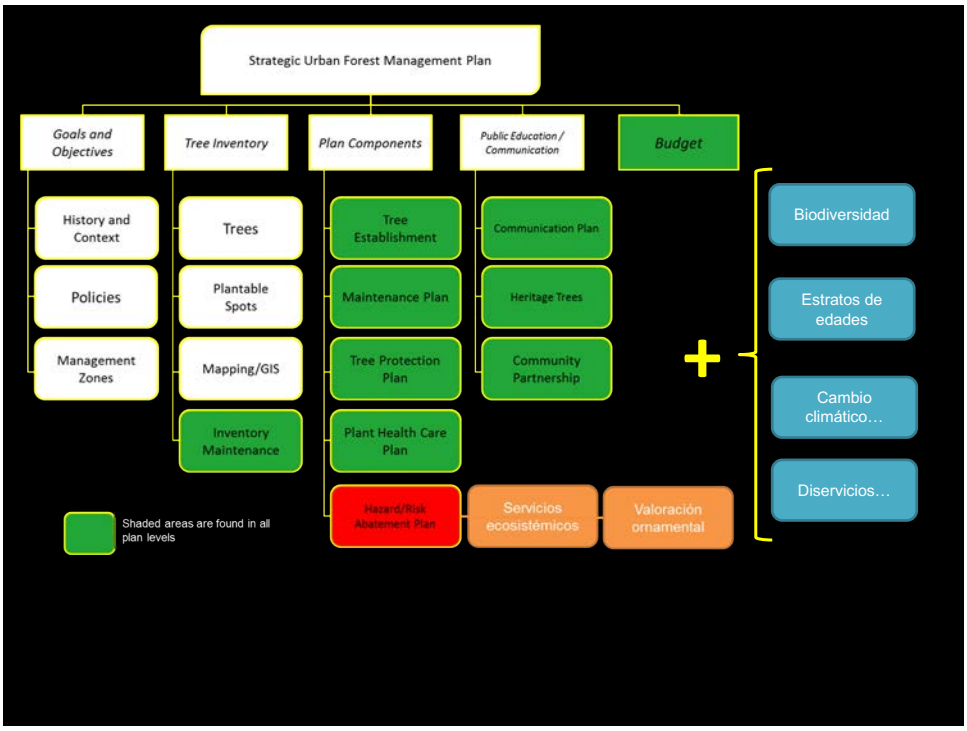
Commonly related Sometimes related Rarely related

* Source: Burgess (2015)

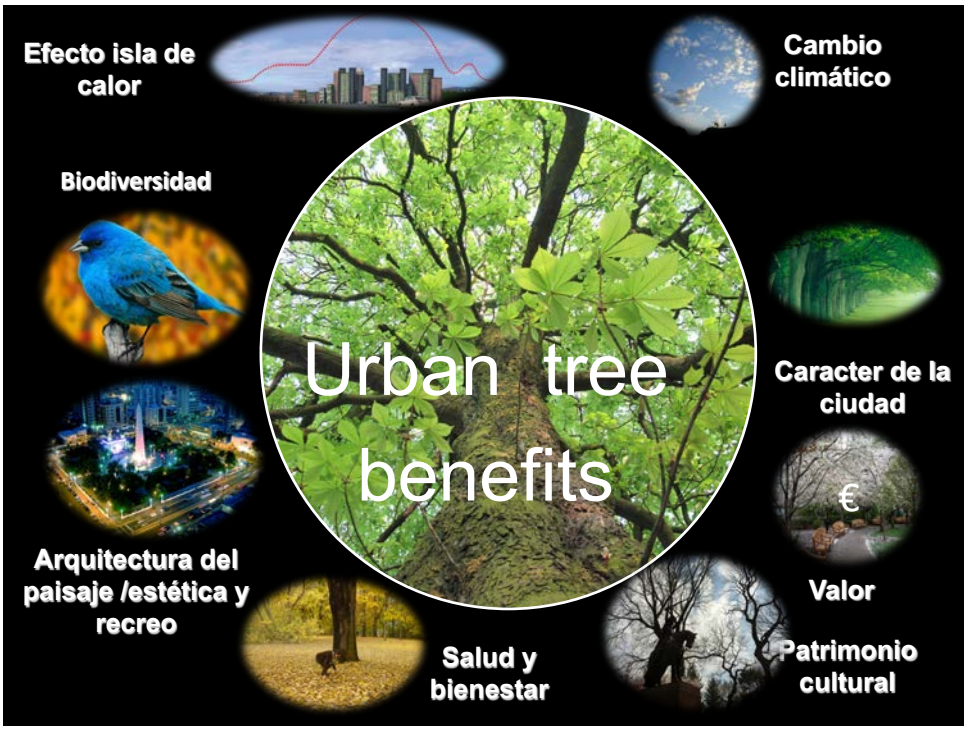
Objetivo de la gestión del arbolado urbano.

Optimizar el área foliar de los bosques urbanos estableciendo y manteniendo una copa de árboles y arbustos genéticamente apropiados (adaptados y diversos) con el mínimo riesgo para el público y de una manera de coste efectiva.

Dr. Andrew Kenney, 2010

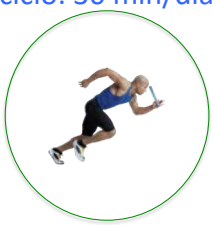


beneficios
24.10.2004


Efecto isla de calor
Cambio climático
Biodiversidad
Urban tree benefits
Caracter de la ciudad
€
Arquitectura del paisaje /estética y recreo
Valor
Salud y bienestar
Patrimonio cultural

www.vitoria-gasteiz.org.ceac

Ejercicio: 30 min/día



300 m

15 min

Residencia

Estudios de Aplicabilidad en términos de accessibilidad… **300 m** maxima d a un EV (ECI, 2003; ANGS, 2010; Wendel-Vos et al., 2004) **>5000 m2** (ECI, 2003) + condiciones apropiadas para realizar

Servicios ecosistémicos

beneficios que la poblaci n obtienen de la naturaleza (Forestry Comission 2017).

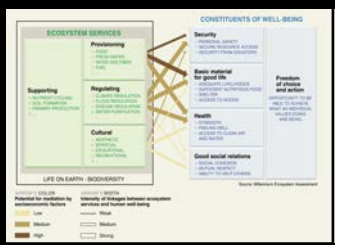
Servicios ecosistémicos.

a) Servicios de aprovisionamiento: productos de alimentación, materiales y fuentes de energía proporcionadas por los sistemas vivos.

b) Servicios de regulación y mantenimiento: todas las formas en que los organismos vivos pueden mediar o moderar el entorno ambiental y que afectan a las actividades y bienestar humanos.

c) Servicios culturales: incluyen todos los aspectos de los ecosistemas que afectan al estado físico y mental de las personas.

d) Servicios de soporte. Son los procesos ecosistémicos y estructuras necesarias para que sea posible la generación de los otros tipos de servicios ecosistémicos. Por ejemplo, la formación de suelo.



Millenium Ecosystem Assessment (2005), MEA, UK National ecosystem Assesmment (UK-NEA, 2011)
Turner (2008) , Constanza (1997), De Groot (2002) , Wallace (2007) , etc.

CICES

Towards a common classification of ecosystem services

European Environment Agency

Hosted on Behalf of the EEA

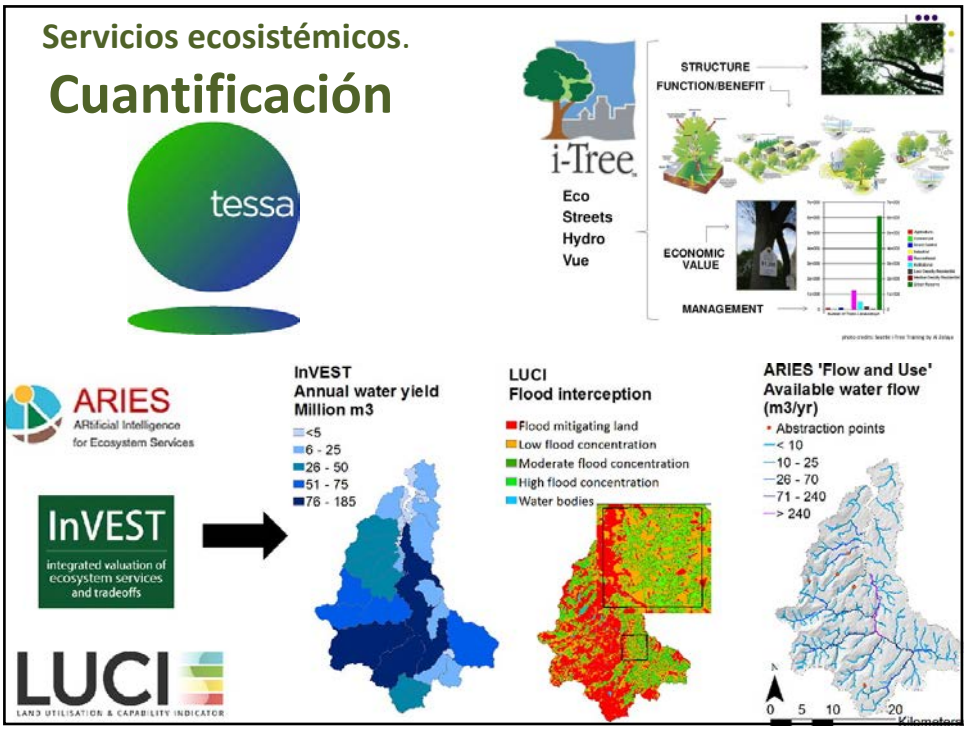
3 tipos de servicios:
Provisión.
Regulación.
Culturales.

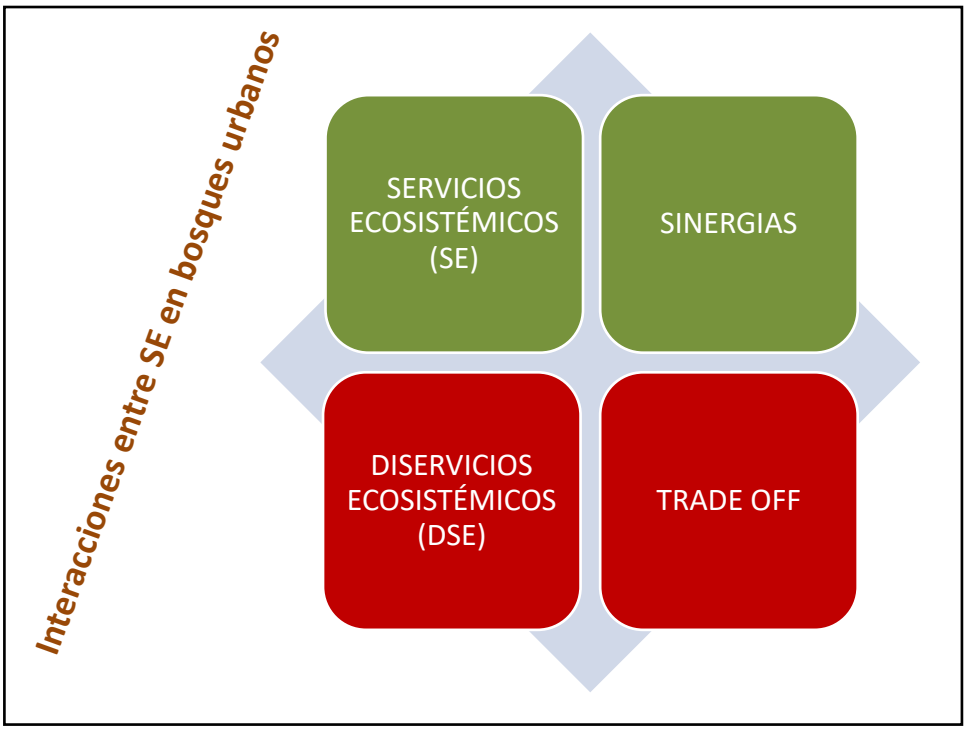
ESMERALDA

OpenNESS
Operationalisation of Natural Capital and Ecosystem Services

Los servicios ecosistémicos se definen como las contribuciones que los ecosistemas hacen al bienestar humano… (CICES, citado en JCR, 2018). Estas contribuciones se enmarcan en términos de

¿qué aportan los ecosistemas a la población?


