



Management of contaminated forest and meadow environments in Ukraine based on monitoring data and model predictions

Kashparov Valery

*Ukrainian Institute of Agricultural Radiology
of NUBiP of Ukraine.
08162, Mashinostroitelej street, 7, Chabany,
Kiev' region,
Ukraine*

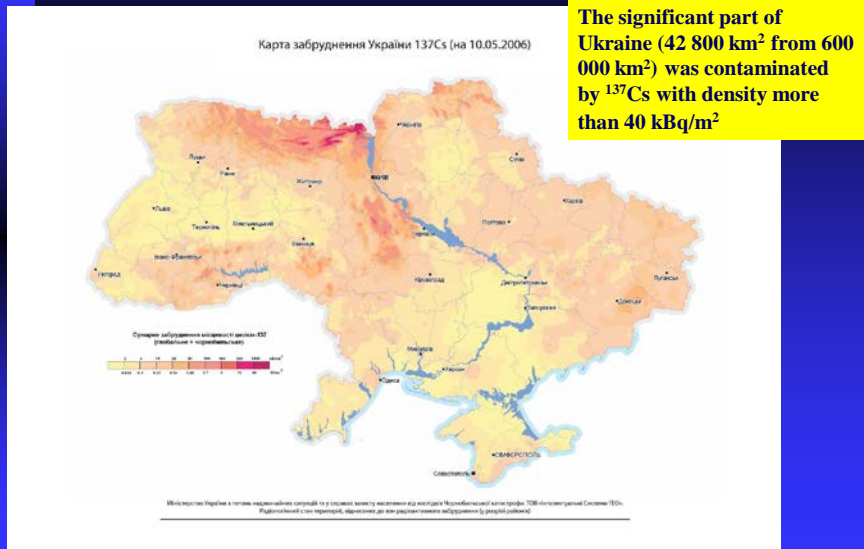


*Tel./fax: (+38044) 5261246
E-mail: vak@uiar.kiev.ua
<http://www.uia.org.ua/Eng/>*



Good afternoon dear colleagues. I'm Valery Kashparov from Ukrainian Institute of Agricultural Radiology. I work in this institute for 27 years and for the past 5 years I'm Director of the institute.

^{137}Cs contamination of Ukraine (Atlas, 2008)



For 2008 area with ^{137}Cs contamination $> 40 \text{ kBq/m}^2$ was 25 500 km², but the area of the zones of radioactive contamination are 53 000 km²



About 40,000 square kilometers was contaminated in Ukraine after the Chernobyl accident.



The forest area of Ukraine with different densities of soil ^{134,137}Cs contamination (1.01.93)

Region	The forest area, thousands of hectares				
	Total	^{134,137} Cs density of contamination, kBq/m ²			
		37-185	185-555	555-1480	6onee 1480
Vinnitsa	31.1	30.6	0.5		
Volyn	42.2	42.2			
Zhytomyr	442.6	343.5	66.7	27.0	5.4
Kiev	194.2	167.4	18.5	4.2	4.1
Rivne	377.9	366.9	11.0		
Sumy	12.5	8.0	4.5		
Cherkasy	39.0	38.4	0.6		
Chernihiv	74.7	70.4	4.2	0.1	
Donetsk	2.9	2.9			
Kirovograd	0.7	0.7			
Lugansk	1.0	1.0			
Odessa	2.7	2.7			
Ternopil	8.4	8.4			
Khmelnitsky	3.9	3.9			
Total	1233.8	1087.0	106.0	31.3	9.5

The areas of contaminated forest now mostly were above 1 million hectare in Ukraine.

Permissible hygienic norms for the ^{137}Cs and ^{90}Sr specific activities in timber and timber production

Production	Permissible level, Bq/kg	
	^{137}Cs	^{90}Sr
Industrial application		
<i>1. Rough wood</i>		
1. Ricker		
- unbarked wood	1500	-
- barked wood	1000	-
- raw materials for veneer and plywood	1000	-
- construction timber for industrial building and temporary buildings	1500	-
- pulpwood	1500	-
- timber for props	3000	-
2. Firewood for technological needs	1500	-
<i>2. Sawn timber</i>		
- edge-unsurfaced lumber	1000	-
- edge-surfaced lumber	740	-
- squared beam, parquet (incl. for manufacturing the furniture)	740	-
- sawn material for Eurotrays	1500	-
- box board and beam	1000	-
<i>3. Production for domestic and economical use</i>		
- firewood	600	60
- fencing wood	1000	-
- souvenirs, domestic appliances (handles, kitchen boards)	740	-



For the forest production we have the permissible level from 2005 in Ukraine. You can see this.

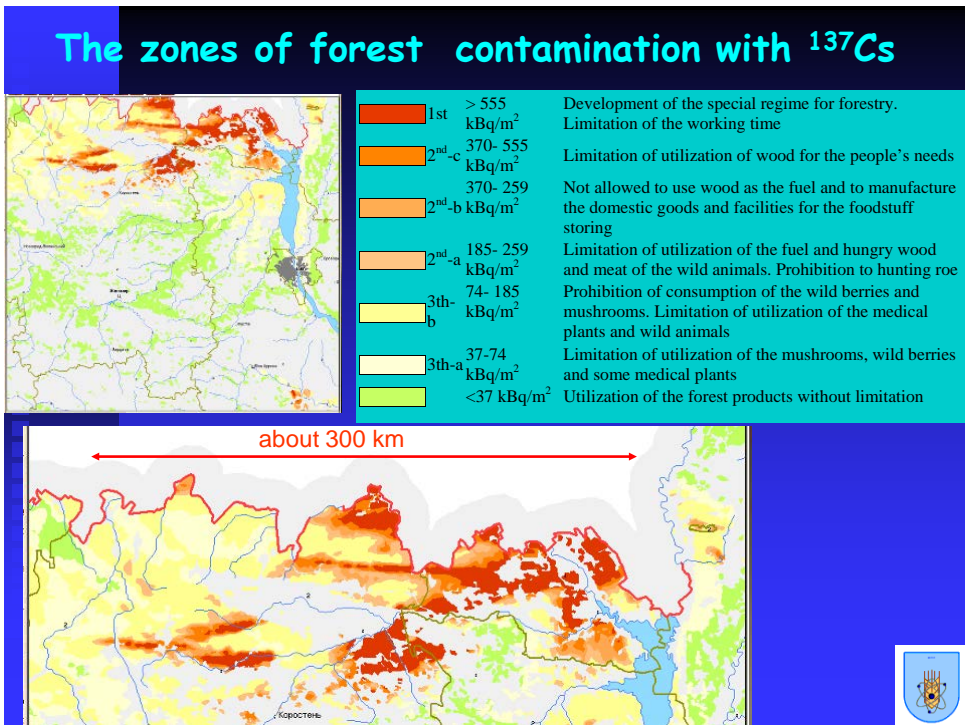
Permissible levels (action levels, Bq/kg) for radionuclides in forestry foodstuff after the Chernobyl accident in Ukraine

FOODSTUFF	Ukraine PL-97 and PL-2006	Japan 2012
Fresh mushrooms and wild berries fresh, frozen, canned	500	100
Dried mushrooms and wild berries	2500	100
Meat of wild animals and birds	400	100
Milk	100	50
Infant food	40	50
Vegetables and fruit	40-70	100
Bread, flour, cereals	20	100



