

Native or Exotic

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[00:00:00] Intro music plays.

Tom Smiley: [00:00:01] Welcome to the ISA science of arboriculture podcast series. This is Dr. Tom smiley at the Bartlett Tree Research Laboratory host of this podcast series, which is brought to you by the International Society of Arboriculture and the FA Bartlett tree expert company. Today's podcast is Dr. Francesco Ferrini, who is a professor and chair of the School of Agriculture and Forestry at the University of Florence in Italy. He will be speaking on native versus exotic landscape plants.

Francesco Ferrini: [00:00:40] Hi, all I'm here to present my talk. It's online unfortunately, we cannot see each other, like we used to be. Today we'll talk about native or exotic species in the urban landscape because it's the very big debate all over the world. I will share [00:01:00] my presentation with my colleague Alessio. Unless you're finish. Probably, you know, me because I have attended so many ISA conferences in the past. I just keep this slide to go to the layout of my presentation. First of all, I will introduce the topic saying some definition of ecosystem biodiversity in urban. And then I will go through the presentation and I will finish with the plan selection criteria to be used in a global change scenario to plant trees in the urban environment.

First of all, what is biodiversity? There are several definitions about diversity. We can use whatever we want. I like to use the simple definition, which is on Wikipedia that is: "biodiversity is the variation of lifeforms within a given ecosystem biome or for the entire earth. Biodiversity is often used as a measure of the health of [00:02:00] biological system." I just read it because it is a formal definition, but usually many people also refer to the United Nation summit in Rio de Janeiro when another but very similar definition by diversity was issued.

But anyway, the second important thing is to define what is urban, because accordingly to the Census Bureau, "urban" is defined as "a densely populated area of more than 2,500 people."

But, you know, it's different if you talk about Japan, United States Italy or a center Europe, or if you refer to South America, maybe Canada or Iceland or the Scandinavian countries in Europe. So a reasonable ecological definition is: urban is an area where a relatively dense congregation of people causes the built environment to dominate over the natural [00:03:00] environment.

But there are different types of urban areas. This picture was taken in Hong Kong, is a typical street in downtown Hong Kong. And this is a typical urban area in that part of the world. The Southeast Asia Southeast China, Southwest China, Hong Kong, Vietnam, and other countries, Thailand.

And, and so on. But also urban area is a square like this with some plants, but still dominated by huge buildings and tall buildings all around yet. Urban is also an urban park with where the green areas, the trees, the grass, and also these water features dominate in this case, the built environment, which is surrounding this area. But also an urban areas it's a big urban park in [00:04:00] downtown of most of the European and North American cities.

For example, I'm in my office now. And my office is just in the middle of the biggest park in my city in Florence. So it I'm still in downtown Florence, but I'm in the middle of urban park where the condition of trees, shrubs and grasses are very similar to the condition they will find. They would find if they were in the

open counter site. We also need to define the urban biodiversity. According to these two authors,... they define the urban biodiversity as “the animals and plants living within the settled areas of a city”. And it's important also to understand how bio-diversity behaves out by diversity is present in urban ... because we have essentially four [00:05:00] kinds of biodiversity: which is the diversity of genes among individuals of a species, animal or vegetable...

Biodiversity of species, which is linked to the number of species that live in a given environment.

Biodiversity of ecosystem, because you know, in the, in the urban environment, many, many ecosystem can co-exist in the same territory.

And then by the biodiversity of landscape, which means diversity of environments of ecosystem in in a region.

We go down to biodiversity in urban centers, we have to deal with natural factors, which effect the, by the vest, like climate, the native species pool and the soils, and then the human factors, anthropogenic factors you know, that mankind has altered several [00:06:00] conditions in the earth, especially in the last two centuries and all these changes have given to alternate climate local and global, they produced pollution. They are still producing pollution. They produce physical disturbances and they modify the landscape design. And also they have some ethics, some management activities related to species selection, plantings and removal of trees, shrubs, and other plants.

In the city or in the urban yards the plant pool, the species pool is affected by the native continental flora, which is filtered by the climate condition and by the horticulture industry pools with preferences and regulation filters.

Matching these two factors, the continental [00:07:00] native flora and the horticulture industry pool, and it builds the greenery in the city.

