

Incontro di confronto con stakeholders afferenti il verde urbano e fasce verdi sul tema delle specie aliene



Le soluzioni basate sulla natura per la gestione sostenibile del drenaggio urbano: l'esempio del rain garden

Dr. Ing. Anacleto Rizzo
IRIDRA Srl



Introduzione e definizioni

Nature-based solutions

*“La Commissione Europea definisce le **Nature-based Solutions (NbS)** come risposte alle sfide sociali che sono ispirate e sostenute dalla natura, che sono economicamente efficaci, forniscono simultaneamente benefici ambientali, sociali ed economici e aiutano a costruire la resilienza.”*



Introduzione e definizioni

Città Spugna

Sponge city (città spugna) è un termine coniato in Cina e riguarda lo sviluppo di città in grado di assorbire l'acqua piovana come delle "spugne", e quindi di ridurre i rischi di allagamento in ambiente urbano dovuti all'eccessiva impermeabilizzazione

Can 'sponge cities' solve China's urban flooding problem?

WADE SHEPARD JULY 28, 2016

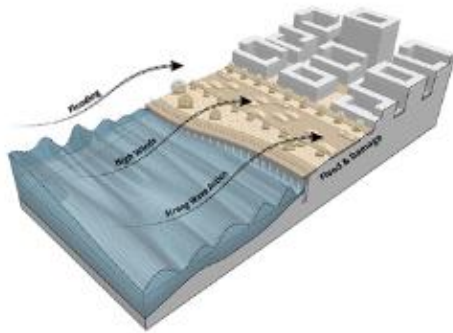


Floods in cities across China this year have caused as much as US\$45 billion worth of damage. (Paul Gonzalez/flickr/cc)



Introduzione e definizioni

Cambiamenti climatici e allagamenti



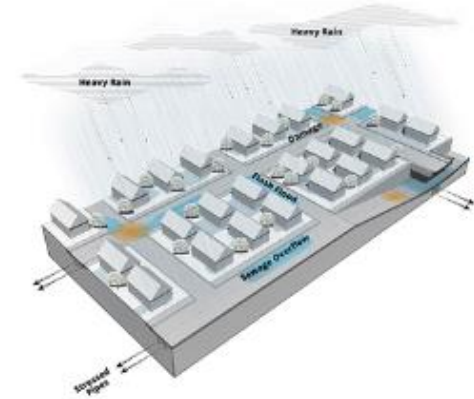
COASTAL FLOODING

Flooding to coastal areas caused by waves / storm surge during a storm



RIVERINE FLOODING

Flooding caused by high river levels



STORMWATER FLOODING

Localized flooding in a community caused by heavy rains



<https://nrcsolutions.org/>



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Introduzione e definizioni

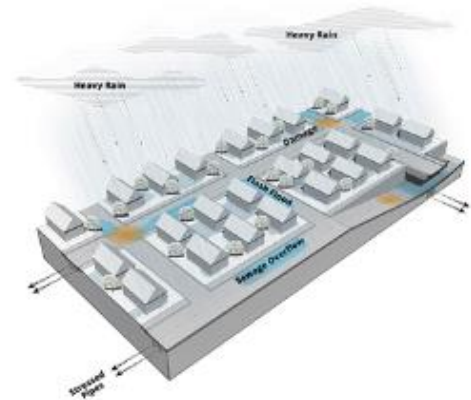
Diverse definizioni di letteratura

Conosciuta con diverse parole chiave:

- SuDS Sustainable drainage systems
- WSUD Water Sensitive Urban Design
- LID Low impact development
- BMP Best management practices

