**VO Selected Topics in Geoinformatics-20240115\_083224-Meeting Recording**

0:08  
It's always more than one kick so we should be ready to go now again very good morning to with Pastor, one of our Kelsa partner universities Kelsa in two different ways in geographic sense.

0:24  
It's a couple hours driving to all about which is one of the historical cities in a Republic and closer in terms of working relationship in a number of joint endeavors.

0:41  
And as I can see that is quite explore of today's participants from the crowd who are participating in the blended intensive program for Digital Earth citizens.

0:56  
And in very few weeks time we will be meeting on site in all of us.

1:03  
While you have met with our store online in our organizational meetings, there is a bit of an opportunity for, yeah, let me call it a topical introduction as well.

1:18  
So where does the city end?

1:20  
Quite yeah question which can be approached on in urban geography respective.

1:31  
Remembering my days as a student when I was working with one of a well recognized urban geographer, Elizabeth Lichtenberger at the end of university.

1:45  
She made us work through all the city models and city models is not the models we would understand today like this 3D fabric of a city was more the 2D growth and organizational structure cities.

2:04  
So happy to explore this from a geospatial information, geospatial analysis perspectives.

2:13  
And with that, I think you've all settled in and ready to go.

2:18  
And I'd be happy to turn it over to you.

2:21  
Anything else, please take it from here.

2:24  
Thank you for the interaction.

2:25  
Hi, everyone.

2:26  
My name is the pastor, as it was mentioned, and I'm from Polaski University, almost in Czech Republic, or as we geographers say, Czechia.

2:36  
Now we can officially use the geographical name.

2:39  
I mean it's been six years since UN officially declared Czechia as a geographical name for our country.

2:48  
But this is just a little bit of context and where does the city end?

2:54  
That's the title of the of the presentation and I will take a look with you at this topic from upside down position, let's say we'll be talking about where are the rural areas the opposite way.

3:13  
So he will take a compliment look on it, but it's pretty much driven by the definition of a city.

3:21  
And I will show you in my presentation some of the contemporary approach of the European Union.

3:31  
And then I will show you some of my own work and research what I did several years ago.

3:41  
But I'm also dealing with this topic these days.

3:44  
And also together with my colleagues, we did some, I think nice applications of the rural, urban, let's say, delimitation that we did for Czechia and also for Europe.

3:56  
So where does the CDN, that's the title, but we'll be talking about the rural Rs as well and I will give you a geospatial perspective.

4:06  
I mean we just we do information, we do not really talk about the stuff, we also analyse the stuff.

4:13  
So it will be rather analytical look on the topic.

4:19  
But you can approach the problem of urbanization from different perspectives, from the sociology perspective, also from the policy making perspective.

4:29  
And also there are very very nice concepts of the psycho geography dealing with cities and urbanization and human society.

4:38  
So it's very very generous topic.

4:42  
So I will give you or offer you just one tiny perspective on this.

4:49  
So yeah, let's get started.

4:54  
If you guys have a question as Joseph mentioned, just unmute your microphones and ask me directly or comment on directly or I think you have a chat available as well or question and answers button available.

5:13  
So feel free to ask the question or comment in the chat.

5:17  
But I would kindly ask yourself if you can then read the question for me because I'm not able to, you know, cover all the screens I have in front of me.

5:28  
So if you if you if there's a question please let me know in the chat.

5:34  
Good.

5:35  
So let's move to another slide after not really short introduction.

5:43  
I need to warn you after after the introduction I will, I will show you where to find data about the topic that we will be talking about and then I will show you some some of my approach with some concluding remarks.

5:56  
So that's the that's the outline.

5:58  
I think we're done in 40 something minutes.

6:01  
So I hope you will not fall asleep.

6:07  
I'll do my best.

6:11  
So what is the topic about Dixon Pullman who are working for the Director General for Regional and Urban Policy at European Commission?

6:26  
They say that in one of the papers, that urban and rural areas are two central concepts used by wide range of policy makers, researchers, national administrators and international organisations like OECD, Organization for Economic Cooperation, Development, United Nations and of course European Union.

6:46  
But these two terms are readily understood by the general public.

6:50  
So we somehow know what is urban, what is rural.

6:54  
But the clear definition at the international level has remained remained elusive.

7:00  
It's not really clear until these days what is rural, what is urban, where does the city end, where the countryside starts.

7:10  
So there is no clear definition, there's no unified definition for for many countries.

7:16  
And also in Europe, the situation is really diverse and it brings some complications to the European Union policies because they have to be unified and applied for all the member countries.

7:30  
But worldwide, the countries are a little bit struggling with the definition, what is urban, what is rural and how we can approach this from the analytical point of view.

7:45  
And also, statistically of course, in the revision three of the Principles and Recommendation for Population Housing, Housing Censuses, which is the UN document somehow giving advice to all the world countries how they should do the censuses.

8:07  
There's a little chapter in that report about the rural urban classifications, and in one of the paragraphs they say because of the national differences, the distinguished urban from rural, the distinction between the urban and the rural population is not yet amendable to the single definition that would be applicable to all countries.

8:35  
And they also recommend where there are no regional recommendation on this matter, countries must establish their own definitions in accordance to their own needs.

8:48  
So it brings us back.

8:52  
There's a need to define what is rural and what is urban on one hand, but on the other hand there's no clear definition and there's no clear methodology or there has not been clear methodology.

9:08  
There's something now, but also the UN United Nations recommend a if you have some special needs, you can include whatever indicator in order to define rural urban areas.

9:23  
So imagine that everybody, I mean every country is doing that, creating and developing their own methodologies on that.

9:32  
But then how you can compare different countries?

9:37  
How we can compare different regions within the countries or regions like national regions?

9:47  
So the problematics here is really, really obvious.

9:52  
So there's a need for a definition.

9:55  
But at the same time, there cannot be the same definition for each one country in the world.

10:04  
So it brings us to the dilemma what to do with that.

10:09  
I'll give you some examples.

10:12  
There are few very clear definitions.

10:14  
What is urban and what is rural?

10:17  
There are these are very, let's say, superficial.

10:21  
They are very clear on one hand, but very simple on the other, which also can bring some some of the, let's say, problems.

10:31  
So one of the clear definitions are based on the total population.

10:38  
So for instance, in Chekia, in my country and in Portugal, every single municipality, I mean the administrative unit that has 2000 and more inhabitants could apply for being labeled as a city.

