

18 Dec
2013

Le:Notre On-line Seminar 2013-2014

Global Perspectives on Planting Design

Interpretations of Nature and the Role of Plants

Perspectives from Italy: Images of nature and green infrastructure concepts

Lecture and discussion with **Maria-Beatrice Andreucci, RLA**

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with the contribution of Chiara Tescione, junior landscape architect



SAPIENZA
UNIVERSITÀ DI ROMA

ECLAS

EUROPEAN COUNCIL OF
LANDSCAPE ARCHITECTURE
SCHOOLS

LE:NOTRE Institute
Landscape Forum

Education and Qualifications

- Sapienza University of Rome (Rome_Italy) Environmental Design PhD programme XXVII
- Sapienza University of Rome (Rome_Italy)_Faculty of Architecture_ *Laurea summa cum laude* in Landscape architecture and Garden design
- INSEAD (Paris_France)_ Master of Business Administration
- LUISS (Rome_Italy)_ *Laurea summa cum laude* in Economics

Research projects

- Green infrastructure
- Landscape economy
- Environmental design
- Italian landscape architecture abroad

Registered Landscape Architect (Ordine degli Architetti, Paesaggisti, Conservatori e Restauratori di Roma e Provincia n. 20429)

Lecturer at Sapienza Faculty of Architecture and Landscape architecture

- Green infrastructure
- Environmental design
- Landscape architecture
- Environmental project evaluation
- Landscape economy

ECLAS Sapienza University member

IFLA Europe member (n.870 AIAPP)

AIAPP Scientific Committee member



Professional practice

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1. Planting Design historical evolution

- ✦ Roman times
- ✦ Medieval times
- ✦ Renaissance

2. Contemporary Planting Design

- ✦ Social architecture and nature
 - Parco della Musica (RPBW)*
 - Centro Elsa Morante (LC-Architettura)*
- ✦ Eco-scapes (Tiber river green corridor)
- ✦ Prairie (Wildflowers)
- ✦ Rural-scapes
- ✦ Peri-urban-scapes
- ✦ City-scapes

3. GI Technology & research

- ✦ Green roofs
- ✦ Phyto-depuration
- ✦ Rain gardens

4. The future of GI

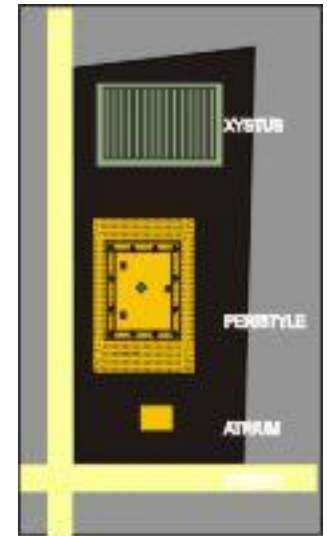
- ✦ Case study: *Post-industrial city landscape*

Planting design in Ancient Rome

The Romans were perhaps the earliest civilization to plant gardens using species with a **primarily ornamental role**

Evergreens were favoured: bay, myrtle, oleander, rosemary, box and ivy.

In **flowers**, the Romans like rose, iris, lily, violet, daisy, poppy and chrysanthemum



Courtyards were made for **specialized purposes**: outdoor eating, entertaining, growing plants.

Historical evolution

Ancient Rome

Ornamental gardens

VILLA ADRIANA (118 e 138 d.C.)

The archeological site of Hadrian's Villa, about 30 kilometers east of Rome, is one of the most important remains of ancient Roman gardens preserved to our day.

The buildings and gardens of the villa were created in the second century A.D., from 118 to 138 by the Roman Emperor Hadrian



Sculptures and artworks of Hadrian's Villa

Historical evolution

Ancient Rome

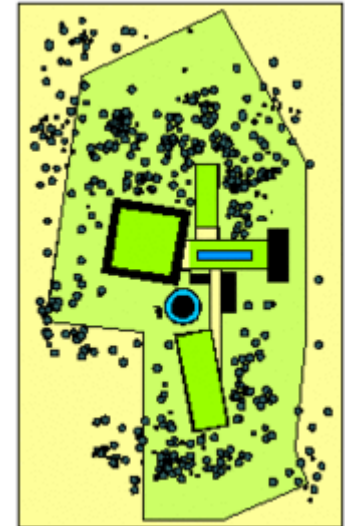


Reconstruction of the garden_Casa dei Vettii, Pompeii

Planting design during the Roman Empire c100

The idea of making villas developed in Greece and reached fulfillment in the Roman Empire. The villa became a **palatial estate** complete with dwellings, gardens and numerous subsidiary buildings.

Typical features included: pools, fountains, colonnades, statuary, evergreens and adjacent hunting parks



The **villa** integrated elements of many earlier garden types: the domestic courtyard, the gymnasium (sacred grove), the temple garden and the hunting park. Both **rustic** and **urban villas** were made.

Historical evolution

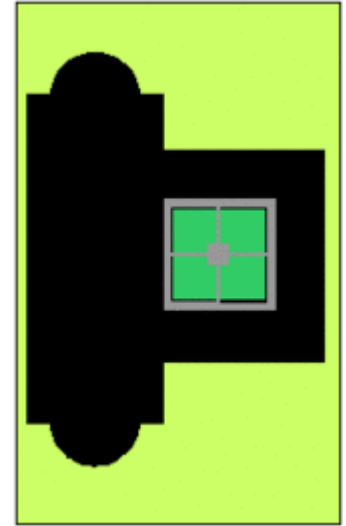
Roman Empire



A rural scene (in the loggia of the Villa Medici at Careggi)

Medieval Planting Design c1200

There was a reversion to the pre-Roman practice of **intermixing culinary and medicinal plants with some flowers.**



The central green space of a typical cloister was known as the **cloister garth** (garden).

There are no medieval records of them having contained any plants except **closely-scythed grass.**

Historical evolution Medieval Times



Orto dei Semplici, Padua

Historical evolution

Medieval Times



Tre Fontane Abbey, Rome, c1140

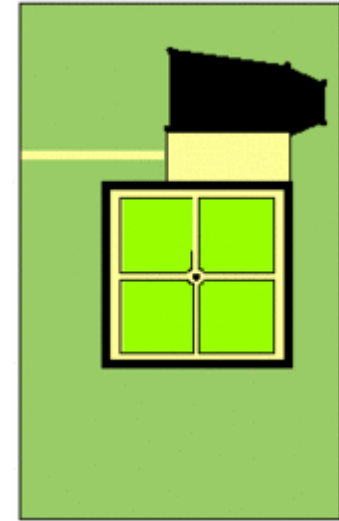
*Garden of **medical herbs***
e.g. *Echinacea angustifolia*, *Elichrysum italicum*, *Verbascum thapsus*, *Salvia officinalis*, *Gentiana lutea*, *Lavandula angustifolia*, *Melissa officinalis*, *Valeriana officinalis*,...

Renaissance Planting Design c1450-1600

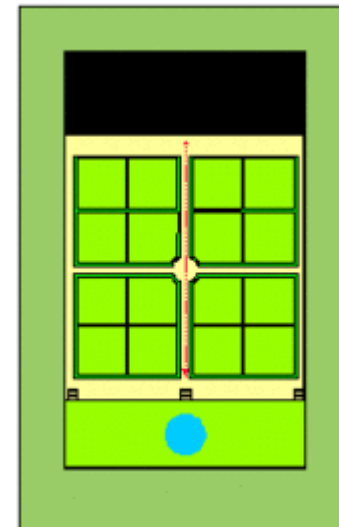
Renaissance designers hoped to **re-create Roman gardens** - but, having little evidence about the Roman style of planting design, assumed they had made “knot gardens”.

Early renaissance planting was of **mixed fruit and flowers** bounded by **low hedges**.

Later renaissance planting was more determinedly **ornamental**.



Early Renaissance Style 1450



High Renaissance Style 1540

Historical evolution Renaissance Times



Orangerie garden at the Parco di Villa Reale di Castello in Florence, c1500

Roman times

Mediterranean
native plants
(*Quercus*)

Mediterranean-Asian
introduced plants
(*Platanus, Pinus, Punica*)

Medieval times

Spontaneous plants
(*Deschampsia cespitosa*,
Helichrysum italicum, Malva
sylvestris,
Salvia verbenaca, Amni majus,...)

Monastery gardens:
“hortus conclusus”
Garden of medical herbs
(*Echinacea angustifolia,*
Elichrysum italicum, Verbascum
thapsus, Salvia officinalis,
Gentiana lutea, Lavandula
angustifolia, Melissa officinalis,
Valeriana officinalis,...)