Urban Water Journal, 2014

<http://dx.doi.org/10.1080/1573062X.2014.916314>



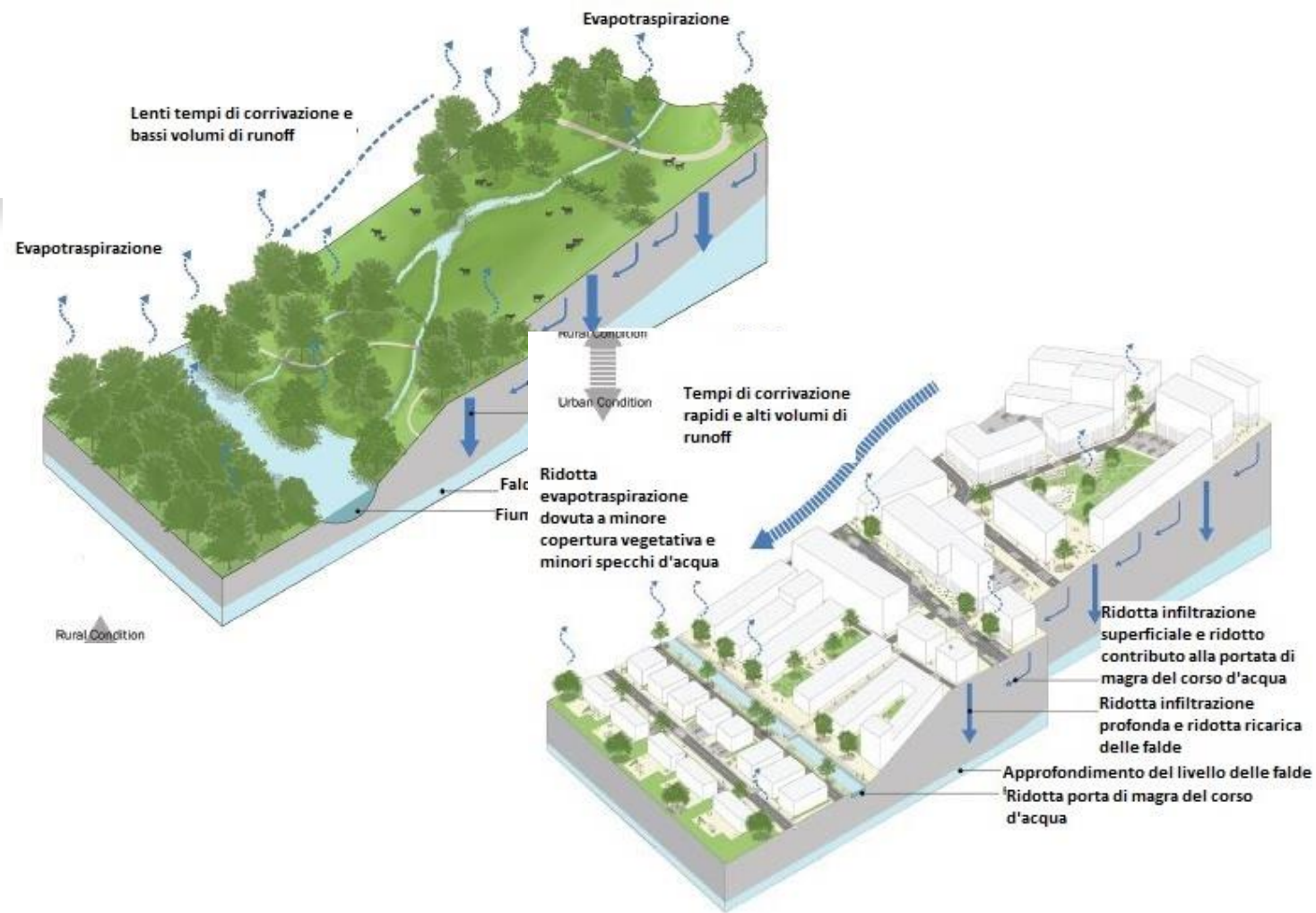
STORMWATER FLOODING

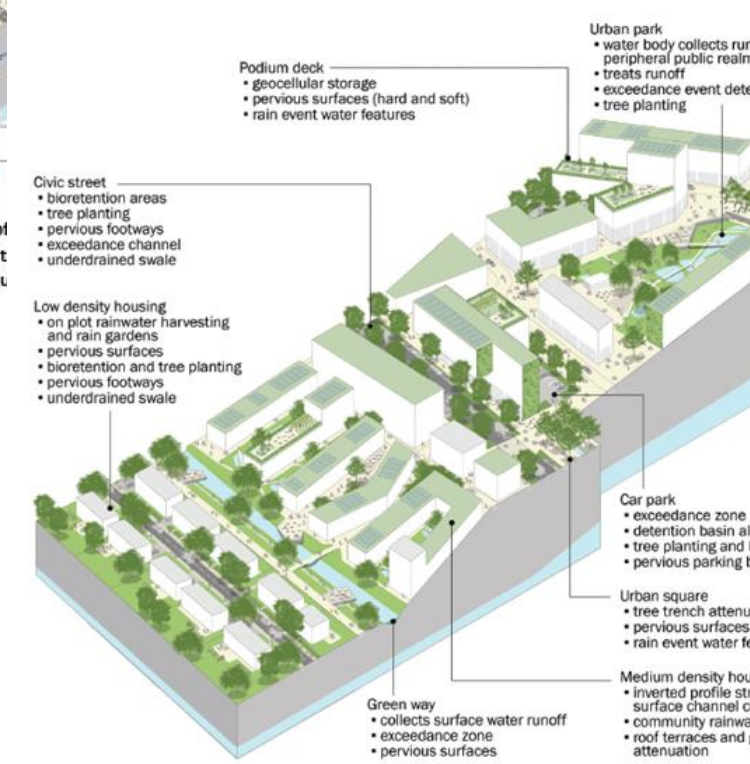
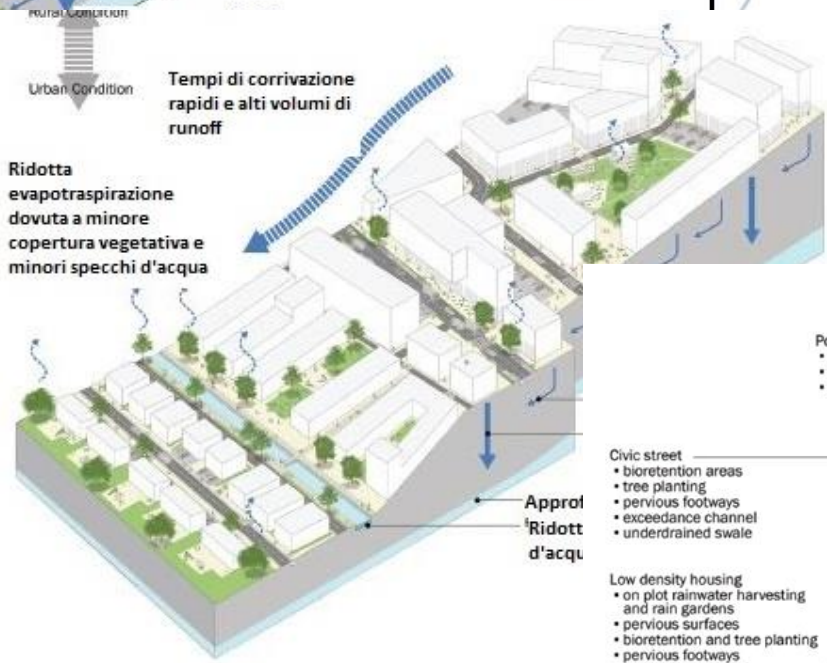
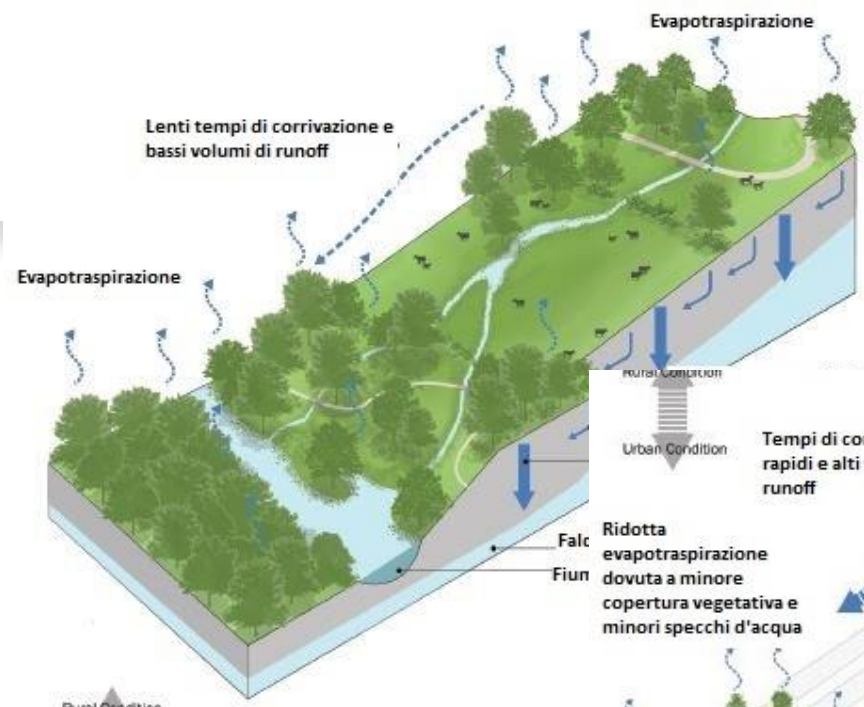
Localized flooding in a community caused by heavy rains