Servicios ecosistémicos.
Cuantificación
tessa
i-Tree
Eco
Streets
Hydro
Vue
STRUCTURE
FUNCTION/BENEFIT
ECONOMIC VALUE
MANAGEMENT
ARIES
ARtificial Intelligence for Ecosystem Services
InVEST
integrated valuation of ecosystem services and tradeoffs
LUCI
LAND UTILISATION & CAPABILITY INDICATOR
InVEST
Annual water yield
Million m3
<5
6 - 25
26 - 50
51 - 75
76 - 185
LUCI
Flood interception
Flood mitigating land
Low flood concentration
Moderate flood concentration
High flood concentration
Water bodies
ARIES 'Flow and Use'
Available water flow
(m3/yr)
Abstraction points
< 10
10 - 25
26 - 70
71 - 240
> 240
0 5 10 20
Kilometers


Interacciones entre SE en bosques urbanos
SERVICIOS ECOSISTÉMICOS (SE)
SINERGIAS
DISERVICIOS ECOSISTÉMICOS (DSE)
TRADE OFF

Interacciones: trade off y sinergias

Servicio ecosistémico	Servicio ecosistémico	Interacción		Ámbito	Fuente
Provisión	Regulación	Trade off		137 distritos del Ayuntamiento de Quebec (CA)	(Raudsepp-Hearne et al., 2010)
Provisión	Cultural	Trade off		138 distritos del Ayuntamiento de Quebec (CA)	(Raudsepp-Hearne et al., 2010)
Provisión	Regulación	Trade off		Dinamarca (estado)	(Turner et al. (2014)
Provisión	Cultural	Trade off		Dinamarca (estado)	(Turner et al. (2014)
Regulación	Cultural	Sinergia	En concreto en áreas urbanas son importantes los tipos de conjuntos de usos mixtos multifuncionales.	138 distritos del Ayuntamiento de Quebec (CA)	(Raudsepp-Hearne et al., 2010)
Regulación	Cultural	Sinergia	En concreto en áreas urbanas son importantes los tipos de conjuntos de usos mixtos multifuncionales.	Dinamarca (estado)	(Turner et al. (2014)
Dependiente del suelo	Dependiente del suelo	Trade off		22 contextos urbano-rurales en el delta del río Yangtze (zona muy desarrollada en China)	(Yang et al., 2015)
No-dependiente del suelo	No-dependiente del suelo	Sinergia		23 contextos urbano-rurales en el delta del río Yangtze (zona muy desarrollada en China)	(Yang et al., 2015)
No existe regulación				Sheffield	(Barbosa et al.,2007)
			Los servicios pueden ocurrir a otras escalas espaciales. La multifuncionalidad puede no ser siempre interesante por los TRADE OFF que se generan.	16 ayuntamientos en Norrström (Suecia)	(Queiroz et al., 2015)

Action COST FP 1204: **Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests**

The Cost Of Ecosystem Services In Cities: Ecosystem Disservices

Coste de los servicios ecosistémicos o ecosystem disservices (ED) (Lyytimäki and Sipilä, 2009).

Delshammar, Ötsberg and Öxell (2015) desarrollaron un estudio de los diservicios del arbolado urbano comparando Goteborg, Malmo y Estocolmo.

The Cost Of Ecosystem Services In Cities: Ecosystem Disservices

- ✓ Diservicios mediooambientales-Ecológicos:

CO2 + VOCs+alergias+…contaminantes (Calfapietra, 2013; Cariñanos et al, 2015.)

http://www.lifegaia.eu/Gli-alberi

1. Impacto en la salud ([CO_2] + BVOCs (Sur et al., 2013) + polen (Bartra et al., 2007) + Artrópodos-alérgicas (Bonamonte et al., 2013); pájaros son vectores de enfermedades (Lohmur-Balbur 2015)+ peligrosidad…)

- ✓ Problemas/peligros Sociales. crímenes…
- ✓ Costes Económicos (I-tree, directos, indorectos,…)

Inconvenientes

- 1.- Problemas de tipo físico y/o mecánico.
  - Problemas originados por el desarrollo del sistema radicular.
  - Rebrotes de raíz.
  - Presencia de espinas.

Inconvenientes

- 2.- Problemas relacionados con la salud de las personas.
  - Presencia de sustancias venenosas.
  - Provocar alergias.
  - Plagas molestas.

- 3.- Problemas que interfieren con el medio en el que se desarrollan.
  - Especies que empobrecen el suelo.
  - Olores desagradables.
  - Frutos que manchan el pavimento.
  - Presencia de sustancias alelopáticas.

Heracleum mantegazzianum

Domingo
8 de julio de 2001

Internacional 23

La víctimas asistían a un concierto de música hebrea al aire libre, que no se suspendió pese al aviso de fuertes vientos

Conmoción en Francia por la muerte de once personas en Estrasburgo por una tormenta

Pese al aviso que el Este de Francia sería azotado por grandes tormentas, en la ciudad de Estrasburgo nadie quiso suspender el concierto de música hebrea que ofreció el grupo Mamas et Papas al aire libre la noche del viernes. Fue el fuerte viento racheado el que acabó aguando la fiesta, al arrancar de cuajo un árbol que se desplomó sobre una carpa que cobijaba a 120 personas. Once jóvenes murieron en el acto al ser aplastados. Otros 18, entre ellos dos niños, resultaron heridos de gravedad. Los franceses asisten conmocionados al desenlace de una tragedia que ya está siendo investigada por la Fiscalía y que algunos creen pudo haberse evitado.

DOMINGOS SAMPEDRO
BRUSELAS. Corresponsal

Astrid Ruff, una joven que asistió al concierto celebrado en los jardines de un castillo situado a las afueras de Estrasburgo, declaró a la televisión francesa que la decisión de celebrarlo «fue imprudente. Podemos decirlo ahora al ver el alcance de esta tragedia».

Aunque visiblemente consternada por lo ocurrido, ella al menos resultó ilesa. No tuvieron la misma suerte los siete hombres y cuatro mujeres que murieron en el acto cuando un árbol arrancado por un repentino pequeño tornado se desplomaba sobre la carpa inestable en la que se guarecían de la fuerte lluvia. El suceso tuvo lugar poco antes de las diez de la noche del pasado viernes. Otras 65 personas que se refugiaban de la tormenta en el mismo lugar resultaron heridos, 18 de ellos de gravedad.

En alerta

Los servicios de socorro, que estaban en alerta por el aviso de fuertes tormentas, movilizaron 130 bomberos, 35 ambulancias y tuvieron que utilizar máquinas para cortar las ramas del árbol para rescatar a los heridos. En el lugar se vivieron escenas de desolación, con jóvenes, muchos de ellos menores, que vagaban ensangretados bajo la lluvia llamando a gritos a familiares y amigos.

Los organizadores habían recibido la autorización para celebrar el concierto al aire libre, pese al pronóstico de fuertes tormentas para los departamentos de la Alsacia, Lorena y el Franco Condado, todos ellos en el Este del país.

Philippe Marland, responsable del Gobierno en la zona, atribuyó el siniestro a «la fatalidad» y dijo que había sido imposible prever la tragedia.

Un policía permanece junto al árbol derribado por el fuerte viento y que causó la tragedia en Estrasburgo

