



#### THE ROLE OF TREES IN THE FACE OF CLIMATE CHANGE: CURRENT MANAGEMENT AND FUTURE STRATEGIES



National Tree Officers Conference 2019 – Reading 6<sup>th</sup> November

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#### **Turin's Green and Open Space System**



URBAN SURFACE : 130.17 km2

**INHABITANTS: 898.714** 

**GREEN SPACE/INHABITANT : 52.56 m<sup>2</sup>** 

TOTAL PUBLIC GREEN AREAS: 21.429.000 m<sup>2</sup> (23,84 m<sup>2</sup>/in. – 16,46% urban surface)

HILLSIDE FOREST: 7.925.186 m<sup>2</sup>

More than 160.000 public trees:

- 110.000 trees in parks, gardens, riverbanks, boulevards (60.000), school gardens and sporting facilities

- more than 50.000 trees in hill forests

1817: the first tree-lined boulevard estabilished

A system of tree-lined boulevards over km 450 long

An heritage with an incredible value in environmental and economic terms



## **Urban trees area: Organization & Activities**

## ORGANIZATION

- 1 tree manager (coordinator): general and technical codes, relationships w/all stakeholders (politicians, associations, citizens..)
- 2 community groups ACTIVITIES
  - Tree-maintenance planning
  - Issuing public tenders: planting, pruning, risk assessment, etc.
  - Daily works managements and territorial control



#### The Alpine Arch and the Po River plain



Turin is in a unique natural location: surrounded by the Alps, with hills to the east and is crossed by four rivers

#### **Unfavourable Natural Conditions**







Negative effects of poor air circulation in a densely populated and highly agricoltural landscape

#### **Climate Change**

- Climate change may exacerbate regional and local air quality problems
- Summer heat waves can impact the production of ozone
- Longer dry spells and less frequent winter precipitation mean more stagnant air
- Impacts of climate change may be cumulative and indirect
- Heat and drought can cause forest fires that exacerbate air quality



## **Climate Vulnerabilities in Turin**









Source: Regional Agency for the Protection of the Environment





#### **Climate Vulnerabilities in Turin – Heat Waves**



Distribution of the three hazard classes related to heat waves



Effect of industrial buildings on heat waves



Increase in temperatures of + 3 ° C to m 50 from industrial areas, + 1°C between m 50 and m 100 from industrial areas

Data from EU Life DERRIS Project



#### **Climate Vulnerabilities in Turin - Flooding**





#### River flooding and localized flooding

## **A Climate Strategy for Turin**





## Mitigation: towards an energy transition

2009 Turin signs the Covenant of Mayors for Energy - 7481 signatory cities agree to implement EU energy policy 2010 Turin adopts an Action Plan for Energy (TAPE) to *reduce greenhouse gas emissions by 30% below 1991 levels by 2020* 

## **Planning for adaptation**

- MAYORS ADAPT
   Mayors Adapt the Covenant of Mayors Initiative on Climate Change Adaptation, set up by the European Commission to engage cities in taking action to adapt to climate change
- Adapting to climate change is a way of making the city a safer, healthier, greener, and more liveable place for its citizens and visitors. Turin adheres in 2015.

**A Climate Strategy for Turin** 

# Planning for adaptation – EU Life DERRIS Project Partnership between public administration and SMEs to reduce the risks from extreme weather in industrial districts



risk Implement a climate management plan with an integrated approach that fosters coordination between PA and SMEs for the definition of a series of measures to prevent economic, environmental and human health damage caused by climate change.



#### **Planning for adaptation**

#### Formalizing the process

- Municipal resolution launching interdepartmental working group across the administration
- Comprehensive vulnerability analysis including all risk factors: wind, heat, air quality, soil stability, food security, flooding, pollen outbreaks, etc
- Epidemiological assessment of climatic events on local and regional populations
- Development of a Climate Action Strategy with Local Administrations, Regional Environmental Agency, Local Universities and Strategic partners

## **Development of a Climate Action Strategy**

- Survey adaptation actions already being implemented
- Assess the planning and regulatory frameworks that require revision
- Engage stakeholders across the board to develop a comprehensive climate strategy
- Continue exchanging and sharing best practices
- Periodic monitoring and evaluation of the implementation of climate actions, and correct the strategy as necessary
- Develop and implement ongoing **communication strategies** to raise awareness in the general public



## THE TIMING IS RIGHT

An enormous opportunity to integrate the Climate Strategy into existing and new plan