Reinassance times

Exotic plants
(*Washingtonia, Phoenix*)

Papal dominion
(*Ulmus minor, Morus alba*)

Historical evolution Tree Planting



Via Appia Antica

Roman Times

Pinus pinea **L.** (stone pine)

Historical evolution

Tree Planting

Renaissance

Villa Torlonia, Rome

Exotic plants:

Washingtonia filifera **(Lindl.) H.Wendl.** (desert fan)

Washingtonia filifera **H.Wendl.** (mexican fan palm)

Phoenix canariensis **Chabaud** (Canary Island date palm)

Phoenix dactylifera **L.** (atlas cedar)

Phoenix reclinata **Jacq.** (wild date palm)



Obelisk in Villa Torlonia gardens, (XIX)

Historical evolution Tree Planting



Via Cristoforo Colombo (1952)
Source: *Roma Sparita*

Before



Via Cristoforo Colombo (today)

After

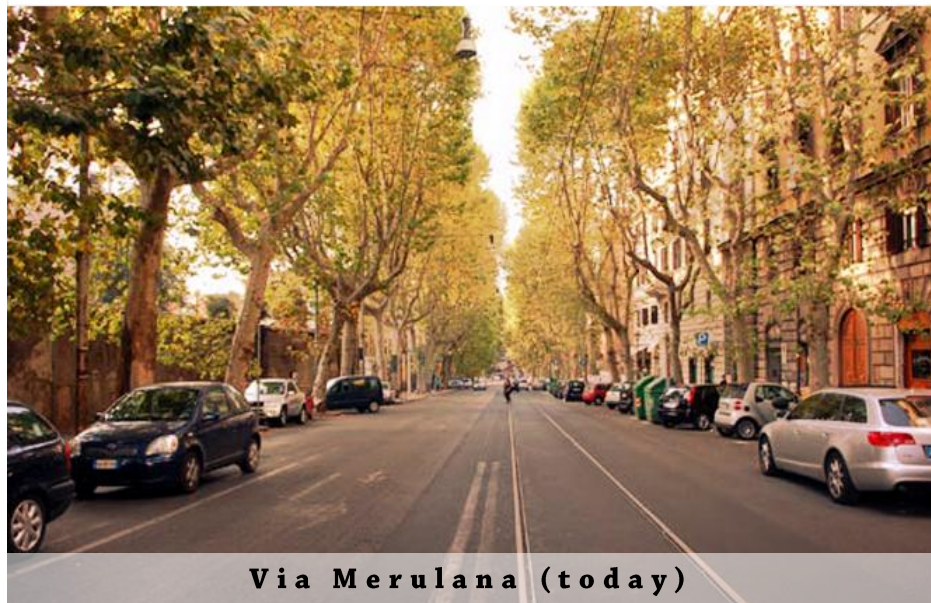
Pinus pinea **L.**
(stone pine)

Historical evolution Tree Planting



Via Merulana (1858)
Source: *Roma Sparita*

Before



Via Merulana (today)

After

Platanus x hybrida **Brot.**
(London planetree)

Historical evolution Tree Planting



Via Ostiense (1940)
Source: *Roma Sparita*



Via Osiense (today)

Before

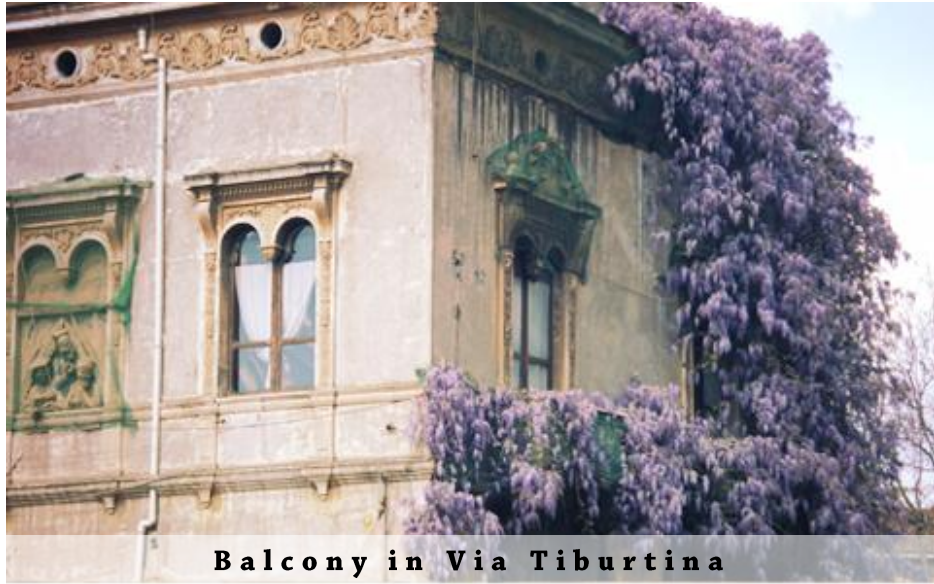
After

Platanus x hybrida **Brot.**
(London planetree)

Quercus ilex **L.**
(holm oak)

Contemporary Urban Planting design

Private Solutions: Balconies



Balcony in Via Tiburtina



Balcony in Via Frattina

EXOTIC PLANTS

Wisteria sinensis **(Sims) Sweet** (chinese wisteria)

Pelargonium zonale **(L.) Aiton** (geraniums)

Jasminum officinale **L.** (common jasmine)

Lobelia erinus **L.** (edging lobelia)

Tropaeolum majus **L.** (garden nasturtium)

AROMATICS

Laurus nobilis, *Lavanda* spp., *Salvia* spp.,
Thymus spp., *Origanum* spp, *Rosmarinus*
officinalis

Contemporary Urban Planting design



PARK(ing) Day



Guerrilla Gardening

Community Solutions:
Public Spaces

The land is ours!

Competences??

Contemporary Urban Planting design



Allotments in Rome (Garbatella)

Allotments benefits:

- **Healthy** leisure activity.
- Social, economic, ethnic **cohesion**.
- **Wildlife** refuge.
- **External funding** for environmental, ecological project.
- **Healthcare** institutions engaging.
- Environmental **sustainability promotion**.

Mediterranean **Aromatic** species

Commonly planted:

Laurus nobilis, *Lavandula spp.*, *Rosmarinus officinalis*,
Salvia spp., *Thymus spp.*, *Origanum spp.*

Social Architecture & Nature



**AUDITORIUM-
PARCO DELLA
MUSICA**
(1994-2002)

**Renzo Piano
Building Workshop-
Franco Zagari
(Consultant)**



Image credits: RPBW

Social Architecture & Nature

AUDITORIUM- PARCO DELLA MUSICA (1994-2002)

**Renzo Piano
Building Workshop-
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(Consultant)**



Image credits: RPBW

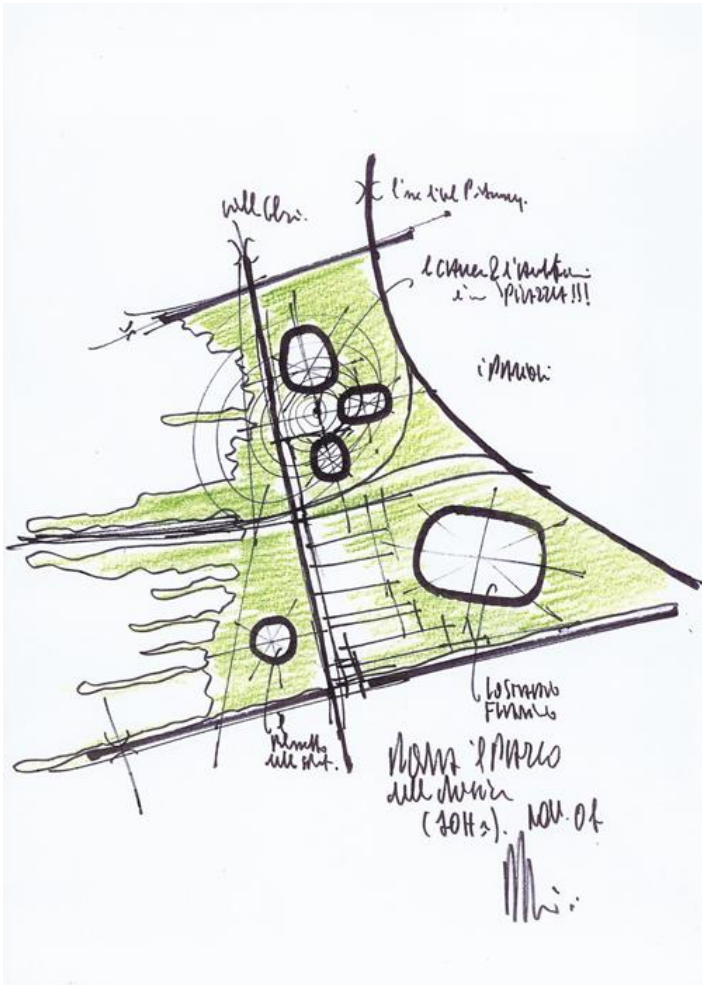


Social Architecture & Nature

AUDITORIUM-PARCO DELLA MUSICA

(1994-2002)

Renzo Piano Building Workshop
Franco Zagari (Consultant)



Variation in species, “in order to have a continuous frequency variation on the same pentagram”. This happens with a clear order, with **an evergreen crown outside** and **some deciduous woods inside**. The selected trees are the same already existing nearby – *Quercus ilex*, *Laurus nobilis*, *Pinus pinea*, *Cupressus sempervirens* – with some specific additions, such as *Liriodendron tulipifera*, *Cercis siliquastrum*, *Quercus suber*, *Olea europea*.