RESEARCH ARTICLE

SUDS, LID, BMPs, WSUD and more – The evolution and application of terminology surrounding urban drainage

Tim D. Fletcher^{a*}, William Shuster^b, William F. Hunt^c, Richard Ashley^d, David Butler^e, Scott Arthur^f, Sam Trowsdale^g, Sylvie Barraud^h, Annette Semadeni-Daviesⁱ, Jean-Luc Bertrand-Krajewski^h, Peter Steen Mikkelsen^j, Gilles Rivard^k, Mathias Uhl^l, Danielle Dagenais^m and Maria Viklanderⁿ





SuDS e Regione Lombardia



GESTIONE SOSTENIBILE DELLE ACQUE URBANE
MANUALE DI DRENAGGIO 'URBANO'

PERCHÉ
COSA
COME



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SuDS e Regione Lombardia

Regolamento Regionale 23 novembre 2017 , n. 7

Regolamento recante criteri e metodi per il rispetto del principio dell'invarianza idraulica ed idrologica ai sensi dell'articolo 58 bis della legge regionale 11 marzo 2005, n. 12 (Legge per il governo del territorio)

(BURL n. 48, suppl. del 27 Novembre 2017)

urn:nir:regione.lombardia:regolamento:2017-11-23;7

https://normelombardia.consiglio.regione.lombardia.it/NormeLombardia/Accessibile/main.aspx?exp_coll=rr002017112300007&view=showdoc&iddoc=rr002017112300007&selnode=rr002017112300007



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SuDS e Regione Lombardia

- Fondi PNRR, 92 Interventi in 4 lotti progettuali
- Lotto 2 (26 interventi). Progettazione DEF IRIDRA – retrofitting SuDS strade e parcheggi



Città
metropolitana
di Milano



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SuDS e Regione Lombardia

Regione Lombardia in collaborazione con ERSAF lancia una *call for ideas* per la selezione di interventi di adattamento e mitigazione ai cambiamenti climatici basati sull'impiego di *SuDS – Sustainable Drainage System* al fine di rendere più permeabili le aree urbane per favorire l'infiltrazione delle acque meteoriche, riducendo il rischio di allagamenti e la formazione di isole di calore, anche grazie ad interventi di piantumazione.

DOCUMENTAZIONE

- [Dgr 5135 del 03/08/2021](#)
- [Call For Ideas + Allegato A Metodologia di valutazione](#)
- [Allegato B Domanda di Partecipazione](#)
- [Allegato C Relazione Tecnica](#)
- [Allegato D Budget Preventivo - aggiornata al 3 settembre 2021](#)
- [Slide dell'incontro del 16 settembre 2021](#)



Drenaggio urbano sostenibile (SuDS – Sustainable Drainage Systems)
Parte 1: L'approccio, le scale di applicazione e le soluzioni tecniche

PhD Ing. Anacleto Rizzo
Iridra Srl

ERSAF
ENTE REGIONALE PER I SERVIZI
ALL'AGRICOLTURA E ALLE FORESTE

IRIDRA
S.r.l.

