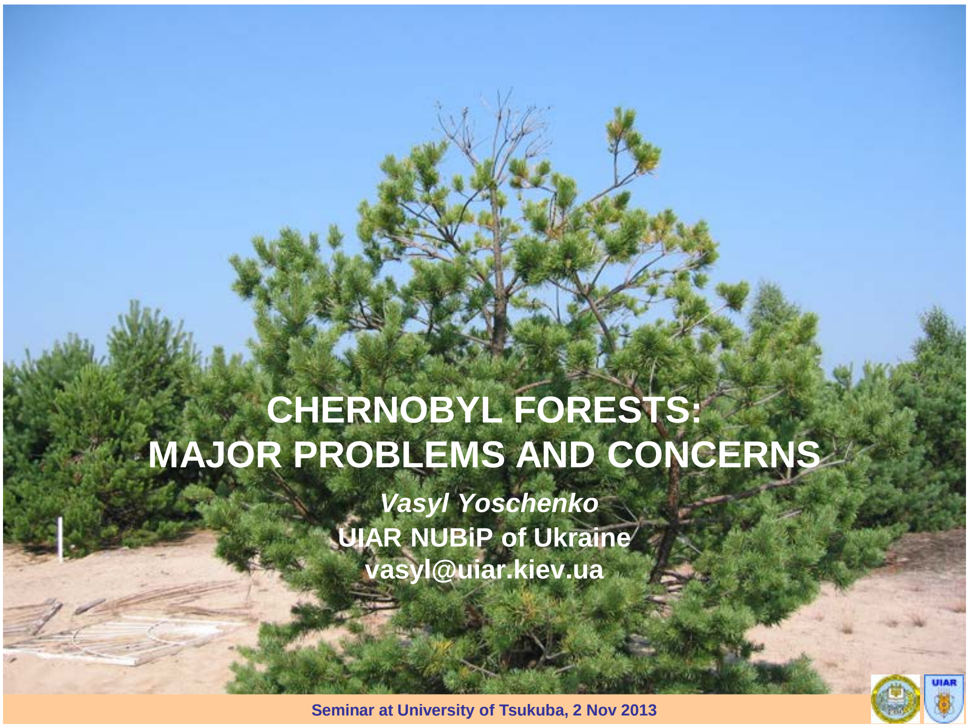
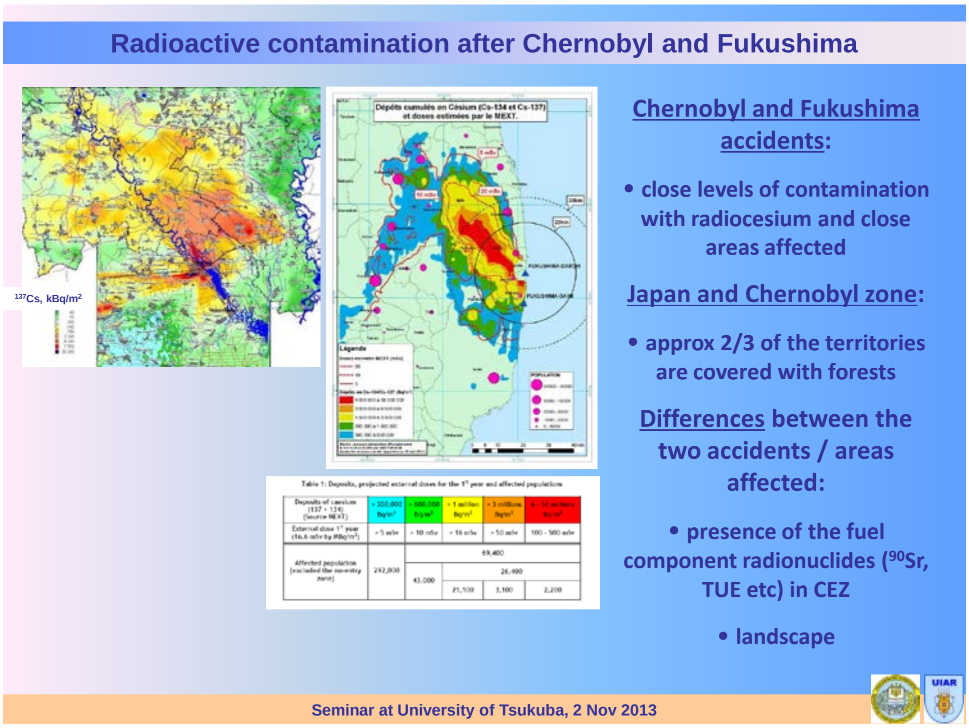


Good afternoon, dear colleagues. I'm Vasyl Yoschenko from Ukrainian Institute of Agricultural Radiology. First of all, I would like to thank you for the invitation to visit your country and the warm welcome here. I have to admit that during this research year we visited many industrial sites and seen the impressive results of agriculture scientists. In general we hope very much that we will have the collaboration in [Unclear]. Valery Kashparov...



Valery Kashparov presented the situation in forest in Ukraine in general. In my presentation I will concentrate on the most contaminated part of the acute territory [Unclear] contaminated territory in Ukraine between the 30 kilometer Chernobyl zone.

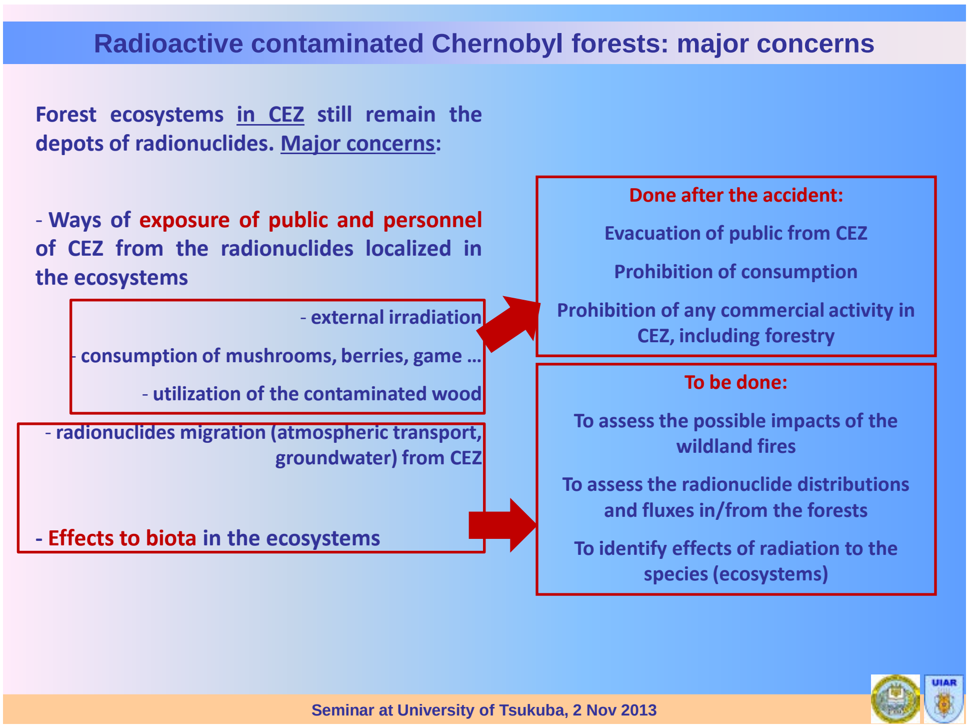
First, I'd like to show you this map, is the map of Chernobyl affected area and this is Fukushima affected area.

These are the maps in same special scale.

You can see in general the territory affected by the Fukushima accident is smaller than the territory affected by Chernobyl and the levels of contaminations in Fukushima are lower but we can say that these are more or less of the same magnitude.

Both for Japan and for Chernobyl zone approximately more than 60,000 [Unclear] territories are covered as well as the forest are important and and there are, of course, some differences [Unclear] in case of Chernobyl presence of strontium and transuranium elements in the release.

And second is different landscape. In Chernobyl, normally, we have the flat landscapes and here [Unclear].



So the forest in Chernobyl exclusion zone will remain for the long time the depots of radionuclides because we don't make any decontamination.

And in this case we have to think about possible exposure to public and personnel along with various other exposure and...

[Unclear] zone we can – in general for the contaminated forest the [Unclear] possible impacts on population we imagine of exposures.

We can especially for the [Unclear] zone another consignment [ph] is possible migration of radionuclides localized in this territory to other territories of Ukraine.

Again, if these ecosystems are contaminated we have to think about the possible effects of biota to wild [Unclear].

For exposure of population as Dr. Kashparov said, it can be profound because we evacuated public from the exclusion zone.

And to address these provisions we performed special experiments, evaluate...

Wildland fires: the problem

Wildland fires frequency (average)

	Number of fires	Area burnt, ha yr^{-1}	Frequency, km^{-2} yr^{-1}
Ukraine 2001-2003, Zibtsev, 2002	3866	3927	$6.4 \cdot 10^{-3}$
Japan 1990-1999, Forestry Agency Japan, 2000	3274	2311	$8.7 \cdot 10^{-3}$

Chernobyl Exclusion zone:

increased frequency – 42-116 fires per year, or (2-5.7) $\cdot 10^{-2}$ km^{-2} yr^{-1};

increased severity of fires – up to average of 80 ha per fire in 1992

Wildland fires impacts:

- **radioecological – radioactivity redistribution (resuspended amounts and transportation range of the radionuclides);**
- **radiological – doses to the firefighters and population (airborne concentrations, dispersal composition, solubility etc);**
- **social (awareness of the authorities and population concerning the actual potential consequences of the fires)**

NOAA, 08 May 2003, 18:30, by UCLRM

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First, one of the possible ways of radionuclides migration from the exclusion zone can be forest fire, wildland fire.

And in this I used the data for Japan which I found in the Internet and I can show that, in general, the number of fires per year and the average burnt area in Japan, in Ukraine are almost the same [Unclear] territory.