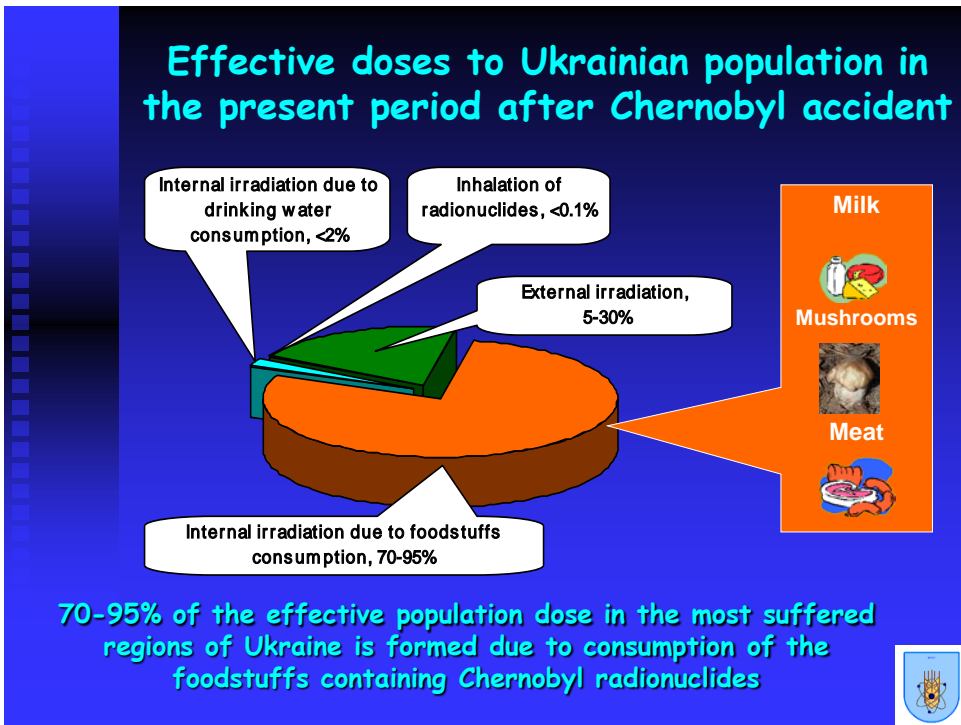
Also we have the permissible level for the mushrooms, berry, and the meat of wild animals.

You can see this level is more or less [Unclear] this permissible level in Japan.



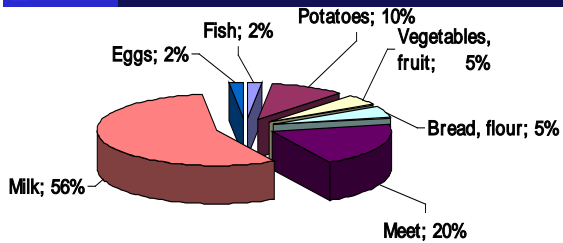
In the Ukraine, from the density of contamination of the territory we have the different zone of forest contamination.

It's a very big territory where we have the density of contamination higher, 37 kilobecquerel per square meter. We have the validation limitation for the mushrooms and wild berry.



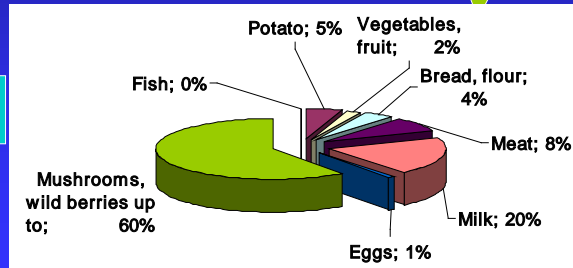
Now Ukraine is most important internal dose of radiation concentration it's higher at 70% by the uptake of radiocesium is milk, mushrooms, and meat.

Averaged contribution of different products to the peroral ^{137}Cs uptake by the rural population



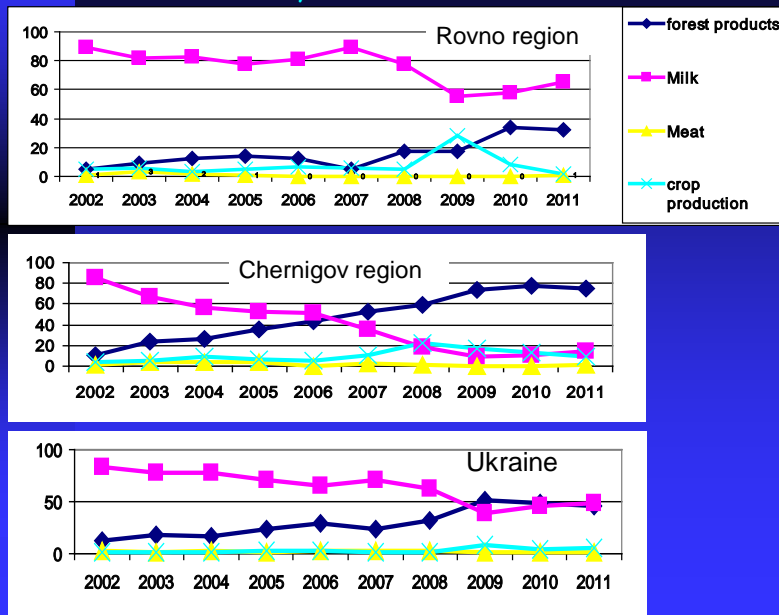
human diet with forest gifts

human diet without forest gifts



The influence of forest product is very high and for the settlement near the forest the influence of mushrooms and wild berry to the uptake of cesium in the border maybe up to 70% of the total uptake.

Relative trend in the number of samples in Ukraine with excess of PL, %



We have the increase of influence of forest products in Ukraine, this time. The relative amount of the sample this activity concentration of cesium high permissible level. For the milk, forest product and milk and flour products. You can see about 50% now high permissible levels its forest product and the milk in Ukraine. For Chernigov region, the forest product is about 80% of sample is high permissible level.

Forestry

■ *Management based countermeasures*

- Restriction of access to contaminated forests and restriction of the use of forest products was the main countermeasure applied in Ukraine:
- Restricted access, including restrictions on public and forest worker access as a countermeasure against external exposure.
- Restricted harvesting of food products such as game, berries and mushrooms by the public that contributed to reduction of internal doses and education on issues such as food preparation.
- Restricted collection of firewood by the public to prevent exposures in the home and garden when the wood is burned and the ash is disposed of or used as a fertiliser.
- Alteration of hunting practices aiming to avoid consumption of meat with high seasonal levels of radiocaesium.
- Fire prevention.

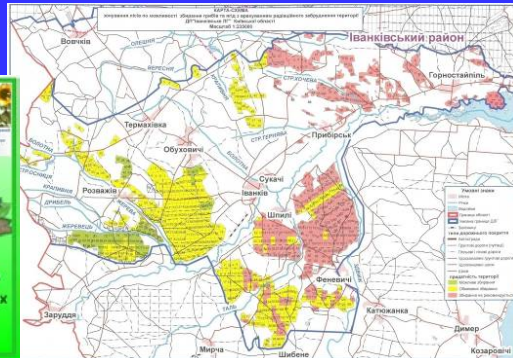


After the Chernobyl accident we use different countermeasures in our agricultural production. For the forest we used only restriction of access for different forest production of the mushroom, berry, root and [Unclear].

Forestry

Technologically based countermeasures

includes the use of machinery and/or chemical treatments to alter the distribution or transfer of radiocaesium in the forest have not been applied after the Chernobyl accident in Ukraine





We don't use the contamination cleanup in the forest after the Chernobyl and specific of our soil and we don't use these countermeasures.

Very important is now and during the time of the accident that it was information of population about the real contamination of forest products.

For example, here is a map site where the level of contamination of mushrooms is highly permissible level, less permissible level. It's information for that place, mass media.