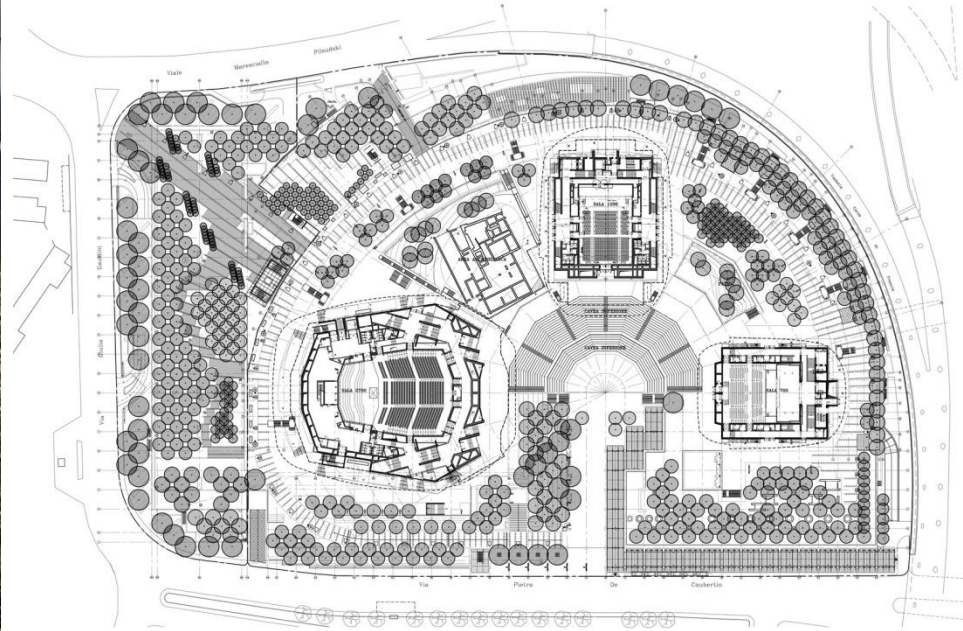
Social Architecture & Nature



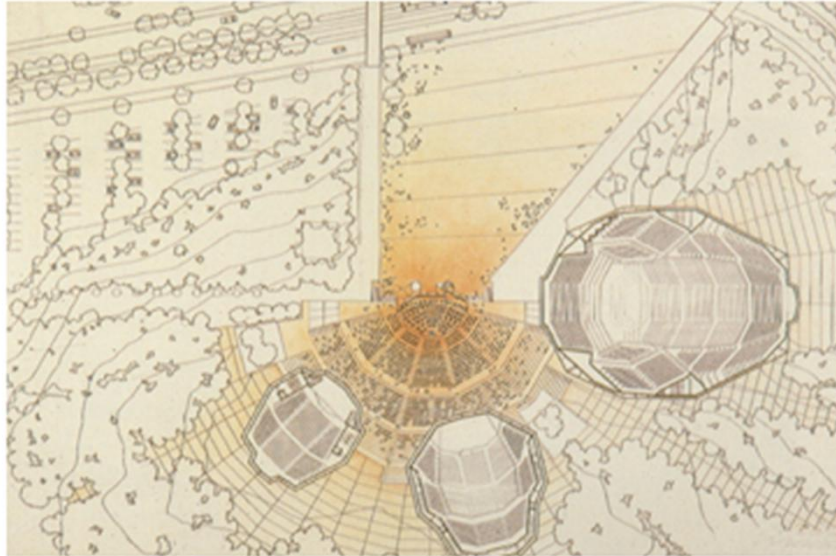
AUDITORIUM-PARCO DELLA MUSICA

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Franco Zagari (Consultant)**



Architecture & Nature



AUDITORIUM-PARCO DELLA MUSICA

(1994-2002)

Renzo Piano Building Workshop
Franco Zagari (Consultant)



Pinus pinea **L.** (stone pine)

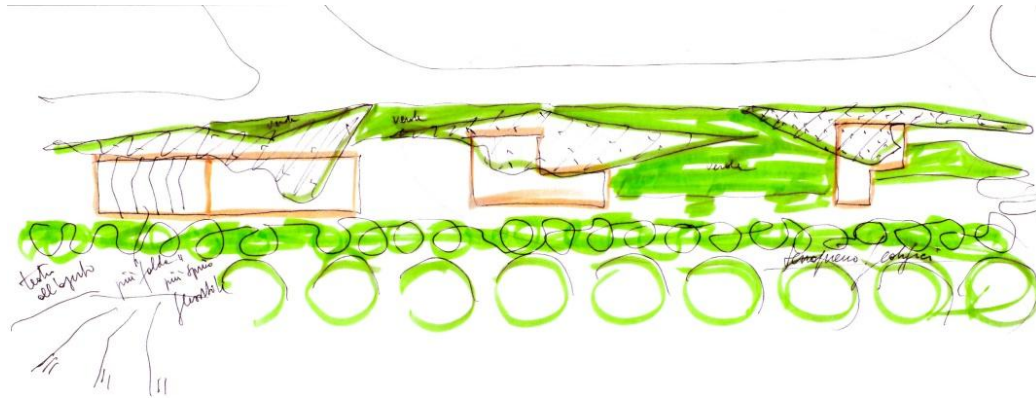
Quercus ilex **L.** (holm oak)

Quercus suber **L.** (cork oak)

Cercis siliquastrum **L.** (Judas tree)

Olea europea **L.** (olive tree)

Social Architecture & Nature



CENTRO CULTURALE ELSA MORANTE

(2005-2010)

LC-Architettura

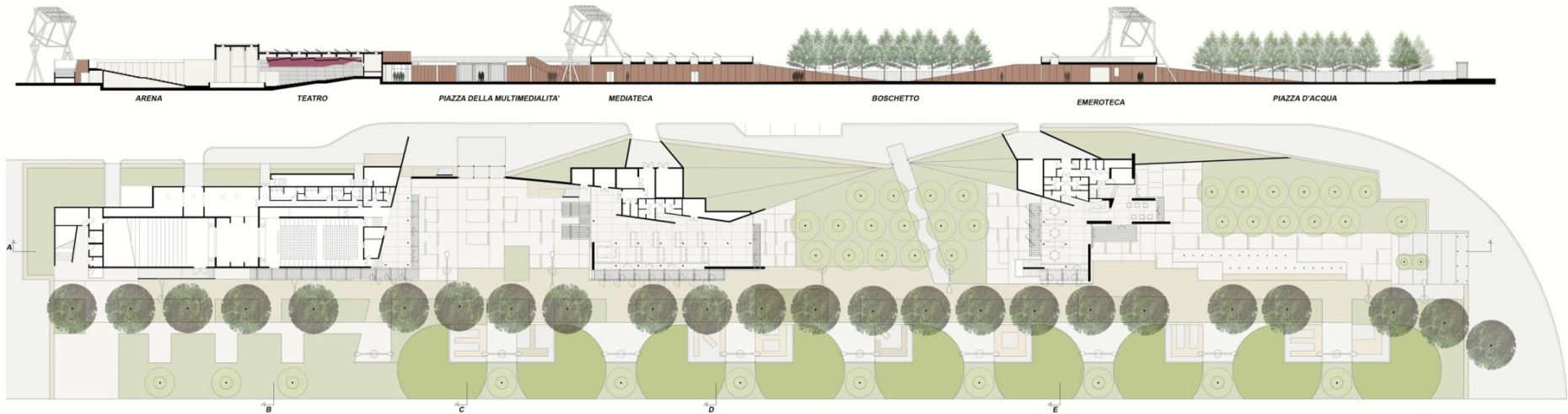


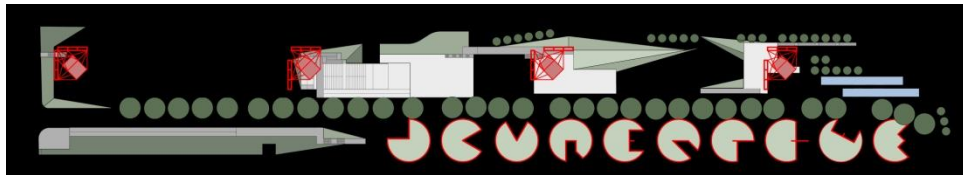
Image credits: LC-Architettura

Architecture & Nature

CENTRO CULTURALE ELSA MORANTE

(2005-2010)