10:57  
That's it, just 2000 people living in the administrative unit and you can be a city.

11:04  
In Spain it's 10,000 people, but in Netherlands it's 20,000 people.

11:13  
In Japan it's, I think if I'm not mistaken, it's 100,000 people.

11:20  
So it it varies from country to country.

11:23  
But on the other hand it's very easy to get these data.

11:28  
I mean data about the total population.

11:31  
This is something what each country has, I mean worldwide.

11:36  
So number of inhabitants.

11:37  
First clear definition 2000 people in Chechia done.

11:42  
You can be a city.

11:44  
There are also some extensions.

11:47  
For instance this is the example clear.

11:50  
Number two.

11:51  
In France a city is a municipality that has 2000 inhabitants.

11:58  
Plus the distance between the houses must not exceed 200 metres.

12:05  
So that's the combination of the the housing density and total population.

12:11  
Similar example in Sweden, but not 2000 people but 200 people only because you know Nordic countries are very sparse in population and they have a huge administrative units.

12:24  
So the definitions are different.

12:28  
And then we come to the really vague definitions like for Bulgaria, so municipality could be labeled as a city if it's legally established as urban.

12:45  
That's it.

12:46  
I mean who decides on that?

12:48  
Based on what?

12:50  
It's unclear.

12:50  
I mean it may be clear for the policy makers in Bulgaria, but that's the that's a very big definition, which is on the one hand good because you or they can decide based on several aspects or indicators or statistical data.

13:09  
But then on the other, on the other hand it's not set, it's not clear, it could vary from region to region in Bulgaria.

13:20  
And these kind of examples, these three examples are you know, common for the whole Europe and also the world.

13:29  
So some of the countries uses very clear definitions.

13:33  
Some of them are very, let's say, biased or unclear or vague.

13:38  
In Germany, according to Directorate General of Regional Policy, the urban areas are those areas that has at least 150 inhabitants per square kilometre.

13:54  
So the population density is as a as a measure is taken as a measure, but there, but based on their, let's say, own definitions, it's the NKO.

14:08  
The city is and municipality that has more than the average population density, which is or was few years ago, 200 and 230 inhabitants per square kilometre.

14:26  
But OECD Organization for Economic Cooperation Development for Germany sets the limit.

14:35  
50,000 people living in the municipality means it's a city.

14:40  
So which one to choose?

14:42  
It's very, very, let's say complicated situation in order to give you a a glimpse how Germany is complicated, because it's a federal state and it's composed of different somehow independent regions or counties.

15:03  
The situation is really, really complicated and every single county in in Germany can, you know, work with the definition and administration in general somehow somehow autonomously.

15:16  
So this is just a look at the German situation.

15:22  
Anyone in this virtual room, Do you know what is the definition of urban areas in Austria?

15:35  
If not, then yeah, here's it.

15:38  
Oh, I can give it a try, but I'm curious where you are going.

15:42  
There is more than one.

15:43  
There is what's called the municipal core areas.

15:48  
Then there is the legal status of a municipality and I don't think there is one related to population or density as such.

16:00  
Yeah it it's not, I mean I I took the definition that was that is mentioned by the Director of General for Regional Policy and I think they they take it from the national policies.

16:13  
So the definition is one of the rather complicated ones.

16:20  
So based on the concept of a functional and structure urban area start, start region or riggion, which is consisting of the can zone, core era and surrounding Arras house zone, housing zone and the surrounding urban Arras is defined as an era in which at least 30% of working adults commute daily into the corresponding era, which is nice definition, one of the one of the few that is taking into account some of the, let's say rhythmic movement of people from the from the, let's say outskirts of the city to the city centre and also from the from the nearby villages and small towns.

17:09  
But it's again, there's no clear, let's say, definition on that in terms of number of population or population density, which is not a criticism that the situation as it is.

17:21  
But imagine that different countries have different definitions and you you need to take a while to understand how it's done in each country in order to make the at least international comparisons.

17:38  
Because a lot of statistics these days, at least in Europe, are used for a regional comparison comparison between the regions within the Europe.

17:49  
So statistically European Union is divided into the Naz units because all the financial support goes to the to the regions which are not that developed as the core regions like the regions containing the capital cities or the industrial areas and so on and so on.

18:11  
So it really it's it's really important to to have let's say comparable statistics on different regions.

18:19  
So there are no national boundaries from the Eurostat perspective, but rather somehow region boundaries which are defined on the on the nuts units and therefore we need also for the rural, urban, the limitation.

18:39  
We also need some no clear guidance how to do it.

18:42  
So each country has different and the Austrian case is from my perspective one of those definitions that is rather unclear before I dive deep into the, let's say statistics and real meaning of the definition of urban slash rural Rs.

19:06  
But it's taking into account the commuting which is good, which is really important.

19:13  
There's also a concept of functional urban Rs which is really used for, you know, creating regions which has some kind of a gravity in terms of having a major city inside and people commuting into that city.

19:31  
So this is also a important concept, but I will not be talking about the functional urban eras, but we rather talk about the degree of urbanisation on the next slides.

19:46  
So the definitions sum up vary from one European country to another and it also varies from 1 country to another country at the different continents.

19:57  
So it's really complicated.

20:01  
Most of the definitions that luckily at least something in common, Most of them are based on number of inhabitants living in the.

20:13  
Local in the locality, they say locality.

20:17  
Either it's administrative unit or it's a grid, so a locality.

20:24  
Once you have number of inhabitants, you can easily calculate the population density.

20:28  
That's fine.

20:29  
Some of the definitions are using distances between the settlement units between houses like in France or Spin, and some of them are using the commuting data or commuting of people, like an example of Austria and in general for the functional urban Rs or units.

20:56  
But where again, where does the city end?

20:59  
And how about the rural Rs?

21:02  
Where do they start?

21:03  
On the other hand, and if we take a look at the rural Rs, are they just complementing urban era?

21:11  
So once we define the urban era, then suddenly sharply a countryside starts.

21:20  
It's not that easy to say.

21:23  
I just need to give you a explanation in terms of where we are heading in this presentation, because I will not be talking about the, let's say physical geography in terms of the change of the landscape or land use.

21:42  
But I will be talking today mostly about the socio economic, let's say definitions or perspective.

21:52  
So we all know and we all can see that if we go outside the city then the density of houses and a greenery will be different than in the city and some other aspects.

22:08  
So we can see somehow but statistically and also it's important for policy making, you cannot always rely on the physical features that you see around you in the landscape.