Regione Lombardia

CONTRATTI di FIUME

WEBINAR - Drenaggio urbano sostenibile (SuDS) con Anacleto Rizzo
21 maggio

Contratti di Fiume Lomba...
281 iscritti

Iscriviti

14

Condividi

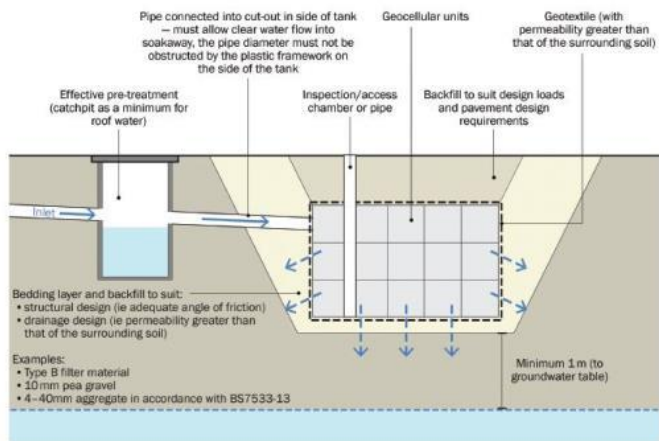


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Tecniche SuDS

Infrastrutture grigie

Fonte: Woods Ballard et al. 2015. "The SuDS Manual"



Pozzi perdenti

Pavimentazioni permeabili e porose



Vasche di laminazione interrate

Sistemi di trattamento tecnologici



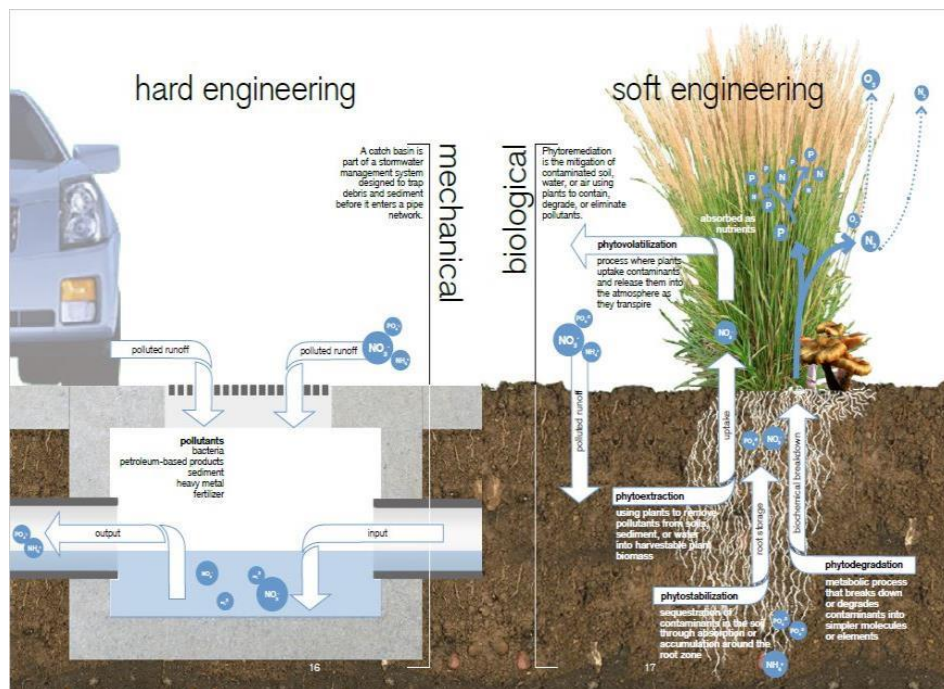
Tecniche SuDS

Servizi ecosistemici

Fonte: Huber, J., 2010. *Low Impact Development: a Design Manual for Urban Areas*

13 esempi di **Servizi Ecosistemici** forniti da soluzioni naturali - *Soft Engineering* - per il drenaggio urbano delle acque di pioggia rispetto agli approcci tradizionali - *Hard Engineering*:

1. regolazione atmosferica
2. regolazione climatica
3. regolazione idrica
4. recupero delle acque
5. controllo dell'erosione e trattenimento dei sedimenti
6. formazione di suolo
7. bilanciamento cicli dei nutrienti
8. riduzione carico inquinante sfruttando i processi naturali
9. pollinazione
10. aumento biodiversità
11. produzione di biomasse
12. aumento aree ricreative
13. educazione ambientale



Tecniche SuDS

Infrastrutture verdi e blu

Fonte: Woods Ballard et al. 2015. "The SuDS Manual"

Tetti verdi



*Trincee infiltranti e bacini di
detenzione asciutti*



Canali



Aree di bioritenzione (rain garden)