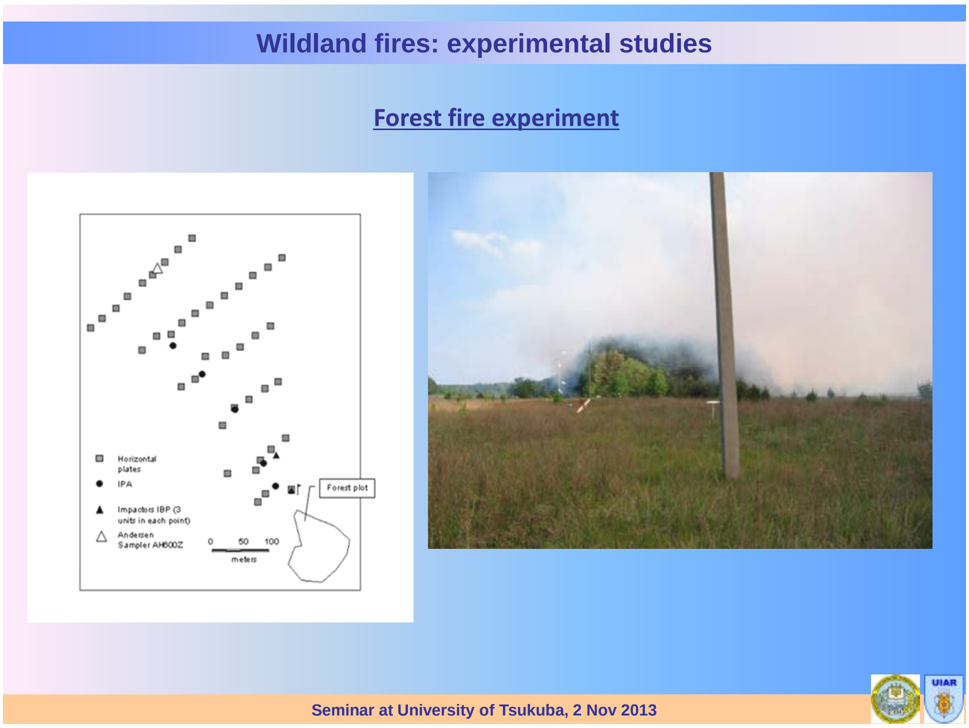
I don't know if this is important for Japan but it can be important for us.

Also after abandoning of the exclusion zone the number of frequency of fires and the severity of fires rise in the Chernobyl exclusion zone.

I hope you can see this green line, shows airborne concentration of radionuclides in Chernobyl during the fire. It exceeds the concentration during the dust storms and during the normal weather.

This is for Chernobyl zone. People in here for example mentioned about the possible impact on their health from the fires at Chernobyl.

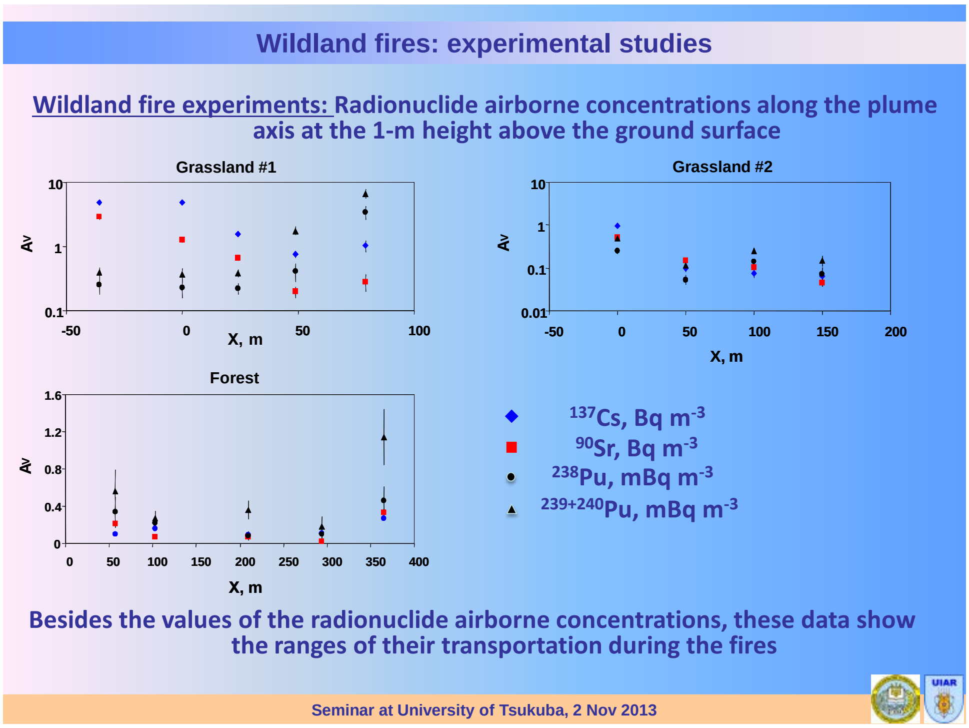
There is some background to say about that. As you can see this is a satellite image of the fire which is localized here. This is in west part of – to the west of the exclusion zone and this is here. This whole blue [Unclear].



In order to determine what is really the danger of the fires we make the experiments control points of the [Unclear] in the exclusion zone.

So firstly, this is a forest, this one. Firstly...

...it's on the research and equipment [Unclear] matters.



In this way we can manage the concentrations of different radionuclides, and the various distances from the social human beings and [Unclear] for forest fire here. There have been concentration of cesium, for example, is also mainly the various [Unclear]. Another interesting point here is a range of spreading of the plume.

In general, the public awareness several hundred meters.

Wildland fires: experimental studies

Wildland fire experiments: Radionuclide resuspension factors, m^{-1}

Calculated for	^{137}Cs	^{90}Sr	^{238}Pu	$^{239+240}Pu$
Grassland fire, #1				
Activity in fuel material	$(1.7\pm0.2)\cdot10^{-5}$	$(1.5\pm0.2)\cdot10^{-5}$	$(3.5\pm1.0)\cdot10^{-7}$	$(2.4\pm0.6)\cdot10^{-7}$
Total activity	$(1.7\pm0.2)\cdot10^{-7}$	$(3.7\pm0.5)\cdot10^{-7}$	$(4.9\pm1.4)\cdot10^{-9}$	$(3.8\pm0.9)\cdot10^{-9}$
Grassland fire, #2				
Activity in fuel material	$(8.0\pm4.8)\cdot10^{-6}$	$(4.4\pm2.6)\cdot10^{-6}$	$(2.9\pm2.3)\cdot10^{-6}$	$(2.6\pm2.1)\cdot10^{-6}$
Total activity	$(1.9\pm1.1)\cdot10^{-7}$	$(1.8\pm1.5)\cdot10^{-7}$	$(1.3\pm1.0)\cdot10^{-8}$	$(1.3\pm1.0)\cdot10^{-8}$
Forest fire, #3				
Activity in litter	$(7.0\pm2.8)\cdot10^{-7}$	$(1.2\pm0.5)\cdot10^{-6}$	$(1.2\pm0.8)\cdot10^{-6}$	$(9.4\pm5.2)\cdot10^{-7}$
Activity in fuel material	$(4.7\pm2.0)\cdot10^{-7}$	$(3.5\pm1.6)\cdot10^{-7}$	$(1.1\pm0.7)\cdot10^{-6}$	$(8.3\pm4.8)\cdot10^{-7}$
Total activity	$(4.7\pm2.0)\cdot10^{-8}$	$(1.1\pm0.5)\cdot10^{-7}$	$(3.2\pm2.2)\cdot10^{-8}$	$(2.5\pm1.6)\cdot10^{-8}$

These data (at least orders of magnitude) can be used to estimate the radionuclides resuspension during other wildland fires

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Also we determined the resuspension factors and other parameters which characterize distribution of radionuclides during the fires.

Wildland fires: experimental studies

Wildland fire experiments: Doses to the firefighters (1 hr exposure, conservative scenario; for inhalation – 50 yr effective equivalent dose)

	Maximum airborne concentration, Bq m^{-3}, in the site			Way of exposure	Dose, μSv, in the site		
	#1	#2	#3		#1	#2	#3
^{137}Cs	5	1	0.27	External from the cloud	$6.9 \cdot 10^{-4}$	$1.4 \cdot 10^{-4}$	$3.7 \cdot 10^{-5}$
				Inhalation	$6 \cdot 10^{-2}$	$1.2 \cdot 10^{-2}$	$3.2 \cdot 10^{-3}$
^{90}Sr	3	0.5	0.33	External from the cloud	10^{-4}	$1.7 \cdot 10^{-5}$	$1.1 \cdot 10^{-5}$
				Inhalation	0.24	$4.1 \cdot 10^{-2}$	$2.6 \cdot 10^{-2}$
^{238}Pu	$3.4 \cdot 10^{-3}$	$2.5 \cdot 10^{-4}$	$4.6 \cdot 10^{-4}$	Inhalation	**7.1**	**0.53**	**1**
$^{239+240}$Pu	$6.7 \cdot 10^{-3}$	$5.1 \cdot 10^{-4}$	$1.1 \cdot 10^{-3}$	Inhalation	**17**	**1.3**	**2.8**
External irradiation from soil and vegetation					16	10	4.2
Total dose					40	12	8