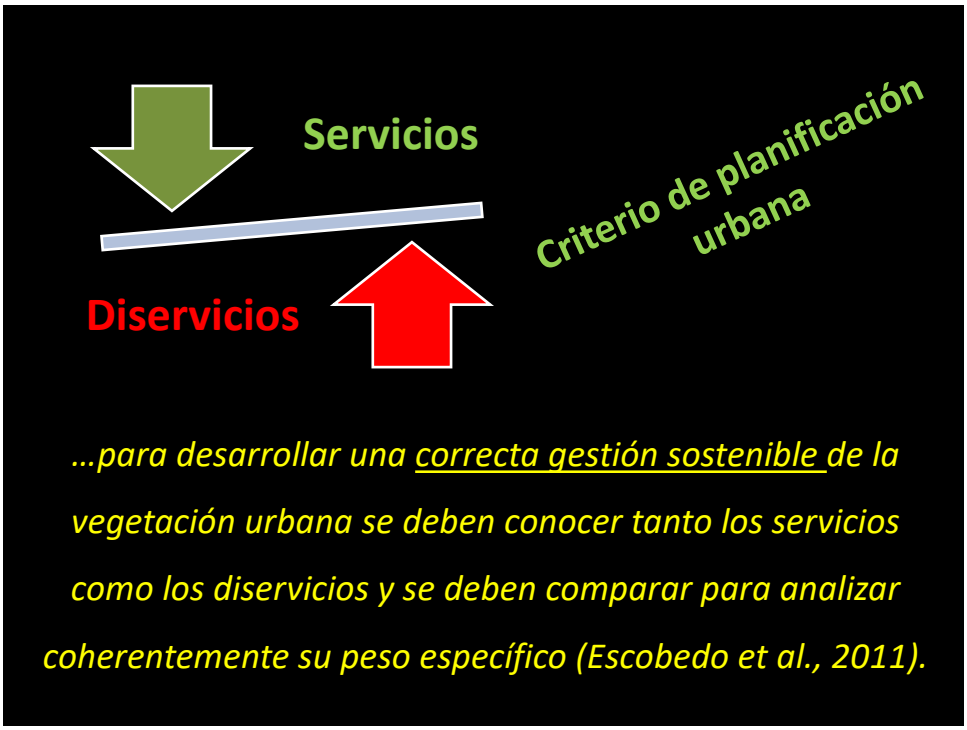
JEAN MARC LOOS / REUTERS

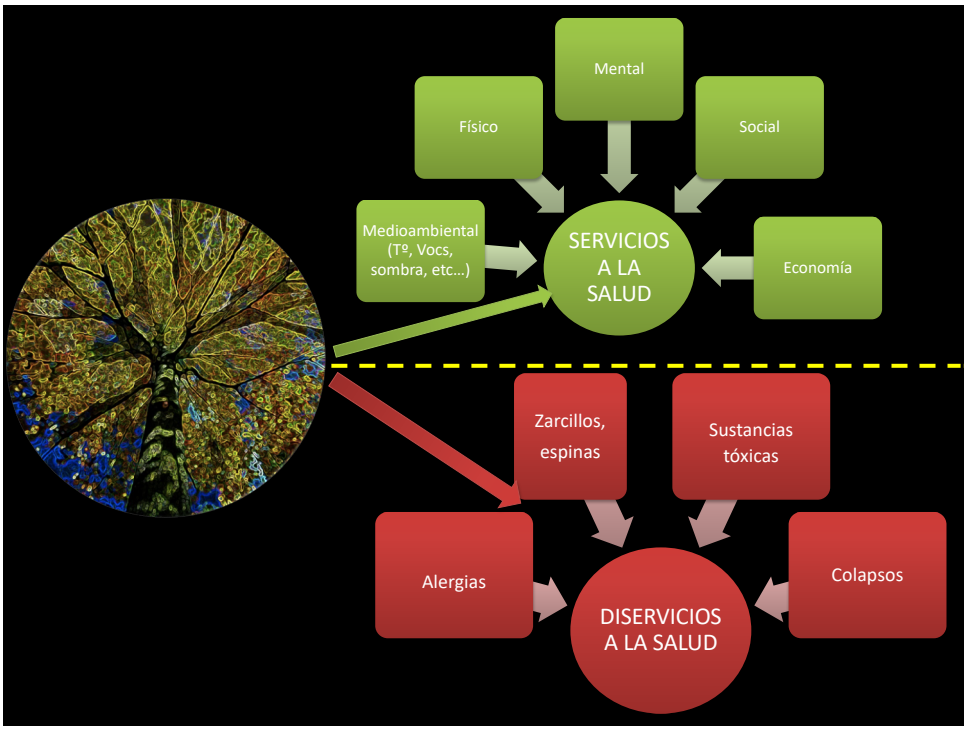
Estragos en otros lugares del país

La Fiscalía de Estrasburgo abrió ayer una investigación para esclarecer las circunstancias del siniestro que ha costado la vida a once personas. Se trata de esclarecer si existe alguna responsabilidad del Centro Europeo para la Cultura Judía, organizador del Concierto al aire libre, por no haber suspendido la actuación pese que el Servicio de Meteorología francés había recomendado que no se saliese de casa e incluso y la gente evitase refugiarse debajo de los árboles.

La tormenta también causó estragos en Tulle, centro-este del país, donde fueron evcuados cientos de vecinos, y en Belfort fue interrumpido un concierto de rock al que asistían 20.000 personas y no circulan trenes. También en el norte de Italia, un huracán arrasó la región de Lombardía, que dejó 60 heridos y numerosos daños.

Además, en el municipio de Felsberg, en el cantón suizo de Grisons (este), una roca de alrededor de 200.000 metros cúbicos, equivalente a un centenar de casas, cayó la pasada noche sin causar víctimas ni daños.


Servicios
Diservicios
Criterio de planificación urbana
…para desarrollar una correcta gestión sostenible de la vegetación urbana se deben conocer tanto los servicios como los diservicios y se deben comparar para analizar coherentemente su peso específico (Escobedo et al., 2011).


Mental
Físico
Social
Medioambiental (Tº, Vocs, sombra, etc…)
SERVICIOS A LA SALUD
Economía
Zarcillos, espinas
Sustancias tóxicas
Alergias
DISERVICIOS A LA SALUD
Colapsos

SE y Bosques urbanos

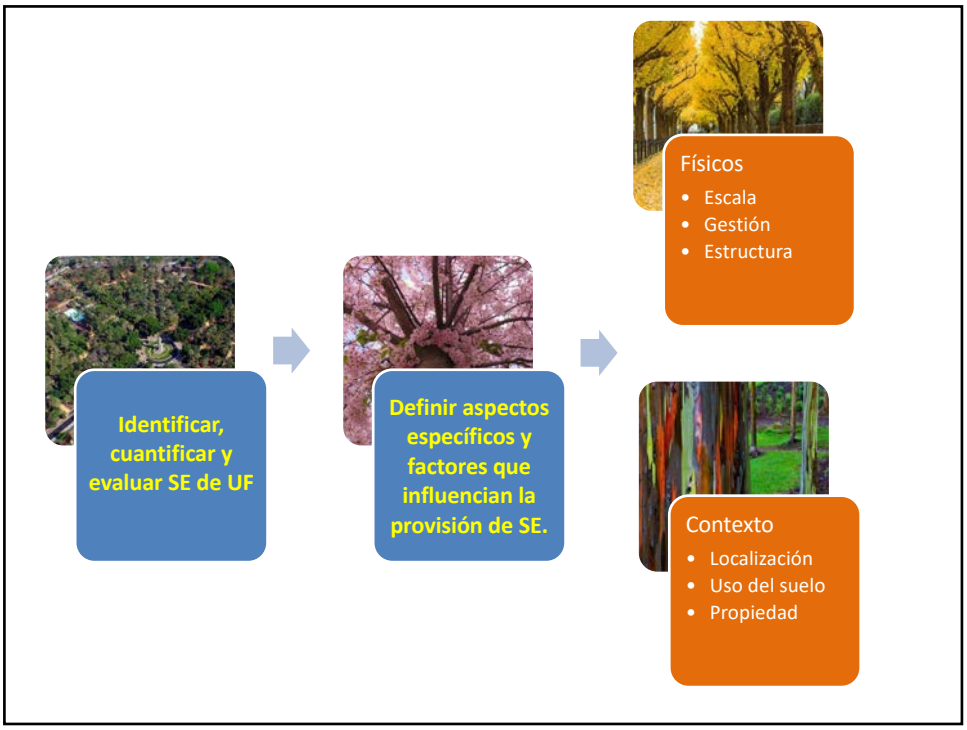
Table 2 Matrix of the relationship between ecosystem services and urban forest components.

	Ecosystem service	Urban forest components			
		Single tree	Line of trees	Tree cluster	Woodland
Provisioning	Food provision				
	Fuel provision (woodfuel)				
	Wood provision				
Regulating	Carbon sequestration				
	Temperature regulation				
	Stormwater regulation				
	Air purification				
	Noise mitigation				
Cultural	Health				
	Nature and landscape connections				
	Social development and connections				
	Education and learning				
	Economy				
	Cultural significance				
Disservice	Fruit and leaf fall				
	Animal excrement				
	Blocking of light, heat or views				
	Decrease in air quality				
	Allergenicity				
	Spread of pests and diseases				
	Spread of invasive species				
	Damage to infrastructure				
	Creation of fear				
	Tree and branch fall (especially during storms)				

Commonly delivered Sometimes delivered Rarely delivered

Servicios ecosistémicos

beneficios que la poblaci n obtienen de la naturaleza (Forestry Comission 2017).

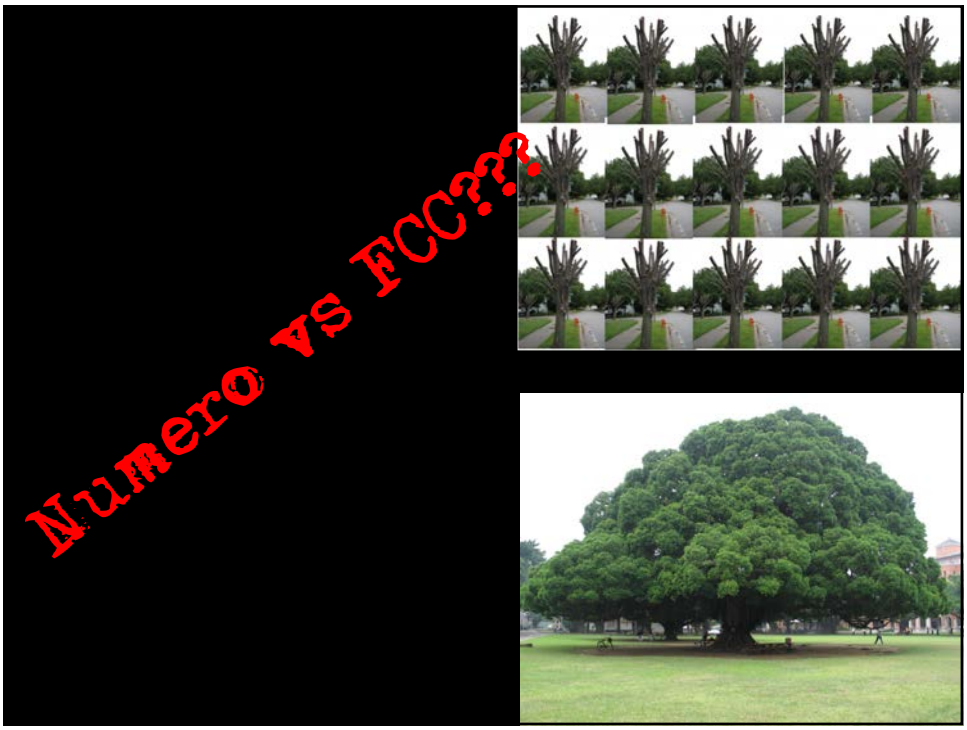

Identificar, cuantificar y evaluar SE de UF
Definir aspectos específicos y factores que influencian la provisión de SE.
Físicos
• Escala
• Gestión
• Estructura
Contexto
• Localización
• Uso del suelo
• Propiedad

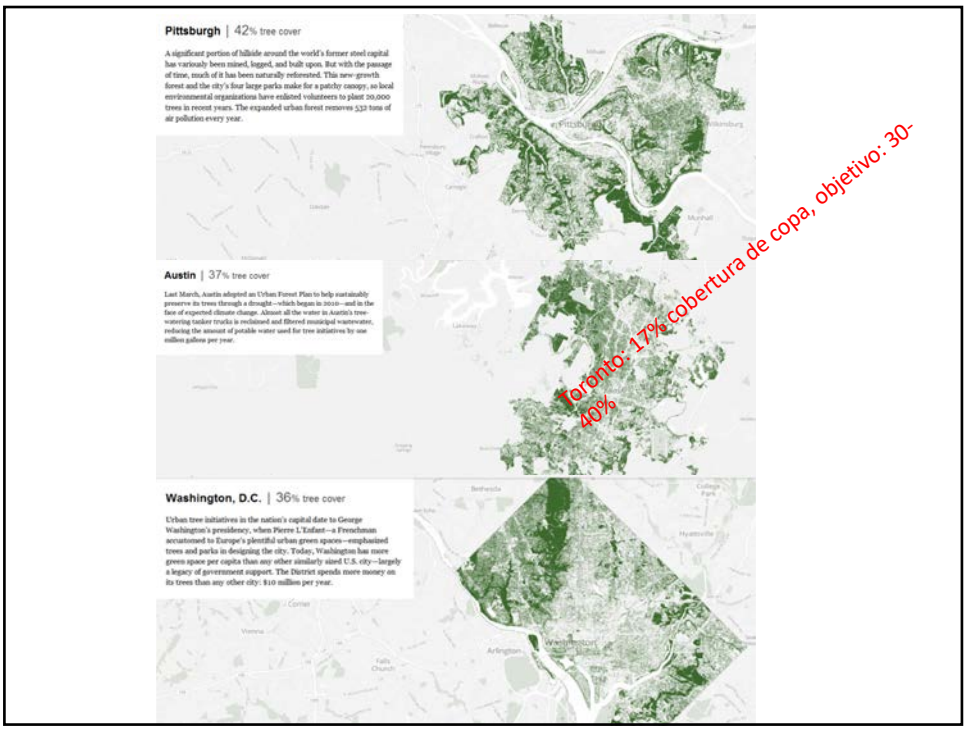
Escala y gestión
Valorados como conjuntos
Provisión y regulación. FCC>>> (McPherson, 1994, Nowak and Crane, 2002)
Árbol aislado
Alineación de árboles
Cluster de árboles
Bosques urbanos (urban woodland, 5000 m2 y 20 m)
Técnicas de arboricultura
Tcas de silvicultura (Kenney et al., 2011)

Físicos
- Escala
- Gestión
- Estructura

Físicos
- Escala
- Gestión
- **Estructura**

- Densidad y separación
- Distribución de clases diamétricas y edades
- Sanidad vegetal
- Composición de especies
- Área de superficie foliar
- FCC


Numero vs FCC???