Box alberati filtranti



Stagni

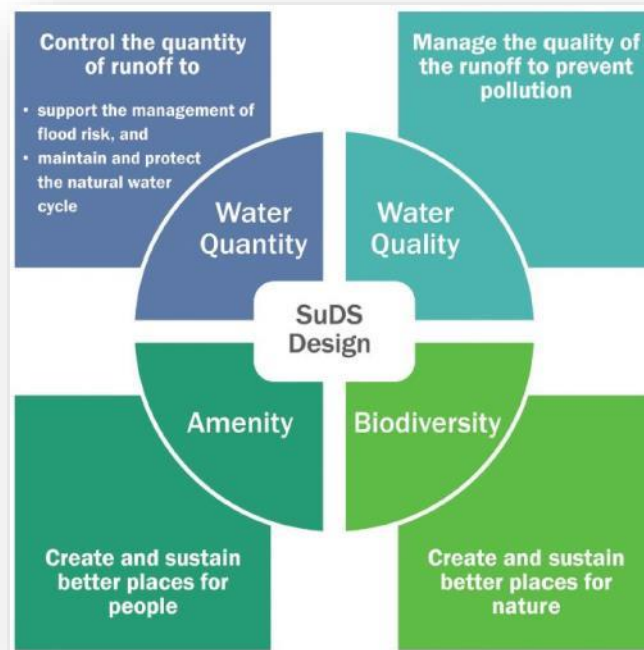


Drenaggio urbano sostenibile

Progettazione Multiobiettivo

TABLE 7.1 SuDS component delivery of design criteria

Component type	Description	Collection mechanism	Design criteria					
			Water quantity (Chapter 3)			Water quality (Chapter 4)	Amenity (Chapter 5)	Biodiversity (Chapter 6)
			Peak runoff rate	Runoff volumes (Interceptions)				
			Small events	Large events				
Rainwater harvesting systems	Systems that collect runoff from the roof of a building or other paved surface for use	P		•	•		•	
Green roofs	Planted soil layers on the roof of buildings that slow and store runoff	S	○	•		•	•	•
Infiltration systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	P	•	•	•	•	•	•
Proprietary treatment systems	Subsurface structures designed to provide treatment of runoff	P				•		
Filter strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	L		•		•	○	○
Filter drains	Shallow stone-filled trenches that provide attenuation, conveyance and treatment of runoff	L	•	○		•	○	○
Swales	Vegetated channels (sometimes planted) used to convey and treat runoff	L	•	•	•	•	•	•
Bioretention systems	Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils	P	•	•	•	•	•	•
Trees	Trees within soil-filled tree pits, tree planters or structural soils used to collect, store and treat runoff	P	•	•		•	•	•
Pervious pavements	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/or allowed to infiltrate into the ground below	S	•	•	•	•	○	○
Attenuation storage tanks	Large, below-ground voided spaces used to temporarily store runoff before infiltration, controlled release or use	P	•					
Detention basins	Vegetated depressions that store and treat runoff	P	•	•		•	•	•
Ponds and wetlands	Permanent pools of water used to facilitate treatment of runoff – runoff can also be stored in an attenuation zone above the pool	P	•			•	•	•



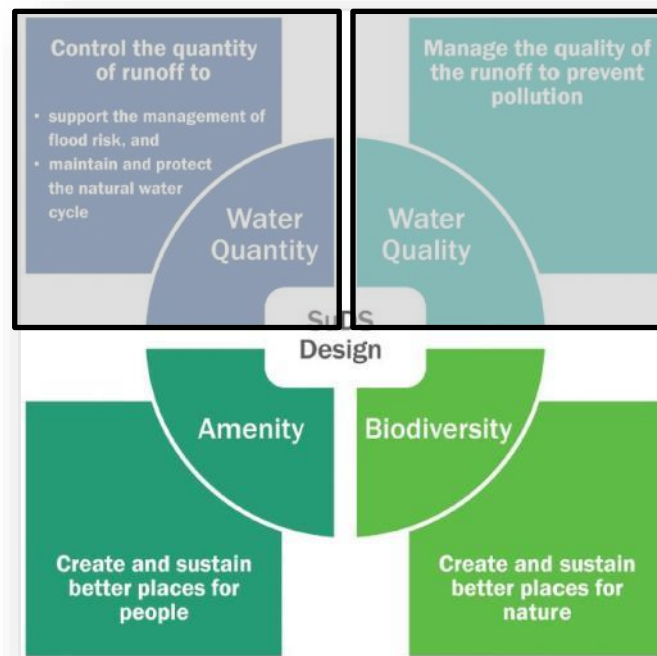
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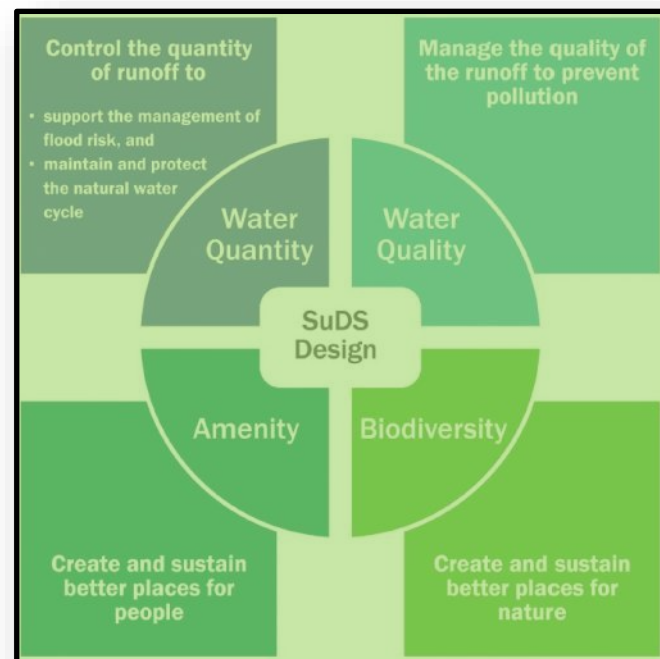
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Drenaggio urbano sostenibile