Processing factors (ratio of activity concentrations in the product after and before processing) for various foodstuffs

Countermeasure	¹³⁷ Cs
Washing of vegetables, berry and fruits	0.8-0.9
Boiling of vegetables, berry and fruits	0.5-0.8
Pickling of vegetables and fruits	0.2-0.9
Processing vegetables, berry and fruits to juice	0.4-1
Washing of mushrooms	0.4
Boiling of mushrooms	0.1-0.3
Soaking of mushrooms	0.1
Pickling of mushrooms	0.1-0.2


Very important for the forest products is processing of mushrooms, for example, because if you eat use the boiling of mushrooms, pickling of mushrooms, the reduction factor maybe [Unclear].

http://www.uiar.org.ua/Russ/index.htm

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Радіоактивне забруднення ^{137}Cs грибів

Експериментальні дані НВПІ України по вмісту ^{137}Cs в пробах грибів
(Норматив (ДР-2884) - 588 Бк/кг сирого та 2588 Бк/кг сушеного)

№	Проба	Дата збирання	Місце збирання	^{137}Cs , Бк/кг	Аб. %
Гриби					
1	Лисичка(сморчок) (сирого в.)	31.07.12	Закарпатський р-н, с. Рудка	280	15
2	Лисичка	1.03.12	Закарпатський р-н, с. Яворин	240	15
3	Лисичка	11.09.12	Закарпатський р-н, с. Ціпля	658	25
4	(Boletus edulis)	11.10.12	Закарпатський р-н, с. Ціпля	1958	20
5		11.09.12	Закарпатський р-н, с. Ціпля	2726	18
6		11.09.12	с.м.т. Івано-Франківськ	265	12
7		11.09.12	Закарпатський р-н, с. Стари. Славина	250	15
8		1.03.12	Закарпатський р-н, с. Яворин (сирого)	2258	17
9	Радикальна цибуля (Погодинський лісництво)	29.05.12	Закарпатський р-н, с. Яворин	2558	15
10	Рудка (сирого в.)	29.09.12	Закарпатський р-н, с. Яворин	588	15
11	Рудка (сирого в.)	10.10.12	Закарпатський р-н, с. Глибочинський	201	10
12	Полічник (сирого в.)	29.05.12	Закарпатський р-н, с. Яворин	1188	14
13	Полічник (сирого в.)	10.10.12	Закарпатський р-н, с. Глибочинський	1037	10
14		11.09.12	с.м.т. Івано-Франківськ	2726	18
15		10.10.12	Закарпатський р-н, с. Глибочинський	728	10
16		10.10.12	Закарпатський р-н, с. Глибочинський	2488	10
17	Пабарбарочка	18.10.12	Закарпатський р-н, с. Глибочинський	2588	10
18	(сирого в.)	18.10.12	с.м.т. Івано-Франківськ	50	10

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We have the system of control contamination of forest product. For example, berries, mushrooms and people can see this information on the site of our institute.

The decrease of the ^{137}Cs specific activity of in the components of forest ecosystems is very slow ($T_{1/2}=20\text{-}30$ years), from Chernobyl forum, 2005

Environmental Consequences of the Chernobyl Accident and their Remediation: Twenty Years of Experience

Report of the Chernobyl Forum Expert Group: Environment

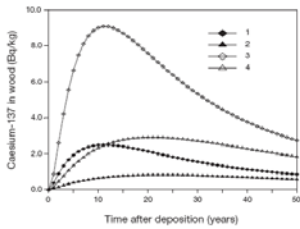
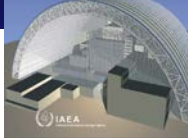


FIG. 3.43. Predicted ^{137}Cs activity concentration in wood for different types of forest soil and ages of trees calculated using a computer model, FORESTLAND, for a deposition of 1 kBq/m^2 [3.87]. 1, 2: automorphic soil, 3, 4: semi-hydromorphic soil, 1, 3: initial age 20 years; 2, 4: initial age 80 years

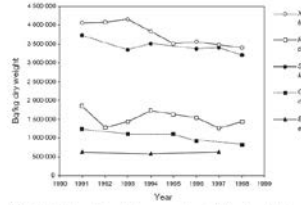


FIG. 3.40. Caesium 137 activity concentrations (Bq/kg dry weight) in selected mushroom species harvested in a pine forest in the Zhytomyr region of Ukraine, approximately 130 km south-west of Chernobyl. The soil deposition of ^{137}Cs at this site in 1986 was 555 kBq/m^2 . From Ref. [3.68].

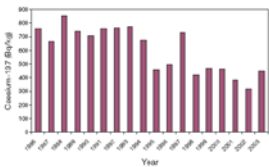


FIG. 3.41. The average concentration of ^{137}Cs in moose in one hunting area in Sweden, based on approximately 100 animals per year [3.83].



Now, the process of the least contamination of root, mushrooms, meat of wild animals decreasing very slowly, a small change we studied.

Decision-making support for forestry on the contaminated areas after nuclear and radiation accidents

- return to economic use of forests excluded
- long-term management of contaminated forest

What we want?

Long-term (till 100 years) prognoses of wood and gift radioactive contamination in a different forest type (mushrooms, game, berries, edible parts of plants ...), and also local milk production in forest

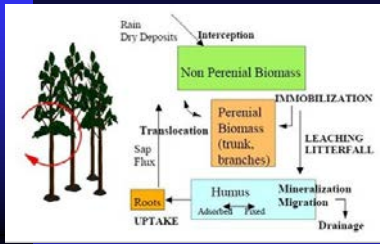


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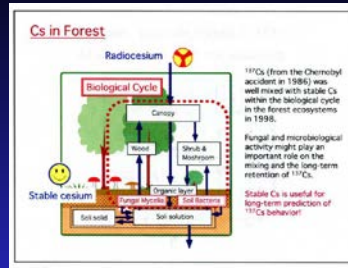
What is important task now for us is return to economic use of forest excluded up producing after the accident and long-term management of contamination forest.

We start the long-term prognoses of wood and different forest product contamination is very important.

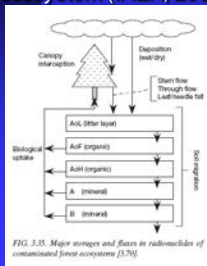
Conceptual models for the Fukushima and Chernobyl forest areas



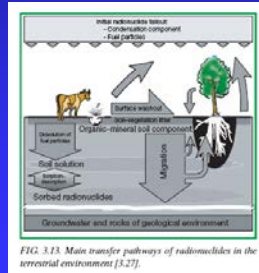
- A general scheme of the biogeochemical cycling of radiocaesium within a forest ecosystem (IAEA, 2002)



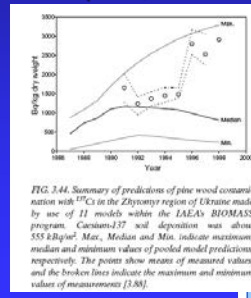
- Satoshi YOSHIDA (NIRS, Japan)



FORESTLAND (Fesenko S.)



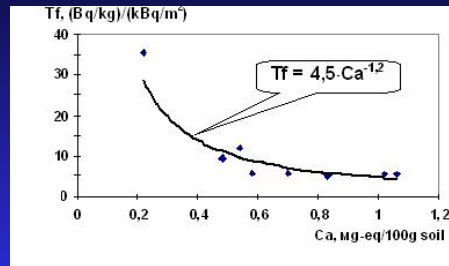
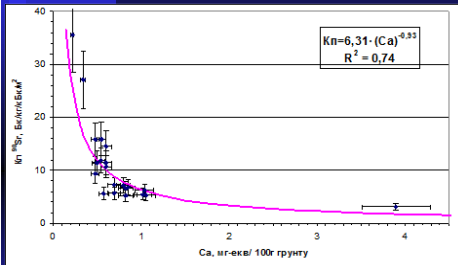
- MATPASS, UIAR, Ukraine



There are very different model of migration of radionuclide in forest ecosystem.

The concept of this model is the same.

Dependence of transfer factor of ^{90}Sr in the pine wood on the content of exchangeable calcium in the mineral layer (0-20 cm) of soil.