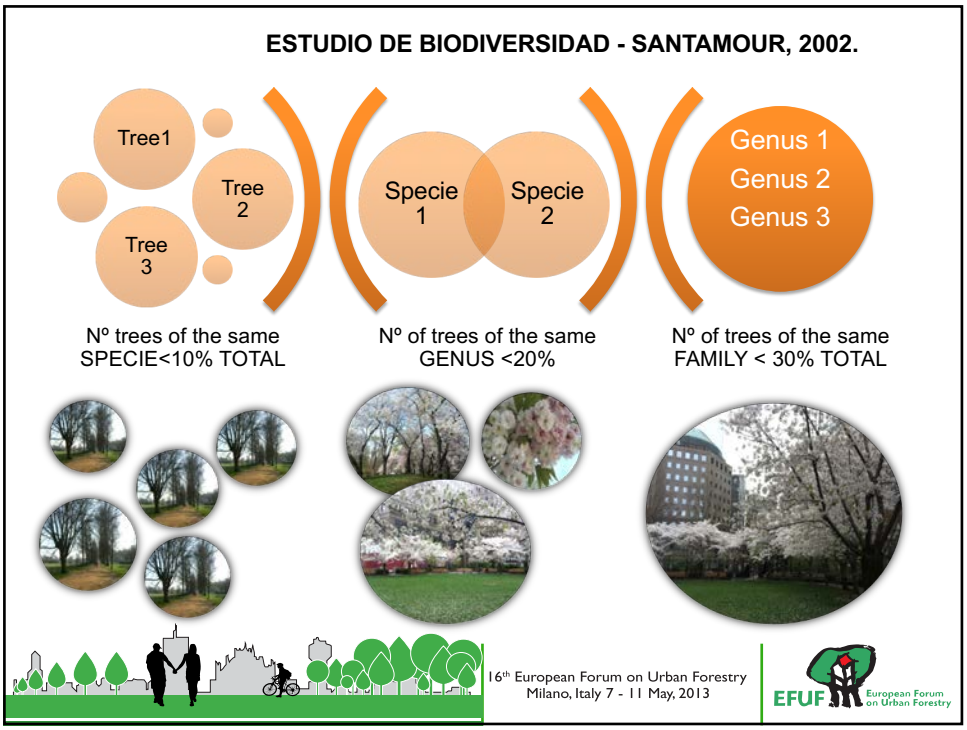

Pittsburgh | 42% tree cover
A significant portion of hillside around the world's former steel capital has variously been mined, logged, and built upon. But with the passage of time, much of it has been naturally reforested. This new-growth forest and the city's four large parks make for a patchy canopy, so local environmental organizations have enlisted volunteers to plant 20,000 trees in recent years. The expanded urban forest removes 532 tons of air pollution every year.
Austin | 37% tree cover
Last March, Austin adopted an Urban Forest Plan to help sustainably preserve its trees through a drought—which began in 2010—and in the face of expected climate change. Almost all the water in Austin's tree-watering tanker trucks is reclaimed and filtered municipal wastewater, reducing the amount of potable water used for tree initiatives by one million gallons per year.
Washington, D.C. | 36% tree cover
Urban tree initiatives in the nation's capital date to George Washington's presidency, when Pierre L'Enfant—a Frenchman accustomed to Europe's plentiful urban green spaces—emphasized trees and parks in designing the city. Today, Washington has more green space per capita than any other similarly sized U.S. city—largely a legacy of government support. The District spends more money on its trees than any other city: $10 million per year.
Toronto: 17% cobertura de copa, objetivo: 30-40%

Necesitamos hojas, no rboles

(adaptado de Nowak)

Arbolado urbano sano:

biodiversidad + estratos de edad

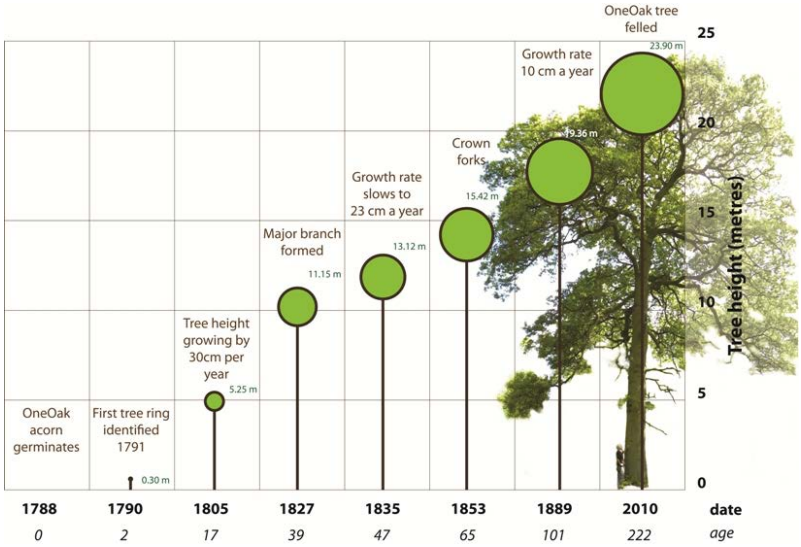


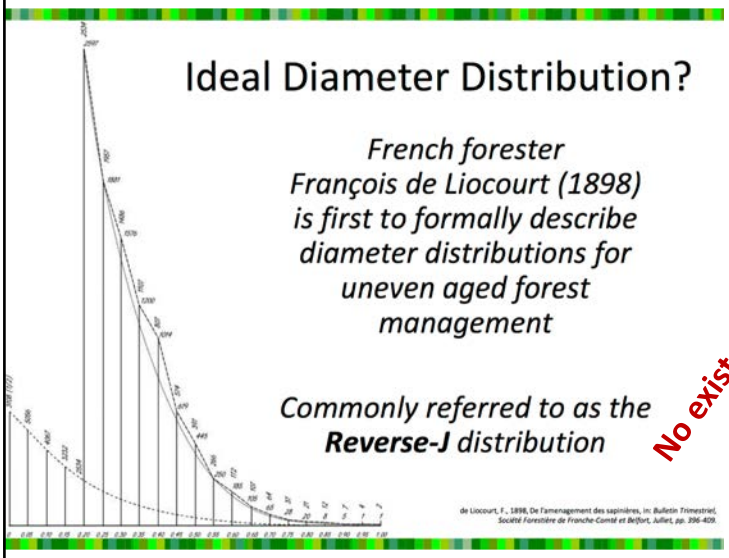
Distribuci n diamétrica de la masa arb rea urbana

Perception of a Problem

"Large old trees are disproportionately vulnerable to loss in many ecosystems worldwide as a result of accelerated rates of mortality, impaired recruitment, or both"

Lindenmayer, D.B., Laurance, W.F., Franklin, J.F., Likens, G.E., Banks, S.C., Blanchard, W., . . . Stein, J.A.R. (2014). New Policies for Old Trees: Averting a Global Crisis in a Keystone Ecological Structure. *Conservation Letters, 7(1), 61-69. doi: 10.1111/conl.12013*





Ideal Diameter Distribution?

French forester François de Liocourt (1898) is first to formally describe diameter distributions for uneven aged forest management

Commonly referred to as the ***Reverse-J*** *distribution*

de Liocourt, F., 1898, De l'amenagement des sapinières, in: *Bulletin Trimestriel, Société Forestière de Franche-Comté et Belfort, Juillet, pp. 396-409.*

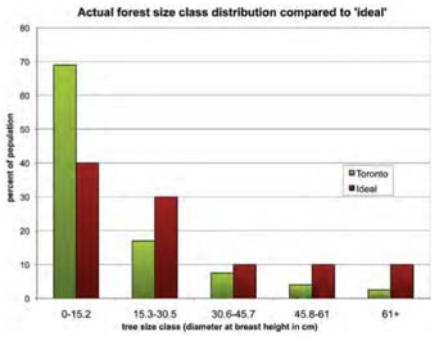
No existe una distribución ideal

A well distributed age-class helps maintain a stable canopy cover. If all the trees within a particular area or neighbourhood are approximately the same age they will mature and decline more or less at the same time, leaving that area with a deficient urban forest canopy. In some parts of Oakville, mature Norway and silver maple trees have begun to decline in health (Town of Oakville 2006). To mitigate against the impacts of a decreasing canopy cover in neighbourhoods dominated by these two species, Oakville should take steps to increase the age class and species distribution where possible.

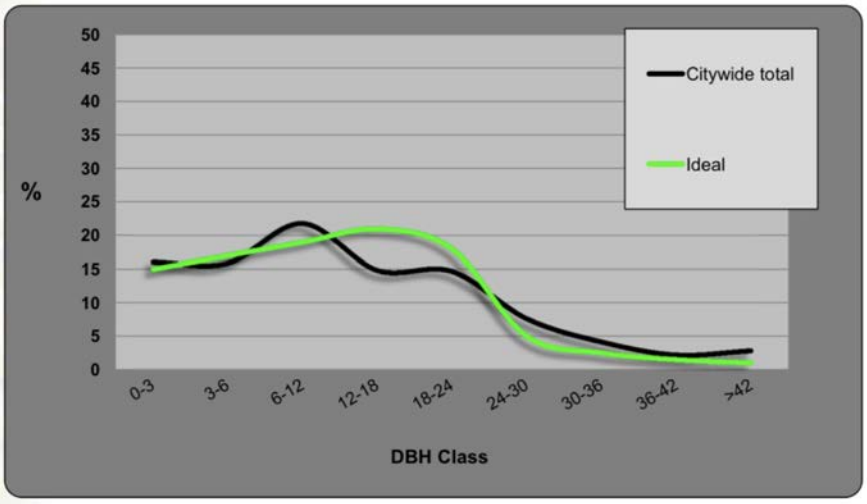
For example, the City of Davis, CA established the following standard for desired age structure:

- 40% young (< 15 cm DBH)
- 30% maturing (15-30 cm DBH)
- 20% mature (30-60 cm DBH)
- 10% old (>60 cm DBH)[14]

At present, Oakville has only 0.5% large-stature trees.[15] Management activities should strive to improve this to at least 10% of all trees in Oakville.