Contrary to what the public opinion feels and sometimes thinks it's not proven that the urban areas contains a lower degree of species – it is just the country, because it has been proven that in the urban areas, we can find a higher level of biodiversity. And most of the scientists now agree that the urban areas are somewhat indispensable for the conservation of some key species that can be under real threat in the open lands.

So the biodiversity in the city it's made of native species, like in this picture, I put the big trees [00:08:00] of European Huckberry...plus exotic species. I put to a species of Zelkova, which is very similar to Celtis ... a European Huckberry and these leads sometimes to homogenization and because it has been observed that the big cities of the three boreal continents, Asia, Europe, and North America host species which are quite similar to each other. Each of them with the surrounding environment. In United States, there are some oaks that are very similar to European oaks and vice versa. And it's very important also in terms of biodiversity to keep in mind two main factors: the patch sides and corridors, because the high by diversity is associated with larger patch size. You see that the did the larger is a [00:09:00] park. The larger is a patch. The bigger is the bio-diverse and also a corridor has a very high importance in supporting urban biodiversity. You see in this slides, which I took from two authors dating back to 2015. You see that the, the ethics sides of the corridor is much higher than the other green area, the agriculture area. And also you should note that the sealed surfaces reviews below zero, the species richness. This is a problem in the urban..... The soil seeding, which leads to a much lower by diversity, a loss of by the vest loss of species.

It's important also to see that the tree species, the shrub species by diverse, it's very important also because it affects animal by the way. So reduced [00:10:00] fragmentation of the species richness, which is much higher along the city edges compared to the city center and how small parks, also lower by diversity compared to larger parts. And it's very nice to note how the, the, the main activities affected these by diversity the picture in, in the right lowest side of the, of this slide was taken during the lockdown.

Last March in Italy, you see two deer is waiting for a haircut in front of a closed shop. All the shops were closed. And the animal, like deer, wide boar, even some wolves were seen and filmed in my city during the lockdown. It was terrible because, you know we're all forced at home, but it was nice to see how the nature can [00:11:00] immediately retake its position in our cities.

Also it's important how the different ethogeneity of forest trees, it's important to maintain and to improve biodiversity. Because if you realize green areas... the stratified vegetation and of uneven age things then you will have higher biodiversity. And also this is a related somewhat related to diameter. The biggest is the diameter, the highest the biodiversity.

It's important also these conceptual scheme that I take from other authors in 2016, they published this scheme. Very interesting is the concept conceptual scheme of the six biodiversity scales, which are used to analyze on the perceptual and [00:12:00] devaluation of urban biodiversity as is written in the slide. The six different scales, the genes, the trade, the single species, the species communities, the ecosystem, and the green versus, and gray and how they're important in devaluation of urban biodiversity.

So we need to maintain the highest biodiversity as possible. But we had to be very careful about invasive plants and how they can deal with native plants. In the picture, you see the ..., the tree of heaven, which is actually the tree of hell because it's probably the biggest and the most widespread tree invasive plant in the world.

There are some advantages of using native plants. This is especially eradicated in the popular thinking. People think that native species are best adapted to local [00:13:00] condition, but condition. What condition, the present condition in this climate change times or 280 years ago, 300 years ago, condition ...because there were different those condition. The condition which were common 300 years ago, were very different from the climate condition of today.

Then a species it's available for all local soil and light condition. Also about this statement, I'm not that sure. Probably true, but not, not always.

Provide habitat for wildlife. It's not definitely true because I have seen nests, ...I have seen animals, birds, and other kinds of animals. Even on foreign plants, on alien plants, they just don't care about which species of tree is a species that is used in urban environment. They just nest, whatever they think it's better [00:14:00] to nest.

And then people think that native plants are part of the local heritage. Which is correct, but, and we'll see that it's not definitely true, especially if you talk about a country like Italy, where I live. But we have to be careful of the danger of invasive plant. These are four major invasive in Europe and especially needs the tree of heaven, the paper Mulberry, the Royal Polonia and Rubin will be surprised because you know, ...is a very nice tree. Very nice flowers, very scented flowers, very nice full coral of the leaves, but in Europe and especially Italy is considered invasive, even though it's used for wood production and for stabilizing slopes

and landslides. But anyway, probably being in US. If you are looking at this presentation from United States, you will think that.... maple, which is a native plants in Europe. It's a [00:15:00] weed, it's an invasive plant for you. It also depends the invasive or not invasive depends on where you, where you live, where you are, where you work.