22:24  
So the policy makers needs to have a very clear guidance and numbers, what is the city, where does it end and where the rural Rs start.

22:37  
So one of the approach, it's a little bit old now.

22:42  
I mean the history goes back into 2000, I think 4 or 6.

22:47  
And the first product, the European Union or European Commission or the Eurostat derived was the geostat grid population grid in 2011.

22:57  
So it's 12 years of 13 years from now when they came with a gridded structure covering whole Europe, all the member countries and also some of the associated countries like Turkey defining the grid one square kilometre.

23:17  
And in that grid they calculated the population and population density based on the address points, which are really key thing for censuses.

23:30  
I don't know how the census is done in Austria, but I can imagine that every single person in Austria gets the questionnaire or can do it online, but it's based on the address point where do you actually live?

23:44  
So that's the let's say usual residence place, not the permanent one, but the usual residence place at least in Czechia.

23:53  
So based on that every single statistical office in Europe has this kind of data at least where and how much people live.

24:03  
So that's it.

24:04  
So these are the address locations and from the others locations they they aggregated the number of people living in that address locations into the one kilometre square grid.

24:18  
So that that's the geostat grid and based on the geostat grid with the with the number of people living in that in that cell or also population density in that cell.

24:32  
Based on that or building on that they created a thing that they call degree of urbanisation, which is dealing with the delimitation of rural and urban areas.

24:46  
And then in the degree of urbanisation they transfer it back from that grid into the local administrative units in the administrative boundaries because decision making is based or applies to administrative boundaries, not to the grid cells.

25:05  
So it brings us you to the practicality, because we as Geo informaticians, we would at least if I may, speak on my behalf.

25:15  
A grid structure is one of the best structure if you're dealing with the socio economic data because administrative units and the mouth problem, if you've heard modifiable RA unit problem, that brings a lot of complications to an analysis.

25:33  
So if there are statistics in a grid, I will be more than happy to use them.

25:40  
But they are not because the decision making is based on any administrative unit.

25:46  
That's the way it is.

25:47  
Every single municipality has its own mayor, so and these people needs to make decisions based on the administrative boundaries.

25:55  
So also this kind of degree of urbanisation approach is converting the the degree of urbanisation back to the local administrative unit.

26:10  
But I will show you in the next slides.

26:14  
So what is urban or rural based on the degree of urbanisation?

26:19  
I also already mentioned the one square kilometre grid cells.

26:24  
They are classified based on the population density and also continuity and also population size.

26:31  
This is the degree of urbanisation European Union approach and local units are then classified based on the type of a grid cells their population resides in.

26:42  
So it takes some, you know, percentages of the of the area of the of the local administrative unit in which it falls into the grid units.

26:55  
So it's then back recalculated somehow.

26:59  
There are two versions of degree of urbanization.

27:02  
The first one is simpler 1 which defines at the end, which defines the municipalities or local units into the cities, towns and semidence Rs and rural Rs.

27:17  
That's all three classes.

27:20  
That's.

27:20  
That used to be enough, but later on they extended.

27:25  
I think it's four or five years ago they extended this degree of urbanisation into seven classes, which is which brings more detail and more granularity.

27:35  
Let's say in classification where city is a city, same as in the degree of urbanization level one.

27:44  
But then the middle category, the towns and semi dense areas are further divided into dense towns, semi dense towns and suburban and very urban areas and rural regions.

27:59  
In that extension is then classified into villages, dispersed dispersed rural areas and mostly unhabited areas.

28:08  
So on the pictures on the left hand side you can see the level 1° of urbanisation.

28:16  
It's a city of Durban, South Africa, where on the very left picture you can see the great.

28:24  
I hope it's somehow visible.

28:26  
These are the squares and then it's reclassified into the, let's say, local administrative units in South Africa.

28:37  
Back to something what policy makers like, which is the administrative division of the of the country, again divided into the city towns and rural areas.

28:49  
On the right hand side on the picture, the very same principle grid structure with the with the population density defining the urban centres, urban clusters and so on and so on.

29:06  
And then on the very right hand side picture there's a reclassification back to the administrative units using all the seven categories, 7 classes, which is more detailed and better.

29:19  
That's still still fine.

29:23  
Little bit about the probe process, how it's calculated.

29:27  
I will take it from the bottom.

29:30  
They say in the definitions in the methodology that rural Rs are all the Rs with more than 50% of its population living in rural grid cells.

29:44  
So what is rural grid cell?

29:49  
Rural grid cell is every single cell that is outside urban cluster cell.

29:56  
So then what is urban cluster cell?

29:59  
Urban clusters are contagious grid cells with the density at least 300 inhabitants per square kilometre and minimum population of 5000 people.

30:18  
So now it brings us back to the indicators, because we have to calculate somehow what is the urban cluster or urban centre.

30:27  
And there are two numbers that we use only population density and total the population.

30:35  
And they, I mean it's the methodology made by Mr.

30:42  
Diksra and Pullman from the European Commission.

30:46  
And they somehow said, well, somehow there must be some research behind.

30:53  
But they said that the threshold values are 300 inhabitants per square kilometre and minimum population of 5000 people.

31:03  
So a combination of two very simple indicators.

31:07  
But my question is again, 300 inhabitants per square kilometre, is it enough or not?

31:14  
What if it's 400 and minimum population of 5000 people?

31:19  
Again, is it enough for Sweden?

31:21  
Is it enough for a Greenland, is it enough for a Netherlands?

31:32  
That's the question mark.

31:33  
I don't know.

31:33  
I don't want to argue with them because they are really smart people and they they work for a European Commission.

31:40  
So they have they have to know simply they have to know what's the best.

31:44  
But that's the that's the these are the threshold values.

31:48  
So urban clusters plays a major role in their definitions and there's also an urban centre which is a cluster of of grid cells with identity at least 1.5000 people per square kilometre and total population 550 thousand people.

32:10  
And on the pictures you can see the procedure.

32:15  
So I will try to show you.

32:17  
Yeah, so these three cells are in urban centres, these are, this is the population density, but all of those cells are urban clusters in the first stage of defining the areas.

32:39  
But if you take a definition of urban cluster which has a minimum of the of the total population being 5000, then these cluster cannot be classified as urban cluster.

32:56  
So then it comes into play.

32:59  
The combination of population density and minimum population to be classified as urban cluster, Urban centres stays.