- Update of the Urban Master Plan in process
- Update of the Sustainable Urban Mobility Plan to begin
- Civil Protection Plan *will be updated*
- Turin Action Plan for Energy to be reviewed
- Strategic Green Infrastructure Plan (*new plan*)
- Air quality plan (*new plan*)
- Zero waste strategy (*new plan*)

## **Integrating the strategy**

## Updating the City Masterplan by 2021

- Greenfield and soil conservation
- Integrated metropolitan mobility
- Hydrological balance and surface permeability
- Green infrastructure conservation/development



## **Integrating the strategy**

# **Green Infrastructure Plan**

- Quantitative and qualitative analysis of recreational green infrastructure
- Ecological assessment: Biodiversity and habitat connectivity
- Ecosystem services: Risk mitigation and management assessment: land stabilization, soil conservation, shading/cooling and ventilation, CO<sub>2</sub> capture, stormwater management
- Urban agriculture and food security



Target: 25 square meters per resident

## Awareness of the Multiple Benefits of Urban Trees



Planting trees in cities is particularly effective both for direct CO2 sequestration and for microclimate improvement

Urban trees have a direct impact on human healt New N.U. «Urban Agenda to 2030» considers green spaces one of key points for sustanaible cities

#### Why trees are good for us



According to the European Commission Green Infrastructures themes will be strategic

The cities of the future should have more trees

#### **Trees & Complex Urban Environments**



Our tree stock is ageing and feeling the effects of a complicated coexistence with human activities

History full of mistakes, wrong choices also from arborists and municipal ones and the result is....

**Reduction of life expectancy and structural stability factors** 

#### **Problems related to tree stability in cities**



Extreme weather events are more frequents and show structural instability of our public and private tree stock



## **Tree failures: Causes and Frequency**

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TREE FAILURES & REMOVAL	2013 (WIND > 100 km/h)	2014	2015	2016	2017	2018
GLOBAL	253	43	65	70	100	103
TRUNK	30	9	13	7	38	5
COLLAR	25	4	0	1	2	6
ROOT PLATE	83	18	36	30	24	60
CANOPY	115	10	16	32	36	32

- Importance of analysing data and trends over the years
- Failures could help us better understand tree history and vulnerability to improve our management
- It's key to point out critical issues and analyse causes and errors

## Trees normally fail ..... in Turin as well

TREE FAILURES & REMOVAL	2013 (venti > 100 km/h)	2014	2015	2016	2017	2018 (30/10/18)
GLOBAL	253	43	65	70	100	103
WITH ORDINARY WEATHER CONDITIONS	3	2	5	1	9	3

- Despite risk assessment activities trees fall down, also ones with lower failure risk
- 43-100 trees x year on 160.000 represents 0,02%-0,06% of the total, it's neither a lot nor a little... it depends on how many are avodaible failures and the extent of the damages.....
- Avoid alibi of extreme weather conditions and focus on climate change *as the new normal*

## ALBERA.TO web-GIS Platform for Tree Management



Web application to plan and manage public tree stock

Open to the tree-technicians and consultants Easy to use and web interface (pc, laptop, smartphone)

Privileges are set according to different users (*municipal technicians and arborists, consultants, citizens...*) Flexibility: system admnistrators can customize data sheets



## ALBERA.TO web-GIS Platform for Tree Management



Web-gis to ensure an easy and sure access to all users

Preserve historical info, know-how and experience

Decision-making based on historical data

Planning maintenance activities Reporting and statistical analysis Support quality process activities (ISO 9001 standards)



#### **ALBERA.TO & Tree Assessment**

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> 70.000 assessment reports loaded

All data related to tree inventory and assessments is available for all stakeholders

Useful in case of accidents with damages and injuries

Indispensable tools to improve management: safety for trees and citizens

#### **ALBERA.TO & Tree Assessment**

Possibility to store and analize accidents and damages related to tree failures

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After an event once the emergencies have been resolved, it's normal to go back to routine management, with a risk of losing valuable info Need to analize data to evaluate critical issues in a sort of troubleshooting process

## **Tree Risk Assessment & International Context**



**Tree Risk** 

Assessment

Second Edition

inst in the ANM ARIO Fort O Two Merch of

- In Italy V.T.A. has been used for more 20 years
- The professional landscape is very sophisticated

There's a national protocol processed/drawned by ISA Italy Chapter with different interpretations and approaches In Italy the first TRAQ and QTRA

certifications were estabilished in 2016





#### **Risk Assessment**

T.R.A. FORMS

#### ISA Basic Tree Risk Assessment Form

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Risk Assessment is a process based on matrix that consider

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- hazard
- target
- consequences
   With a qualitative
   (T.R.A.Q.) or
   quantitative (Q.T.R.A.)
   approach