But what do we mean by invasive? You see these two plants Polonia and the, I took this picture just outside of my office, where we have the greenhouses.....Polonia was planted, would use for an experiment a few years ago. Some flowers probably produce seeds and now it's everywhere.

So the biologist referred to an invasive plant as one that when planted in gardens, and botanical gardens may escape cultivation and when in the wild has a tendency to establish monocultures by clustering and shocking out native species.... I read it because this, the exact definition of invasive coined by some biologists.

But in what [00:16:00] is the danger? The danger is to have biological invasion to lose habitats and then losing some endangered animals. We can have a destabilization causation of natural ecosystem and the global threat. To biological diversity and sometimes repairable damages to the environment like it's happening in Rome, where is colonizing the slopes, which are in the cities. And also you see, they can bring new allergies for people who are sensitive to allergies.

It's important to be very careful when we select trees, shrubs, and any kind of plans for new projects for the future, for the city of 2050, maybe for the city of 2100, because what we plant today would be probably a big, a huge tree in 80 years. So we have to consider what will happen in, in the [00:17:00] future short-term, medium term, and long-term future.

What are the trees that should be used in green infrastructure? Because now we have to talk about green infrastructure. We cannot talk about just trees in the row, along the streets, trees in the square or small urban forest. We have to think about and talk about green infrastructure. We need three major factors 1) plasticity, which is how species are adaptable to a wide range of environmental conditions in terms of temperatures, soil, characteristics pollution, tolerance, water, logging, drought, and et cetera, 2) the ecological resilience, which is the capacity to maintain its functions after environmental disturbance. Which is related to plasticity. And then 3) we have to be we have to consider the [00:18:00] structural diversity, which describes this partial complexity offered by plan shape, and is generally applied to a set of plans rather to a single, a single tree or a single shrubs.

And we have some question on plant material selection that we had to answer in a global change, not just climate change, but a global change scenario. The first question is which species are most suitable to face the climate change, for example, drought, a flood tolerant, because we can have a long period of drought alternated by heavy rain, which produces flooding produced water logging and salt. So we need species that are both tolerant to water logging and to drought.

Then the second question is which species should be planted to maximize CO2 sequestration and storage. [00:19:00]

Third question can the natural tolerance of some species be increased using sustainable management techniques, and then maybe we should decide to use only native species or maybe introduce some exotic species that are suitable for a certain environment.

I think that at the base of everything we should think about avoiding the manageable and managing the unavoidable. Meaning that we cannot plant, we cannot use in our new green areas, trees, shrubs, or plants that we will not be able to manage in a reasonable and economic way. And at the same time we have to manage what we have. Something that probably we wouldn't plant now what it was planted, 100 years ago... And now we have trees that are [00:20:00] very old, but the sometime they're also veteran trees and we have to maintain them with security, with safety and in full shape, and to continue to have the benefits these trees provide.

We had to choose trees that are able to mitigate to prevent the climate change. For example using also other techniques like the emission reduction, which is the first thing we should do, sustainable transportation, et cetera. And then adaptation to respond to the impact of climate change, which means also to plant trees and straps with high drought tolerance and more resilience. Is the least of the species which is Adaptable to the Mediterranean base and all the Mediterranean, like climates like California, probably some part of the [00:21:00] Oregon/Washington state and some parts of Australia, South Africa and maybe some parts of South America. These species are in green, the species, which are a native of my country or metering amazing. All the others, as you can see are not native, are alien species, or a lockton of species, but the all species that are that will be much more adaptable than native species in the future climate change scenario.

I wrote this article a few years ago for Arborist News, so you can go back to these to find more information about the, the, the debate between native and versus exotic.

But anyway, what should be the criteria to select species for future cities?