LC-Architettura



Pinus pinea **L.** (stone pine)

Ginkgo biloba **L.** (ginkgo)

Quercus ilex **L.** (holm oak)

Acer buergerianum **Miq.** (trident maple)

Acer platanoides "globosum" **L.** (Norway maple)

Image credits: LC-Architettura

Tiber River Green Corridor

SPONTANEOUS SPECIES in RiverScapes:

- 1) *Salix purpurea* L., 2) *Phragmites communis* Trin, 3) *Juncus acutus* L., 4) *Rubus ulmifolius* Schott.,
5) *Mentha acquatica* L., 6) *Apium nodiflorum* (L.)Lag., 7) *Iris pseudacorus* L.,
8) *Nasturtium officinale* R.Br., 9) *Eupatorium cannabinum* L.



Populus x canescens L. (grey poplar)

Populus alba L. (abele)

Populus nigra L. (black poplar)

Salix alba L. (white willow)

Invasive species:

Robinia pseudoacacia L. (black locust)

Ailanthus altissima (Mill.)Swingle
(tree of heaven)



South-Tiber River



Lungotevere Prati

TREE PLANTING DESIGN
in **Eco-Scapes**:

Platanus x hybrida **Brot.**
(London planetree)



Lungotevere Ostiense

Photo credits: Chiara Tescione



Olea europea L. (olive tree)

Family: *Oleaceae*
 Foliage: *evergreen*
 Heigh: *up to 10-15m*
 Sun: *full sun*
 Water: *medium*



Pinus pinea L. (stone pine)

Family: *Pinaceae*
 Foliage: *evergreen*
 Heigh: *20-25m*
 Sun: *full sun*
 Water: *dry to medium*



Platanus x hybrida Brot. (London planetree)

Family: *Platanaceae*
 Foliage: *deciduous*
 Heigh: *up to 30-35m*
 Sun: *full sun*
 Water: *medium to wet*



Populus nigra "Italica" L. (italian poplar)

Family: *Salicaceae*
 Foliage: *deciduous*
 Heigh: *up to 30m*
 Sun: *full sun*
 Water: *medium*



Cupressus sempervirens L. (mediterranean cypress)

Family: *Cupressaceae*
 Foliage: *Evergreen*
 Heigh: *up to 30m*
 Sun: *full sun*
 Water: *medium*



Cercis siliquastrum L. (Judas tree)

Family: *Fabaceae*
 Foliage: *Deciduous*
 Heigh: *3-8 (10)m*
 Sun: *full sun to part shade*
 Water: *medium*

Quercus ilex L. (holm oak)



Quercus robur L.
(english oak)



Quercus pubescens Willd.
(downy oak)



Quercus trojana Webb
(macedonian oak)



Quercus suber L. (cork oak)



Quercus petraea
(Mattuschka) Liebl.
(sessile oak)



Quercus frainetto Ten.
(hungarian oak)



Quercus macrolepis
Kotschy (valonia oak)



Quercus coccifera L.
(kermes oak)



Quercus cerris L.
(turkey oak)



Quercus crenata Lam.
(lucombe oak)



Quercus congesta Presl





Parco degli Acquedotti

SPONTANEOUS SPECIES in **Rural-Scapes**:

Papaver rhoeas **L.** subsp. *Rhoeas*
(corn poppy)

Nigella damascena **L.**
(ragged lady)

Agrostemma githago **L.**
(common corn-cockle)

Centaurea cyanus **L.**
(cornflower)



Parco degli Acquedotti



Peri-urban park (South Rome)

Photo credits: Chiara Tescione

SPONTANEOUS SPECIES in **Peri-urban-Scapes**:

Deschampsia cespitosa **(L.) P.Beauv.**
(Tufted Hair-grass)

Helichrysum italicum **(Roth) G. Don**
(curry plant)

Leontodon tuberosus **L.**
(hawkbits)

Non-native specie:

Conyza bonariensis **(L.) Cronquist**
(Flax-leaf Fleabane)

SPONTANEOUS SPECIES in **City-Scapes**:


Malva sylvestris **L.** subsp. *sylvestris*
(common mallow)

Papaver rhoeas **L.** subsp. *Rhoeas*
(corn poppy)

Salvia verbenaca **L.**
(wild clary)

Nigella damascena **L.**
(ragged lady)

Orlaya grandiflora (**L.**) **Hoffm.**
(orlaya)



Parking lots in Garbatella

Photo credits: Chiara Tescione



PLANTING DESIGN in City-Scapes:

- 1) *Agrostemma githago* L., 2) *Ammi majus* L., 3) *Chrysanthemum carinatum* Schousboe, 4) *Cyanus segetum* Hill,
5) *Glebionis segetum* (L.) Fourr., 6) *Matricaria chamomilla* L., 7) *Nigella damascena* L.,
8) *Papaver rhoeas* L. subsp. *rhoeas*, 9) *Silene armeria* L., 10) *Trifolium incarnatum* L.



Wet meadows:

- 1) *Blackstonia perfoliata* (L.) Huds., 2) *Saponaria officinalis* L.,
3) *Carex pendula* Huds., 4) *Allium roseum* L.,
5) *Astragalus glycyphyllos* L.,
6) *Centaurium pulchellum* (Sw.) Druce subsp. *pulchellum*,
7) *Centaurium spicatum* (L.) Fritsch, 8) *Convolvulus tricolor* L.,
9) *Melilotus albus* Medik., 10) *Ferula communis* L.

<p>T. scap. ∇ 5-50cm</p> <p>① Centauriaceae I VI II VII III IX IV X V XI VI XII</p>	<p>H. scap. ∇ 30-70cm</p> <p>② Caryophyllaceae I VI II VII III IX IV X V XI VI XII</p>	<p>H. caesp. ∇ 60-140cm</p> <p>③ Cyperaceae I VII II VIII III IX IV X V XI VI XII</p>	<p>G. bulb. ∇ 30-50</p> <p>④ Alliaceae I VII II VIII III IX IV X V XI VI XII</p>	<p>H. rept. ∇ 5cm</p> <p>⑤ Fabaceae I VI II VIII III IX IV X V XI VI XII</p>
<p>T. scap. ∇ 3-10cm</p> <p>⑥ Centauriaceae I VI II VII III IX IV X V XI VI XII</p>	<p>T. scap. ∇ 3-10cm</p> <p>⑦ Centauriaceae I VI II VII III IX IV X V XI VI XII</p>	<p>T. scap. ∇ 10-30cm</p> <p>⑧ Convolvulaceae I VII II VIII III IX IV X V XI VI XII</p>	<p>T. scap. ∇ 50-120cm</p> <p>⑨ Fabaceae I VII II VIII III IX IV X V XI VI XII</p>	<p>H. scap. ∇ 100-300cm</p> <p>⑩ Apiaceae I VII II VIII III IX IV X V XI VI XII</p>

PLANTING DESIGN in **City-Scapes**:

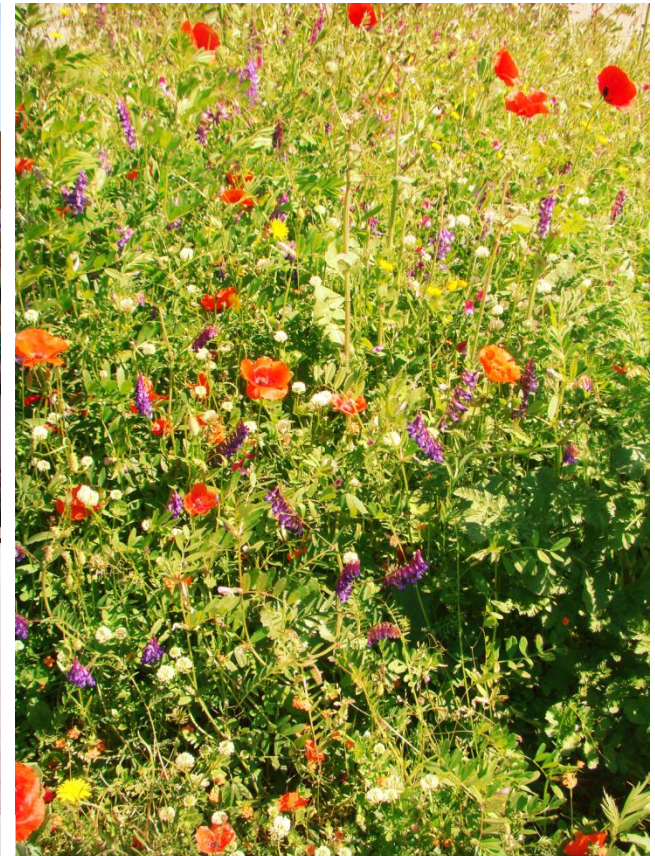
Cercis siliquastrum L. (Judas tree)