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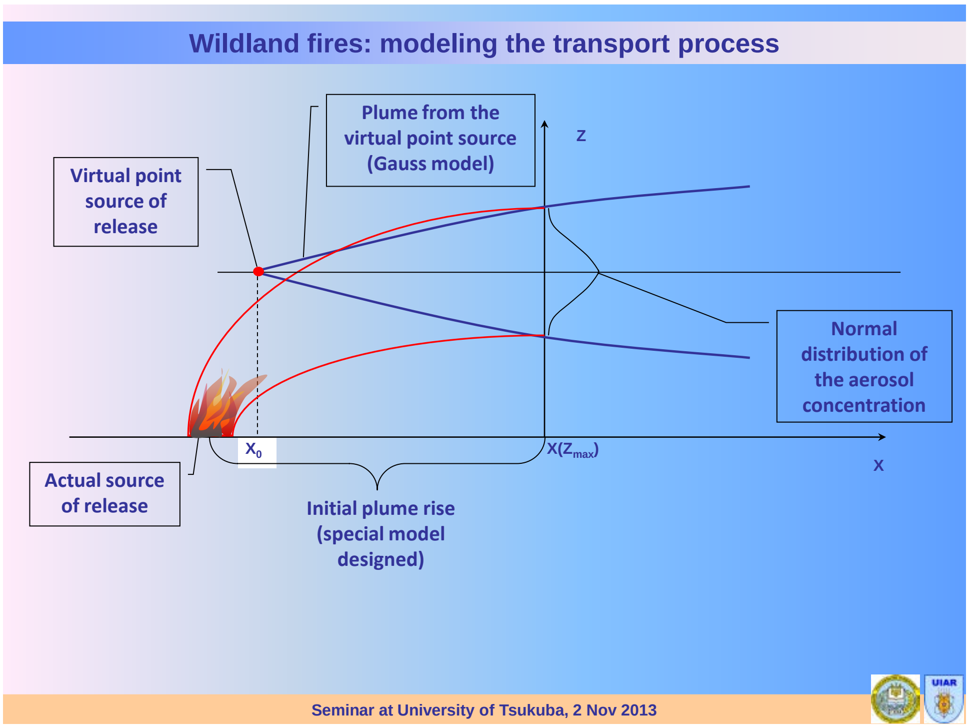
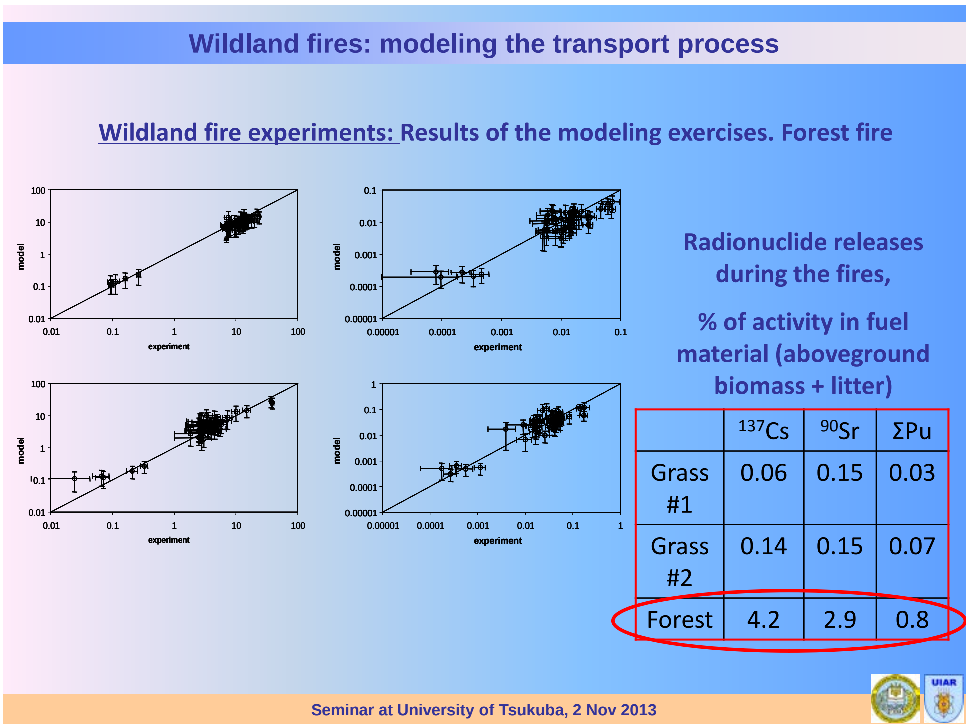
This is really [Unclear] of the dose in especially to fireman calculated for the very conservative scenario that this fireman stands in the most contaminated point.

These are exposure during 1 hour and we've calculated here effective equivalent dose. Now the important information here is for this another case and internal doses can be equal or even exceed the doses from external inhalation during the same period. We think this is from inhalation and the total dose is say external is 60 and the total [Unclear].

But this is because of inhalation of plutonium by the dose, and cesium and strontium did other smoke...

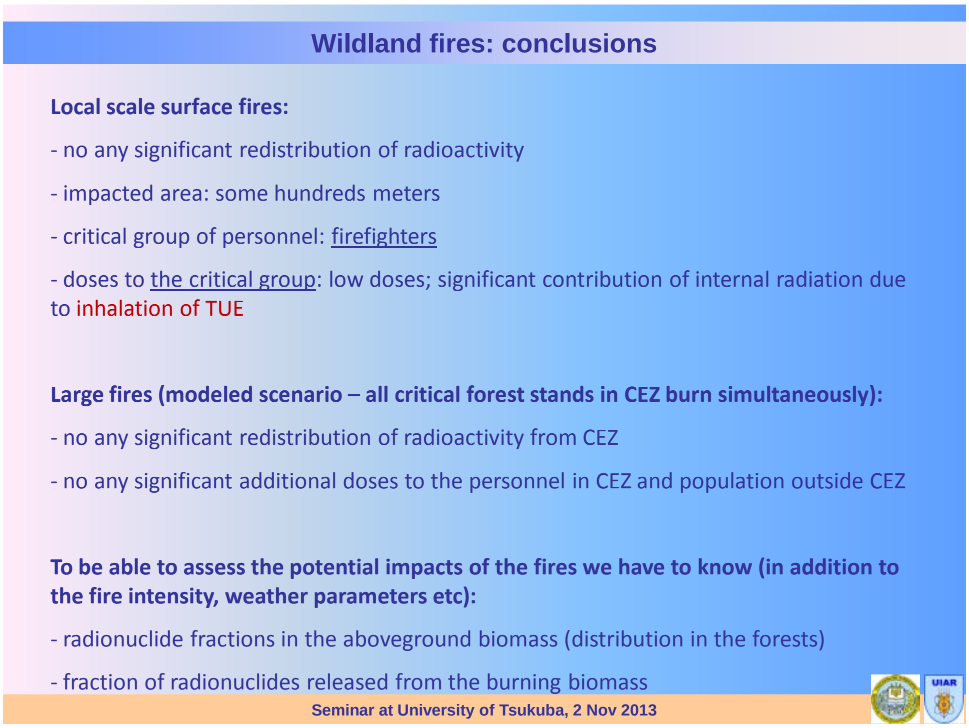


We've made some modeling exercise and the modeling...



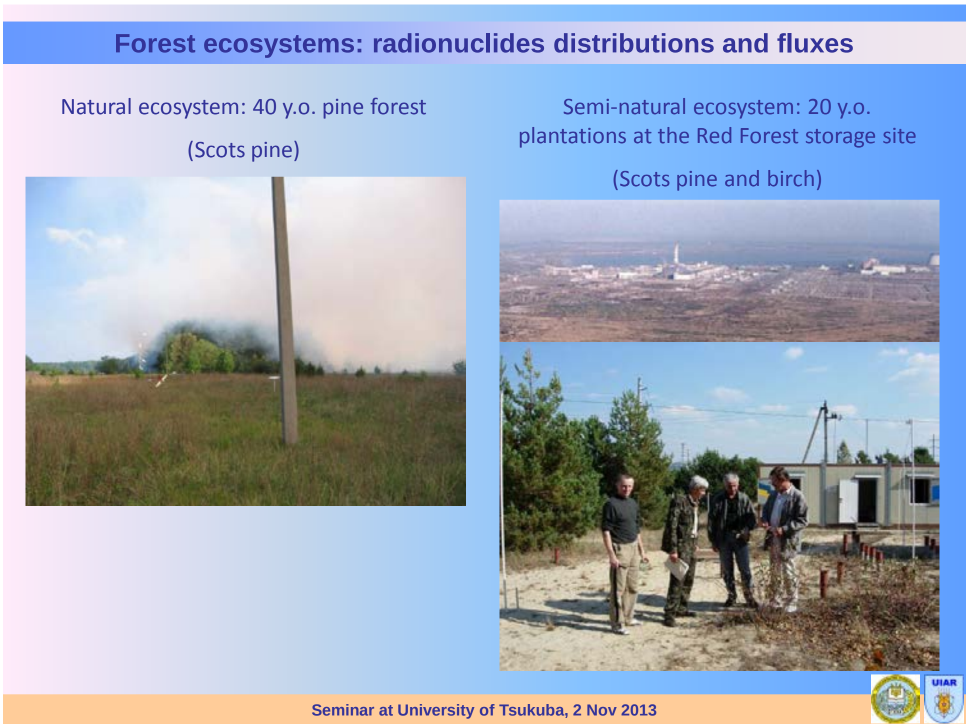
In this right here, conduct this experiment and calculate the data and we did it among the activities, the percent of activity which was reduced in the fire from the burned, from the above-ground biomass and litter.

Forest fires and some parts of [Unclear].



That's the conclusion and here I've assumed…

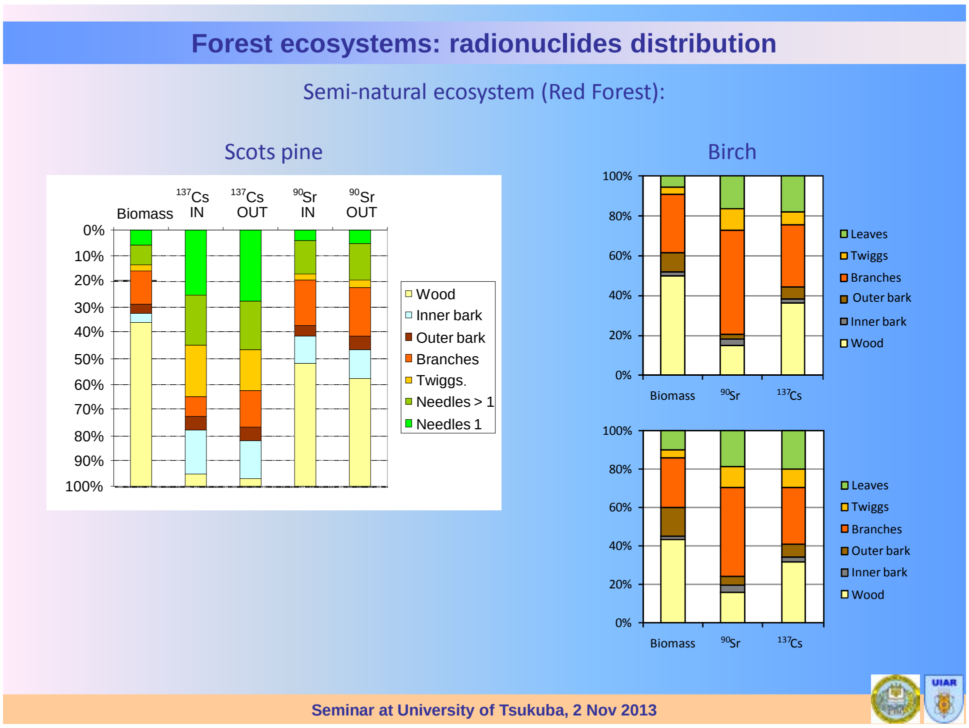
Important thing here is that to be able to assess the potential impact of forest fires we have to know the fractions of radionuclides in the aboveground biomass.



[Unclear] we did extensive activities about the radionuclides distribution in the forest ecosystem. We performed extensive activities [Unclear] radionuclides distribution and fluxes in the forest ecosystem.