33:09  
I mean it's these three cells and also this one, but taking into account also population density and at the same time minimum population of 5000, it's not applicable for this, let's say set of cells of great cells.

33:32  
So the final urban cluster is defined as this one and the rest of it becomes rural Rs.

33:43  
Also, these cells with relatively high population density.

33:50  
I mean, in this example it's the highest population density.

33:55  
Over 2000 people per square kilometre would be classified binary, let's say as a rural area.

34:07  
This is really complicated procedure, but it's one of the best I've ever seen so far and that's why I'm showing you, because this is something and it's in it's extended version in degree of urbanization ext 2.

34:25  
The the other one that creates 7 classes instead of three.

34:31  
This is one of the best that is used today not only in the European Union, but it's also let's say freshly few years part of the OECD methodology and also it's a part of the UN United Nations methodology.

34:49  
So it's really important because this, this, this originally only European methodology is now being recommended by those umbrella organisations like OECD and United Nations.

35:07  
Again, how it works, just to give you a summary, we have a geostat grid grid cells only.

35:19  
Then we define what is rural grid cell and what are the urban clusters and urban centres and then we transfer it back to the local administrative unit or the administrative unit in general defining rural areas, towns and suburbs and cities in case of Europe.

35:38  
When we use the NUTS levels, NUTS regions, then it's then further reclassified into the rural regions, intermediate regions and urban regions.

35:51  
So the methodology itself is nicely described in in various documents.

35:58  
At the end of my presentation there are there is the references, so you can use them if you wish or if you want to learn more about it.

36:06  
But this is the basic approach.

36:08  
Again, we have a grid cells with the total population or population density and then based on that we'll build a procedure in order to define what is the city, where does it end and where the rural Arra start.

36:25  
This is how it looks.

36:26  
On the left hand side there's nuts, nuts, three regions.

36:31  
So this is the let's say high level aggregation let's say and on the on the right hand side it's the degree of urbanisation based on the smallest unit that the European Union is taking into account statistically which is local administrative unit #2.

36:57  
Basically at least in my country it's the every single municipality and I think it's the same in Austria as well.

37:04  
So that's the classification, what is the city, what is the urban, let's say town and what is the rural area.

37:15  
Very brief showcase on data.

37:17  
So I will now show you where to find the data about it.

37:22  
If you if you want to work with this because European Union is opening all the stuff they do because it's their approach.

37:33  
So if you if you want to look for the rural urban typology and just type in rural urban typology into the Google typology from Eurostat, I will open that and here is the manual how it was done.

38:00  
Your start websites are really really nice because they have a links for the definitions and the methodologies and also direct access to database, so it's nicely interlinked with the data and with the manuals and with the documentation as such.

38:21  
But I also have a visualisation visualisation tools.

38:26  
One of it is regions and cities illustrated.

38:30  
So if I click on it, there's a visualisation tool looking a little bit older, but functionality is still good, let's say.

38:42  
So urban and rural typology by Knots 3 regions.

38:47  
There's a kind of interactive kind of a map.

38:51  
So if I zoom in, it takes a while and try to find Salzburg.

39:01  
Oh well, it's back to the garden here.

39:03  
So you are living based on that typology in intermediate region which is not urban, not rural, but somewhere in the middle.

39:13  
So this is this is your region.

39:17  
My region is the same, but that's not enough.

39:22  
I mean Nats 3 units are, at least in my country too big, combining very heterogeneous landscape.

39:32  
So we have to take a closer look, which is provided by degree of urbanisation as such, which is on the next step in the visualisation tool, not offering a map but offering a combination of different statistics.

39:50  
So if you are wondering in your country, what is the, for instance, unemployment rates or yeah, unemployment rate based on the area.

40:05  
So you can now see that in Austria, the OR its employment rate, sorry, the highest employment rate is in the rural areas, the green, green spots.

40:20  
And the lowest employment rate, which means the highest unemployment rate, is surprisingly in the cities.

40:31  
In Chechia we have it different.

40:33  
In the cities, most people are employed.

40:37  
But there's a problem in the rural areas where there's a more people unemployed.

40:43  
So you can now based on that classification, cities, towns and rural Rs.

40:49  
You can choose the statistics which you want to compare with or there's a for instance Internet use.

40:58  
So Internet use with the relation to the urban and and rural Rs.

41:06  
So this is a very very nice tool to have it available.

41:13  
So this is visualisation using the degree of urbanisation and rural, urban, let's say classifications.

41:22  
But there are also a data about the geostat grid and some other and some other products by European Union or Eurostat.

41:33  
So I will show you where to get those data right now.

41:37  
So very simple, you search for the Eurostat, it's these European statistical office.

41:47  
So if I go there, we can access the database itself, statistical database.

41:56  
But what they have, which is important for us geospatial people, they have a geographical information unit and I click on it and the the, the abbreviation is Gisco or gisco.

42:11  
Give me a second.

42:13  
And they also offering Geo data on different topics including the land use and land cover from the Copernicus.

42:27  
Oh, it's rather slow now, yeah, but also the other products.

42:33  
Let me explore it, administrative units, population distribution and demography and so on and so on.

42:44  
So here are the data for the statistical units, very fresh.

42:50  
I mean in terms of European Union, it's very fresh if you refer to 2021 data.

42:57  
But there's also what I want to highlight.

43:00  
There's also that geostat population grid, urban clusters and degree of urbanisation itself.

43:07  
So if I click on degree of urbanisation then you have different years of that degree of urbanisation and in different formats as well.

43:21  
Unfortunately it's at this moment it's only available in a shape file, which is a format that is rather old one.

43:33  
But if we look for the NUTS data for the administrative units, they also offer a different formats of such data like TOPO, Jason, Geo, Jason and also Scalable Vector Graphics in different scales in different coordinate systems which are referenced for the European Union countries.

43:56  
So it's very nicely done these days, at least for the administrative units, but you can search and download the data also about the geostat population grade and then do your own calculations.

44:10  
Or you can download the ready to go layers like urban clusters and degree of urbanisation.

44:18  
So remember that that there's a disco at the Eurostat providing reference data for European Union and associated countries.

44:30  
So this is really, this is really nice.

44:34  
So this was a brief showcase about the about the data sources, feel free to use it.

44:44  
It's very nice data set covering the whole Europe and it's very useful and it's very nicely done.

44:56  
Any questions?

44:56  
So far, I don't see any questions in the chat or the Q&A.

45:05  
OK, so I will need to go ahead.