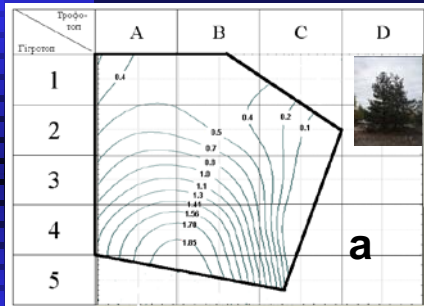
- Normally, exchangeable calcium content in the pine forests growing at the soddy-podzolic soils in the north of Kyiv region is 0.5-1 mg-eq per 100 g of soil. The ^{90}Sr soil-to-pine wood transfer factor is **5-10 (Bq/kg)/(kBq/m²)**. Taking into account the permissible level for ^{90}Sr in the firewood (60 Bq/kg) we can derive the level of the maximum terrestrial density of contamination with ^{90}Sr of **6-12 kBq/m²**, which allows to manufacture the pine wood with the ^{90}Sr specific activity less than 60 Bq/kg.




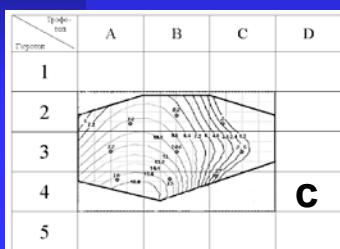
Its migration radionuclide to litter from litter to the soil and the trees and plants [Unclear].

We cannot with transfer factor of strontium for the wood, for example, we have very good dependence from the content in the soil exchangeable calcium.

Transfer factors (Tf) of ^{137}Cs : a- to wood of *Pinus sylvestris* (d.w.), b - to mushrooms: c - to berries of *Vaccinium myrtillus* (f.w.) in the ecological area



Τροφολογία \ Γεωτόπος	A	B	C	D
1	33,33	30,0	12,8	7,2
2	30,2	23,57	19,3	8,0
3	54,1	43,6	20,7	8,3
4				b
5				



For the cesium we use ecological situation in the forest. It's the properties of the soil and the environment condition for the transfer coefficient, for example, cesium to the root and mushrooms and berries.

For example, you can see for the pine trees the difference mainly 20 times.

Radioactive contamination of milk at use of meadows in forest



№/№	Назва територія, населений пункт (назва району)	Дата обстеження	¹³⁷ Cs у г/кг сирого молока	Філія господарства	¹³⁷ Cs у млоч. Базі	Виробля. Базис
1012	Львівська 1 1012	21.06.2008	52	Кіровоград М.А.	226	11
1013	Львівська 1 1013	21.06.2008	52	Черкаська М.А.	244	4
1014	Львівська 1 1014	21.06.2008	52	Львівська Л.А.	136	8
1015	Львівська 1 1015	21.06.2008	52	Львівська Л.А.	141	20
1016	Львівська 1 1016	21.06.2008	52	Львівська Л.А.	171	25
1017	Львівська 1 1017	21.06.2008	52	Львівська Л.А.	184	21
1018	Львівська 1 1018	21.06.2008	52	Львівська Л.А.	186	27
1019	Львівська 1 1019	21.06.2008	52	Львівська Л.А.	202	11
1020	Львівська 1 1020	21.06.2008	52	Львівська Л.А.	218	12
1021	Львівська 2 1021	20.06.2008	45	Хмельницька І.В.	138	6
1022	Львівська 2 1022	20.06.2008	45	Львівська І.В.	140	6
1023	Львівська 2 1023	20.06.2008	45	Львівська І.В.	140	7
1024	Львівська 2 1024	20.06.2008	45	Львівська І.В.	150	6
1025	Львівська 2 1025	20.06.2008	45	Львівська І.В.	150	8
1026	Львівська 2 1026	20.06.2008	45	Львівська І.В.	150	10
1027	Львівська 2 1027	20.06.2008	45	Львівська І.В.	150	7
1028	Львівська 2 1028	20.06.2008	45	Львівська І.В.	150	10
1029	Львівська 2 1029	20.06.2008	45	Львівська І.В.	150	10
1030	Львівська 2 1030	20.06.2008	45	Львівська І.В.	150	10
1031	Львівська 2 1031	20.06.2008	45	Львівська І.В.	150	10
1032	Львівська 2 1032	20.06.2008	45	Львівська І.В.	150	10
1033	Львівська 2 1033	20.06.2008	45	Львівська І.В.	150	10
1034	Львівська 2 1034	20.06.2008	45	Львівська І.В.	150	10
1035	Львівська 2 1035	20.06.2008	45	Львівська І.В.	150	10
1036	Львівська 2 1036	20.06.2008	45	Львівська І.В.	150	10
1037	Львівська 2 1037	20.06.2008	45	Львівська І.В.	150	10
1038	Львівська 2 1038	20.06.2008	45	Львівська І.В.	150	10
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1047	Львівська 2 1047	20.06.2008	45	Львівська І.В.	150	10
1048	Львівська 2 1048	20.06.2008	45	Львівська І.В.	150	10
1049	Львівська 2 1049	20.06.2008	45	Львівська І.В.	150	10
1050	Львівська 2 1050	20.06.2008	45	Львівська І.В.	150	10

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Also we have information about the contamination of milk if the people use meadow in forest, small area.

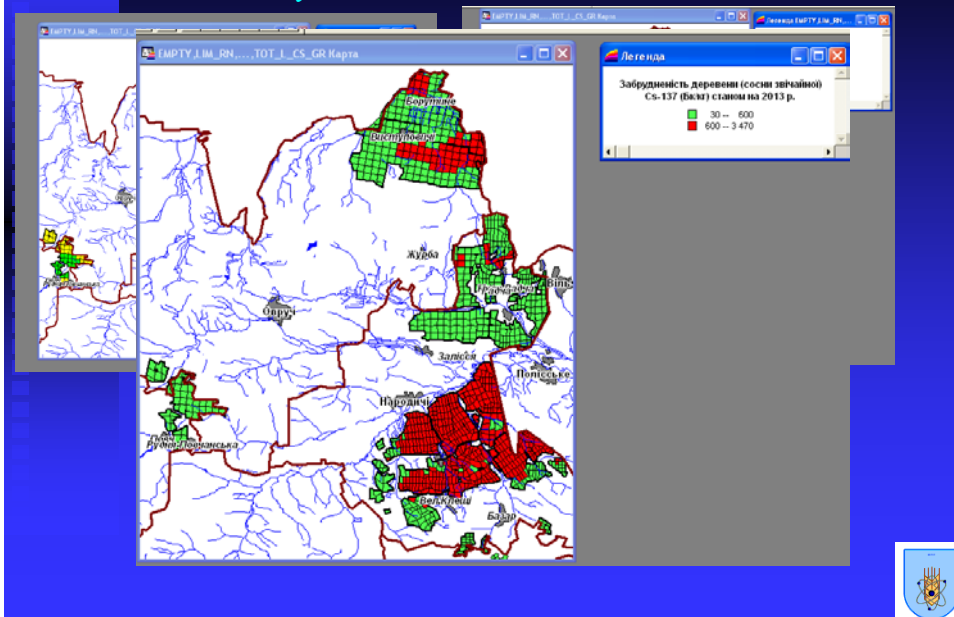
Decision-making support for forestry on the contaminated areas after nuclear and radiation accidents (return to economic use of forests excluded)

The screenshot displays the ESTER software interface. On the left, there is a data entry form with fields for 'Номер объекта', 'Дата обследования', 'Состояние древесины', 'Тип лесозащитного участка', 'Приспособление', 'Возраст древесины', and 'Бюджет леса'. Below these fields is a table with columns for 'Элемент лес.', 'Возраст, л.', 'Высота, м.', and 'Диаметр, см.'. The main window shows a map of a forest area with a color-coded legend indicating different levels of contamination. A smaller window titled 'База данных' is visible at the bottom left, showing a list of objects for inventory.

- The software **ESTER** (Expert Support of Technology for Remediation) has been developed within framework of IAEA Technical Co-operation Projects RER/3/004 "Radiological support for the rehabilitation of the areas affected by the Chernobyl nuclear power plant accident" in 2008–2011

For the each site of contamination the forest in Ukraine we have the data pins. This software was created with the support of International Atomic Agency. We have the contamination of the soil, the different forest characteristics of each site. Contamination properties of the soil, contamination of the mushrooms, etcetera.