Our results from [Unclear] ecosystem one is, the pine tree growth in the experiment is 40 years of pine forest

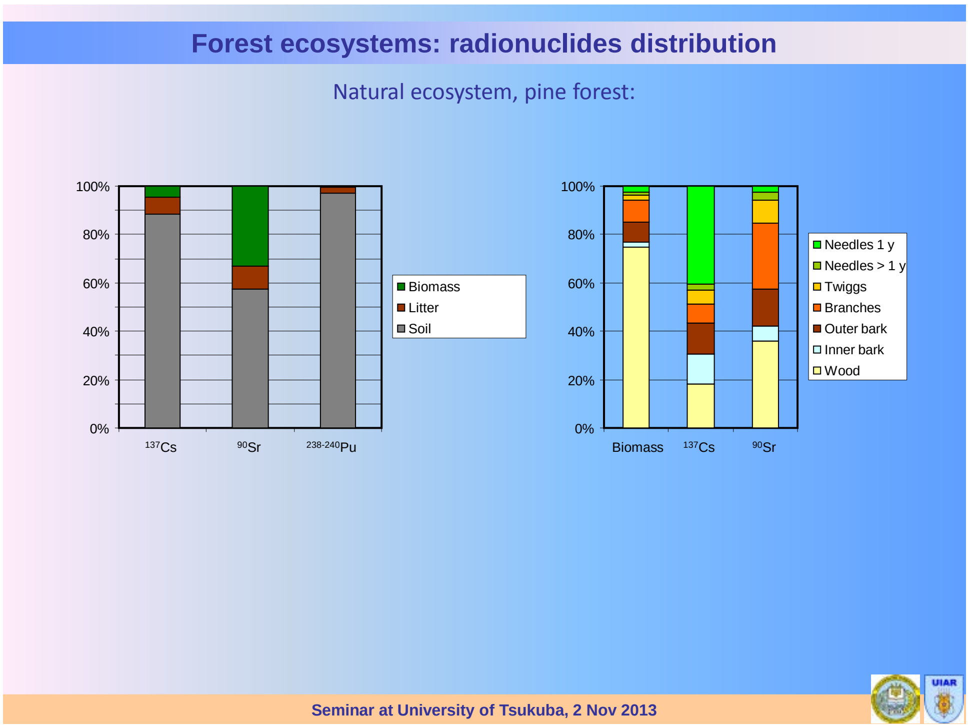
Another is semi-natural ecosystem. This is plantation of Scots pine and birch and they're here in the territory of the Red Forest.



In the Red Forest, we have our main experimental site and as always Dr. Kashparov was at site.

In Red Forest you can see the distribution of radionuclides in different compartments of the leaves, of the above-ground biomass.

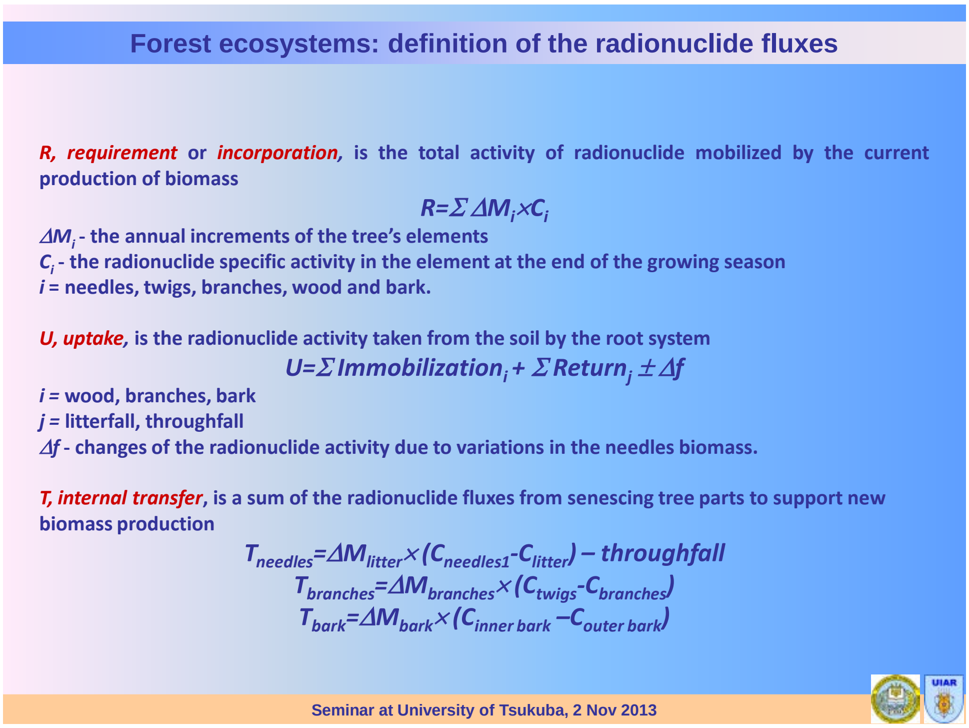
Here, what's strange [ph] for example, was cesium.



And the same is for the natural ecosystem.

[Unclear] weather here, with first season, the total activity in aboveground biomass is say 5% of the total activity in the ecosystem. This is much lower than normally in Japan forest fire outside [Unclear].

But there is big problem with strontium in pine tree because its total content in the above-ground biomass can be [Unclear] of the total [Unclear] in the ecosystem.



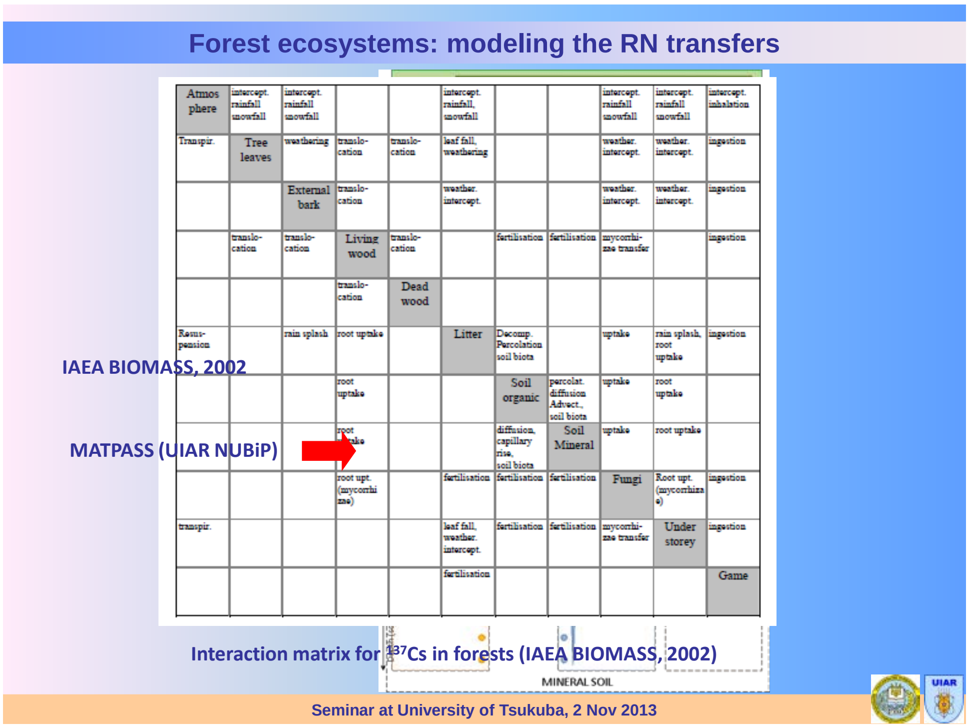
We were once approached to determine the radionuclides once it's [ph] in the ecosystem [Unclear].

Male Participant

Can you please repeat?

Dr. Vasyl Yoschenko

We were once approached to determine to recognize [ph] the radionuclides cycle in the ecosystem.



Atmos phere	intercept. rainfall snowfall	intercept. rainfall snowfall			intercept. rainfall, snowfall			intercept. rainfall snowfall	intercept. rainfall snowfall	intercept. inhalation
Transpir.	Tree leaves	weathering	translo-cation	translo-cation	leaf fall, weathering			weather. intercept.	weather. intercept.	ingestion
		External bark	translo-cation		weather. intercept.			weather. intercept.	weather. intercept.	ingestion
	translo-cation	translo-cation	Living wood	translo-cation		fertilisation	fertilisation	mycorrhi-zae transfer		ingestion
			translo-cation	Dead wood						
Resus-pension		rain splash	root uptake		Litter	Decomp. Percolation soil biota		uptake	rain splash, root uptake	ingestion
			root uptake			Soil organic	percolat. diffusion Advect., soil biota	uptake	root uptake	
			root uptake			diffusion, capillary rise, soil biota	Soil Mineral	uptake	root uptake	
			root upt. (mycorrhizae)		fertilisation	fertilisation	fertilisation	Fungi	Root upt. (mycorrhizae)	ingestion
transpir.					leaf fall, weather. intercept.	fertilisation	fertilisation	mycorrhi-zae transfer	Under storey	ingestion
					fertilisation					Game

We were just finishing [Unclear].

The IAEA in the [Unclear] biomass group recommends the interaction matrix for cesium in forest.

There is a lot of compartments with different relations between them. But it was too complicated and we [Unclear] we created [Unclear] MATPASS which is less complicated but the main part present here is the uptake from the total biomass and especially the renewable mass, translocation between these two components depend on the litter and soil and also depend in the ground and [Unclear] particles which is not from Japan. And the soil is basically several layers with different geochemical [ph] factors.

Semi-natural forest ecosystem: radionuclides fluxes (2005)

Radionuclide annual fluxes in Red Forest (Scots pine plantation, 3300 trees ha^{-1}):

Fluxes	^{137}Cs		^{90}Sr	
	GBq ha^{-1} y^{-1}			
	OUT	IN	OUT	IN
Incorporation	0.67	1.13	4.6	22.9
Uptake (1+2+3)	0.3	0.36	7.6	37.5
(1) immobilization	0.05	0.06	1.97	11.0
(2) return to soil	0.21	0.24	5.56	26.1
(3) Δf	0.04	0.06	0.11	0.4
Internal transfer	0.39	0.8	-2.95	-15.9

ARE THESE FLUXES BIG?