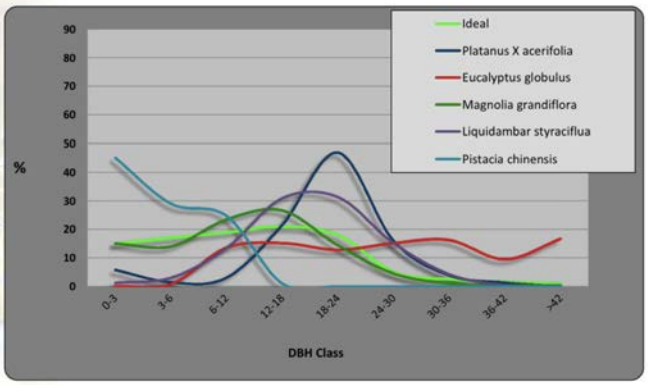


Distribuciones ideales muy diferentes en f del contexto...



Age Structure

Proven Solutions for a Growing Wor



12.11.2015

From Sapling to Maturity - Exploring Structural Diversity in Urban Forests

Justin Morgenroth
New Zealand School of Forestry
University of Canterbury

David Nowak
USDA Forest Service

What is the ideal UF dbh distribution?

Urban Ecology, 7 (1982/1983) 159–171
Elsevier Scientific Publishing Company, Amsterdam — Printed in The Netherlands

DIVERSITY AND STABILITY IN A STREET TREE POPULATION

N.A. RICHARDS
College of Environmental Science and Forestry, School of Forestry, State University of New York, Syracuse Campus, Syracuse, NY 13210 (U.S.A.)

(Accepted 5 May 1982)

ABSTRACT

Richards, N.A., 1982. Diversity and stability in a street tree population. *Urban Ecol.*, 7: 159–171.

The relationship of species diversity to the stability of a street tree population is explored, using data from Syracuse, NY. Because streetside spaces are complexly stressed environments, one generally observes that relatively few species prove wide adaptation and good longevity in a particular community, and that there is greater species diversity among recently planted trees than among older trees in the population. The few species surviving to be well represented among the older trees are likely to be better prospects for contributing to population stability in the uncertain future than are short-lived, ill-adapted, or little-tested species that may be added to increase diversity. Population stability depends on species adaptation to the diversity of streetside conditions in a community over time, rather than on species diversity per se. Good age diversity, to provide adequate successful replacements, is essential for population stability. Undue emphasis on species diversity in replacement plantings may further threaten stability by causing inadequate replacement of the proven adapted species in the older population.

- Richards most cited in UF literature
- But is distribution ideal or generally applicable?
- Richards calls them "*my approximate guidelines*"

Richards, N. A. (1983). Diversity and stability in a street tree population. *Urban Ecology, 7(2), 159-171.*

My Approximate Guidelines…

- Richards' "*approximate guidelines*"

"For adapted, long-lived species […] in Syracuse, […] a good age distribution for population stability would be about ***40% trees under 20 cm*** *diameter,* ***30% 20 – 40 cm*** *trees in the early functional stage,* ***20% 40 – 60 cm*** *functionally mature trees, and* ***10% older trees*** *with most of their functional life behind them."*

Richards, N. A. (1983). Diversity and stability in a street tree population. *Urban Ecology, 7(2), 159-171.*

What is the ideal distribution?

Journal of Environmental Management

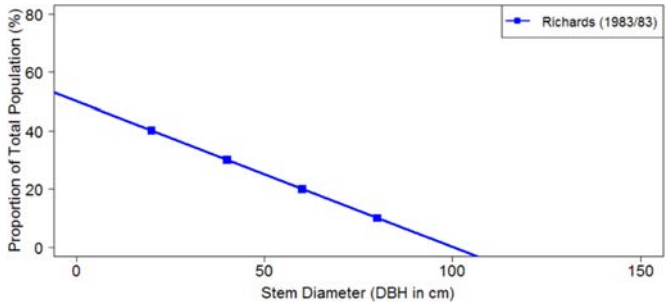
Structure of a forested urban park: Implications for strategic management

Andrew A. Millward, Sensa Sabir

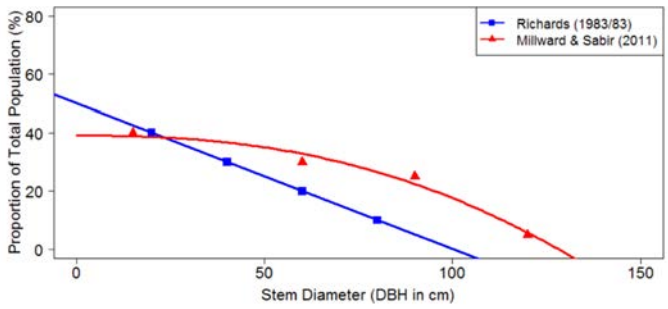
- Millward & Sabir modify Richards and propose:
- "...a generalized ideal distribution [...] that would see **40%** of a tree population fall within a DBH class of **0 – 15 cm**, **30%** from **15 – 60 cm**, **25%** in class **60 – 90 cm**, and **5%** classified as **90 cm** and above."

Millward, A.A., & Sabir, S. (2010). Structure of a forested urban park: Implications for strategic management. *Journal of Environmental Management, 91(11), 2215-2224. doi: http://dx.doi.org/10.1016/j.jenvman.2010.06.006*

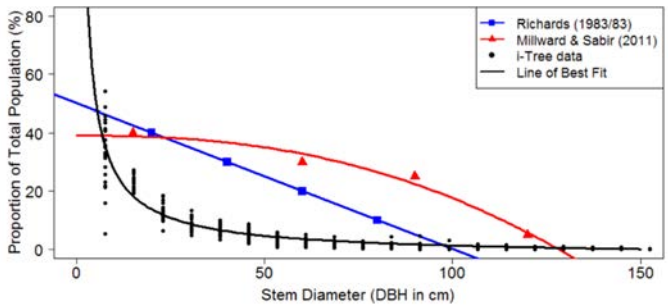
Diameter Class Distributions



Diameter Class Distributions



Diameter Class Distributions



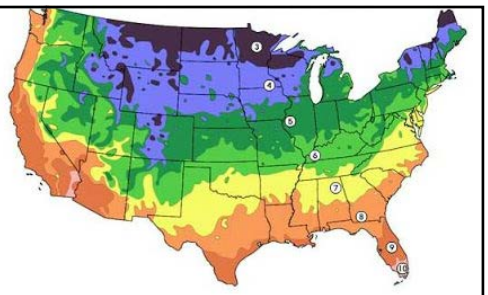
1. Trees & Forests – Targets related to the status of the vegetation resource itself and/or knowledge of that resource.

#	Target	Key objective	2017 Rating			
			Low	Fair	Good	Optimal
T3	**Species diversity**	Establish a genetically diverse tree population across municipality as well as at the neighborhood level.	Five or fewer species dominate the entire tree population across municipality.	No single species represents more than 10% of total tree population; no genus more than 20%; and no family more than 30%.	No single species represents more than 5% of total tree population; no genus more than 10%; and no family more than 15%.	At least as diverse as "Good" rating (5/10/15) municipality-wide – *and* at least as diverse as "Fair" (10/20/30) at the neighborhood level.
T2	**Age diversity (Size class distribution)**	Provide for ideal uneven age distribution of all "intensively" (or individually) managed trees – municipality-wide as well as at neighborhood level.	Even-age distribution, or highly skewed toward a single age class (maturity stage) across entire population.	Some uneven distribution, but most of the tree population falls into a single age class.	Total tree population across municipality approaches an ideal age distribution of 40% juvenile, 30% semi-mature, 20% mature, and 10% senescent.	Total population approaches that ideal distribution municipality-wide as well as at the neighborhood level.

KITCHENER (CA)