The software ESTER (Expert Support of Technology for Remediation)



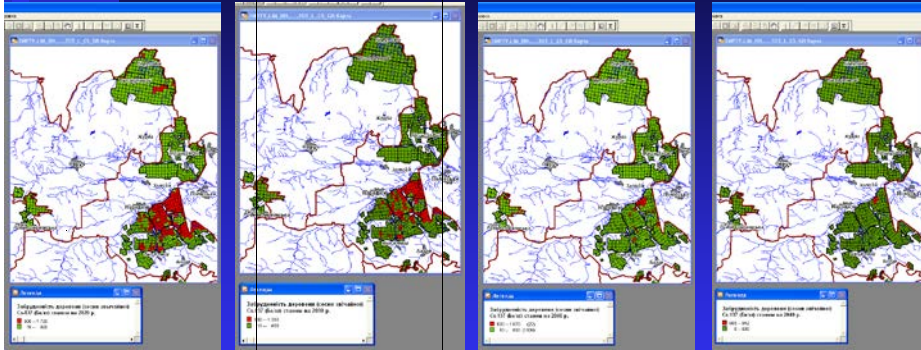
Here you can see the density of contamination for each site forest. And here is the properties of the soil.

From this data we can calculate the contamination of the root, different kinds of wood.

This varies 600 becquerel per kilogram is permissible level in Ukraine for cesium for the firewood.

Red, its territory higher with contamination and below [Unclear].

The software ESTER - Decision-making support for forestry on the contaminated areas after nuclear and radiation accidents



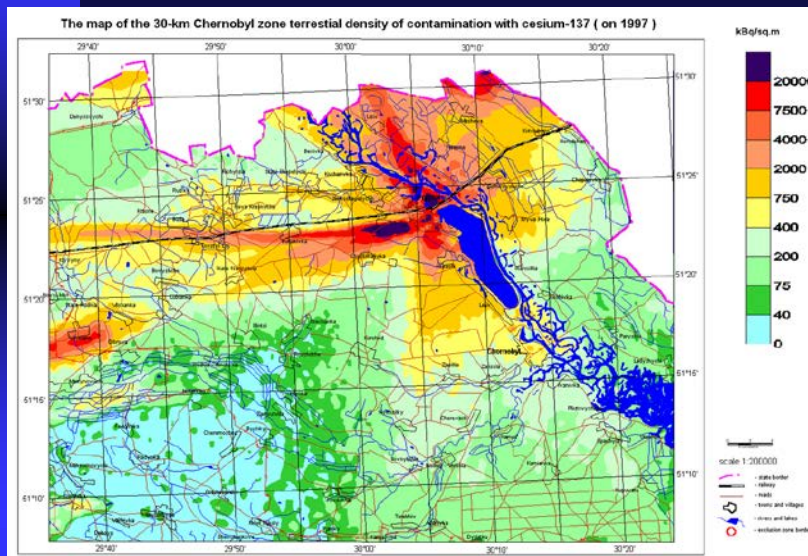
- Distribution quarters to forestry Zhytomyr Oblast at the 2020-2050 year where ^{137}Cs content in the wood would not exceed the hygienic standards– 600 Bq/kg



Here you can see the same estimation for different time for 2020, 2030, 2040 and 2050.

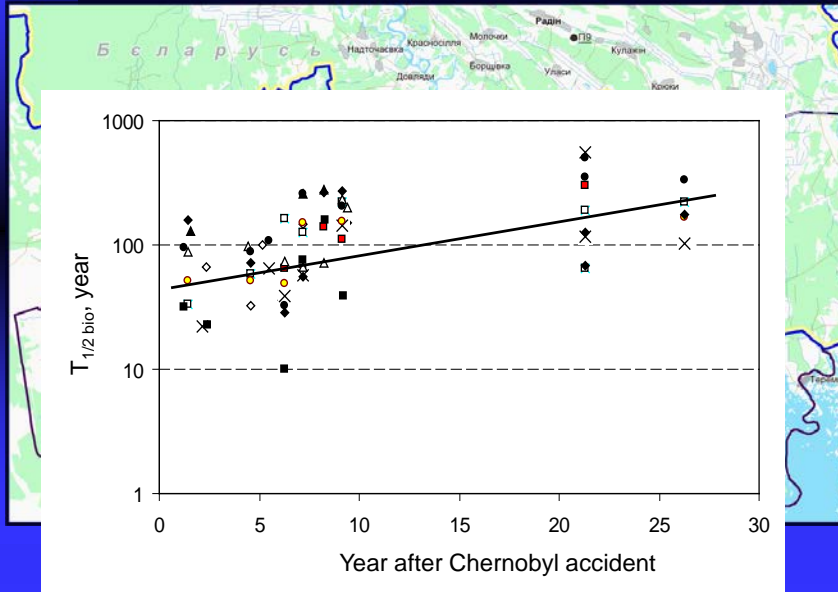
In 2040 year we will have very small area with contamination of wood high 600 becquerel [Unclear].

Our experimental sites in 30-km exclusion zone



Exclusion zone is most contaminated territory, 30 kilometer zone [Unclear].
The maps of the zone is strontium and plutonium was created [Unclear].

Vertical ^{137}Cs migration in soil is very small



We studied vertical migration of radionuclide for different conditions in the exclusion zone. The point or cycles are studied.

We studied the migration after the incident and during range of 7 years.

Now, in real we have a vertical migration of cesium and we have the biological half life of cesium higher 100 years.

It's equilibrium condition of [Unclear]. Okay, it's half life – the eligible [ph] half life migration of cesium from root layer it's for the 10 centimeter of needle.

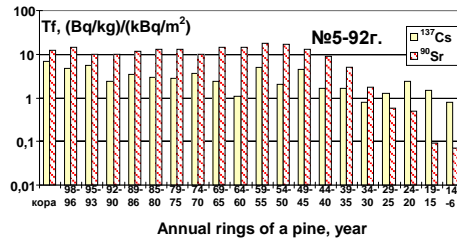
So, 10 centimeter of root layer.

12 site in forest



Tf ^{137}Cs : oak > pine > aspen > birch > acacia

Site ID	Coordinates		Trees species	Age, years
	latitude	longitude		
PP 1	51°18'59"	30°07'54"	Pines, birch	25-30
PP 2	51°22'22"	30°01'14"	Pines, birch	45-55
PP 3	51°20'18"	30°08'32"	Pines, birch	35-40
PP 6	51°26'49"	30°08'12"	Pines	30-35
PP 7	51°28'52"	30°07'47"	Pines	20-25
PP 8	51°26'17"	30°06'37"	Pines, birch, oak, aspen	25-30
PP 9	51°24'15"	30°02'21"	Pines	40-45
PP 11	51°21'05"	29°59'01"	Pines, birch, aspen	40-45
PP 12	51°22'43"	30°01'59"	-	8-12
PP 13	51°22'29"	30°00'44"	Pines, birch, oak, aspen	45-50
PP 14	51°19'11"	30°17'18"	Pines, oak, birch, aspen	40-45
PP 15	51°19'20"	30°17'01"	Pines	40-45



Tf ^{137}Cs : buds > needles of 1 year > twigs > inner bark > bark of lateral branches > needles of 2 year > branches of 2 year > outer bark > wood of lateral branches > stemwood (h=1.3m):

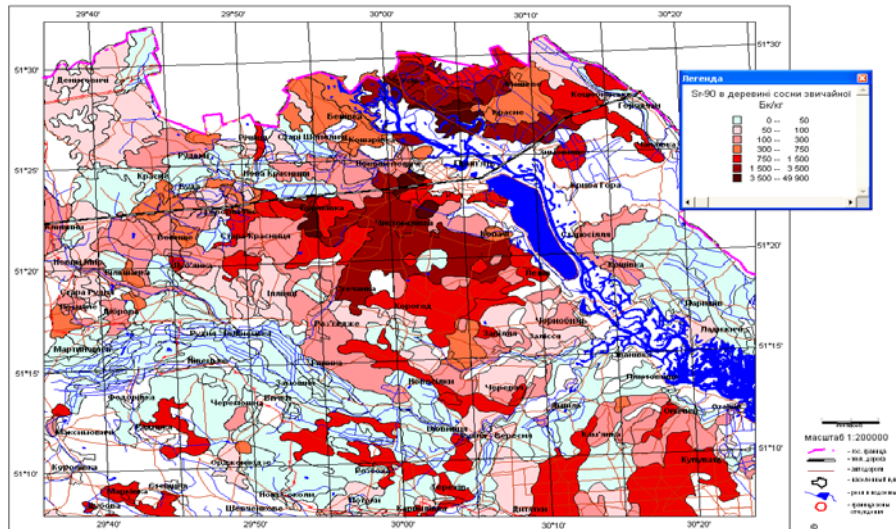


We have 12 experimental sites in forest in exclusion zone.