First criteria to plant species, [00:22:00] which are not in the South or North end, if you are in the Southern hemisphere, part of their distribution range at the planting site. So you should choose a trees which are which come from the Southern part, if you are in Northern hemisphere from the Northern part, if you are in, in the South hemisphere. Do not limit the choice to the native species. Using drought tolerant species, and then diversify plant is I think you are familiar with it. 30/20/10 rule issued 30 years ago. John Ball a few years ago, talked about ten/five, and who knows maybe 1%, 2%, maybe 5%, which means 30% of the, of plants belonging to the same family, No more than 20% of plants, belonging to the same genus and no more than 10% of species [00:23:00] belonging to the same species.

And then plant species with the low emission of large lateral organic compounds and where, and when possible using non allergenic species.

You see that the, the number of species using some citizens US, these data, quite old, 30 years ago I took them from, I worked with for several months dating back to 1994. And you see that, how you see how biodiversity and how the total number of street species changes, according to different places in United States with the Western state like California, Washington, Oregon, and also the British Columbia in Canada being much, much richer in by the rest then the states located in the central part of us like Ohio, Indiana and [00:24:00] Illinois and, and so on.

And so the other principal to be kept in mind is that, is that diversity can be the key against adversity. So w we should, and we must, we have to, we must improve the number of species to be used in the urban planting.

But we have given a definition of by the what you can see in this slide is not a biodiversity is something that is nice to see, but it's not also sustainable. But sometimes we love and we want by biodiversity, but it's not

always what we expect it to be. I don't like for example, myself, to see an iguana walking, when I'm visiting a botanical garden or a garden in some parts of the United States or in South America or in Australia.

And also sometimes we say that we like, we love by [00:25:00] biodiversity, but biodiversity is also to see trees that are dead falling trees, trees that are invading the paths and so on, but this is the real biodiversity. Sometimes we like it only when we see it on a screen, on a TV or on a newspaper, but we don't like it to the real biodiversity.

And also the second factor is what's native in this place? Because those who are stating that we should use only native species in the urban environment, species that are belonging with the same area that originated that evolved in the same area are not native of this place. What is native here? Buildings are not native. Pavements are not native cars are not native and so on.

Now we have to explain why we should use both native and exotic species.

You see that in this slide, I put the...Excelsior [00:26:00] it's a species which is native all over Europe, but it's, it likes cooler climate than the climate in Italy. It likes a, a humid soil and organic soil. And if you plant these trees, even though it's native also within some parts of Italy, this is the results.

On the other picture, there is a big Gingko. There are three big Gingko trees which are doing. Quite well everywhere, probably in the world. They're not native, but probably the one, the one on one of the best patients in the world for the urban environment.

Example, the black alder is native of all over Europe from Russia to Spain, to Greece, to Turkey, to UK Scandinavian countries and all the Mediterranean, basically, even in some part of North Africa, you can find the black alder, but [00:27:00] in geography, a species is defined as indeed in the genius or native to a given region or ecosystem if its presence in that region is the results of all the natural resources with no human intervention. In the upper part of this slide, you see the native slide for the black alder in the North of Italy, very humid area, close to rivers, close to streams and very organic soil. And so if you plant the same trees, also very nice trees coming from the nursery in an urban area, with all the payments, with a very limited irrigation. That is the results, or this is the results you see that even a few miles from the native site the same tree, the same species don't survive because it's native of a special site, not native [00:28:00] of that kind of site.... Payment limited water availability and so on.

And also another example. This is Norway maple, very spread all over Europe and in Italy, this is the results of a planting close to a Lake in central Italy. Even they provide some irrigation the summer in central Italy that is very hot and dry and so these trees couldn't survive without a reasonable irrigation every single week, maybe twice a week.

So sometimes I have discussed with the so-called green.... who are strongly agaisnt any kind of exotic species in urban environment. This road it was planted with the calorie pear Chanticleer cultivar, so very tolerant to any [00:29:00] kind of factors, pollution, drought, and so on. You see after eight years, how big those trees are. Nice. They are in summer and I drove along this road this morning and trust me, they're becoming yellow and red, and this road is just beautiful, probably any other native species could have been done better than ain that specific environment.

And also it's not true that a non-native species can or always cause a problem because you see about 85% of exotic plants and animals pose, no substantial environmental problems.

And I want to show you some picture of places around my city. What do you think aboutis an icon of the Italian historical [00:30:00] gardens. It's not native. It comes from Lebanon. It was imported 350 years ago, but now it's everywhere in Italy. It's an icon of our gardens, especially historical garden and also historical parks.