45:08  
Move on, yeah, please.

45:11  
Yeah.

45:12  
But in the view and recommendation, as I already mentioned, they also say in the further paragraphs that the populated population density may not be sufficient criteria in many countries, particularly where there are large localities that are still characterized by a truly rural way of life.

45:35  
So such countries will find it necessary to use additional criteria and developing classifications that are more distinctive than a simple rural, urban definitions.

45:46  
Which means that UN and I also say it if you have more data that that are somehow helpful to define what is city, what is rural region, then use it.

46:00  
That's the that's the recommendation.

46:04  
So we did it and there is a three fold motivation for for doing so.

46:10  
The first one is the UN recommendation of course.

46:15  
The second one is the OR was the state-of-the-art.

46:21  
How they I mean they check statistical office.

46:24  
They did it in in my country, they they took the simple definition, 2000 people and more.

46:31  
That's the urban era.

46:32  
That's the red colour in the left hand side map.

46:37  
That's it.

46:40  
On the right hand side picture there's a degree of urbanization for check here as well.

46:44  
That's it.

46:46  
Three classes or in check case two classes only that's the that's the only approach they used.

46:56  
So I did it for the Europe.

46:58  
How it would look like if we use the EU classifications which means 300 inhabitants per square kilometre.

47:09  
This is the left hand side map this one.

47:14  
So this this is the Europe, the red administrative units are cities and the rest of the Europe is kind of a rural village region.

47:26  
Based on this, if I take the total population only 5000 people, then it looks like this.

47:36  
Here's a closer look at the Spain and Portugal.

47:40  
300 people per square kilometre and 5000 people in the local administrative unit.

47:47  
That's it.

47:49  
That's the approach if you use only two indicators, not combining them together, not using the degree of urbanisation classification, but this simple thing like population density and total population.

48:05  
But my question is, my question was what if a population density changes by one person per square kilometre going down or up through a threshold value?

48:18  
Or what if total population drops and or rises by one inhabitant up and down or up or or down?

48:29  
Is it a still rural region or rural municipality if it has 5001 person?

48:38  
Or should I classify it now suddenly into the urban region?

48:42  
Nothing changed.

48:43  
It's still rural municipality, but there's maybe a baby boom in the municipality.

48:51  
Does it make it urban suddenly by those sharp numbers?

48:57  
That was the main motivation.

48:59  
Let's make these sharp boundaries these sharp thresholds.

49:04  
Let's make it more, let's say blurry, more vague, more like Fluence between these two, or between, between the being urban or being rural.

49:20  
And it's the same in everyday life.

49:22  
I mean, how can you define a tall person being 180 centimetres tall?

49:33  
And what if the person is 179.99999 centimetres tall?

49:40  
Is that a small person?

49:41  
Now you know where I'm heading.

49:45  
So of course we have to set the thresholds.

49:49  
Computers need it.

49:50  
We live in a binary era still computers I binary zeros and ones.

49:58  
But people are talking in a in a, let's say human language.

50:04  
If we if, if I ask you what is the temperature in your town now and you say, yeah, it's pretty nice and it's bore me and it will be getting a little bit colder, we understand that.

50:20  
But in terms of numbers, what does it mean to have a nice, nice warm weather?

50:27  
For me nice warm weather it's 30° plus.

50:34  
But for a person from Saudi Arabia, 30° is kind of a nice cold weather where they can relax suddenly.

50:44  
So it differs from person to person first thing.

50:49  
But what I want to say that we humans, we use linguistics to express our feelings let's say and we also use the human language to talk to each other, not the not the numbers, computers use the numbers.

51:09  
So what I wanted to achieve was to bring more let's say human language into the definitions, what is city and what is urban area in the very same way as I mentioned with the height of the of the person.

51:26  
So who is tall, who is small in terms of height.

51:30  
So it's the same in their rural urban fringe or these these boundaries is really a city, a municipality that has 2001 person living there or 5001 person living there or if we take the Dutch classification, 20,000 and one person.

51:52  
So let's let's make the interval little bit more fluent.

51:57  
And that's exactly what the fuzzy logic in fuzzy sets does.

52:03  
It allows smooth or smoothen the sharp boundaries between the values, between the thresholds and that fuzzy logic in fuzzy set.

52:15  
The history goes back into 60s of the last century, 1965.

52:23  
It was lot Lotfy Zadeck who defined the fuzzy logic and it's since then it's been used in many many many practical applications.

52:33  
Like in vacuum cleaners for instance those automatic ones or the thermostat that the the device that regulates the temperature inside the room.

52:44  
So imagine that you set up the temperature in the room on a 20° and the heating is going on until it reaches 20°.

52:55  
But if it's a sharp 20° then it turns off directly and in one minute in a room you you are having back are called, let's say conditions.

53:06  
So fuzzy logic is used also in these things to define let's say wider boundaries where the the device should work or not.

53:18  
And it's also used in in cars in that automatic, you know, braking systems and so on.

53:24  
So imagine that you are driving a highway which has a speed limit 130 kilometres per hour, and you reach that limit and then it suddenly starts breaking, I mean stopping the car, it will be disaster.

53:40  
So it's kind of a fluent, let's say, algorithm that is using a as numbers.

53:50  
It's using some, you know, a transition between the thresholds.

53:57  
So instead of having a low high, you can set up low, high in this sense somewhere around the threshold value and you decide that yes, this value and below this is 100% low, but then it continuously rises into the high.

54:22  
So it's not a sharp threshold, but it's somehow graduating.

54:29  
So this is what fuzzy logic does with the sharp numbers.

54:33  
With the crisp numbers, they say, transferring them into the fuzzy numbers somehow blurred somehow vague numbers.

54:43  
And this is what we applied for rural urban Ares as well.

54:47  
So instead of having the sharp threshold in Chekia for let's say 2000 inhabitants, we just move the boundaries below and above the threshold and make a transition area and this is called fuzzy membership function.

55:10  
This one is linear which is very easy to calculate, it just grows with one unit by 1 units.

55:17  
But it could has the this kind of sinusoidal or any other curve in between based on the phenomena you are studying.

55:29  
So this is what we do.

55:31  
Instead of having a sharp threshold between the rural urban areas, we made it wider and put some kind of a transition function in between what we achieved.

55:45  
It's in check, but you can probably understand the image what we achieved.

55:50  
It was kind of a continuum between what is rural and what is urban.