It's very different. Trees different, kind of forest.

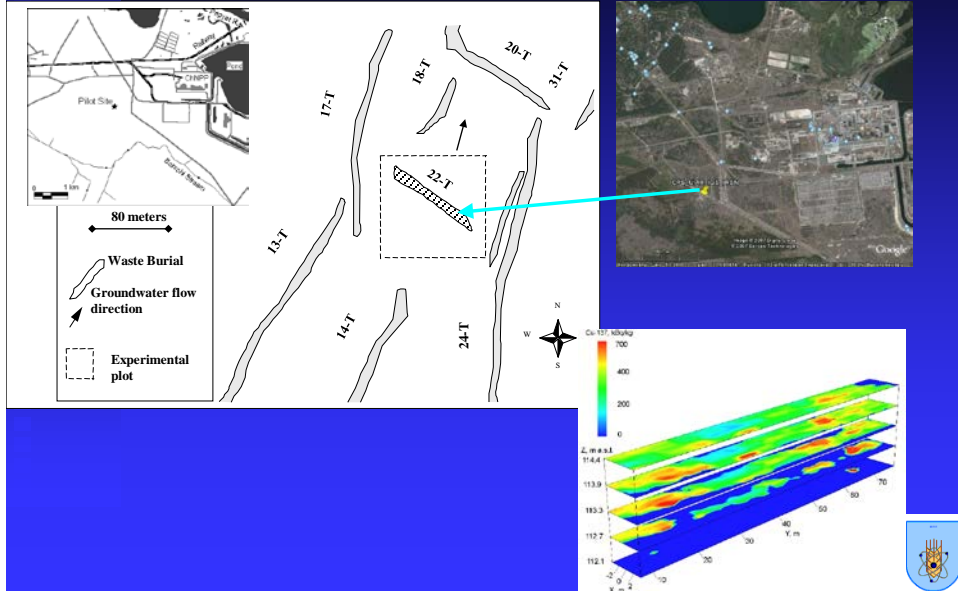
Here we study the contamination of the different part of trees, mushrooms, contamination of soils, migration of radionuclides in soil during [Unclear].

Map of predicted ^{90}Sr activity in the stemwood of Scots pine in 2030



Through these data we create the map of contamination, root, for example, for the 30 kilometer zone for different type of [Unclear].

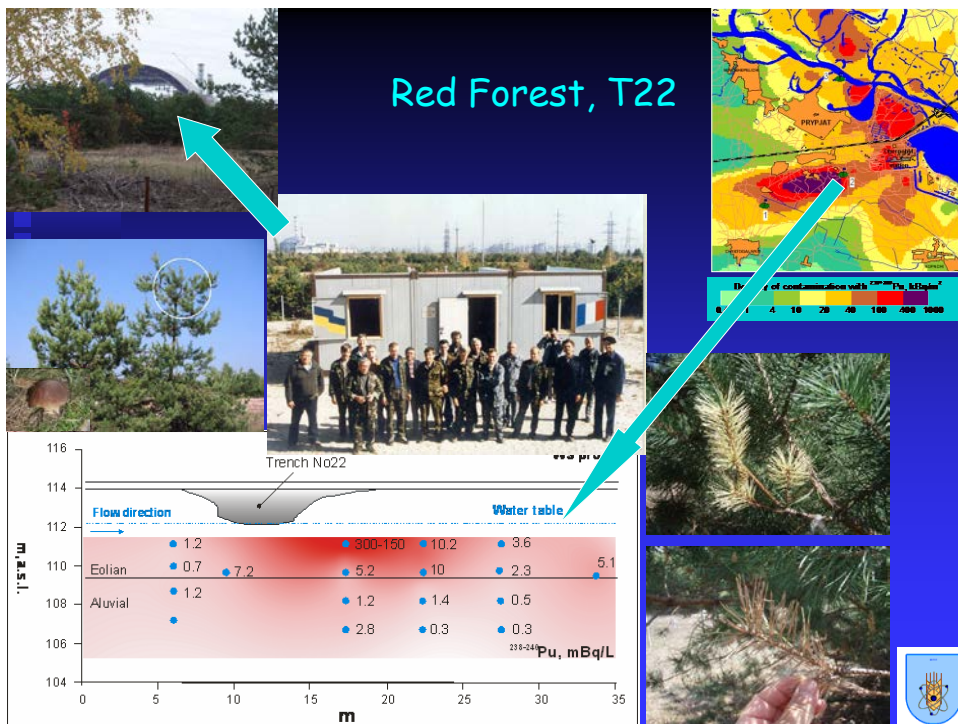
Chernobyl Pilot Site "Red Forest, T22"



Here, for example, for strontium.

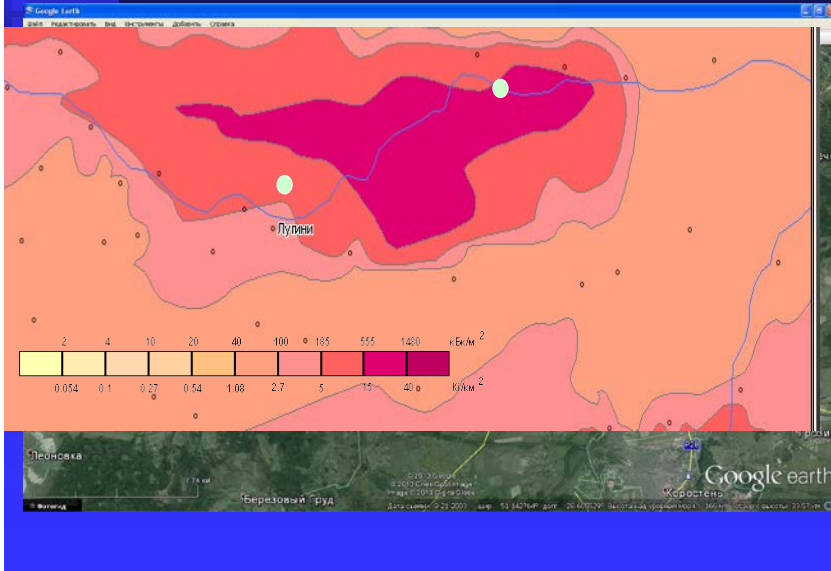
Also together with our French colleagues from Paris and we have the experimental site near the nuclear power plant, the Red Forest.