Zonas USDA PHZM

Calentamiento global



1990

2012

Zones

2 3 4 5 6 7 8 9 10

http://planthardiness.ars.usda.gov/PHZMWeb/#

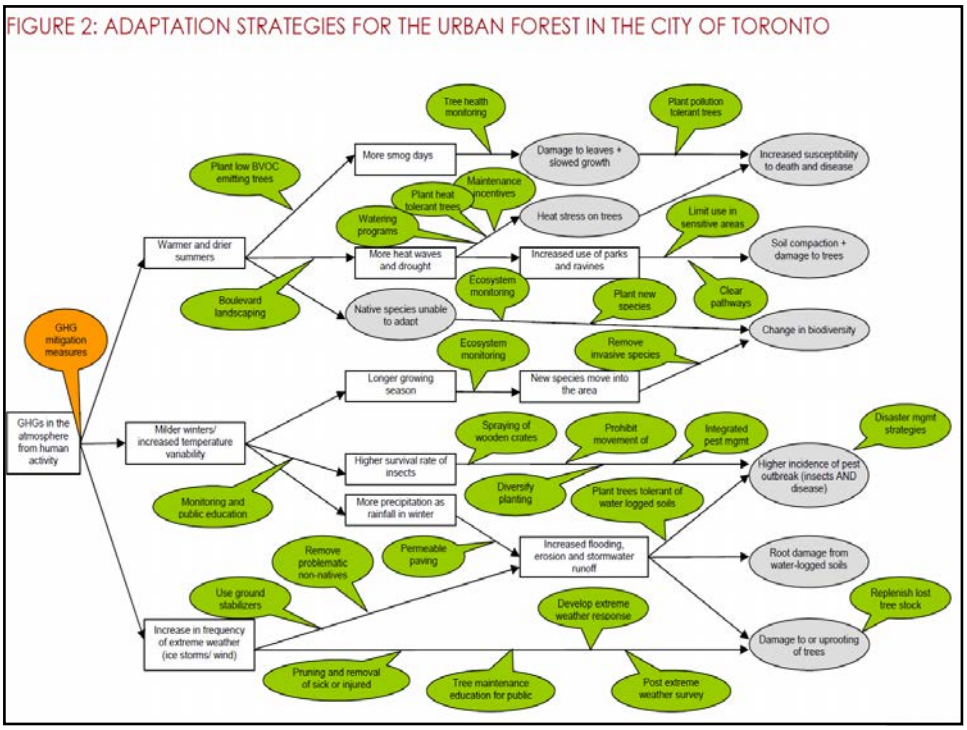
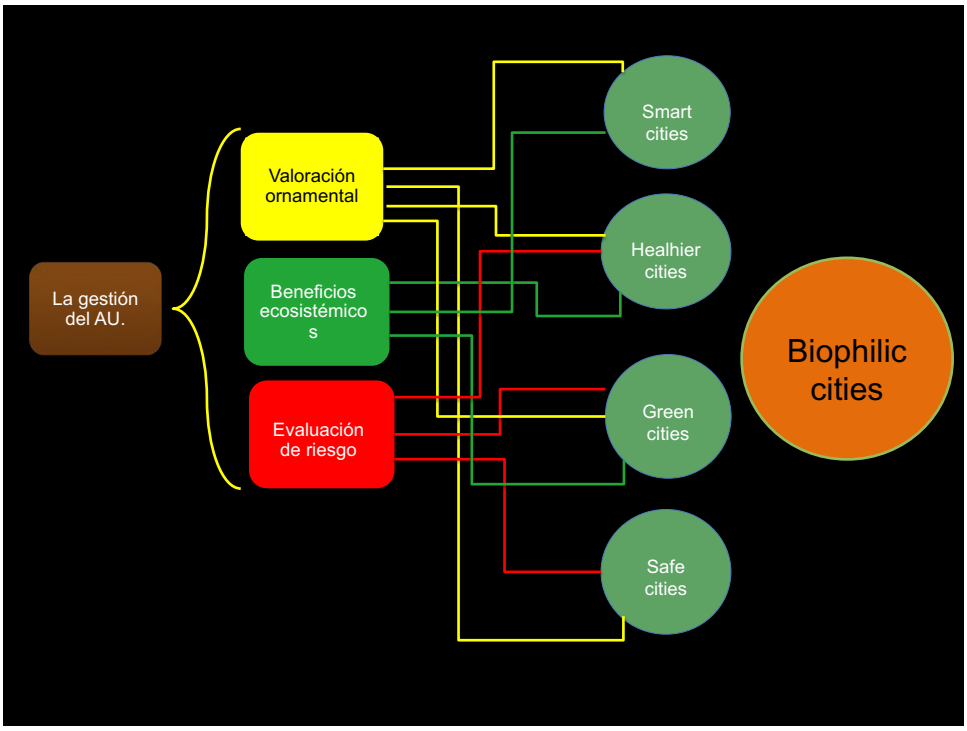
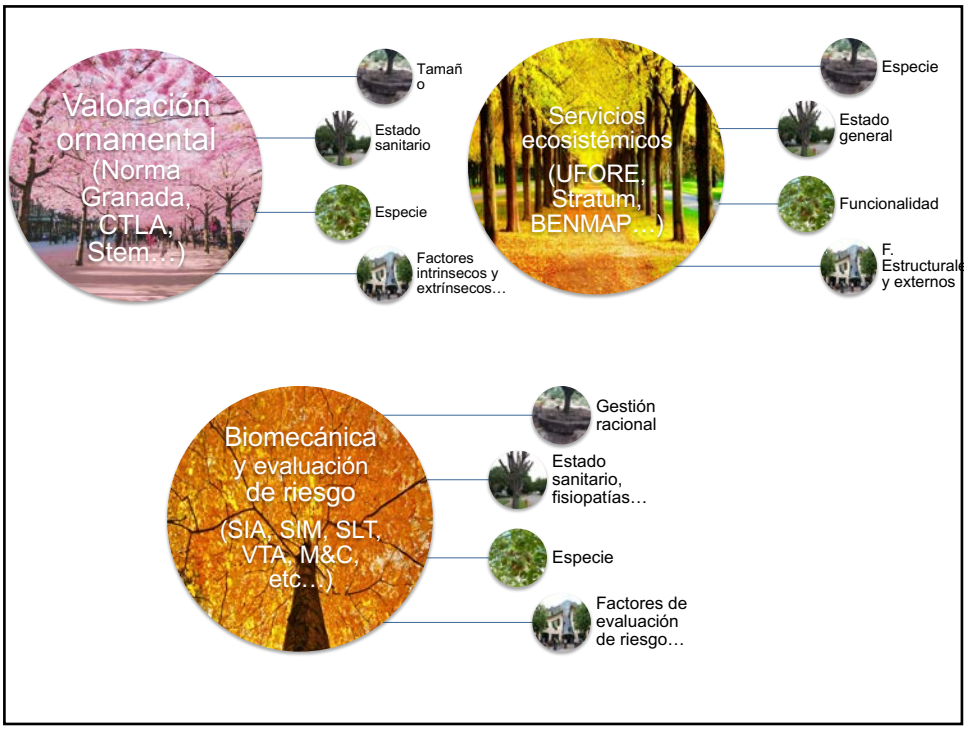
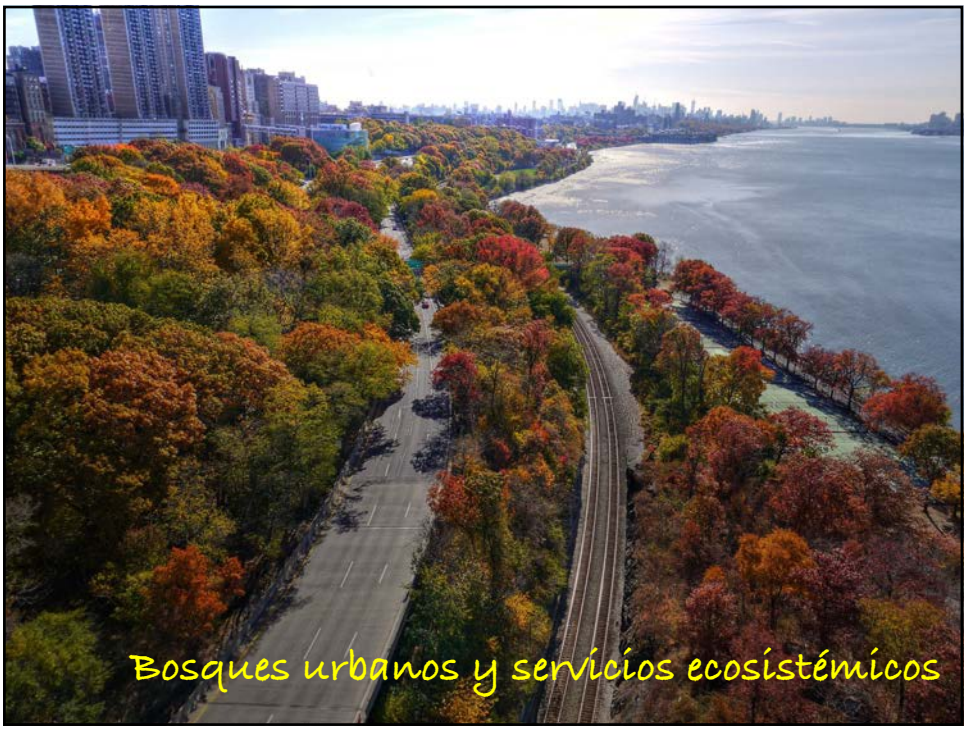
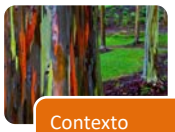


FIGURE 2: ADAPTATION STRATEGIES FOR THE URBAN FOREST IN THE CITY OF TORONTO
GHG mitigation measures
GHGs in the atmosphere from human activity
Warmer and drier summers
Milder winters/ increased temperature variability
Increase in frequency of extreme weather (ice storms/ wind)
Plant low BVOC emitting trees
Boulevard landscaping
Monitoring and public education
Use ground stabilizers
Remove problematic non-natives
Pruning and removal of sick or injured
More smog days
More heat waves and drought
Native species unable to adapt
Longer growing season
Higher survival rate of insects
More precipitation as rainfall in winter
Increased flooding, erosion and stormwater runoff
Tree health monitoring
Watering programs
Plant heat tolerant trees
Maintenance incentives
Ecosystem monitoring
Ecosystem monitoring
Spraying of wooden crates
Diversify planting
Permeable paving
Tree maintenance education for public
Damage to leaves + slowed growth
Heat stress on trees
Increased use of parks and ravines
New species move into the area
Plant new species
Remove invasive species
Prohibit movement of
Plant trees tolerant of water logged soils
Develop extreme weather response
Plant pollution tolerant trees
Limit use in sensitive areas
Clear pathways
Integrated pest mgmt
Post extreme weather survey
Disaster mgmt strategies
Replenish lost tree stock
Increased susceptibility to death and disease
Soil compaction + damage to trees
Change in biodiversity
Higher incidence of pest outbreak (insects AND disease)
Root damage from water-logged soils
Damage to or uprooting of trees


La gestión del AU.
Valoración ornamental
Beneficios ecosistémico s
Evaluación de riesgo
Smart cities
Healhier cities
Green cities
Safe cities
Biophilic cities


Valoración ornamental
(Norma Granada, CTLA, Stem…)
Tamaño
Estado sanitario
Especie
Factores intrínsecos y extrínsecos…
Servicios ecosistémicos
(UFORE, Stratum, BENMAP…)
Especie
Estado general
Funcionalidad
F. Estructurales y externos
Biomecánica y evaluación de riesgo
(SIA, SIM, SLT, VTA, M&C, etc…)
Gestión racional
Estado sanitario, fisiopatías…
Especie
Factores de evaluación de riesgo…


Bosques urbanos y servicios ecosistémicos



Contexto
- Localización
- Uso del suelo
- Propiedad

Uso del suelo y propiedad

FCC está afectada por el uso y propiedad del suelo.

Afecta a la accesibilidad y visibilidad.

La morfología urbana es crítica. Caracteriza el suelo en base a características físicas y las actividades que acomodan.

Los SE dependen de la gestión del suelo urbano.

SE y Bosques urbanos

Table 2 Matrix of the relationship between ecosystem services and urban forest components.

	Ecosystem service	Urban forest components			
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Provisioning	Food provision				
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	Education and learning				
	Economy				
	Cultural significance				
Disservice	Fruit and leaf fall				
	Animal excrement				
	Blocking of light, heat or views				
	Decrease in air quality				
	Allergenicity				
	Spread of pests and diseases				
	Spread of invasive species				
	Damage to infrastructure				
	Creation of fear				
	Tree and branch fall (especially during storms)				

Commonly delivered Sometimes delivered Rarely delivered

SE de provisión y Bosques urbanos

- Provisión directa (frutos, semillas, nueces, etc.).
- Provisión indirecta (setas, ciervos, etc…)
- Servicio específico de ciertas especies. Conversión y almacenaje de la energía vía la fotosíntesis en materia biológica comestible.
- Productividad de fruta…. 500-600 árboles por ha.
- Más comunes en Londres: *Pyrus sp., Malus sp. …* (Rogers at al., 2015)

SE de provisión y Bosques urbanos. Provisión de alimentos.

Table 3 Urban forest parameters that are reported to improve the ecosystem service of food provision.