And Cypress is the typical feature of century Italy and especially of Tuscany and these evocative cypresses Avenue inspire the one of the most famous poet Italian poet, who wrote a poem, which is famous problem all over the world, not just in Italy, and this road is more than two miles in length. And it attracts now hundreds of thousands of tourists every single year when they could come to easily to take, to take picture of this Magnificent Avenue made of cypresses, which are not native. They came from Middle East. They came from [00:31:00] Turkey, from Iran, from Iraq, but they are not native of the Mediterranean, strictly metering and basing as the Italian stone pine. It was important by people who came to Italy, probably 3000, maybe 4,000 years ago. And they important these three, which is needed in the Island and in the part of Spain and North Africa, a Italian stone, pine, Italian umbrella pine, or whatever you want to call it. It's now spread everywhere all over it's a typical icon of the roads along the sea or close the sea. Like this road is beautiful, it's magnificent, but people think that Italian stone pine is native. It's also called Italian, but it's not native from Italy, strictly native.

And you see this picture. I took this picture very, very close thing, 50 minutes by work from my, from maybe 20 minutes by walk from my house. You [00:32:00] see Italian cypresses, which are not Italian, olive trees, that came from Middle East and ..., same from Lebanon or from the Malayan mountain chain. And you see this, the typical landscape in the Florentine time heals in Tuscany, made mainly of exotic species and also the temple Valley, Sicily almond trees that came from China and also cypresses and olives, and pines, you see pines that are typical of the North Africa and Middle East in Asia.

So we should introduce the concept of visual uniformity and biological diversity. We can use species, which are very similar in aesthetics and in shape and colors, but they are completely different from a biological point of view.

For example, these are a European Linden tree on the left [00:33:00] and the Now the, I don't remember the name in English, hazelnut Caucasian as not or something, something like that. Very similar in shape. A leaf shape, a leaf color, but completely different in terms of genetics. So they can be used alternatively to improve by diversity.

And also we had a problem in Europe with the parasite, which attacks the horse Chestnut. We can use ice very similar, different color of the flower, but very similar shape, very similar growth. They are not attacked by these insect.

.... European hackberries spread all over the place, in Italy, very drought tolerant also very frost resistant. But you know, at present, there are no dangerous parasites for these trees, these species, but we don't know in the future what will happen. And so it's better it would be better [00:34:00] on my opinion to introduce some trees like, which are very similar or the, which are very similar and in shape in growth, and also the leaves are very similar. To improve by diverse and to reduce the danger of some parasites we have a lot of these maples.... We have two species that come from the lower part of the South, the Southeast part of Italy and from Greece, from Macedonia, from the Balkan Peninsula. And so we can, we can use also these two trees, which are very similar to the mountain maple to introduce them in that area where drought spells are longer or where, you know the solar radiation is higher, because they're much more adaptable than mountain maple.

And according to Eric Silmon, a colleague from Sweden [00:35:00], I took this pictures from his doctorate, his PhD thesis, very well done by the way, he said that it's necessary to acquire information on the performance of little known species in urban environment and their natural habitats and they must be well-studied. Also, we have to know that in the nursery, the conditions are very different. And so when you put the pLNTA in the urban stand, they can behave in a very different way. It's just a complete different environment.

And also, we need to know how the species changes along a mountain or a Hill profile. So if you choose species from a mountain, from a slope, which is facing south, you cannot put them in a slope that is facing North and vice versa because probably they will not be suitable for this use. Also you see that how the species composition in [00:36:00] China and this mountain in China, changes according to the different exposition of this of this map.

And also it's important when do you use more than one species that grow together, know that it' important to know that, for example, Norway maple and Scott's spine behave completely different in drought soil, or most moist and wet drained soil with Norway maple, which is doing much better than in moist and wet drained soil, then Scott spine. So if you put Scott Pine and Norway maple in a drought soil you will probably find that the Scotts pine overwhelm the Norway maple. And it's just the opposite if you plant these two trees, these two species, in moist when drain soil. So you have to be very careful about what species to be used, where.

[00:37:00] We have some trial here at university of Florence to check the some different kind of species composition for urban woods, current climatic condition. We are comparing with the future climatic conditions. So we have changes all these species to be used for the next planting for the urban forest and urban woods.