The range is relative storage [ph] with Red Forest, from the Red Forest



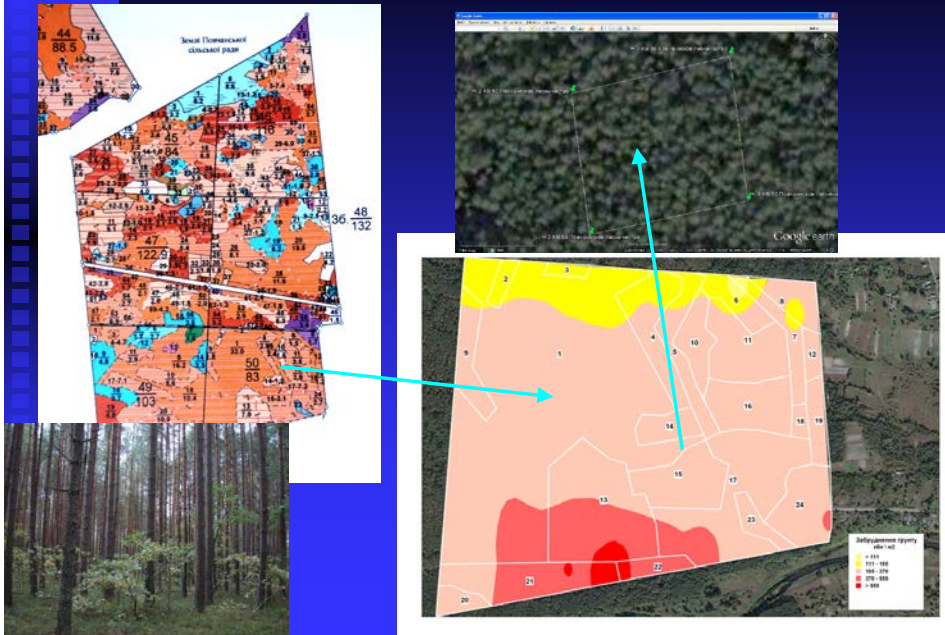
Here we study the migration of radionuclide from trench to the groundwater and from the trench to the trees.

UIAR site outside 30-km zone



In the next presentation, Dr. Yoschenko will speak about it.
Also we have the experimental site outside the exclusion zone.

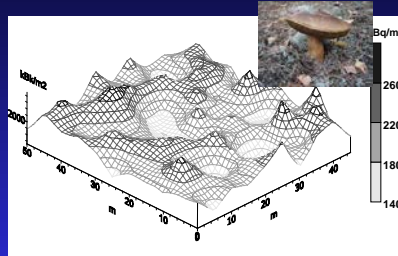
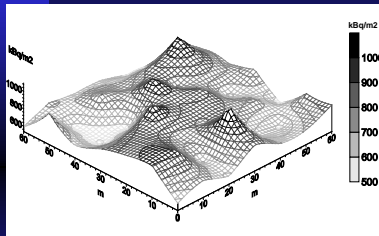
Povchanske, Zhitomir region of Ukraine (pine)



For example, here is experimental site in pine trees.

You can see the density of contamination is very, very different.

Geostatistical image of the ^{137}Cs contamination of the sites

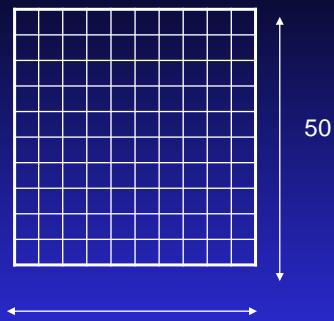


The standard deviation of logarithm of the soil contamination density with ^{137}Cs at the non-gradient contaminated sites for sampling area $> 50 \text{ cm}^2$ does not depend on the contamination density, type of fallout, features of landscape and in the first approximation (at the measurement uncertainty of the radionuclide activities in sub-samples of soil samples $\leq 10 \%$ at the level $\pm 2\sigma$) can be estimated as 0.30 ± 0.09



Here you can see the different density contamination for the very small site, 50 meter to 50 meter.

Povchanske, Zhitomir region of Ukraine - 222 trees



- Dose rate – 5 m;
- Soil sampling for density of contamination – 5 m;
- Vertical distribution – 5 points up to 40 cm;
- The characteristics of all trees
- Contamination of trees, mushrooms, bushes, grasses etc.



The measurement of the dose rate on our experimental site and the density of contamination is set 5 meter.

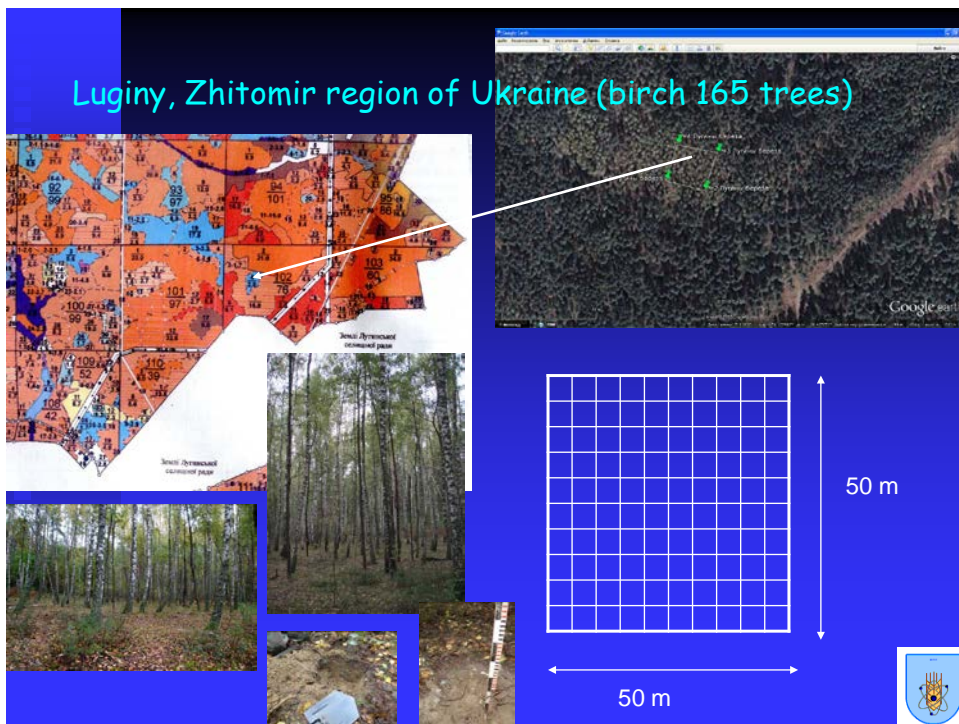
Also we will measure contamination old trees on the site, small site, 50 meter to 50 meter.

The clusters of radionuclide, the contamination of mushroom, berries and other parts.



Here you can see the typical soil profile, it's 10 centimeter.

[Unclear] layer is about 10 centimeter and litter also of the top, 10 centimeter.



Another site, it's another kind of trees. It's birch.
And also we have the same very, very identical measurement for each site for the verification of our model.

Taking into account the long-term significance of the forest radioecology studies in Ukraine and Japan, we would like to:

- - have the support of both Ukrainian and Japan governments for the national institutes;
- - have the complimentary studies, which would be consistent in ideological and methodological aspects on the basis of the close cooperation and staff exchange;

Taking into account the 27-y period since the Chernobyl accident, we can use the Chernobyl data for the more precise long-term prognosis of situation in the forests of Japan.

- Unfortunately, to the moment Ukrainian institutes do not possess all necessary up-to-date analytical methods.



And here is the conclusion what we want.

Just like to have the support of Ukrainian Government for our work and forest work.

Also we'd like to have the same method or methodological study of forest system for different team for the continue of the result and used for the validation of model in different condition.

And also in our case, we have very big time for the investigation and you can use this data for the prognosis your situation in future.

Thank you very much for your attention



Thank you very much for your attention.

Male Participant

Thank you very much Dr. Kashparov. Thank you very much.

質 疑

Male Participant

He told us mushrooms and berries are the dominant source of internal dose exposure of population, yes. Then we don't know what kind of food the local people eat usually but comparing with people in the town, city or urban areas.

Dr. Valery Kashparov

After the accident most important was animal production, milk and meat.

[Japanese]

Dr. Valery Kashparov

Consumption ratio of the milk [Unclear] above 100 liter.

[Japanese]

Dr. Valery Kashparov

The natural process absorption cesium and agricultural countermeasures, specific activity cesium in the milk decreased during this time, higher than 100 time, very big decrease in contamination of the milk.