#### Hazard vs Risk

Clarify difference between hazard and risk, in Italy there's still too much confusion

<u>Hazard</u> is the possibility of a negative event (failure) occurring. It is in a sense related to the nature of the object



<u>**Risk</u>** is the potential impact of the hazard based on the vulnerability of the site. It is related to the nature and extent of the damage that a failure can cause on the surrounding environment</u>

#### **Risk Assessment**



Likelyhood 01 failure according as per V.T.A. Growing accuracy depending on zoning and exposure

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## **Risk Assessment and Risk Management**

Transition from likelyhood of tree failure to potential risk pose by considering context (history, characteristics, <u>occupancy rate</u>) and consequences Likelyhood of tree failure is a part of risk assessment

## Zero risk doesn't exist!

Risk mitigation depending on target, risk level, site restriction Defining acceptable risk level



Risk assessment/management are connected to acceptable risk level which is influenced by different factors (political, technical, economical, insurance and emotional)

According to Italian criminal law *acceptable risk threeshold must be determinated by the tree owner*/manager, not the consultant

An acceptable risk level evaluation is about *balancing citizens safety with tree stewardship* 

In the face of a failure event *a Judge generally weighs safety over tree stewardship* 



## Need to clarify roles and responsabilities in the Italian context

## **Clear up the mandate**

- Tree inventory
- Tree stability assessment
- Tree risk assessment

## **Clear up the roles**

- Arborists
- Analyst
- Tree risk assessor
- Tree risk manager

When a tree analysis is commissioned the real question is **«Is that tree healty?» «Could it fall?»**...

#### **Tree Inspections in Turin**



Activities entrusted to external consultants selected with call for tenders

Consultants decide if visual or instrumenctal inspection, tree failure categorization and how to mitigate it...<u>City arborists evaluate risk!</u>



In Turin tree stability controls are focused on evaluating the likelyhood of failure.

It's not necessary to evaluate every trees in the same way: it's technically uncorrect and not sustenaible

We're in a transition phase, risk assessment will be a mixed process:

- territory zoning decided by manager to determinate time frame and tipology of control

- likelyhood of tree failure determinated by consultants
- risk mitigation through a shared decision

#### **Management Plan of Public Tree Heritage**



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and that connects different aspects

Importance of having a multiyear tree stock management plan based on census and monitoring information



## Are our existing urban trees able to face this challenge?

- With a different approach based on life expetancy that introduces planned tree renowal but not forgetting tree risk assessment on existing trees
- Tree risk assessment is a part in tree management process
- Maximum effort to reduce and minimize risk, but since a zero risk scenario doesn't exist and we need to accept a certain amount of risk as the price for the multiple benefits of trees

## Tree Planting campaign to Mitigate Climate Change

Trees are considered as one of the most effective and affordable solutions to mitigate climate change effects

How do we mantain the exisisting tree stock and grow it in numbers?

- reforestation of former industrial sites
- micro-interventions of NBS within the exisisting urban fabric
- extending the benefits of tree to areas where it is not possible to create new green space





Green roof



Strategies to reduce heat island effect and better manage stormwater runoff Use pilot projects to demonstrate best practices for public and private projects





Project to create multi-functional micro green areas at the block and street level (heat islands and stormwater runoff) repurposing areas dedicated to streetside rubbish collection which are currently being eliminated. Micro areas could provide co-benefits by supporting more equitable and sustainable lifestyles



- Twice annual initiatives to plant trees with citizens
- Over 2000 trees planted since 2016
- 20.000 trees will be planted by end 2019, 10.000 by 21/11 our National Arbor Day

Urban tree planting campaigns with residents, community groups, local organizations and political representatives

Urban reforestation with private sponsors and institutional partners





First experiences with private enteprises investment Collaboration protocols with no profit org. expertise in urban forestry activities to engage private partners Forestry certifications process of public hillside forest (more than 250 ha.) according to ecosystem services benefits



#### Final thoughts

- Engage this challenge to save our historical tree stocks from climate change effects and both demonstrate how trees can mitigate climate change effects
- The future of trees in our cities requires a **paradigm shift** from trees as on ornamental feature of the **urban landscape** to trees as an integral part of the **urban ecosystem** providing multiple ecosystem services and benefits to contrast climate change
- Approach tree management not forgetting our roots and introducing a new vision, new solutions
- Zero risk scenario doesn't exist we need to accept a certain amount of risk as the price for the multiple benefits of trees
- Engage all stakeholders because trees is a public good



## make the world a better place, one tree at time!



#### THANKS FOR YOUR PATIENCE AND ATTENTION

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