We have to choose the species on the environmental performances and not just on It's very important. The same picture I showed you a few may be full before you see how a foreign species like a pear like Ginko, or like a pear again, or Sequoia, for example do very well.

I didn't take this picture in the Sequoia Park nor in the Redwoods Park, it was taken very close to my house. There is a big [00:38:00] Sequoia wood, which was planted in the late 18 hundreds by a man who loved Sequoia. And the climate in that area is very similar to the climate in Southeastern Oregon or in Northern California. You see these how big they have become in a little more than 100, probably 130-140 years. So we shouldn't be scared about using exotic species and we shouldn't be too fundamentalist in our choices because what we choose now, it's very important to build the city of the future. So rather than try to achieve environmental conformity with all the regulation that excludes the use of exotic species in the future project. For in my opinion it would be much more reasonable to stimulate the landscape architects, the designer, to a [00:39:00] plan does a green areas using a much higher variety of native as well as a non-native species.

So the take-home message, this point is that we have to answer, I put 10 simple question. Maybe they can be seven or eight. Maybe they can be 15. I don't know. I just put a 10 simple questions, not read them all because you can see it again with presentation, but anyway, we have to answer all these 10 questions before choosing a species, not just native or exotic species, but we have to answer this is 10 questions.

And because we know we have to plant the right tree in the right place. We have repeated, I don't know how many times these statement:the right tree in the right place.

And then we have to give to the trees, the right [00:40:00] management, to keep them living and providing ecosystem services. So we have to maximize the effect of climate to better manage the water, to increase CO2 sequestration, carbon storage, and to reduce pollution. So these are the main principle on which we should choose our future trees.

And also we have to be careful, because we have to involve the stakeholders, we have to involve the policymakers, we have to involve the developers and we have to involve at the end citizens and home owners, because they, they should be informed about how to use some species, where to plan some species and which species to be planted because otherwise, our speeches, our talks, our presentation remain [00:41:00] in a very limited number of people who attend conferences who are ISA members or members of other horticulture society. We have to give this information also to the people who are outside of our world, but they are the people who will benefit of the right choice of the trees for the, the city of the future.

So I have given you a lot of theoretical notion and then, some years ago when I was working with Nina B., when she showed up me these data, you see that the principle species, the most widespread species at that time in some cities in Europe, in upper New York state, where was the Norway maple, which is considered an invasive tree in the United States, especially in that part in the United States, and it's also [00:42:00] susceptible to several diseases.

So why? I was wondering why it's so widely spread. Also the genus was representing from 34 - 58% of the total number of species in these three cities Rochester, Syracuse and Ithaca. And I had no answer that time, I was wondering why. And Nina told me that, when the Dutch Elm disease killed all the elm trees, which were so common in these cities, also common in other parts of the United States. They replaced them with a species, which was fast-growing, which was nice, which had a very brilliant coloring in a fall. And so on. But I was wondering why was the first choice was [not a species native to the US?]

And the answer is quite simple, if you look for a fast growing shade tree species with nice shape, attractive foliage, with bright fall color, you check a nursery, and the first thing first tree chosen with these characteristics that you find in the nursery catalog, the choice was made based on the first one that was found, it was the first one that was used.

And it is terrible. If you think that there are, you know, thousands of species that can be used. And so we might have, we hope that we won't have a problem like ...disease in the, in the near future. But we have repeated planting ...Norway maples in the place of elms.

We have repeated the same mistakes using too many trees of the same species for urban [00:44:00] planning. And so changing the face can change nothing, but facing the change can change everything. So we have to face the change and changing the face, changing our mind about plant choices. We need to choose, we must choose plants, which will thrive in our city of the future and that will provide the highest benefits for us because we need those benefits. We need trees because trees are good. And arborist care for trees. Thank you very much.

Tom Smiley: [00:44:36] This concludes the talk by Dr. Francesco Ferrini from the University of Florence in Italy on native versus exotic landscape plants.

This talk was originally presented at the 2020 ISA virtual conference. The views and information expressed are those of the presenter. If you would like [00:45:00] additional information on plant selection, go to the ISA web store. There are numerous books on this topic and tree planting. Join us next month for another presentation of the ISA science of arboriculture podcast series.