[Japanese]

Dr. Valery Kashparov

Decrease in contamination of mushrooms during 27 year was about 3 or 4 time only.

[Japanese]

Dr. Valery Kashparov

The average consumption ratio of mushrooms for the population now about for the forest area it's about 10 kilogram per year.

[Japanese]

Dr. Valery Kashparov

It's fresh weight.

[Japanese]

Dr. Valery Kashparov

But the contamination of the mushroom is very high.

[Japanese]

Dr. Valery Kashparov

For example, in the distance, 300 kilometer from the Chernobyl we have the contamination of mushrooms 40,000 becquerel per kilogram per square meter.

[Japanese]

Dr. Valery Kashparov

This is becquerel in a kilogram.

[Japanese]

Male Participant

I have additional questions about the same point. At the beginning you told us that the internal dose is more important than the external dose for the residents in these areas. I think that is quite different from Japanese situations now, so I'd like to ask that how much percentage of the total food is coming from the local areas or how much percent is coming from other areas? So that I assume that most of the food in that area is coming from the local area from the forest or the kitchen gardens or something like that, am I right? Do you have any statistical values for that?

Dr. Valery Kashparov

Very important to ask internal dose because we have resettlement of the people from the density of contamination higher 565 kilobecquerel per square meter. It is the same now, the density of contamination 300 kilobecquerel

per square meter for cesium. It is equal the average effective dose. About 0.4 millisievert per year for the external dose, it's effective real external dose. For the internal dose, in our case the people used only local products, about 90% mainly had. Only the bread, the people buy in the shop and bread products and other it's local products. Vegetables, potato, milk, meat, and the forest region its [Unclear] region of Ukraine is forest region. The tradition that people used the wild berries, wild mushrooms in very big amount and use mushrooms in different dishes and soup and it's typical. The influence of the mushrooms now is increased and will not change in the future.

Male Participant

I have one more question. You mentioned about concentration of cesium in root and you used 600 becquerel as a kind of borderline. Is it the kind of permissible level of the root in your country or something like – I mean is there any meaning on this 600 becquerels?

Dr. Valery Kashparov

600 becquerels here is the minimum, only for the firewood. For another kind of use of the wood, will be very, very different value. For example, in this case the value is 3000 becquerel per kilogram for the wood.

Male Participant

I see.

Dr. Valery Kashparov

If we use the wood for the different setting.

Male Participant

Yeah. I understand. So it depends on the usage...

Dr. Valery Kashparov

Yes.

Male Participant

...how do we use. Yeah

Dr. Valery Kashparov

You can see. If additional normative from the health ministry in our country and we must use this normative.

Male Participant

Yeah, okay. It's quite reasonable. Thank you.

Dr. Valery Kashparov

There are the same normative in Belorussia and Russia, but the difference there for each country.

Shingo Shibata

Nice to see you again Dr. Kashparov and welcome to Japan. My name is Shingo Shibata [ph] and I'm with Tokyo University. I'd like to ask couple of questions regarding the mushroom. The first one is that I'd like to ask that I have read some articles that I think the local people normally do not stop eating mushroom even though your campaigns. So my question is, first one is, is there any damages to health or diseases reported so far on the local people who eat heavily contaminated mushrooms? That is my first question. Are you monitoring doing any studies related to this monitoring?

My second question is I understand your government or you printed many brochures regarding the absorbing capacity of – you categorized the mushrooms into four different types, based on the absorption capacity. I'd like to know these extension materials are effective in changing the local people's behavior?

Dr. Valery Kashparov

About the first question, about the dangers of mushrooms, the mushrooms and forest product is relatively important conduits [ph] another source of uptake radionuclide in the body but in real situation in Ukraine now we really have a problem with effective dose for the population because we have the information about the content of radionuclide in the body. Here you can see the root is the [Unclear] additional vary from the consumption ratio of mushrooms, of milk and multiply in the concentration in mushrooms and in milk, we can calculate the effective dose, its efficient level.

Here is name of the settlement village with proper [ph] internal dose higher 0.5 millisievert is total amount. And rate it's effective dose calculate from the measurement content of cesium in the body of the people in this settlement. The real dose now it's more or less 0.5 millisievert you can see. Because consumption ratio of the milk is very low and the real influence of mushrooms to the dose is not very high and it does not, I think, for the health it is not very important in real situation.

[Japanese]

Dr. Valery Kashparov

Yes, of course, we have very good information about transfer factor for cesium for different kind of mushrooms and this time we have the change of transfer factor for different kind of mushrooms. For one kind of mushrooms we had increase of transfer factor now for another we have the decrease for in another kind. We know that this kind of mushroom is very contaminated and this kind of mushroom low contaminated. For example, we have the mushroom, I don't know in English [Foreign Language]. It's mushrooms [Foreign Language].

Male Participant

Mushrooms which are growing on the trees, on the bottom of the trees.

[Foreign Language]

Male Participant

It looks like the [Unclear] which are growing on the bark.

[Foreign Language]

Male Participant

It's the most biggest [ph] mushroom.

Dr. Valery Kashparov

We from the mass media from the special booklets inform population about

the contamination of mushroom. What is most contamination, what is low contamination? The real people use this information. Also we have the special maps where dangerous to collect mushrooms. It does not only depend on the density of contamination it's very important properties of forest, of ecological situation in the forest for the transfer of radiation. And now the information of population for the forest production is most important countermeasures.

Shingo Shibata

Thank you very much. Thank you for the talk.

Dr. Valery Kashparov

Arigato.

Shingo Shibata

Thank you. Could you show us the software, ESTER?

Dr. Valery Kashparov

ESTER?

Shingo Shibata

Yeah, ESTER [Unclear] of some, I don't know, sorry. In your presentation...

Dr. Valery Kashparov

Yes, yes. I opened but [Unclear].

Shingo Shibata

Yes. Maybe next, [Unclear], at the back, yes, yes. Okay. Thank you very much. So you have measured the contamination level of forest first by intensive work and then you predict the future change in the contamination of the forest. This kind of information have been used. My question is, is this kind of possible level have been used to the forest practice like prohibited the cutting or [Unclear] or whatever so anything have been done in your country?

Dr. Valery Kashparov

Yes because we have the government resolved against [Unclear]. We have

the additional governmental forestry agency and this is additional information for the [Unclear], for the local part of this energy for the strategy used for the forest wood production because they know and now can use this part and the planning of the work and production of the wood in the future. It's very important because after the accident we used only density of contamination, but it is not good because if you have the same density of contamination you can have the very different contamination of the wood and this information is next step of that.

Shingo Shibata

But this kind of work have been applied to the department of forestry?

Dr. Valery Kashparov

Yes, okay, of course.

Male Participant

That kind of thing is totally lacking in Japan. Maybe in the next 3-4 years [ph].

Dr. Valery Kashparov

Yeah, because you have private forest. It's very big production government.

[Japanese]

Male Participant

Thank you very much. Nice to meet you again Dr. Kashparov in Ukraine last year. My question is about the behavior of the consumers because in Japan consumer don't choose agricultural product even if that agricultural and the radioactivity level is lower than the permissible level. So I ask you to how about the Ukraine, the consumers' behavior about that kind of the food? Yeah. Did you understand?

Dr. Valery Kashparov

Maybe but the real in Ukraine now they also haven't any problem is agricultural products from the farm, from big farm, from the shop for the – you have the problem only for the very small local production when the people

have animals and for the self consumption. No marking [ph] production and for these case very difficult to use different countermeasures because it's very small area and now Ukraine is also private area and very difficult we know as to how clean production. We have also the problem this production. I know in Japan there haven't been a problem with contamination of agricultural products because I remember the activity concentration in milk you can't [Unclear] 10 becquerel per liter it's very, very low and average internal dose is about maybe 4 microsievert per year. It's very, very low.

Male Participant

Thank you very much.

Dr. Valery Kashparov

Okay.