- 1) *Agrostemma githago* L., 2) *Ammi majus* L., 3) *Chrysanthemum carinatum* Schousboe, 4) *Cyanus segetum* Hill,
5) *Glebionis segetum* (L.) Fourr., 6) *Matricaria chamomilla* L., 7) *Nigella damascena* L.,
8) *Papaver rhoeas* L. subsp. *rhoeas*, 9) *Silene armeria* L., 10) *Trifolium incarnatum* L.



Traffic roundabout in Via delle Sette Chiese

Photo credits: Chiara Tescione





Rome, from Monte Mario_Photo credits: Sonja Radovic Jelovac

Green Roofs

Tree Planting

Bioretention & Infiltration

Permeable Pavement

Water Harvesting



California Academy of Sciences_Photo credits: Maria Beatrice Andreucci

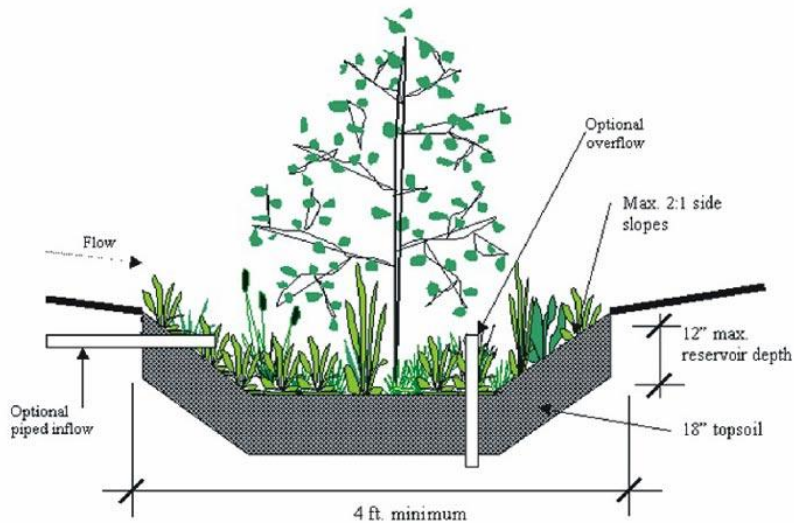
- ☛ Reduces Stormwater Runoff
- ☛ Reduces Energy Use
- ☛ Improves Air Quality
- ☛ Reduces Atmospheric CO2
- ☛ Reduces Urban Heat Island
- ☛ Improves Community Livability
- ☛ Improves Habitat
- ☛ Cultivates Public Education Opportunities



Photo credits: Sonja Radovic Jelovac

- ☐ Reduces Stormwater Runoff
- ☐ Increases Groundwater Recharge
- ☐ Reduces Energy Use
- ☐ Improves Air Quality
- ☐ Reduces Atmospheric CO₂
- ☐ Reduces Urban Heat Island
- ☐ Improves Community Livability
- ☐ Improves Habitat
- ☐ Cultivates Public Education Opportunities

Landscape Infiltration



Section Not to Scale

Image credits: EPA

- Reduces Stormwater Runoff
- Increases Available Water Supply
- Increases Groundwater Recharge
- Improves Air Quality
- Reduces Atmospheric CO₂
- Reduces Urban Heat Island
- Improves Community Livability
- Improves Habitat
- Cultivates Public Education Opportunities

Green Roofs



Green Roofs

Intensive vs. Extensive Gardens

Intensive gardens have **thicker soil depths** and generally require **more management** and **artificial irrigation systems**.

The **plants** chosen for these gardens must thrive in the **specific roof environment** they inhabit.

Intensive gardens are heavier than extensive gardens, requiring **more structural support**.

Green Roofs

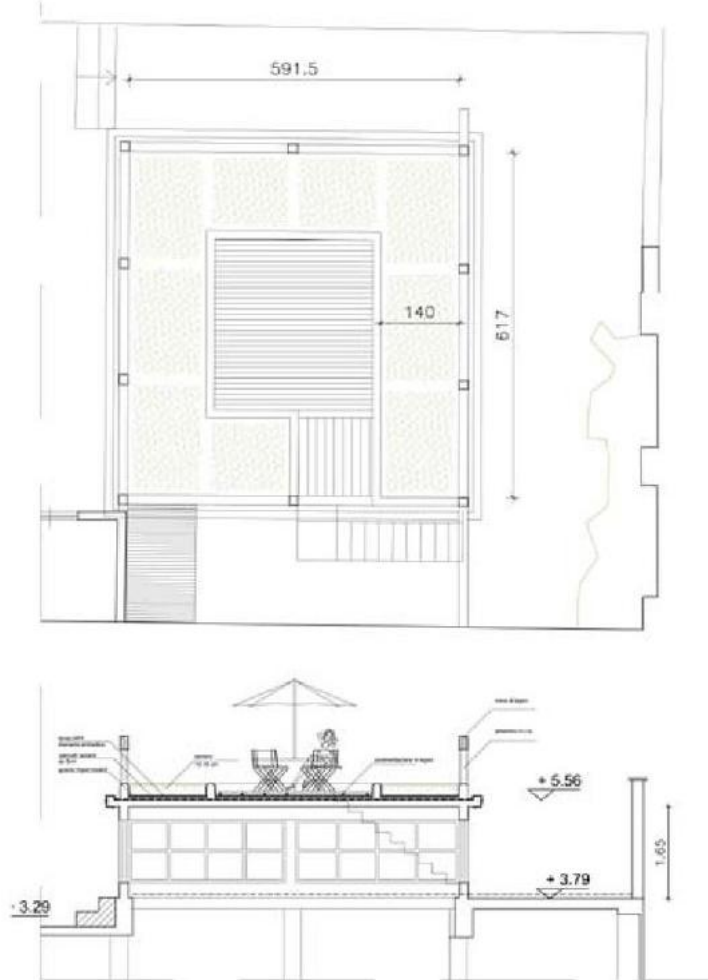
Intensive vs. Extensive Gardens

Extensive gardens have **thinner soil depths** and require **less management** and structural support.

They do **not** require **artificial irrigation**.

Plants chosen for extensive gardens are **low maintenance, hardy species** and do **not** have **demanding** habitat requirements.

The idea of an extensive planting design is to have **a self-sustaining plant community**.



Our secret garden - a vegetable garden on the roof
Studio999_Turin 2010

Green Roofs

Species already used in Italy:

1) *Sedum sexangulare* L., 2) *Sedum acre* L., 3) *Sedum album* L., 4) *Cerastium tomentosum* L., 5) *Thymus serpyllum* L., 6) *Delosperma cooperi* (Hook. f.) L. Bolus
7) *Helychrisum italicum* (Roth) G. Don, 8) *Hyssopus officinalis* L., 9) *Antirrhinum latifolium* Mill., 10) *Antirrhinum majus* L., 11) *Centranthus ruber* (L.) DC. subsp. *ruber*.



Selection of other **Mediterranean Species** that can also be used :

Micromeria juliana (L.) Benth. ex Rchb., *Calamintha nepeta* (L.) Savi s.l., *Lavandula stoechas* L. subsp. *stoechas*,
Satureja montana L. s.l., *Thymus vulgaris* L. subsp. *Vulgaris*, *Origanum vulgare* L. s.l., *Cyanus segetum* Hill, *Agrostemma githago* L.,
Consolida regalis Gray s.l., *Anthemis arvensis* L. s.l., *Orlaya grandiflora* (L.) Hoffm., *Nigella damascena* L., *Papaver rhoeas* L. subsp. *rhoeas*,
Echium vulgare L., *Silene latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet, *Campanula medium* L., *Dianthus carthusianorum* L.,
Scabiosa columbaria L., *Salvia verbenaca* L., *Galium verum* L.