55:56  
So we are not saying that this municipality is intermediate by classification, but we say it's 1.4 more urban and 1.6 or 0.6 more urban.

56:15  
So we just somehow put it on the scale on on the continuous scale.

56:21  
But we also what we did of course in order to get the exact, let's say at least classifications, we divided that continuous scale into some classes as you can see in the legend over here.

56:37  
So these are this is this is very same approach as as check statistically office uses and then consequently used by European Commission to define what is urban, what is rural.

56:51  
Whereas the CDNS where the rural regions start and we do not say it, it's over here by sharp but we give the user or the reader of the map a little bit of let's say degree of freedom to decide what is more rural, more urban.

57:13  
And we can use the linguistic terms like the terms that we understand saying that this is little bit more urban area than this one.

57:24  
So we can use the terms that the human brain is more capable to understand.

57:34  
We, we also did it for the European countries and for all the local administrative unit which is more than I think it's more than 150,000 units in Europe.

57:48  
Very simple thresholds as I mentioned in the degree of urbanisation.

57:54  
This is the origin value of total population.

57:58  
This is the population density.

58:00  
So we did the thresholds a little bit wider.

58:04  
So what is below 3500 in terms of total population?

58:09  
OK.

58:10  
No question.

58:11  
That's the rural area.

58:14  
What is, what is above this number?

58:16  
That's urban, OK.

58:18  
And we modelled the space in between.

58:21  
But theoretically we can set up the thresholds like 0 and indefinite number, so we can model the whole continue.

58:32  
So this is what we've done, What we've done also taking into account population density and then we combine those two numbers together by two methods, simple mean of the fuzzy numbers and Lukashevichti Norm, I don't want to go into the details, but I will show you the results.

58:53  
So on the on the left hand side, if you combine these two numbers, these two fuzzy numbers, then here you go with the rural urban continuum.

59:04  
And if you remember the original degree of urbanization, that's a huge difference and you can see the intermediate space being modelled from zero to 1, moving in that continuum more, let's say fluently than in the three classes level in the degree of urbanization.

59:36  
Different results when using Lukashevichteenorum, which is more strict in terms of combining 2 numbers, but still we have this kind of continuum and you can see these lighter colours especially around the big urban areas in Europe.

59:51  
So it gives us a little bit more transition than the traditional degree of urbanization.

1:00:02  
So this is for the whole Europe.

1:00:04  
And based on the recommendation of UN that we should include more indicators that are more relevant to describe what is rural and what is urban, we did it for Chechiya using 7 indicators instead of two.

1:00:21  
Total population still there, but then we use total population per build up area, flats in family houses, number of completed flats, population change, driving distances as well and urbanised are as per overall municipality era.

1:00:38  
We could afford it because in check we had this kind of data, but I can, I can imagine that in different countries they do not have this kind of data for each municipality, so we could afford it.

1:00:50  
So what we did was that in each indicator, total population and flights and family houses and so on, we did exactly this one that we set up the transition zone for each one of it.

1:01:07  
Then instead of having two indicators to be combined, we have seven of them.

1:01:15  
So we we created a fuzzy inference system which is a system that combines the different inputs like if the total population is this and that and total population build up area is this and that and change of population is this and that and driving distance is this and that then the degree of membership to urban and rural will be this.

1:01:42  
So there were more than 250 rules in that fuzzy inference system.

1:01:47  
So it's really complex one and and we just took the seven indicators transferring them into the fuzzy numbers, shuffled the box, it's not a black box it was really clear but shuffled the box and then we had the membership degree into the rural and urban space in Checkia and this is the result and it's the fully the continual scale the the the scale bar is not there.

1:02:20  
I mean the the legend is not there but believe me it's from zero to 1 when one means fully urban, 0 means fully rural and each municipality in Chikia got got got the got the number between zero and one.

1:02:38  
So that that that is what we did.

1:02:40  
And then we could compare what is more urban, what is more rural, what are the transition zone, what are the transects?

1:02:49  
Where does the city end actually?

1:02:51  
Is it by the local boundaries or does it somehow extend?

1:02:55  
So if you take a look at the Prague, the lighter colours over here means that all these municipalities, although being classified as rural by Czech law or villages as you wish, they are 1.8 urban areas, so mostly behaving as a cities.

1:03:21  
But officially they are not cities.

1:03:23  
So it's more kind of a natural approach how to define what is rural, what is urban, where does the city end and where the rural areas start.

1:03:38  
So this this is the rural urban approach using the fuzzy sets and fuzzy logic and how can we use it?

1:03:47  
We all remember COVID-19 unfortunately.

1:03:50  
So we tried to compare the incidence of COVID-19 number of people get infected if it varies in urban areas or urban regions and in rural areas.

1:04:08  
So first you have to have the rural urban definition.

1:04:12  
So we use that fuzzy approach to have rural, urban and then we have the cumulative incidence of COVID-19 cases.

1:04:21  
And what do we found out?

1:04:24  
There was no difference between rural and urban areas in Chikia in terms of getting infected of COVID-19 because the the disease was that hugely spread throughout the country.

1:04:40  
So regardless you live in you got you you you had the same chance to get the COVID-19 at the beginning.

1:04:49  
The most spreading, let's say locations of COVID-19 were urban areas where a lot of people meet and have close contact.

1:05:02  
But if you have it cumulatively, this are using the data after the I think 1 1/2 year after the COVID outbreak.

1:05:14  
So then it spread it throughout the throughout the check, yeah, evenly.

1:05:21  
So it's of course it started in urban areas massively but then rural areas were not you know unaffected by the COVID-19.

1:05:33  
So it it was really surprising for us.

1:05:38  
We thought that urban Rs will be more affected by COVID-19 but they were not.

1:05:44  
It's the same then we also modelled the accessibility of physicians in terms of vaccinations.

1:05:55  
It's it was in the in the hot or let's say period of COVID-19 where there were new vaccines freshly available and there was a strategy in Chikia that every physician, every medicine doctor could do the vaccination.

1:06:13  
So we modelled the accessibility of physicians using the two step enhanced accessibility algorithm, something what special epidemiologists use.

1:06:27  
And we took a closer look if this if that accessibility is lower or higher in urban or rural areas, because politicians said that rural areas will have lower accessibility to get vaccinated.

1:06:45  
But it was not true, as you can see on the chart as well.

1:06:48  
The accessibility was even in rural and in urban Rs as well.

1:06:55  
Because in urban Rs you have more medicine doctors, but you also have more people.