Scale and management	Pest and disease control will ensure that trees stay healthy and thus produce higher quality fruit (Goldschmidt, 1999). Tree pruning and feathering techniques can result in greater yields of fruit (Robinson *et al.*, 2007).
Urban forest structure	Trees with pyramid-shaped crowns produce more and better quality food than those with globe-shaped crowns due to the greater exposure to light (Robinson *et al.*, 2007). The harvesting of fruit, berries and nuts, as well as ongoing tree maintenance, is easier for smaller trees (Robinson *et al.*, 2007). Larger trees tend to produce larger fruit (Clark and Nicholas, 2013). Urban orchards in Europe are typically planted at a density of 500–600 trees per hectare due to diminishing returns (Robinson *et al.*, 2007). Some species produce greater yields in monocultures due to resource competition from other species, while some fare better in polycultures with complementary processes (Rivera *et al.*, 2004).
Location and proximity to people	Trees located near transport routes may have trace metal content (e.g. cadmium and lead) in their fruits, nuts and berries; however, they are less susceptible to pollution than vegetables (von Hoffen and Säumel, 2014). The closer food producing trees are to urban populations, the more likely people are to benefit from the increasingly popular trend of eating locally grown food (Clark and Nicholas, 2013). The feasibility of harvesting food from local trees or woods may be reduced where accessibility is difficult or impractical (e.g. due to the height of the tree or an adjoining busy road).
Land use and ownership	Fruit trees can be used as incentives for city dwellers to plant trees in private gardens (McLain *et al.*, 2012). Publicly owned and accessible open space is likely to be best suited to the provision of public food trees (McLain *et al.*, 2012).

SE de regulación y Bosques urbanos.

Regulación de aguas de tormenta.

Materiales de Albedo bajo afectan a la Tº y a la infiltración…

BU interceptan y almacenan agua de lluvia, favorecen evaporación y minimizan erosión

Table 7 Urban forest parameters that are reported to improve the ecosystem service of stormwater regulation.

Scale and management	Greater canopy cover increases rainfall interception (Inkiläinen *et al.*, 2013).
	Isolated, single trees use more water due to greater exposure and canopy size (Nisbet, 2005).
	Weed, pest and disease control will ensure that trees and canopies stay healthy, while arboricultural thinning affects structural density, thus reducing interception and increasing the speed with which rainfall reaches rivers (Xiao and McPherson, 2002).
Urban forest structure	Taller trees (~30 m) can reduce the amount of rainfall converted into throughfall more than smaller trees (~10 m), as aerodynamic turbulence and evaporation increase (Llorens and Domingo, 2007).
	Large-canopied trees play an important role in regulating stormwater through greater evapotranspiration (Gill *et al.*, 2007).
	Annual and peak event rainfall interception per tree increases with stem diameter, multiple layers of branching and rough bark surfaces (Xiao and McPherson, 2002).
	For small (canopied) trees, infiltration is more effective at reducing runoff than interception (Armson *et al.*, 2013b).
	Trees with greater LAI (denser canopies) can reduce the amount of throughfall through greater interception rates (Nisbet, 2005).
	Coniferous and evergreen broadleaved trees are more effective at intercepting rainfall than deciduous ones for which interception is significantly reduced during the leaf-off season (Xiao and McPherson, 2002).
	Fast-growing and deep-rooting trees transpire more water than slow-growing and shallow-rooting trees (Calder *et al.*, 2008).
	Structural diversity in (broadleaved) woodland increases its aerodynamic roughness and thus its evaporation rate (Calder *et al.*, 2008).
Location and proximity to people	Urban woodland is most effective at reducing flooding if located upslope of urban areas (Matteo *et al.*, 2006).
	Flooding is decreased and groundwater recharge increased when trees are located next to roads and rivers (Matteo *et al.*, 2006).
	Trees planted over pervious surfaces reduce surface runoff by more than those planted over impervious surfaces (Armson *et al.*, 2013b).
	Greening of sandy soils is more effective at reducing runoff than greening of clay soils (Gill *et al.*, 2007).
	In terms of the distribution of trees, studies typically focus on increasing tree cover in low tree cover areas across a city as a whole in order to have measurable reductions on runoff (Ellis, 2013; Sjöman and Gill, 2014).
	Peri-urban and even rural woodlands (in the riparian zone and floodplain) can contribute to flood alleviation in urban areas by delaying the downstream passage of flood flows (Forest Research, 2010).
Land use and ownership	Recategorising parkland to account for individual trees as distinct from amenity grassland results in more accurate scores for flood control (Farrugia *et al.*, 2013).
	The potential for maximising the possible contribution of green infrastructure to stormwater regulation is largely dependent on co-operative management of privately owned land (Ellis, 2013).

SE de regulación y Bosques urbanos.

Purificación del aire.

Deposición mecanismo por el cual los contaminantes gaseosos y particulados son capturados por las plantas y absorbidos por sus hojas, ramas y troncos.

Table 8 Urban forest parameters that are reported to improve the ecosystem service of air purification.

Scale and management	The greater the (continuous) canopy cover and tree density, the greater the deposition of air pollutants (Alonso *et al.*, 2011).
	Unhealthy or stressed trees have reduced ability to remove air pollutants due to stomatal closure (Jim and Chen, 2008).
	Managing urban forests at intermediate scales (e.g. remnant patches around neighbourhoods) can reduce PM_{10} more effectively than landscape-scale tree cover (Escobedo *et al.*, 2011).
	Management of street trees and woodlands were found to be a cost-effective way of reducing PM_{10} compared to technological or policy measures such as the use of greener fuels (Escobedo *et al.*, 2008).
	The presence of street trees is associated with reduced prevalence of asthma (Lovasi *et al.*, 2008).
Urban forest structure	Conifers absorb the least O_3 and evergreen broadleaf species the most (Alonso *et al.*, 2011).
	Deciduous species assimilate more nitrogen oxides (NO_x) than evergreen species (Bowler *et al.*, 2010b).
	Coniferous trees are better at accumulating airborne $PM_{2.5}$ particles on their foliage than broadleaved species because of their thicker wax layer (Nguyen *et al.*, 2015).
	Trees with larger crown dimensions are more effective at air pollution removal (Alonso *et al.*, 2011).
	Air purification by trees is lowest in winter and highest in spring and summer due to leaf-on period (Baró *et al.*, 2014).
	The removal of air pollutants is related to total leaf area (Jim and Chen, 2008).
	Urban forests with diversified species and biomass structures are better for mitigating air pollution as overall canopy is increased (Jim and Chen, 2008).
Location and proximity to people	The availability of moisture in the soil will enhance a tree's ability to remove air pollutants (Baró *et al.*, 2014).
	Trees in closer proximity to a pollution source will be more effective at mitigating it, thus those between high pollution areas such as busy roads and vulnerable areas such as playgrounds, schools, hospitals and residential areas should be prioritised (Escobedo *et al.*, 2011).
	Conifers are generally less tolerant to high traffic-related pollution, so are less suitable for roadside plantings (Nguyen *et al.*, 2015).
	In narrow, busy streets tall and/or densely planted trees can reduce wind speed to the extent that pollutants may be trapped beneath the canopy, thus reducing air quality for pedestrians and cyclists – this is known as the street canyon effect (Vos *et al.*, 2013).
Land use and ownership	The greater the proportion of built area, the higher the level of PM_{10} exposure (Weber *et al.*, 2014).

In The Nature Conservancy – in coordination with C40 Cities Climate Leadership Group – has tried to understand whether nature can play a role in helping to solve these twin challenges.

The answer appears to be a qualified "yes."

Street trees can be a part of a cost-effective portfolio of interventions aimed at controlling particulate matter pollution and mitigating high temperatures in cities.

While trees cannot and should not replace other strategies to make air healthier, trees can be used in conjunction with these other strategies to help clean and cool the air.

In the right spot, trees can both help make our air healthier and our cities more verdant and livable.

SE cuturales y Bosques urbanos.

Conexiones naturales y paisaje.

Table 11 Urban forest parameters that are reported to improve the well-being benefit of nature and landscape connections.

Scale and management	Individual trees, especially veteran ones, can provide great character and sense of history to a place (Scottish Government, 2014b).
	Individual trees have a positive effect on the perceived aesthetics of urban squares, enhancing city image, duration of visit and the willingness to revisit (Raškovič and Decker, 2015).
	Lines or clusters of trees can provide aesthetic enhancements to streets, civic spaces and parks (Coles *et al.*, 2013).
	Woodlands should be of a suitable size (minimum of 2 ha) to create a woodland environment (Coles and Bussey, 2000).
	The greater the number of greenspaces the greater the overall aesthetic value, though with diminishing returns (Mitchell and Popham, 2007).
	Management activities such as selective arboricultural thinning and undergrowth clearance (as well as removal of litter and graffiti) can improve visual perceptions (Tyrväinen *et al.*, 2003).
Urban forest structure	Large, mature trees are generally more aesthetically pleasing than small, immature ones (Tyrväinen *et al.*, 2005), though this is less important in residential environments (Coles *et al.*, 2013).
	Broadleaved or deciduous species are typically preferred to coniferous ones, though mixed woodlands are preferred overall (Coles and Bussey, 2000; Gerstenberg and Hofman, 2016).
	Crown size and density are both positively related to people's preferences, with globe-shaped crowns particularly preferred (Gerstenberg and Hofman, 2016).
	The smell of damp wood after rain and of pine trees, and the sounds of walking on crunchy leaves, bird song and the wind in trees, add to feelings of connection with nature (O'Brien *et al.*, 2014).
	Perceived naturalness can enhance the visual appeal of a woodland, and thus the use of native species may be beneficial (Ryan and Simson, 2002).
	Woodlands with greater structural complexity (more canopy layers and different species) are preferred (Coles and Bussey, 2000).

SE cuturales y Bosques urbanos.

Conexiones naturales y paisaje.

Estimulación sensorial y sentimientos de conexión con la Nª.
Visual. Sonora. Olorosa. Tacto.

Location and proximity to people	Trees and woodlands must be visible and in fairly close proximity for the service of aesthetic enhancement to be provided, as evidenced by the effect of green views on property prices (Jim and Chen, 2006). Access to and views of greenspace within a workplace have significant benefits for well-being as well as increased productivity (Grahn and Stigsdotter, 2003). There is enhanced recovery from illness or surgery when patients have views of trees from hospital (Ulrich, 1984).
Land use and ownership	A view of a (publicly inaccessible) greenspace can be as effective for mental well-being as having access (Grahn and Stigsdotter, 2003).

Shinrin Yoku

Respira. Relájate. Camina.
Toca. Escucha. Recupérate.

"caminando de manera suave iremos aspirando los elementos y sustancias tan beneficiosos que deprenden las plantas y árboles, que se irán incorporando a nuestro sistema respiratorio y entrando en nuestro torrente sanguíneo de una manera natural…"

Adaptado a cualquier persona.

SE culturales y Bosques urbanos. **Educación y aprendizaje.**

Desarrollo personal para población de todas las edades… Forest Schools (O´Brian, 2009).

Table 12 Urban forest parameters that are reported to improve the well-being benefit of social development.