Phytodepuration

Phyto-depuration is a purification technique characterized by biological type treatments, in which **plants** growing in water-saturated soil develop a **key role** for **direct action** of the bacteria that colonize the **root system and rootstock**.

These treatments are seen both as **alternatives** as well as **support to traditional systems** based on biological processes and chemical and physical reactions.

Phytodepuration

In **Italy** “Phytodepuration” **systems engineered, designed and built to reproduce natural self-depurative processes in a controllable environment.**

In comparison to natural wetlands, Phytodepuration systems allow for the **choice of the site, the flexibility in the dimension, control of hydraulic flows and retention times.**

Phytodepurifying **functions** can be preferred and additionally exploited with opportune **strategies**, like the choice of **plant species** and **substratum** and **control** of the **flow of water.**

Phytodepuration

With **Phytodepuration systems**, pollutants are removed through a **combination of chemical, physical and biological processes**.

The most effective processes are **sedimentation, precipitation, adsorption, assimilation** from plants and microbial activity.

Phytodepuration **technology** adds the medium's adsorbing ability to the traditional biological oxidation depurative treatment (filtering action by plant roots that also provide a large surface suitable for developing microbial masses involved in the treatment) and removal of nutrients due to their growth.

Phytodepuration

EUROPE:

Council Directive **91/271/EEC** of 21 May 1991
“Urban waste water treatment”

ITALY:

Legislative Decree **152/99** of 11 May 1999
“Law of the waters”

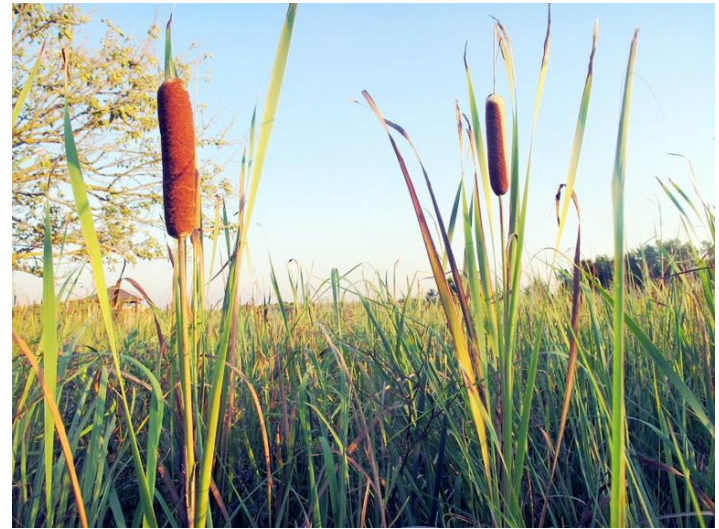
ISPRA (Institute for Environmental Protection and Research):
**Technical guidelines for the assessment and management of
phytodepuration systems**

Phytodepuration

Phragmites australis (**Cav.) Trin. ex Steud.**
(Common reed)



Typha latifolia **L.** (common bulrush)



Phytodepuration

Species already planted in Italy:

HELOPHYTES:

Thypha minima, *Thypha angustifolia*, *Schoenoplectus lacustris*, *Juncus spp.*, *Butomus umbellatus*, *Caltha palustris*, *Carex fusca*, *Carex hirta*, *Carex elata*, *Iris pseudacorus*, *Eupatorium cannabinum*, *Mentha aquatica*, *Epilobium irsutum*, *Alisma plantago aquatica*, *Lythrum salicaria*, *Stachys palustris*, *Sparganium erectum*, *Glyceria maxima*

HYDROPHYTES:

Myriophyllum spicatum, *Potamogeton natans*, *Potamogeton crispus*, *Ceratophyllum demersum*, *Elodea canadensis*, *Nimphaea alba*, *Nimphaea rustica*, *Nuphar lutea*, *Nymphoides peltata*, *Callitriche stagnalis*, *Hottonia palustris*, *Hydrocharis morsus – ranae*, *Lemna spp.*, *Wolffia arrhiza*, *Eichornia crassipes*

Rain gardens



A rain garden is a garden which **takes advantage** of **rainfall and stormwater runoff** in its design and plant selection.

Usually, it is a **small garden** which is designed to withstand the extremes of **moisture and concentrations of nutrients**, particularly **Nitrogen** and **Phosphorus**, that are found in stormwater runoff.

Rain gardens are sited ideally **close to the source of the runoff** and serve to **slow the stormwater** as it travels downhill, giving the stormwater more time to infiltrate and less opportunity to gain momentum and erosive power.

http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm

Rain gardens



On the surface, a rain garden looks like an **attractive garden**.

It may support **habitat for birds and butterflies**, it may be a **formal landscape amenity** or it may be **incorporated into a larger garden** as a border or as an entry feature.

What makes it a rain garden is in **how it gets its water** and **what happens to that water once it arrives in the garden**.

Rain gardens



There are two basic types of rain gardens – **under-drained** and self-contained.

Both types of rain gardens are used to **improve stormwater quality, reduce runoff volumes** and generally **facilitate infiltration of cleaned water**.

Which type of garden is selected to be built is a balance of **volumes of water** to be treated, existing **soil conditions**, available **space**, and **budget** for the project.

Rain gardens



Plants with deep fibrous roots tend to have a competitive advantage in a rain garden and provide the most cleaning and filtration benefits to the environment.

Typical rain gardens are populated with **natives** or native cultivars because those are most **well adapted to a locality, but other** ornamental horticultural plants that are **non-invasive** but able to grow in the garden conditions can also be excellent choices.

Rain gardens



Most of the examples of rain gardens that are available to review are populated with either **herbaceous perennials**, woody shrubs or **trees**.

This does not mean that annuals are not a possible choice for such gardens; rather it means that the gardens constructed have been designed for **habitat and low maintenance goals** rather than purely seasonal aesthetics and color effects.

Some annuals are good candidates for a higher maintenance version of a rain garden.

Rain gardens



PLANTS SELECTION CRITERIA:

- 1** **Water** needs
- 2** **Resistance to pollutants**
- 3** Adaptability to **mediterranean climate**
annual precipitation: above 800 mm
average temperature of coldest month: 12°
average temperature of warmest month: 30°

Rain gardens



Plants that could be used in Italy:

Carex, Lobelia, Eupatorium, Aster, Ranunculus, Lamium, Lysimachia, Mentha, Rudbeckia, Deschampsia, Caltha, Potentilla, Cornus, Iris, Juncus, Corylus, Malus, Magnolia

Native plant benefits:

- Best adapted to **local conditions**.
- **Water conservation**, that means, once plants are established in the right place, no need for supplemental watering.
- Native plants require **less care** than non-native species.
- Won't harm natural areas and **won't become invasive**.

Post-industrial City landscape

Abstracts from Graduation Thesis of Chiara Tescione,
Tutor, Maria Beatrice Andreucci (RLA),
Sapienza University of Rome, 2013
«Post-industrial city landscape»

Photo credits: Chiara Tescione



Plant Selection **Criteria:**

- 🍃 **Native** and/or **adapted** vegetation
- 🍃 **Water requirements** and adaptability to the mediterranean climate
- 🍃 Site adaptability: **tolerance** for water and soil **contamination** of pollutants
- 🍃 **Functional performances** (filtering out pollutants, potential of roots growth,...)
- 🍃 **Nitrophylous** and **oxygenating** plants
- 🍃 **Ornamental** appeal

Role of Plants in Phytodepuration:

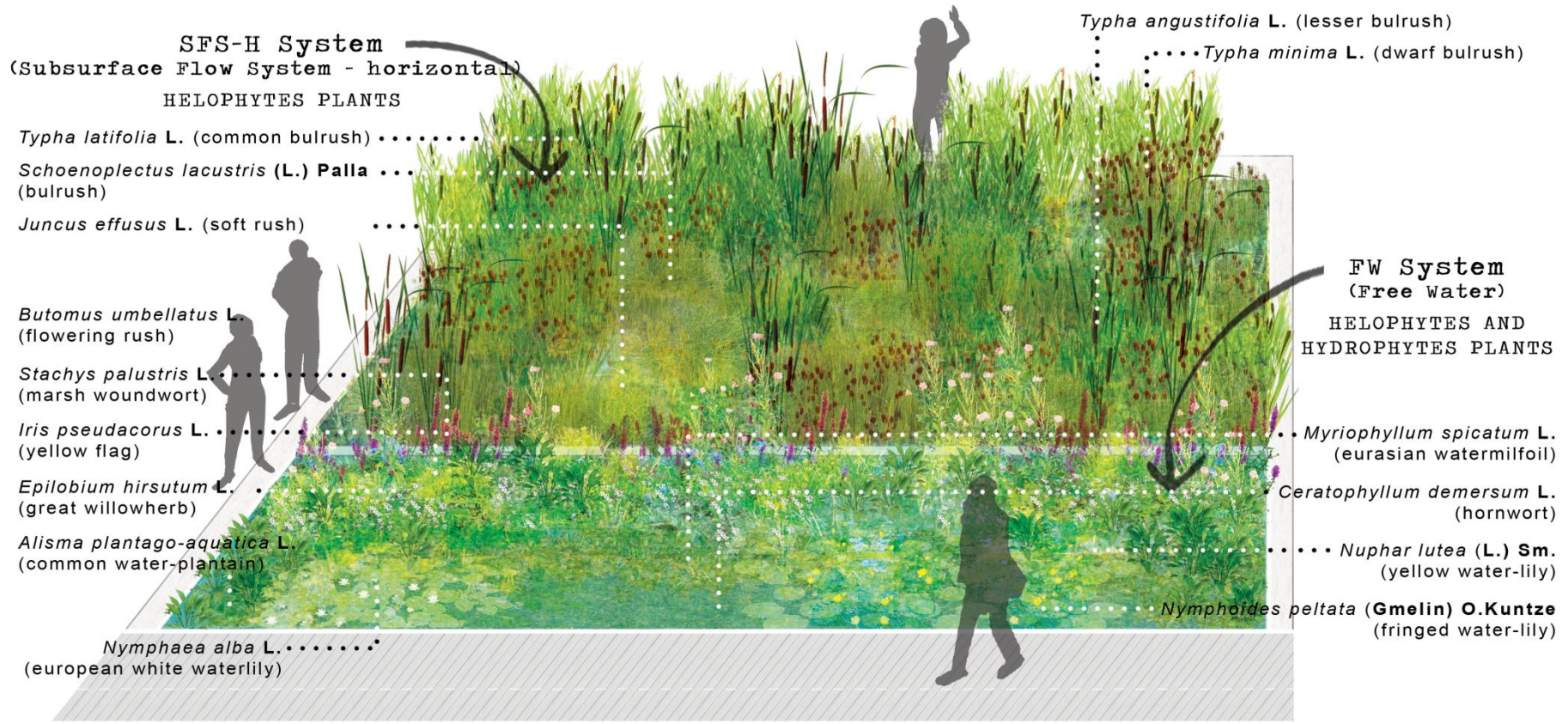
- 🍃 Improving water quality by filtering out pollutants
- 🍃 Protect communities from flooding and drainage problems
- 🍃 Removing nutrients, chemicals and sediments
- 🍃 Native and adapted vegetation
- 🍃 Protecting from urban pollutants
- 🍃 Providing and promoting biodiversity
- 🍃 Enhancing the beauty of Landscape

Phytodepuration Tanks



Post-Industrial Landscape

Plants selection:



Plants selection:

Water need:



Geophytes and Hemicryptophytes



Elophytes

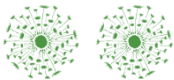


Hydrophytes

Site adaptability (distribution in Rome):



Low

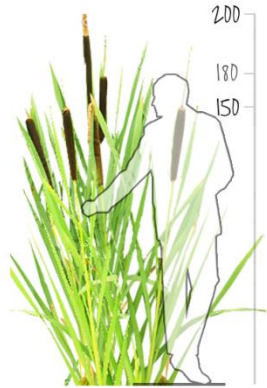


Medium



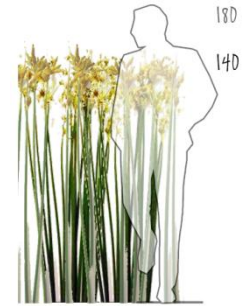
High

Plants selection:



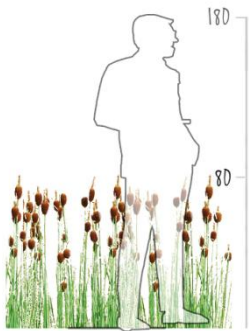
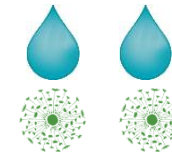
Typha latifolia L. (common bulrush)

FUNCTIONAL CHARACTERISTICS:
Nitrophyllous and oxygenating



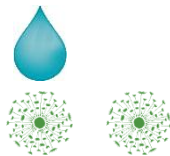
Schoenoplectus lacustris (L.) Palla
(bulrush)

FUNCTIONAL CHARACTERISTICS:
Nitrate and phosphate remover



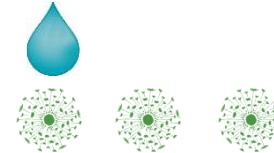
Typha minima L. (dwarf bulrush)

FUNCTIONAL CHARACTERISTICS:
Fast growing, resistance to pollutants



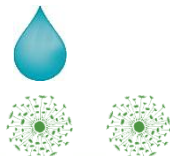
Juncus effusus L. (soft rush)

FUNCTIONAL CHARACTERISTICS:
Nitrate remover



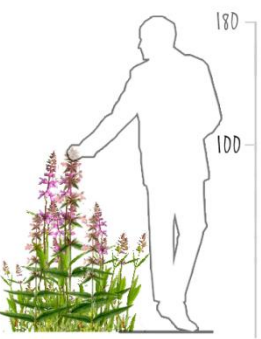
Typha angustifolia L. (lesser bulrush)

FUNCTIONAL CHARACTERISTICS:
Resistance to pollutants



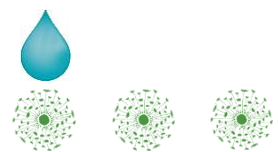
Post-Industrial Landscape

Plants selection:



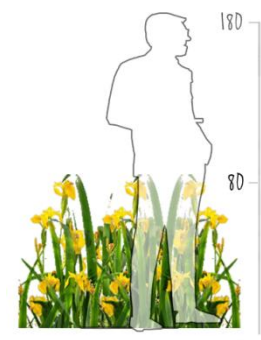
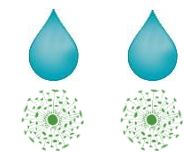
Stachys palustris L. (marsh woundwort)

FUNCTIONAL CHARACTERISTICS:
Resistance to pollutants



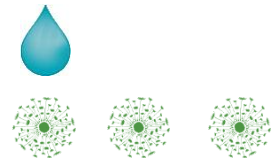
Butomus umbellatus L. (flowering rush)

FUNCTIONAL CHARACTERISTICS:
Oxygenating



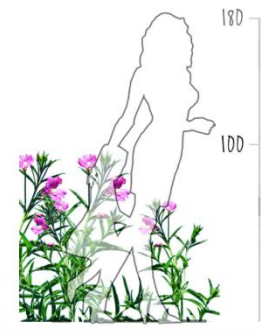
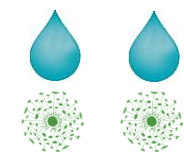
Iris pseudacorus L. (yellow flag)

FUNCTIONAL CHARACTERISTICS:
Nitrate and phosphate remover



Alisma plantago-aquatica L. (common water-plantain)

FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



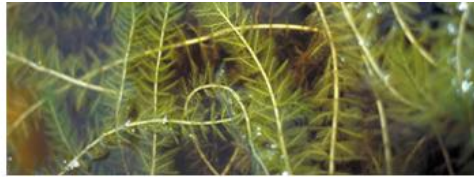
Epilobium hirsutum L. (great willowherb)

FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



Post-Industrial Landscape

Plants selection:



Myriophyllum spicatum L. (eurasian watermilfoil)



FUNCTIONAL CHARACTERISTICS:
Oxygenating



Ceratophyllum demersum L. (hornwort)



FUNCTIONAL CHARACTERISTICS:
Oxygenating



Nymphaea alba L. (european white waterlily)



FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



Nuphar lutea (L.) Sm. (yellow water-lily)



FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



Nymphoides peltata (Gmelin) O.Kuntze (fringed water-lily)



FUNCTIONAL CHARACTERISTICS:
Bioaccumulation

Post-Industrial Landscape

Plants selection:



Myriophyllum spicatum L. (eurasian watermilfoil)



FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



Ceratophyllum demersum L. (hornwort)



FUNCTIONAL CHARACTERISTICS:
Oxygenating



Nymphaea alba L. (european white waterlily)



FUNCTIONAL CHARACTERISTICS:
Oxygenating



Nuphar lutea (L.) Sm. (yellow water-lily)



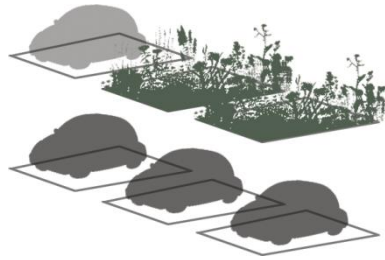
FUNCTIONAL CHARACTERISTICS:
Oxygenating



Nymphoides peltata (Gmelin) O.Kuntze (fringed water-lily)