Total activities in the studied trench: ^{137}Cs ~ 600 GBq, ^{90}Sr ~ 290 GBq

Total activities in the trees biomass at the trench: ^{137}Cs ~ 0.024%, ^{90}Sr ~ 2.52% of the radionuclides inventories in the trench

Annual uptake fluxes: ^{137}Cs ~ 0.0038%, ^{90}Sr ~ 0.82% of the radionuclides inventories in the trench

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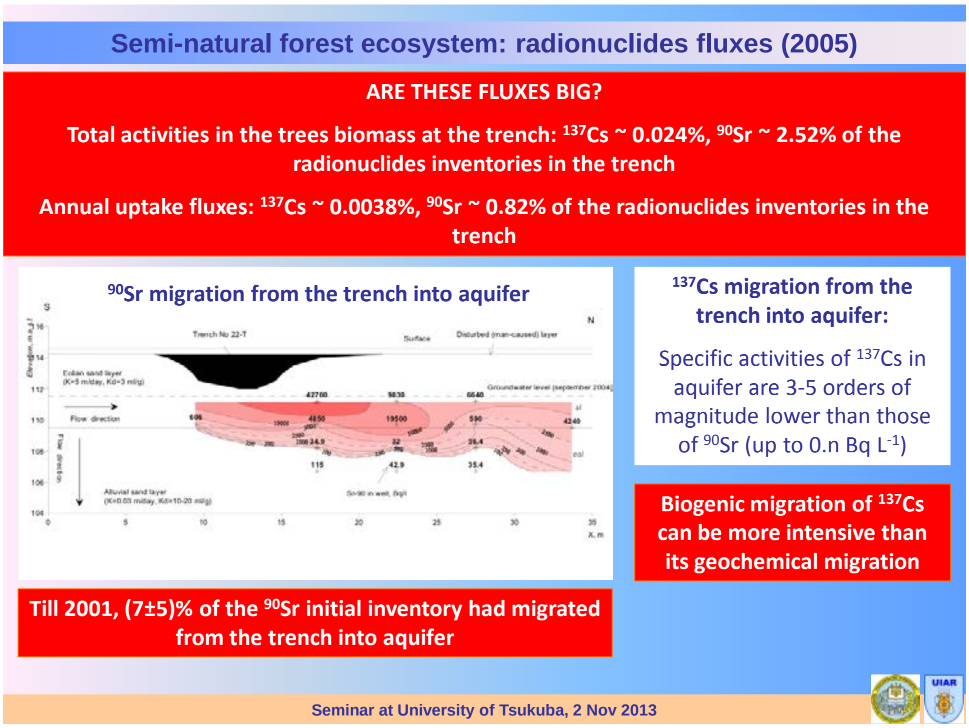
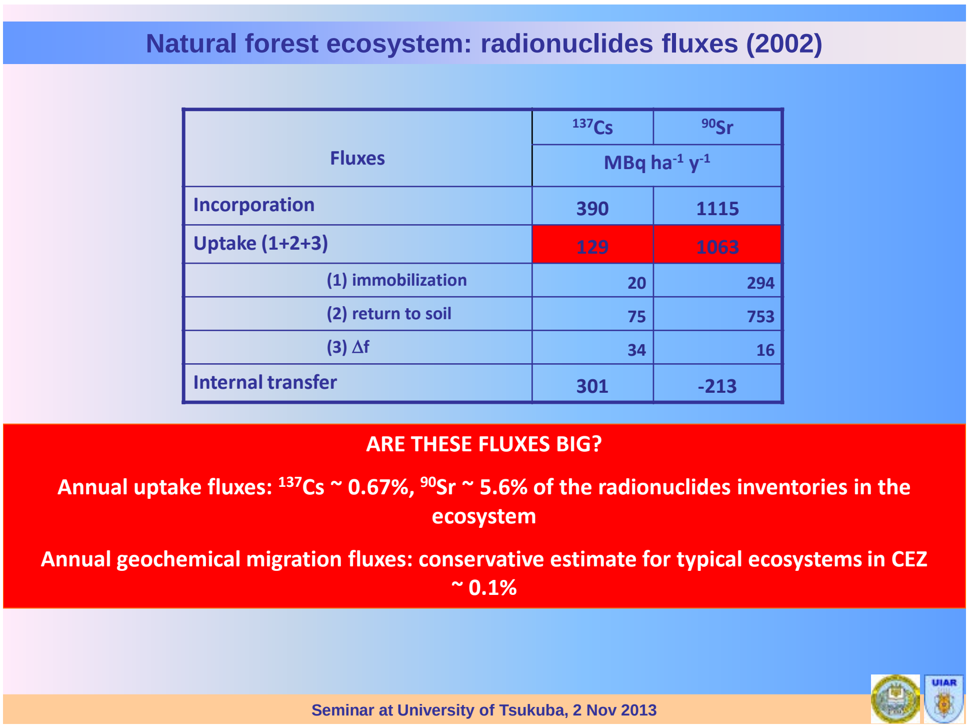
Here are the reference of the flux estimations for Scots pine. It refers to the total values of uptake of radionuclides from soil and we have to [Unclear]. Comparing to the radionuclides contents in the trench for various trees [ph] cesium in the ground biomass is a small number, but for strontium that is 2.5%.

Although uptake flux of cesium is small but for strontium this is almost 1% of the total content in the trench.



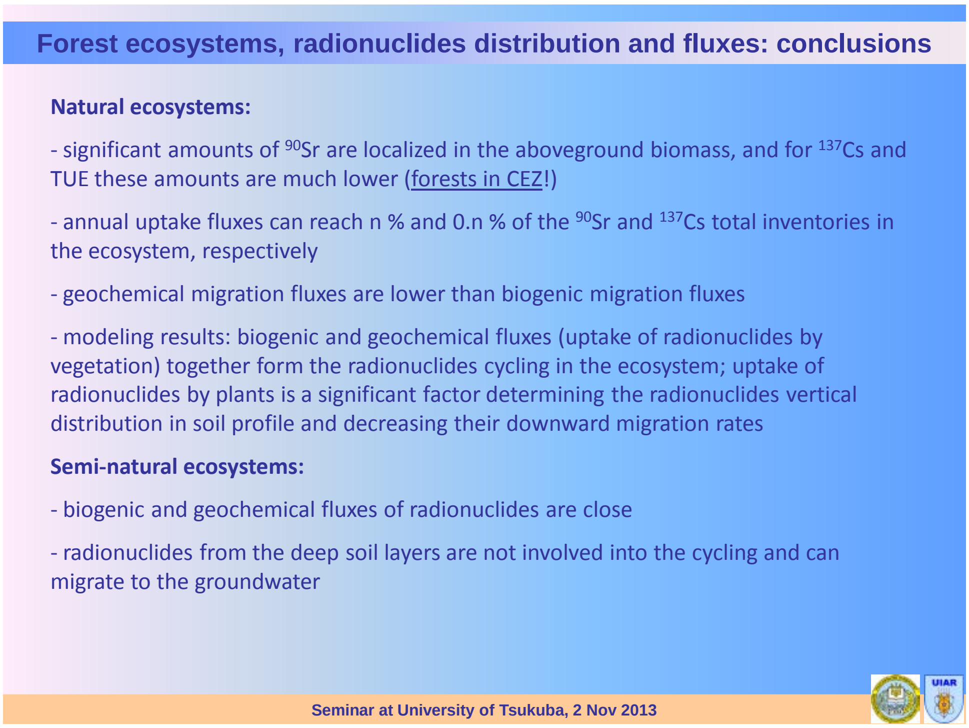
Comparing to the migration [Unclear] migration from the trench the base values for strontium are even bigger because during the 15 years there is migration order of several percents so it is – this one is bigger.



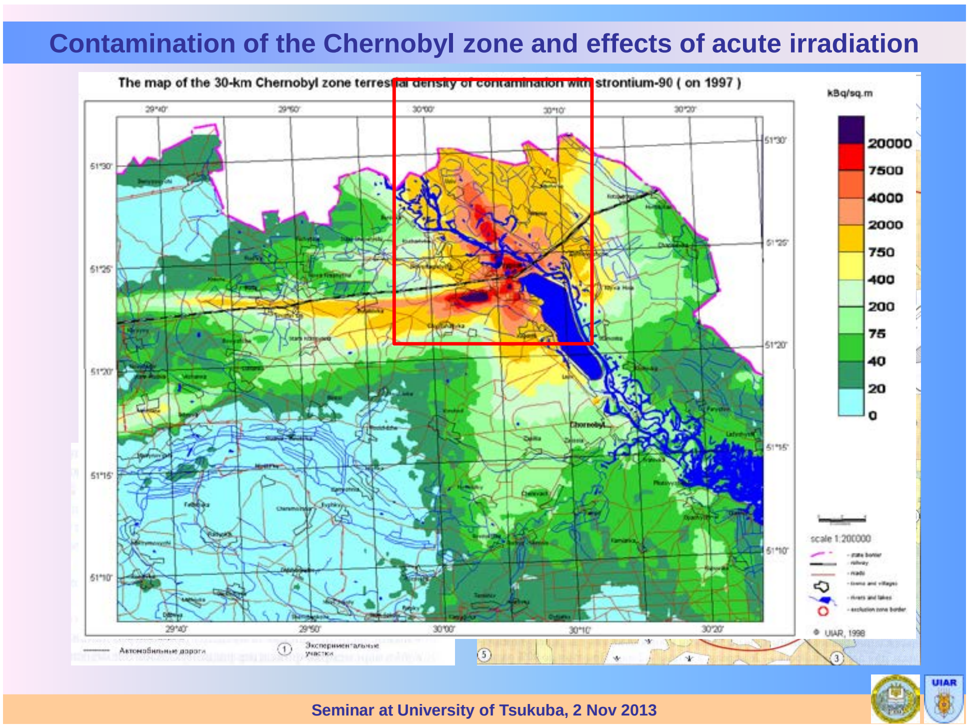
Also biogenic migration of cesium can be more intensive than its geochemical migration. And also…

For the natural ecosystems, the annual uptake fluxes can be some percents, up to 1% of the total radionuclides inventory in the ecosystem and several percent for strontium.

While the geochemical migration on the ecosystem – on the typical ecosystem in the Chernobyl exclusion zone are much lower.