Scale and management	The encouragement of community management of woodlands (e.g. tree planting schemes or volunteer conservation groups) can engage people in social activity and improve self-esteem (Elmendorf, 2008). Management activities that improve aesthetics will encourage community use (Tyrväinen *et al.*, 2003).
Urban forest structure	People are more likely to congregate in attractive woodland settings; thus tall, mature trees are preferred (Tyrväinen *et al.*, 2005). Native species may be considered more representative of an area and thus contribute to sense of place and community spirit (Ryan and Simson, 2002). Large and more densely planted woodlands, and those with homogeneous trails, can mask the number of users, easing perceptions of overcrowding which can reduce the quality of social encounters (Coley *et al.*, 1997). Social contact and community cohesion can be fostered by woodlands and small groups of trees near housing estates (Kuo, 2001).
Location and proximity to people	The use of outdoor spaces and the amount of social activity that takes place within them increases with the presence of trees and grass (Coley *et al.*, 1997). Woodlands and greenspaces in closest proximity to where people live are more likely to be used for social activities (O'Brien and Morris, 2013). The lower prevalence of higher quality woodlands in deprived areas excludes their use by those who may benefit most from social interaction (Seeland *et al.*, 2009). Urban parks serve as settings for interacting with families, helping immigrants (or other people new to an area) to develop memories and emotional connections to their environment, and to preserve their traditions and culture (Peters *et al.*, 2016).
Land use and ownership	Woodland must be publicly accessible for there to be social cohesion benefits (Seeland *et al.*, 2009). The encouragement of community management of woodlands (e.g. tree planting schemes or volunteer conservation groups) can engage people in social activity and improve self-esteem (Elmendorf, 2008).

Significance of urban forest type for human health and well-being

Urban forest type	Significance (on a scale of 1–5*)
Peri-urban forests and woodlands	
City parks and urban forests (>0.5 ha)	
Pocket parks and gardens with trees (<0.5 ha)	
Trees on streets or in public squares	
Other green spaces with trees	

FAO (2016)

* Where 1 = very low significance and 5 = very high significance.

Bosques urbanos y Objetivos de desarrollo sostenible: 11. Sustainable cities and community and 3. Good health and well-being.

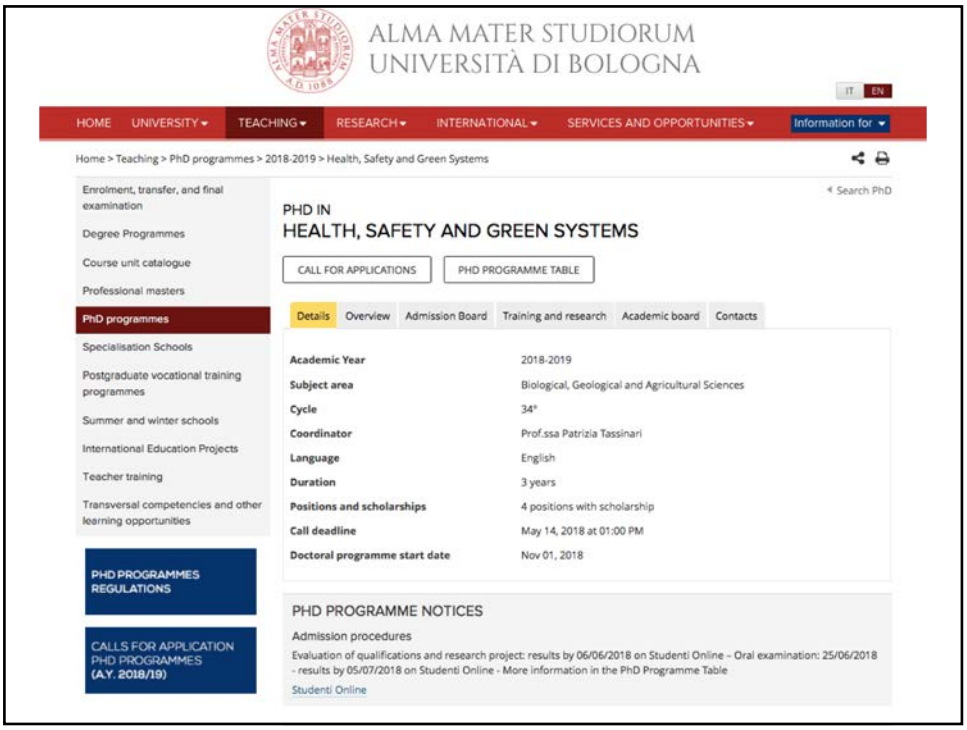
Key actions

Policy and legal framework

- ***Promote and adopt strategies and financial and administrative mechanisms to maximize the potential for GS to deliver positive environmental and health benefits***.
- ***Promote collaboration and information-sharing*** *among the sectors involved in* ***urban greening, urban planning and healthcare***.
- ***Ensure the inclusion of health and well-being objectives in policies on urban forests and green spaces***.

Planning, design and management

- ***Adopt sound standards for the design and management*** **of urban forests** with the aim of encouraging *physical activities* and improving *mental health*.
- **Include urban forests in the planning and design of hospitals and schools for their proven therapeutic and psychological benefits.**
- **Minimize the potential undesirable impacts of urban forests** on human health and well-being in designing and managing urban forests.



Ahorro económico

- Menor asistencia médica
- Menor consumo de medicamentos
- Menos bajas y absentismo laboral

Un estudio en Filadelfia demostró que el mantenimiento de espacios verdes revierte en 69,4 millones de dólares por año en salud pública (Philadelphia Parks Alliance, 2008).

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Investment in green city good for health and healthcare budget

News item | 16-05-2012 | 16:14

Savings of €65 million can be made in the healthcare budget by developing more green spaces in urban areas. More green spaces can also result in less health-related absenteeism in the work place, a saving of EUR €328 million. These are the results of a study by KPMG, commissioned by the Ministry of Economic Affairs, Agriculture and Innovation.

Economic value of investment in nature in relation to healthcare

For the first time, the economic value of investing in nature in relation to healthcare has been studied. Although scientific research appears to show that living in a green environment has a positive effect on public health, its economic effect has never been calculated.

Depression and obesity

On the basis of two case studies in the Amsterdam neighbourhood of Bos en Lommer, KPMG has calculated the effects for the whole of the Netherlands. The studies examined the effect of green space on reducing cases of depression and obesity in young people. The study showed that 10% more green space in a neighbourhood could result in 130 fewer patients suffering from depression.

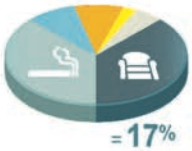
Cost savings

The savings in healthcare and workplace absenteeism amounts to €800,000. For the Netherlands as a

Prescribing Green Space - *is it important?*

1 of 2

Early Deaths UK



= 17%

Physical inactivity now rivals smoking as one of the nation's biggest health problems and is responsible for 17% of early deaths in the UK.

The **Cost** of physical inactivity:

The overall cost to the economy of physical inactivity in England is estimated to be £8.2 billion per year.[i] As a result the value of encouraging people to be active is huge, simply "reducing the sedentary population by one percent could reduce both morbidity and mortality rates at £1.44 billion a year".[ii]

If Central Bedfordshire encouraged 10% of its population to exercise through access to good quality green space it would save an estimated £2.9m in healthcare costs.[iii]

An inactive person spends 37% more days in hospital = 37% more hospital visits

and visits the doctor 5.5% more often.[iv] = 5.5% more GP visits

GPs understand the benefits of exercise but there are barriers to prescribing it[v].

Green space has huge benefits to both physical and mental health[vi] and also significant social benefits.[vii]

Being in green space can improve mood and result in a decrease in blood pressure and muscle tension.[ix]

The availability of good quality green space in a neighbourhood can lead to higher physical activity levels and people living in close proximity to good quality green spaces enjoy better health and live longer.[x]

Improving access to and use of green space can help to reduce health inequalities in key priority health areas.[xi]

Green space is important for prevention and for reducing rates of some chronic diseases: e.g. trees improve air quality and asthma rates in children are found to be lower when there is more tree cover.[xii]

Exercising outdoors in natural and green spaces is more beneficial to health and wellbeing than indoor exercise.[viii]

Physical activity can offer benefits to those receiving cancer treatments and can reduce the likelihood of breast and bowel cancer reoccurring.[xiii]

Green Prescriptions

6-8 months after receiving their green prescription, 63% of patients are more active than they were before and 46% have lost weight.[xiv]

Lose Weight = 46%

To find out more about green prescriptions contact:
The Centre for Sustainable Healthcare - info@sustainablehealthcare.org.uk

www.nhsforest.org

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UK parks save NHS more than £111m a year, study suggests

Fields in Trust charity says regular users are likely to be healthier and visit GPs less often

Press Association
Mon 7 May 2018 04.33 EDT

The UK's parks save the NHS more than £111m a year, according to a report. Regular users of parks and green spaces are likely to be healthier and make fewer visits to their GP, research by Fields in Trust suggests.

"The research also confirms that any decision by a public body to remove a park or green space is completely short-sighted – and will in fact likely cost more money than is saved.

In health alone, parks and green spaces saved the NHS at least £111m per year through prevented GP visits – enough to pay for more than 3,500 nurses."

The charity estimates such spaces provide more than £34bn of wellbeing benefits by improving mental and physical health.

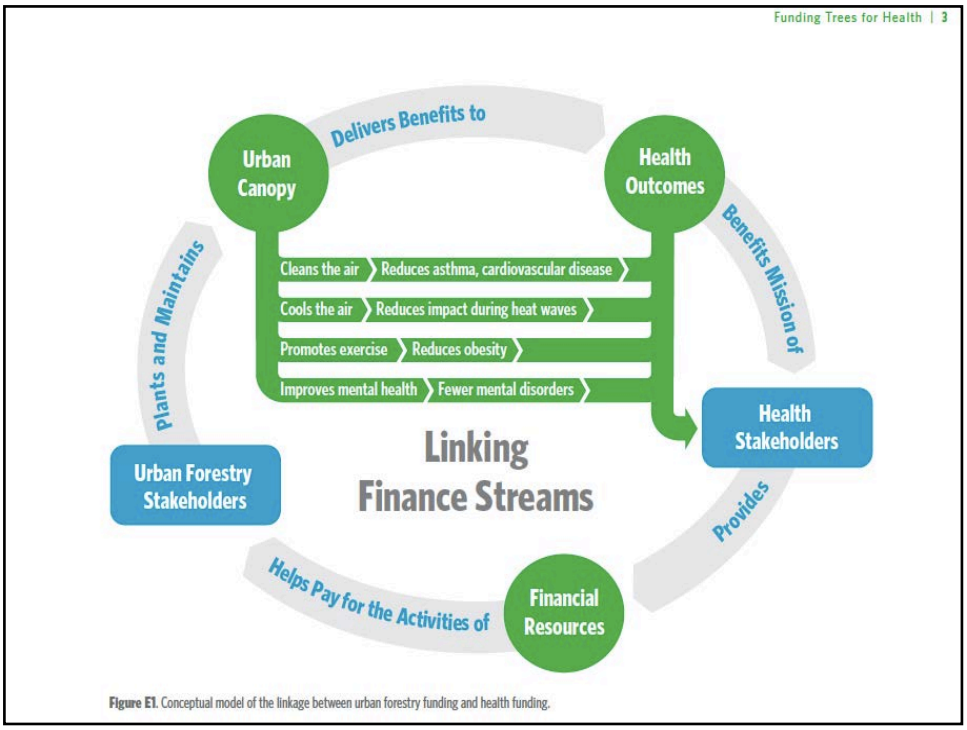

Figure E1. Conceptual model of the linkage between urban forestry funding and health funding.