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Fonte: Woods Ballard et al. 2015. "The SuDS Manual"

Drenaggio urbano sostenibile

Team multidisciplinare



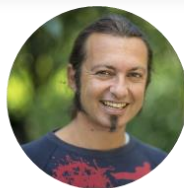
Nicola Martinuzzi,
Mechanical Engineer



Fabio Masi,
PhD Chemist



Giulio Conte
Biologist



Riccardo Bresciani,
Environmental
Engineer



Ivano Filippini
Land Surveyor



Barbara Bonadies
Architect



Anacleto Rizzo
PhD Hydraulic
Engineer



Linda Sabatini
Administration and
Tender



Giordano Fossi
Agronomist



Paolo Armanasco
Agronomist



Kathryn Rivai
Environmental
Engineer



Chiara Sarti
Chemist



Chiara Zurli
Environmental
Engineer



Michela Galletti
Landscape
architect



Riccardo Cilia
Landscape
architect and
Codesign expert



Francesco Leone
Building Engineer

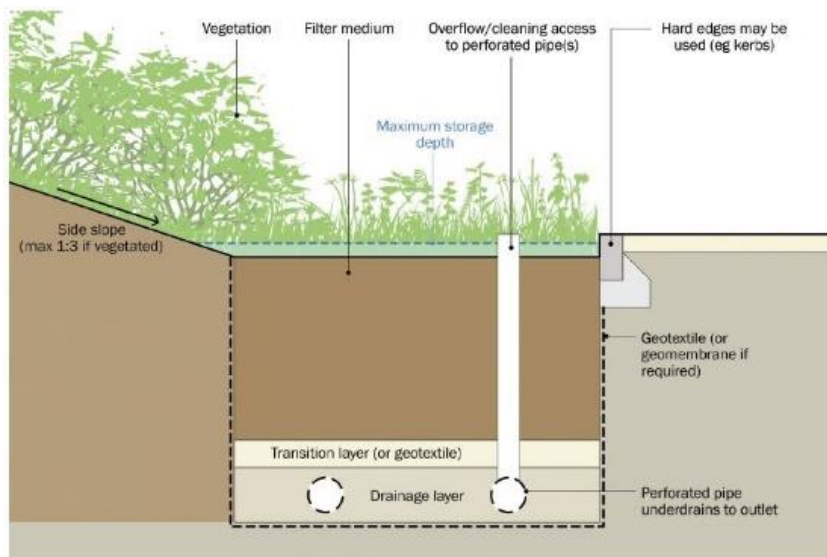


Iliaria Principi
PhD Chemist

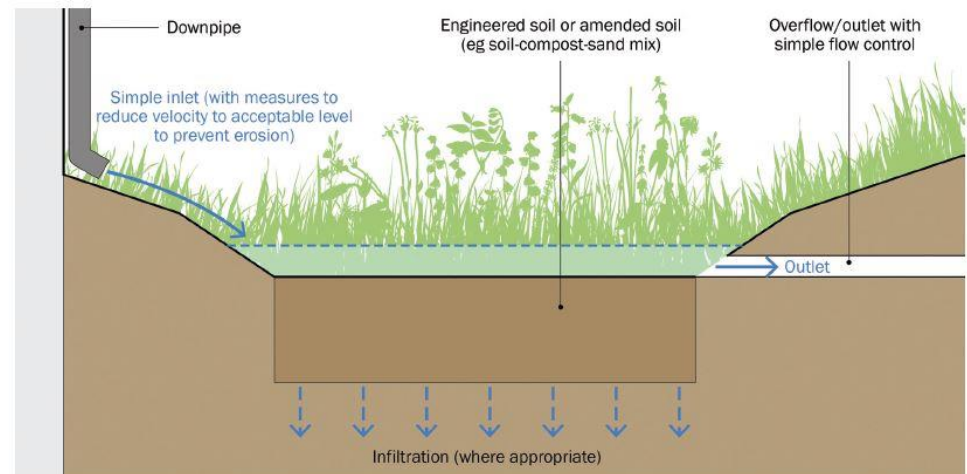


Aree di bioritenzione (Rain garden) Tipologico

Area di bioritenzione



Rain garden



Fonte : Woods Ballard et al. 2015. "The SuDS Manual"

Aree di bioritenzione (Rain garden)

Esempio in Italia

Viale Matteotti, Bovisio Masciago (MB)



Tra i pali della luce



Lungo la strada



Sui marciapiedi

Aree di bioritenzione (Rain garden) Esempio in Italia

Viale Matteotti, Bovisio Masciago (MB)



Incroci



Rotonde

Aree di bioritenzione (Rain garden)

Trattamento acque di prima pioggia

TABLE 18.1 Pollution removal for bioretention systems designed to FAWB guidelines (after FAWB, 2009)

Pollutant	Typical removal efficiency
TSS	> 90%
Total phosphorous	> 80%
Nitrogen	50% on average
Metals (zinc, lead, cadmium)	> 90%
Metals (copper)	up to 60%