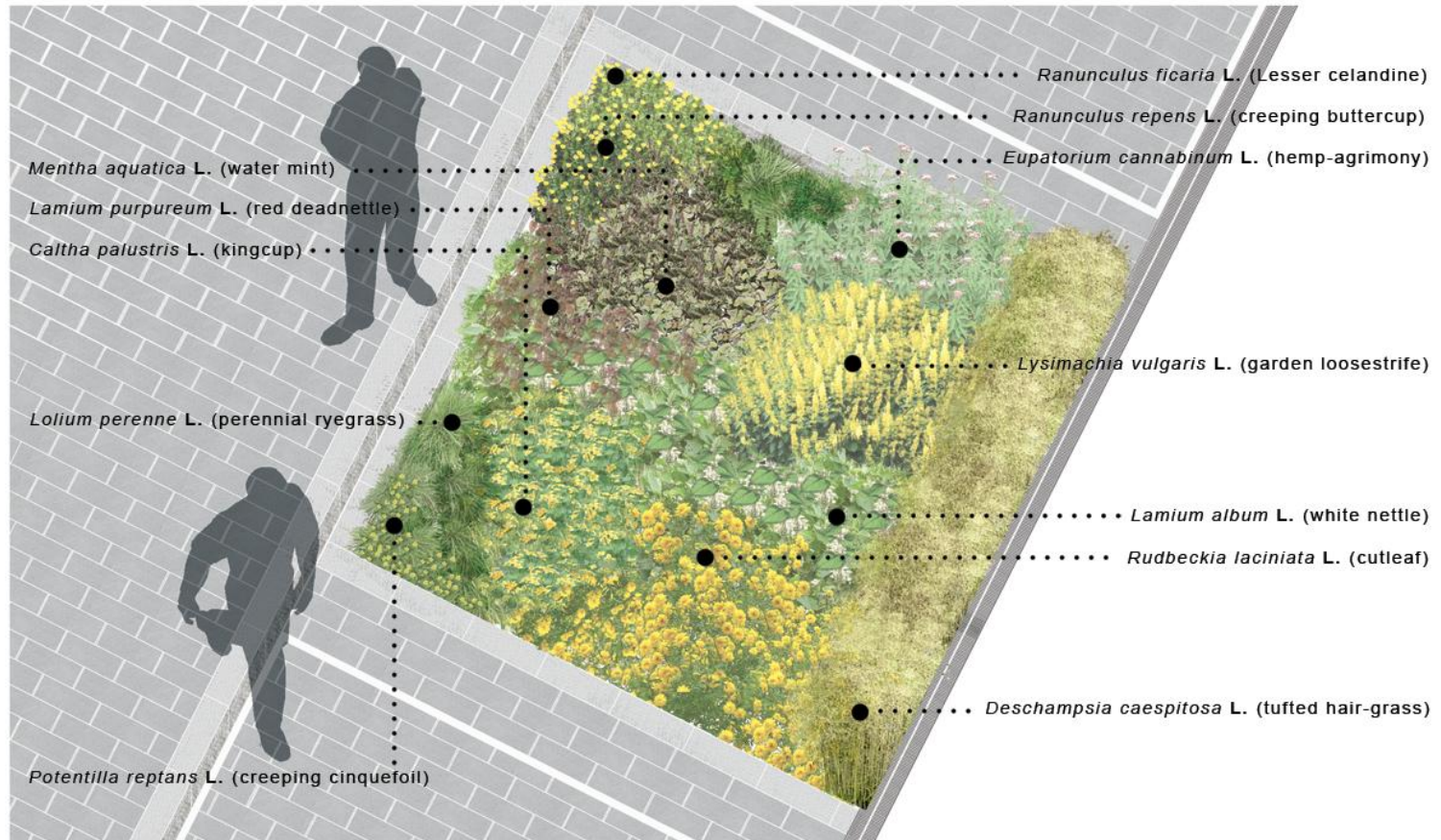
FUNCTIONAL CHARACTERISTICS:
Bioaccumulation



Rain Gardens



Plants selection:



Plants selection:

Light requirements:



Sunlight

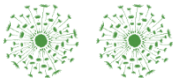


Shadow

Site adaptability (distribution in Rome):



Low



Medium

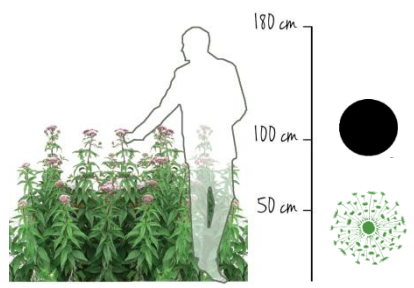


High

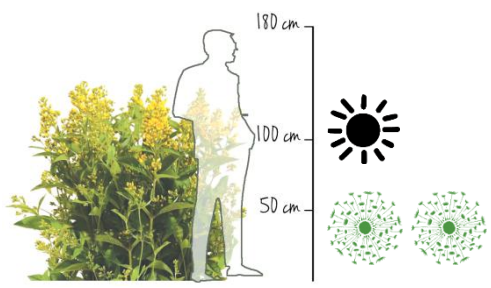
Post-Industrial Landscape

Plants selection:

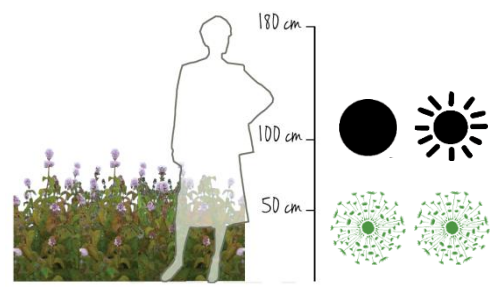
Eupatorium cannabinum L.
(hemp-agrimony)



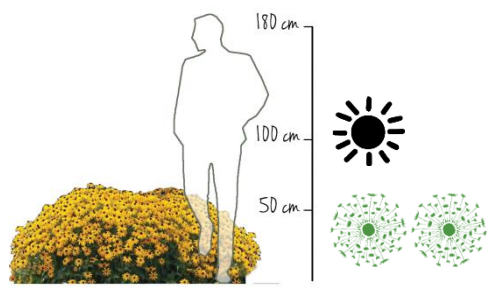
Lysimachia vulgaris L.
(garden loosestrife)



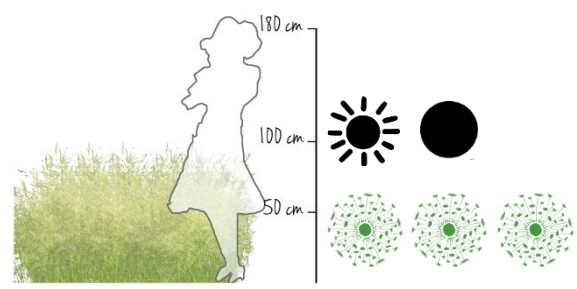
Mentha aquatica L.
(water mint)



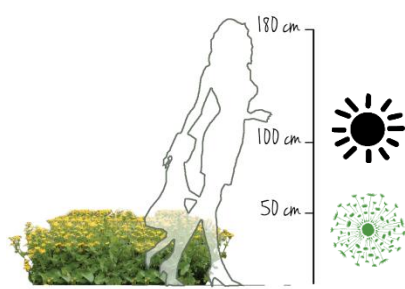
Rudbeckia laciniata L.
(cutleaf)



Deschampsia caespitosa L.
(tufted hair-grass)



Caltha palustris L.
(kingcup)



Plants selection:



Ranunculus ficaria L. (lesser celandine)



Ranunculus repens L. (creeping buttercup)



Lamium album L. (white nettle)



Lamium purpureum L. (red deadnettle)



Potentilla reptans L. (creeping cinquefoil)



Lolium perenne L. (perennial ryegrass)



Conclusions

Key Criteria for successful planting design in GI projects:

- ① Analysis of **site characteristics**:
temperature, precipitation, soil moisture, humidity, orientation, ...
- ① Choose only **site adaptable plants**:
Native and/or adapted vegetation
- ① Functional and aesthetically pleasing design in line with the social, economic and environmental objectives of **sustainable development**

Selected references

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Tutin, T.G. et al. - Flora Europaea, second edition – 1993

Zangheri P. - Flora Italica (2 voll.) - Cedam - 1976

Conti F., Abbate G., Alessandrini A., Blasi C., 2005 - Checklist of the Italian Vascular Flora

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Thank you for your attention!

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