1:07:01  
But in urban but in rural Rs, you have a few doctors but also not many people to get vaccinated.

1:07:10  
So it was no distinct difference between the rural and urban Rs in terms of getting vaccination.

1:07:18  
We also try to model it if we took into account a vaccination venues this big, this this big huge vaccination centres in A located in sporting venues, venues or sports venues.

1:07:33  
So if we included that big mass vaccination errors, then the difference was obvious.

1:07:42  
The accessibility in towns were much more higher or in cities are much much more higher than in than in rural Rs.

1:07:51  
Because most of the vaccination venues, the the, the, the massive big vaccination centres were located obviously in the cities.

1:08:01  
Then it makes the accessibility of vaccines much better than in rural Rs.

1:08:12  
The other application or the 2nd and the last application was what is the quality of life in rural or urban Rs.

1:08:22  
So two different things, quality of life is the different methodologies, different approaches, at least in Chikia.

1:08:30  
So there are at least three that are really nice and valid in Chikia.

1:08:35  
This is one of the best quality of life.

1:08:40  
So we were wondering, is the quality of life better in a city or in a landscape?

1:08:48  
What we did was somehow standardise the scales of course.

1:08:52  
So we somehow classified quality of life into low, medium and high.

1:08:58  
And the very same for the rural urban classification, rather rural to rural.

1:09:07  
Here are the memberships based on the fuzzy and we compare these two things together.

1:09:16  
We did some geographically weighted correlation to now to the urban space, so more green colour.

1:09:24  
You see there's a correlation between quality of life and urban membership.

1:09:31  
So the more green it is, it's the people are living a let's say higher quality of life and they live in urban areas rather where there is a red colour which means there are these are urban areas but people have reported low quality of life.

1:09:58  
So now we can see the regional differences saying that quality of life is not always connected with the with the fact that we are living in the city because that's the that's the usual premise of the quality of life researchers that in a city people have more quality of life in terms of the services, accessibility and education and and services and medical care and so on and so on.

1:10:37  
So it's a premise that there is a high quality of life in urban Rs.

1:10:42  
So we did it and it's not true entirely for the whole check here.

1:10:48  
There are regional differences.

1:10:49  
That's why we use spatial statistics, that's why we it's important to use the spatial information and GIS actually.

1:11:00  
And we also did some kind of typology which is on the right hand side just comparing on a be varied scale, quality of life, high quality of life and rural urban continuum.

1:11:16  
So if you if you look at the dark colours, there's a high degree of urbanity which means this is the city and also high quality of life and the other way around low, low which means low quality of life and living in rural areas, most of those regions are distant regions.

1:11:41  
In terms of the physical geography, they are mounting regions rather or as we call it now structurally disadvantaged regions which has a a socio economic problems coming from the communist era, closing industry, heavy industry and so on.

1:12:03  
So people are deprived in that regions.

1:12:06  
So this is also a connection to it.

1:12:11  
So conclusions.

1:12:12  
Finally I was not 40 minutes apologies for that.

1:12:19  
Rural and urban areas definitions in general are not unified and I say it cannot be unified and it will never be unified because it's it's really dependent on the on the country's approach and data available Eurostat and Directorate General for Regional and urban policies approach.

1:12:40  
That degree of urbanization is now being really used by of course EU but also OECD and United Nation.

1:12:52  
It's easy to adopt.

1:12:53  
There's a clear methodology on how to get the degree of urbanization, but sometimes the data availability limits its extended use because especially in global S not even the country, not, not even even even the total population and population density is not really easy to get for a some of the developing countries.

1:13:25  
And there's also a promise from European Union at least, that the population grid will be enhanced by some additional statistics population statistics.

1:13:38  
And it's also it was implemented in the EU rule 2018 and it should be available.

1:13:45  
I'm really curious.

1:13:47  
It should be available until the end of March 2024.

1:13:52  
So the geostat grid should be enhanced by the not by the some other population statistics like the the gender and the age and the unemployment, unemployment rate.

1:14:03  
So in that one square kilometre grid we should have more information than just a population density in two months.

1:14:11  
So I'm really looking forward to it, but I don't think it will happen, It will be a little later.

1:14:18  
One of the conclusion is also that using the fuzzy approach that I showed you which is offering let's say non binary, look at the at the continuum or the dichotomy between rural and urban, it brings more human friendly results.

1:14:35  
But on on the other hand, I need to admit that it's computationally robust and rather complex approach and I also did not do it myself, but I asked some mathematicians to help me with the calculation because I'm not you know, mathematician.

1:14:52  
Yeah, so that's very nice approach, the fuzzy approach, but it's really complicated to calculate it.

1:14:59  
But some of the very easy calculations like the Lukashevichkinor might show you for the whole Europe, it's very easy to calculate.

1:15:06  
But it's only two indicators and bringing more indicators into the computation brings more complexity as well.

1:15:13  
And why it is important to define what is rural and what is urban?

1:15:22  
To be pragmatic, every single decision making at the European level is or so based on the rural and urban regions in terms of where do they send the support, financial support.

1:15:38  
So usually the rural regions are less developed than the urban ones.

1:15:43  
So there's a cohesion policy, one of the most important policies that European Union, you know, that is aiming at the less developed regions to raise up their quality of different domains like accessibility of services and the infrastructure and so on and so on.

1:16:08  
So it's really important for decision makers, but having kind of a classification of rural, urban, it's also important for sociologists, for politologists, for a political geography in terms of elections for instance.

1:16:26  
It's also important for demography.

1:16:28  
And as I showed you, it could be important also for a healthcare services for instance, or yeah, quality of life in general.

1:16:41  
So these are my conclusions.

1:16:43  
So where does the city End make you get this set?

1:16:47  
How do we know we have reached the edge of the city?

1:16:49  
Is it that aluminium sign, or is it a thinning out of buildings until there is a little but woods and fields?

1:16:58  
Or is it an abrupt shift to small towns and villages across the landscape?

1:17:04  
Perhaps it's none of these, since the city, or at least urbanisation, is now practically everywhere.

1:17:13  
So that's my concluding remark that I borrowed from Matthew Gandy.

1:17:17  
And if you dare to have a question, just ask me directly.

1:17:23  
Thank you.

1:17:25  
OK, thanks a lot.

1:17:29  
I could imagine there's a lot of questions since you were raising a number of different topics.

1:17:35  
So please just raise your hand or unmute yourself and go ahead looking at the at the fussy answer to the original question you were offering.