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

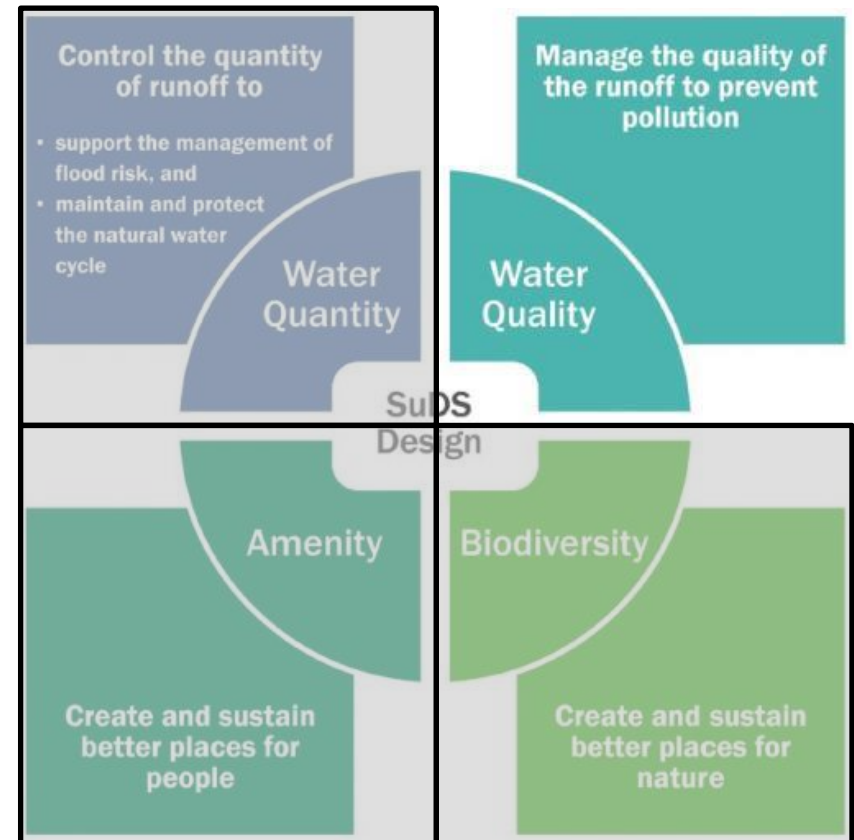
Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Review

Bioretention systems for stormwater management: Recent advances and future prospects

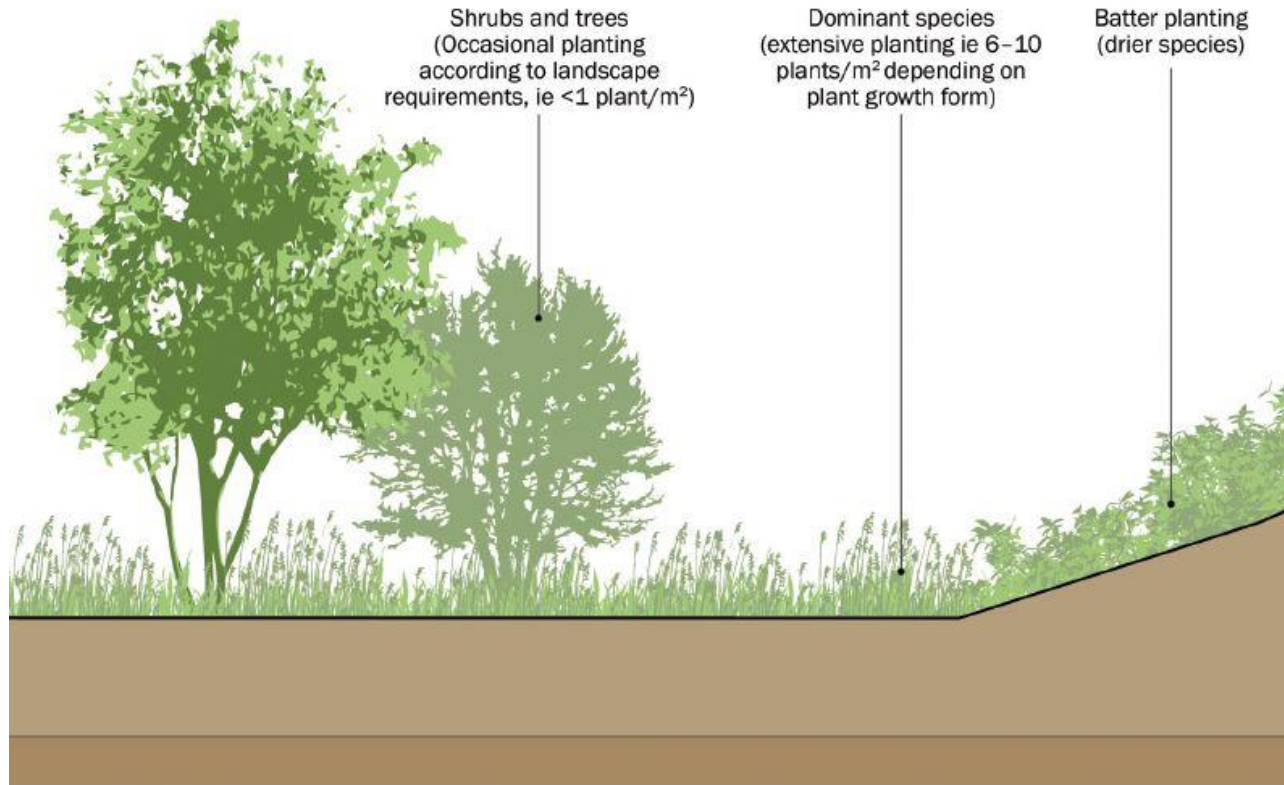
Kuppusamy Vijayaraghavan^a, Basanta Kumar Biswal^a, Max Gerrit Adam^a, Soon Hong Soh^a, Daryl Lee Tsen-Tieng^b, Allen P. Davis^c, Soon Hoe Chew^a, Puay Yok Tan^d, Vladan Babovic^a, Rajasekhar Balasubramanian^{a,*}