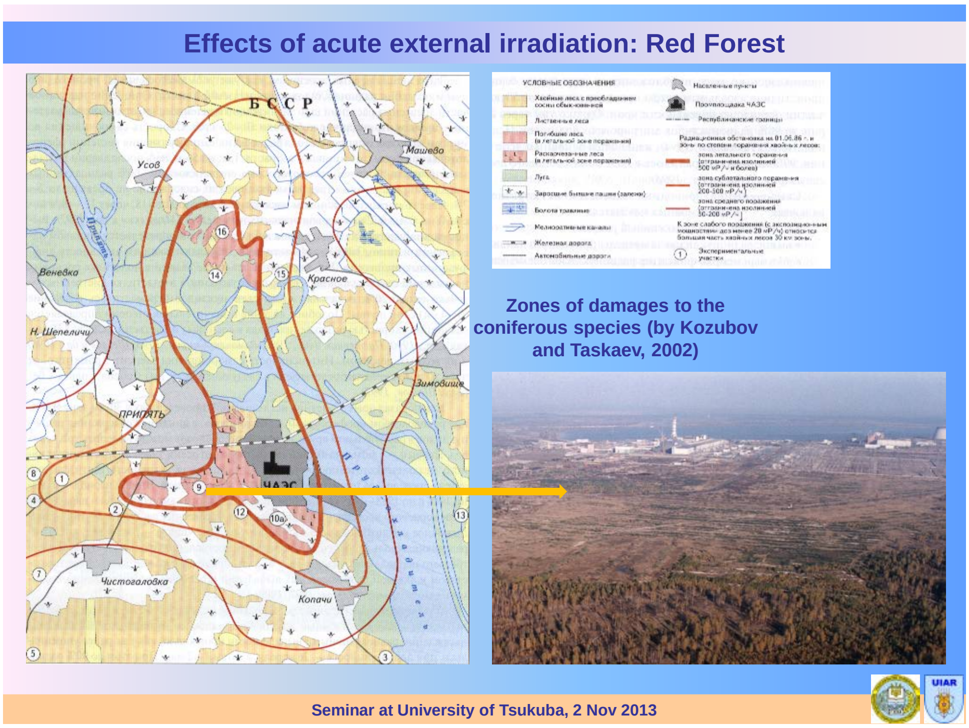


Just my conclusion that biogenic fluxes play a very important role in the formation of cycling of radionuclides in the ecosystem.



The last part of my presentation is around the effects of radiation to biota. So in this map of contamination you can see the heavy contaminated part of the 70 kilometer zone.

For this part, up on the accident, this is the same part. And…



This is very near from the Chernobyl accident.
Chernobyl atmosphere and here is Red Forest and here are some other places in Chernobyl.
These two zones are the zones of the level effects to the coniferous species [Unclear] pine species.
Due to acute irradiation in this area [Unclear].
This is the Red Forest after the trees were dried and cut.

Effects of radiation: non-human biota in the radiation protection system

The approaches to the radiation protection of biota must be developed (active contributors: EMRAS BWG of IAEA, 5th Committee of ICRP …) taking into account:

- biodiversity (various ways of irradiation and doses to the organisms in the same ecosystem, various life spans of species, various radiosensitivity etc)
- relations in the ecosystems (roles of certain species in the ecosystem, evolution of the irradiated ecosystem …)
- final aims of the biota protection (what must be protected – individual organisms, populations, ecosystems? how to protect? …)

Current approach (ICRP…):

- for typical ecosystems (terrestrial, freshwater, marine) the referent animals and plants (RAPs) are selected
- radiation effects are estimated for RAPs and then for the whole ecosystem through application of the risk quotients

Example – ERICA Tool

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PASS

Non-human biota in the radiation protection system

RAPs (*ICRP Publ. 103*, ERICA Tool):

Freshwater	Marine	Terrestrial
Amphibian ***(frog)***	Bird ***(duck)***	Amphibian ***(frog)***
Benthic fish	Benthic fish ***(flat fish)***	Bird ***(duck)***
Bird ***(duck)***	Bivalve mollusc	Bird egg ***(duck egg)***
Bivalve mollusc	Crustacean ***(crab)***	Detritivorous invertebrate
Crustacean	Macroalgae ***(brown seaweed)***	Flying insects ***(bee)***
Gastropod	Mammal	Gastropod
Insect larvae	Pelagic fish	Grasses and herbs ***(wild grass)***
Mammal	Phytoplankton	Lichen and bryophytes
Pelagic fish ***(salmonid/trout)***	Polychaete worm	Mammal ***(rat, deer)***
Phytoplankton	Reptile	Reptile
Vascular plant	Sea anemones/true corals	Shrub
Zooplankton	Vascular plant	Soil invertebrate (worm) ***(earthworm)***
	Zooplankton	Tree ***(pine tree)***

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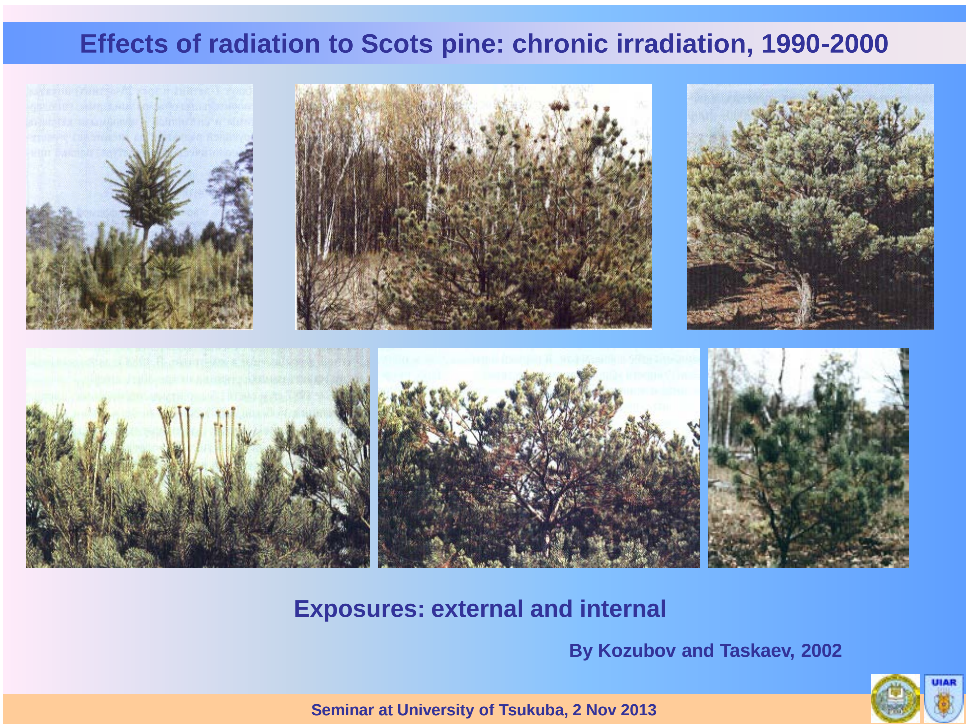
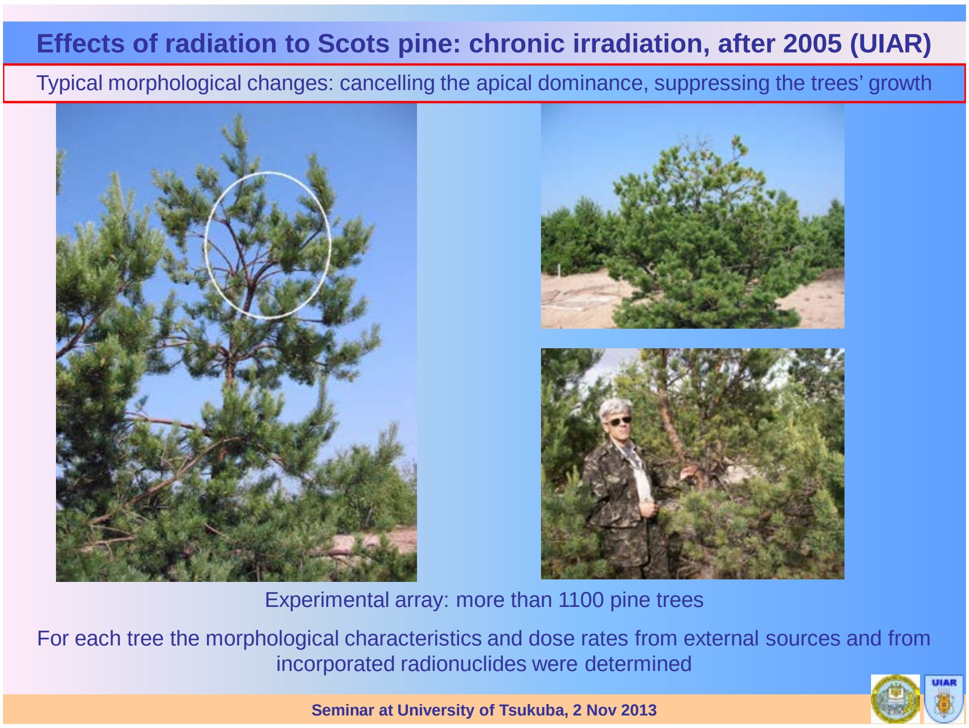
To characterize in general, [Unclear] effects to biota, the IAEA and ICRP and other international organization recommended approach by doing the referent selection.

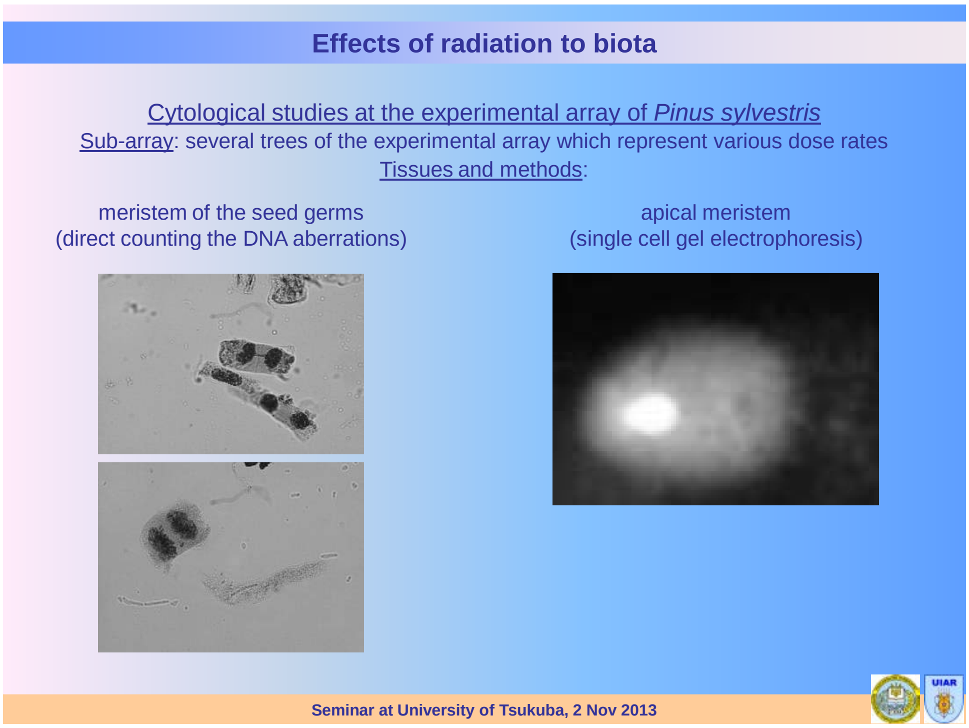
For terrestrial this is [Unclear] from the [Unclear] tree, for pine tree, for shrubs and for grass and herbs.