1:17:48  
In the end, of course, I would look at that from the perspective that what we're doing here is modelling, right, modelling an abstract term, which is urbanization or urban, some other categories.

1:18:04  
And like every model, it depends on the purpose what we do it for.

1:18:08  
It's a model of a phenomenon for a particular purpose, like in, as you mentioned, Australia before.

1:18:14  
I myself am mostly familiar with planning, urban and regional planning related applications of that delineation because there's some things you can do in an urban core and some things you're not allowed to do outside.

1:18:33  
Like the giving a permit for a shopping centre for instance, would be pretty hard in here in an area which is defined as as well.

1:18:43  
And there might be completely different purposes.

1:18:46  
And they definitely like your broad walks through a number of possible applications of that concept from a research perspective, be that COVID or be that quality of life for happiness out there.

1:19:05  
I myself would have a few questions and I will maybe slowly go ahead with these two.

1:19:11  
We don't have that much time left, but we definitely don't let it go without picking your brain on some of these.

1:19:21  
But again interrupt me as well anytime the first thought which was going to my mind when you were introducing the gridded data from Eurostat and them definitely a huge fan of these.

1:19:36  
And actually in in Austria some of the demographic data are available down to a 100m grid.

1:19:44  
Of course we are touching some privacy constraints in that area and you mentioned the modifiable aerial unit problem as well, which immediately we would be hitting, but going back to the one kilometer data.

1:20:00  
There is a 1 kilometer population grid available globally.

1:20:06  
Yeah, which is not based on the, It's from the World Pop project.

1:20:13  
It's done every couple of years.

1:20:16  
It's downsampling approach, it's not address based.

1:20:22  
Have you looked into or would you suggest to sort of go to other areas of the globe beyond Europe and Eurostat by using these one kilometer?

1:20:36  
And by the way, they're available in 100m downscaling as well, well POP datasets.

1:20:45  
I know about it.

1:20:46  
I know about the data set and I think it's derived from the satellite imagery or the remote sensing products, if I'm not mistaken.

1:20:55  
Yeah, it's one kilometre square grid for the whole world is fantastic.

1:21:02  
But as you mentioned, for some of the applications and purposes it's not enough, especially in Europe.

1:21:09  
But definitely I would use the one kilometre grid for the other countries as well.

1:21:15  
And and from sources which are now displayed, I think it was in the the, the second last one, the recommendation on the method to designate cities and so on.

1:21:27  
It was on the 51st meeting of the UN Statistical Commission.

1:21:33  
Dextra and Polman, the guys from European commissions are kind of a lead persons also in that initiative that is using that one kilometre grid that world pop grid.

1:21:44  
So from the perspective there you think that yeah, yes.

1:21:49  
And this is that's why I mentioned that the degree of urbanization methodology is now being used by UN because those guys somehow had the power to, to implement their approach into that global UN approach as well.

1:22:07  
So in that document or one of the documents that I'm showing you on this slide, there's the methodology described also for the whole world.

1:22:18  
So, yes, OK.

1:22:21  
Yeah, thanks.

1:22:21  
And I think it's good to know in particular for some of actually majority in today's audience, there would be interest reaching out beyond Europe as well.

1:22:32  
A completely different thought you had been working with with a fuzzy approach, which of course makes it possible to walk away from the binary or boolean approach there, which for many of the ultimate applications you're suggesting is valuable.

1:22:54  
What was going through my mind there?

1:22:56  
Do you think that a segmentation approach may be followed by a fuzzy classification?

1:23:06  
Would be valuable to go from the quit data to some kind of homogeneous regions or sub regions which then are being classified.

1:23:18  
Have you explored that or are you aware of any work where segmentation is done first, like an image analysis?

1:23:26  
It of course can be done with semantic data too and then take it from there.

1:23:33  
No in in in the era of rural urban applications, not just working with the demographic population.

1:23:41  
Good data, yeah.

1:23:43  
No no, no.

1:23:44  
I I haven't encountered this, maybe it because I did not do a proper research on that or but I don't know about the application.

1:23:53  
But I obviously know that for the also for the rest of data, there's a lot of tools using that fuzzy logic which could be easily easily applied on.

1:24:05  
So there might be a master thesis out there.

1:24:08  
What?

1:24:09  
Yeah, of course, of course.

1:24:11  
I mean there are a lot of things that people can explore in that area.

1:24:16  
So and so it may be finishing with a semantic question.

1:24:22  
You were talking about urban and rural and in at least one of the legends there was urban and non urban, which depending on what people understand and the rural might make a difference.

1:24:40  
I'm just thinking of high mountain areas which we wouldn't really classify as rural, but they would be non urban.

1:24:48  
And I believe some of the areas in in Czechia on your maps, those might have been national parks or conservation areas.

1:24:57  
They were kind of solid green in one of the color schemes.

1:25:01  
So that might be the question whether masking would be applicable in in that context to avoid the semantic confusion with the term of.

1:25:14  
Yeah, definitely.

1:25:16  
I mean you can get the semantic confusion by oversimplifying things.

1:25:22  
So I oversimplify that map that I showed you.

1:25:27  
Just saying that this is urban and the rest is not urban which is comprising of different categories could be little rural, it could be UN uninhibited areas at all, it could be conservation areas.

1:25:43  
So yeah, on the slide you just saw the oversimplification that I wanted to highlight that every model and model gains the value of simplification.

1:25:57  
Anyway, Yeah, so we, we've reached the end of our time and that just would like to thank a lot because you certainly gave all of us a couple of interesting ideas, not the least by the introduction of the European Eurostat data sets, which not everyone I guess would be aware of.

1:26:20  
And they are valuable in many different contexts as well as some methodology ideas.

1:26:26  
In some sense, it's not only a very applied approach, but it's applicable to a number of different domains.

1:26:36  
So just a quick thank you.

1:26:39  
And thank you for inviting me.

1:26:41  
And it was my pleasure.

1:26:43  
And I hope it was not that too boring for the audience.

1:26:47  
Yeah.

1:26:48  
Thank you so much, guys.

1:26:50  
Not at all from my perspective.

1:26:51  
OK.

1:26:52  
Thanks a lot.

1:26:53  
Have a great day and have a wonderful week.

1:26:55  
You too.

1:26:55  
See you guys.

1:26:56  
Bye, Bye.

1:26:58  
Thank you.

1:26:59  
Bye.