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Aree di bioritenzione (Rain garden)

Biodiversità



Aree di bioritenzione (Rain garden)

Biodiversità

Per la scelta della vegetazione è bene prevedere il coinvolgimento di architetti paesaggisti, agronomi o vivaisti. In generale, le caratteristiche da considerare per la scelta delle vegetazione da mettere a dimora sono:

- adattamento a condizioni asciutto/bagnato
- adattamento al carico inquinante veicolato dalle acque di pioggia
- capacità di penetrazione delle radici
- preferenza per piante native
- inserimento paesaggistico
- disponibilità di piante in vivai vicini al sito
- ridotta necessità di manutenzione

altezza delle piante (da considerare per motivi di sicurezza della visuale stradale)



Are di bioritenzione (Rain garden)

CARDIMED

- **Call:** HORIZON-MISS-2022-CLIMA-01
- **Type:** Horizon Innovation Action
- **Duration:** 54 Months
- **Start:** 1st September 2023
- **# of Partners:** 51 (14 countries)
 - 10 Universities & 7 Research Organizations
 - 9 SMEs, 1 large Company and 8 NGOs
 - 6 Regions and 5 Municipalities
 - 5 Authorities/Utilities
- **# of Affiliated Organizations:** 3
- **Budget:** € 20 806 271,44



CARDIMED



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Aree di bioritenzione (Rain garden) CARDIMED



Viale della Circonvallazione e Tondo Gioieni



Allagamenti in Via Etnea



Università
di Catania



Comune di
Catania

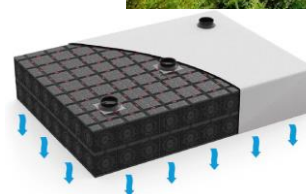
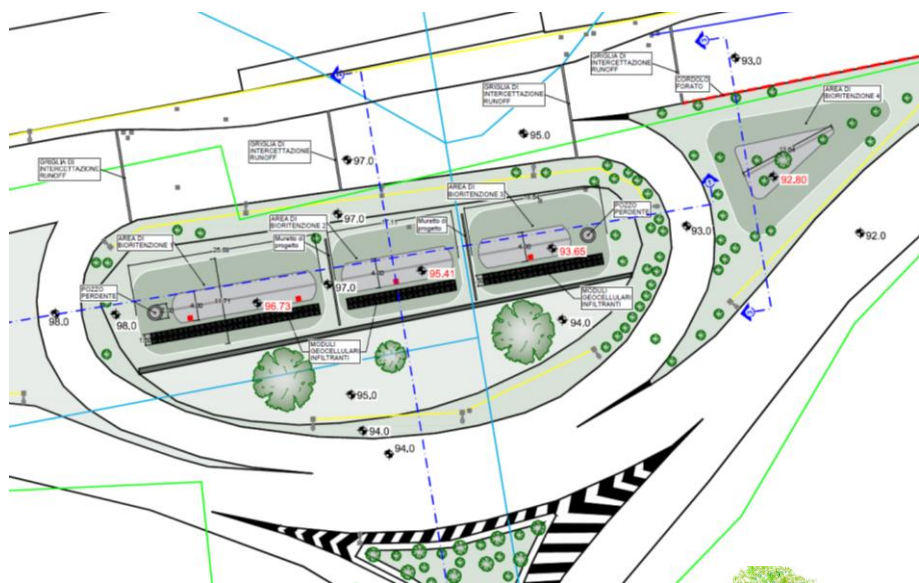


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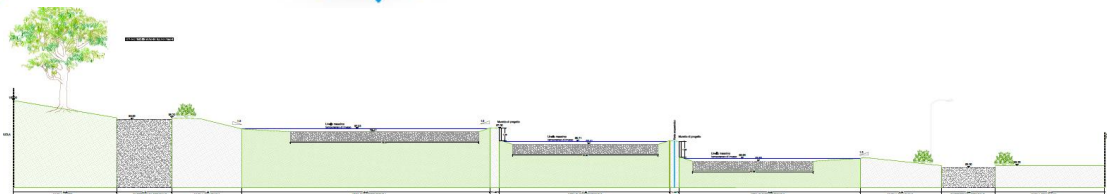
Aree di bioritenzione (Rain garden) CARDIMED



PFTE, PE, DDLL (IRIDRA, Università di Catania, Comune di Catania)



Proposte preliminari stato
di progetto



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Are di bioritenzione (Rain garden) Biodiversità: specie invasive?



Sopralluogo 16 Novembre 2023

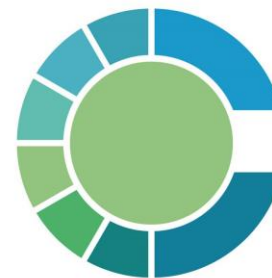
GRAZIE PER L'ATTENZIONE

Dr. Ing. Anacleto Rizzo – IRIDRA Srl

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