After the establishment of the new plantation in the Red Forest in the early clearing we had the numerous kinds of morphological changes in the trees.

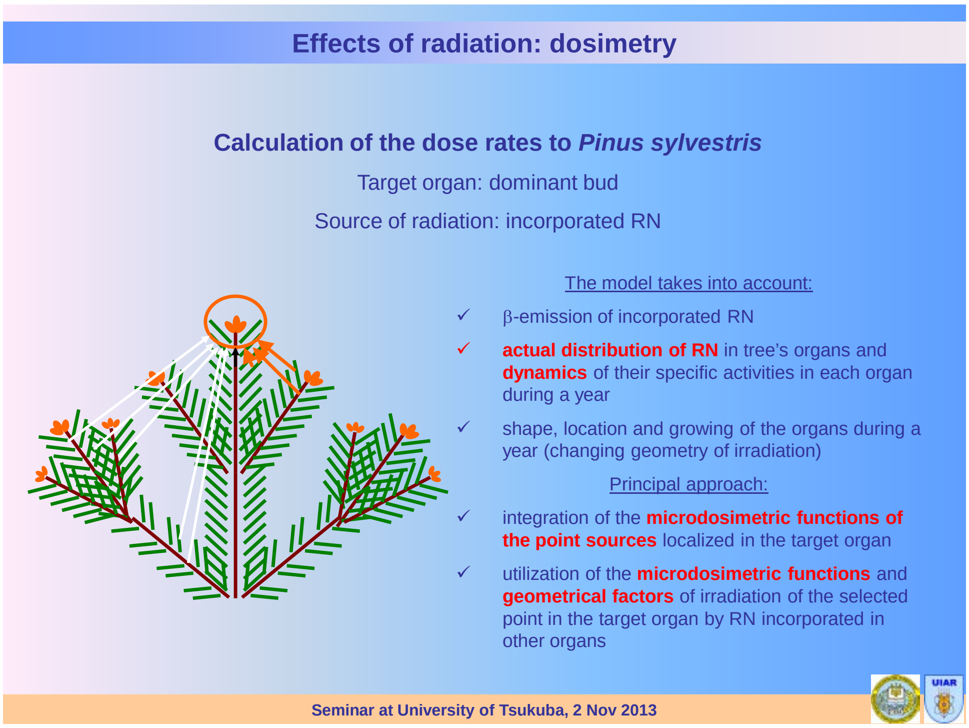


This is [Unclear].
And now if you travel back the changes [Unclear] mainly are on this site.
Normally pine tree has one trunk, and then every year one trunk.
But in some cases the apical dominance is cancelled [Unclear] center of plant and also is dominant the trees.
We implemented more than 1100 pine trees.
For each tree we determine the morphological characteristics and the different doses.



This is the database we made from this.

We applied also the morphological experiments, we applied some cytogenetics to this. We did some DNA aberration methods and by single-cell electrophoresis.



We also have a look at the dosimetry model we just put up for this especially because the, for example, ERICA tool use just a tree will be different [Unclear] others geometry of the trees.

Effects of radiation : dosimetry

Dose coefficients for incorporated RN for *Pinus sylvestris,* μGy h^{-1} (Bq kg^{-1})$^{-1}$

RN	ERICA Tool	Our model
^{137}Cs	3.2×10^{-4}	2.1×10^{-3}
^{90}Sr	6.5×10^{-4}	7.1×10^{-4}

Reason of discrepancy: ERICA Tool does not take into account the actual RN distribution and their activities dynamics.

Also, ERICA Tool operates with the “tree” and does not specify the target organ.

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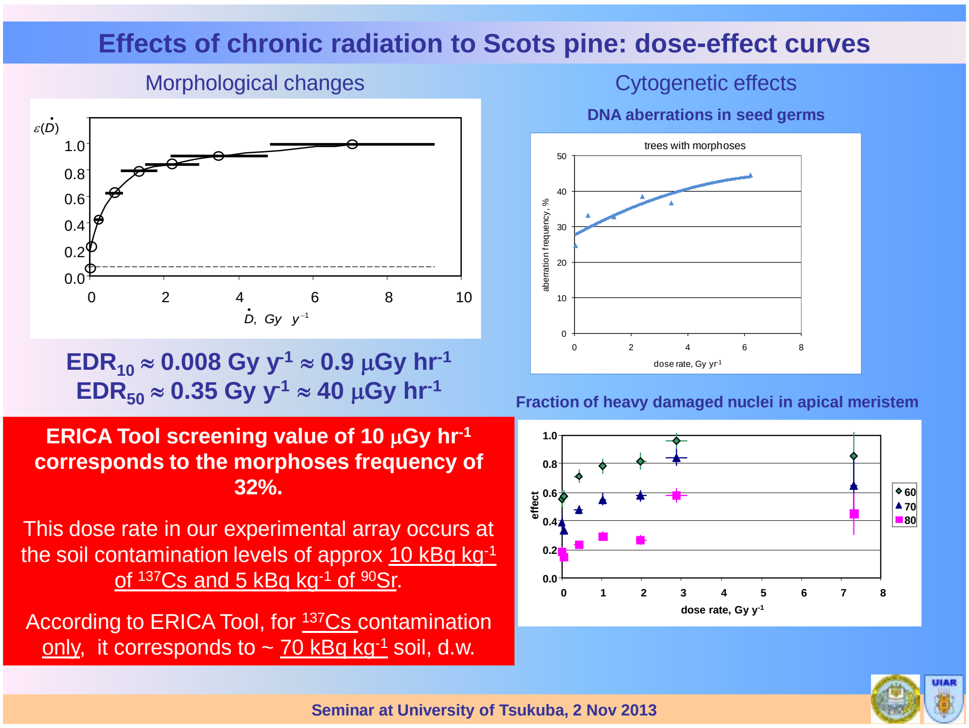
The dose coefficients of that comparing ERICA to our model are different because we take into account the radionuclide dynamics during the year and values of the trees.

Also we select the [Unclear].

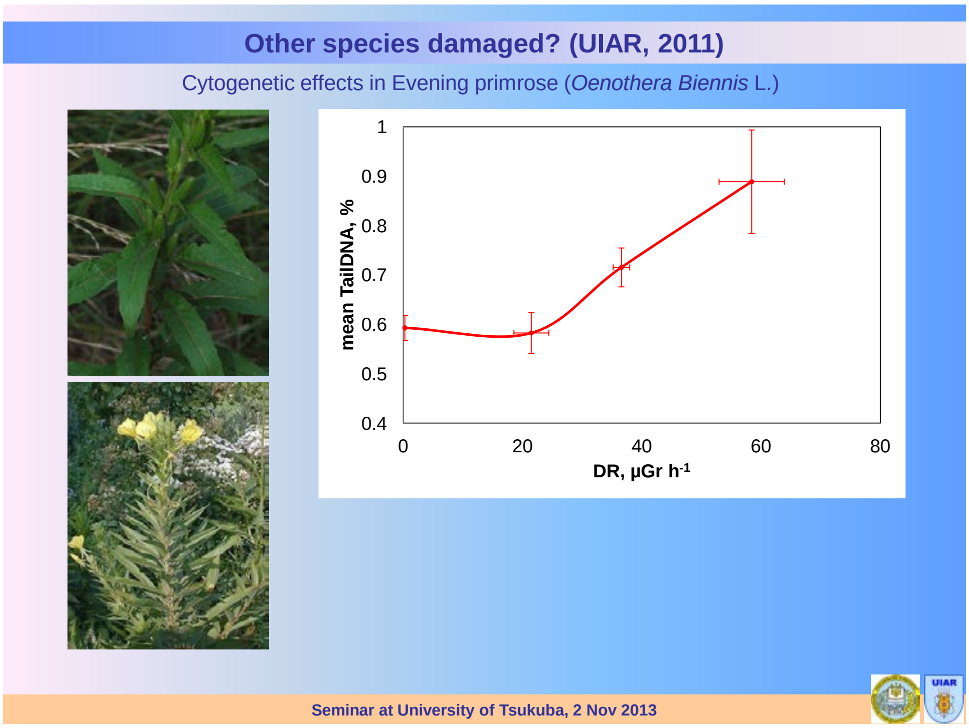


We might factor that [Unclear]

Thus in this way we obtained the dosing factor, the morphological change and the cytogenetic change.

This is important that now [Unclear] screening value is for direct [Unclear] is on your left hand microgray per hour which seems to be same but...

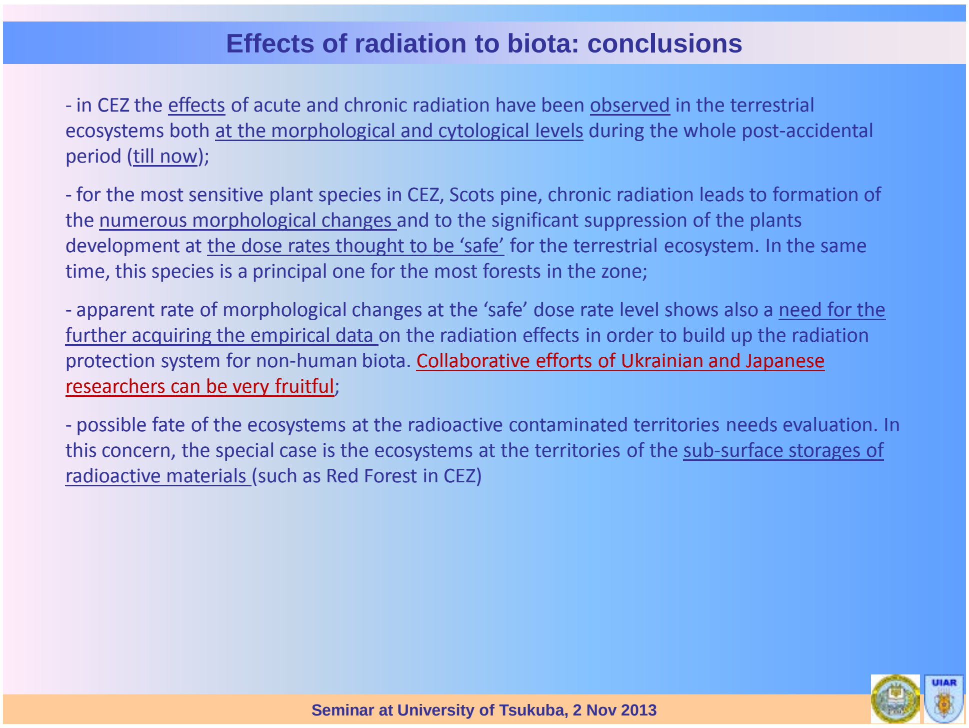
...but in our case, for our ecosystem it was [Unclear] ecological change in each Scots tree.



And also there are some other species.

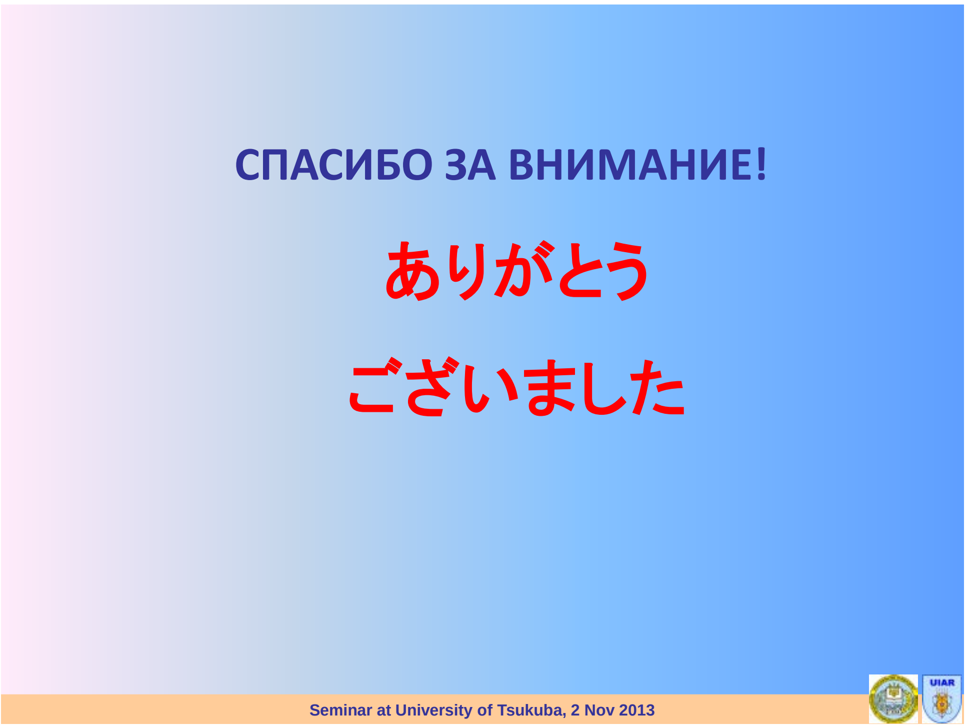
We demonstrate the kind of cytogenetic change in the dose rate.

By the way, I saw this grass yesterday at one of the site near Fukushima site.



I already spoke a lot so from here I will speak to the conclusions because it is what our [Unclear] it is important I believe that in collaborative research we can introduce reliable system of radiation protection of biota.

We've published – this is our publication.



Thank you very much.

質　疑

Dr. Vasyl Yoschenko

Well as I told you that we included in our experimental analysis of treatment with 1100 trees. Approximately 600 of this were selected as Red Forest area and we had frontal [ph] site outside the exclusion zone with 100 trees and there other trees are selected on the west dominated areas of the exclusion zone.

[Japanese]

Dr. Vasyl Yoschenko

But we observe the increased effect of morphological changes requisite even as the territory is less contaminated territories than in the Red Forest.

[Japanese]

Male Participant

Yeah. I want to know because Red Forest area is the right areas but very famous place is trench experiment site. Trench site, I think, is a small area but your study site is outside of trench inside the Red Forest area, yeah?

Dr. Vasyl Yoschenko

Well, our study site in [Unclear] was trench and some adjacent territory. This adjacent territory [Unclear]. Red Forest is very convenient site for us because in the trench we have very contaminated material contained. With the trenches this is much less contaminated, so we have almost the same conditions, almost the same trees, but at the site at very different dose rates. Inside the Red Forest those [Unclear] pine tree. Those rates [Unclear] to the trees and this I forgot to tell that this low rates are caused mainly by the root uptake of strontium-90.

Male Participant

So in the trench area, outside the trench area contamination level is not so different?

Dr. Vasyl Yoschenko
It's much lower. Because the history of this site and of the forest 40 years old pine forest. The first cloud of the explosion passed through this territory and the [Unclear]. And those are autumn of 1986, the green pine trees become red and as such this place got the name, Red Forest. Then the trees were cut and above this top soil was bulldozed in the trenches. This is the territory say 2 kilometer by 2 kilometer and then there are about 200 trenches in this territory. In general in the whole exclusion zone remember there are 800 such trenches. This is not the same, not the right kind for the [Unclear].

Male Participant
Thank you very much.

Male Participant
Thank you very much and I have two questions and first one is on the same as before. Most of the radiation took for the pine seedlings is coming from the internal dose mainly from the strontium-90, am I right?

Dr. Vasyl Yoschenko
Yes.

Male Participant
So the external dose is negligible in that area?

Dr. Vasyl Yoschenko
For the Red Forest, strontium-90 is more than 90% of the total – not total internal but the whole total. For the less contaminated territories, especially somewhere as [Unclear] models of the exclusion zone, the ratio can be different and the external radiation could be suddenly like half of the total group.

Male Participant
But the total dose is quite lower than the contaminated area?

Dr. Vasyl Yoschenko
Yes.

Male Participant

Okay. Thank you. The second one is about forest fire experiment. Did you find any difference of the chemical or physical form between the cesium and plutonium? Are they included in the same particles in air or different in air?

Dr. Vasyl Yoschenko

Unfortunately I don't have the trends here but we measured the dispersal composition of various radionuclides in air. It's clear that, for example, for the forest fire cesium is transferred with vapor [ph] and water groups and [Unclear] deposit material [Unclear]. There are some parts in this of ash zone but for plutonium the general rule is that it metabolize is associated with finer particles, than cesium and especially strontium. Strontium was reduced from the biomass and plutonium was mainly released from litter, maybe even from litter in the case that because the particles are lower and again we don't want as much plutonium in the biomass.

Male Participant

If we see the composition of the radionuclides in air, does the change depends on the distance from the fire place?

Dr. Vasyl Yoschenko

Yes, also there is dependence on radiation.

Male Participant

If we compare it between cesium and the plutonium, which element will go farther?

Dr. Vasyl Yoschenko

Here, this is one concentration of [Unclear] nuclides plutonium [Unclear] for one grass on fire it was almost the same. Here for another grass on fire, we had the decrease of cesium and strontium in the spot. Total volume of deposition was in the more distant area [Unclear] which means that there were fine particles transported to the bigger distance. Mostly you can see increased plutonium deposition at a higher distance and here internal is more or less the same.

Male Participant

Okay, thank you. So it might be 10 on the forest fire type and [Unclear] 5 itself type of [Unclear] I mean which are intensively higher or something like that.

Dr. Vasyl Yoschenko

Yes. We performed our experiment on surface fire. Also we may think about the fire of big intensities we will have countermeasures – so but we have countermeasures for this case. And [Unclear] it's a very worse scenario. Of all the forest in the exclusion zone [Unclear] with – in intense fire with the initial [Unclear] higher and, of course, the activity will be [Unclear]. In this case if you have the higher [Unclear] we have redistribution with distance while plume particles travel [Unclear] so it is from the concentrations of in the east due to this factor. We found [Unclear] that for this case then there will not be any important transfer of radionuclides outside the exclusion zone. The only problems can be related I skipped the conclusion part of [Unclear], in generally the only problems can remain to the firefighters.

Male Participant

And I saw that most of the radiation dose is coming from the plutonium, so if we think about the Japanese case it can be negligible with the forest value curves?

Dr. Vasyl Yoschenko

Yes.

Male Participant

I understand. Thank you.

Female Participant

Thank you. My question is also forest fire related [ph]. How many days does plume of fire remain in the air from the breakout of fire?

Dr. Vasyl Yoschenko

How long time the plume exists in air after the release?

Female Participant

Yes, yes. How many days plume in the air from the fire break?

Dr. Vasyl Yoschenko

We make our fire in forest you can see this is in this forest, which is approximately 1 hectare area. It was burnt in say something like 2 hours. The fire completed and the plumes burned to some say several hundred meters. But of course, maybe there could be another stage of the fire which is just small burning, which can last for some period after the fire. Of course, we could not leave this forest after the fire. The firefighters use quite some waterproof [Unclear]. In general, it can be say several hours up to maybe days but this is if there is a big fire.

Female Participant

I see. It remained only 3 hours or 4 hours only in the air and how long it takes from Chernobyl to Kiev in the plume of – sorry?

Dr. Vasyl Yoschenko

I see. Well, first, the time depends on the [Unclear] okay, but I have to emphasize the plume particles and the particles released from [Unclear] are different but smoke itself which can travel big distance as I've shown from Chernobyl to Kiev like that. The release from the fire [Unclear] likely will never get for such big difference. The impact of that area maybe kilometers pretty much.

Female Participant

Okay, thank you. Plume is not smoke and it's very different…

Dr. Vasyl Yoschenko

Yeah.

Female Participant

Okay, thank you.

Male Participant

Is there any relationship between the concentration in materials that was burnt in the concentration, the total amount in atmosphere?

Dr. Vasyl Yoschenko

If you look at this, this is the fraction which can be released during the –but this is for our case for [Unclear] from forest fires. I would say that there is an intensive grass on fires but we also have very big productivity of grass at the sites here in turn [ph]. I believe it would be site specific but in general in this order of magnitude for the release.

[Japanese]

Male Participant

Thank you very much.

Dr. Vasyl Yoschenko

Thank you.

01:40:03 – 01:44:17

[Multiple Speakers]

END