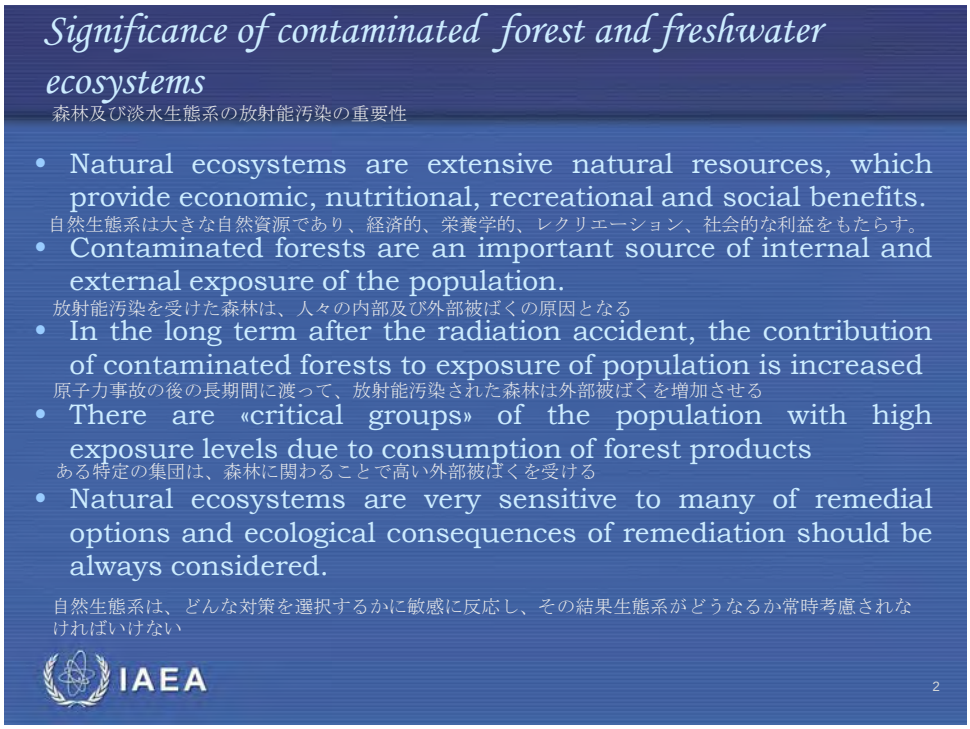
[Unclear] I suppose you're able to hear me well. Okay. Yes, I would like to start my talk with [Unclear] how my colleague and friend Vasyl started, so I'd like to thank you very much for inviting us to take part in this seminar. You take lot of [Unclear] show us your sites, your research, and [Unclear]. Thank you very much, once again. My talk will touch actually several problems. First problem is application of the different management system for assessment of [Unclear] in forests, user based information on cesium [Unclear] etcetera and my second part is review of the models which can be applied for [Unclear]. Would you like to translate or I will proceed?

Yamamoto [ph] [Unclear], Sergey Fesenko, International Atomic Energy Agency for the Energy Environment Laboratories. This is [Unclear] a division and which the department which provides support on the environmental management on contaminated sites. In Belarus, in Kazakhstan, in many, many countries, even Australia, and even [Unclear] etcetera. Well, this is actually a short-term job to provide support in the environmental management.

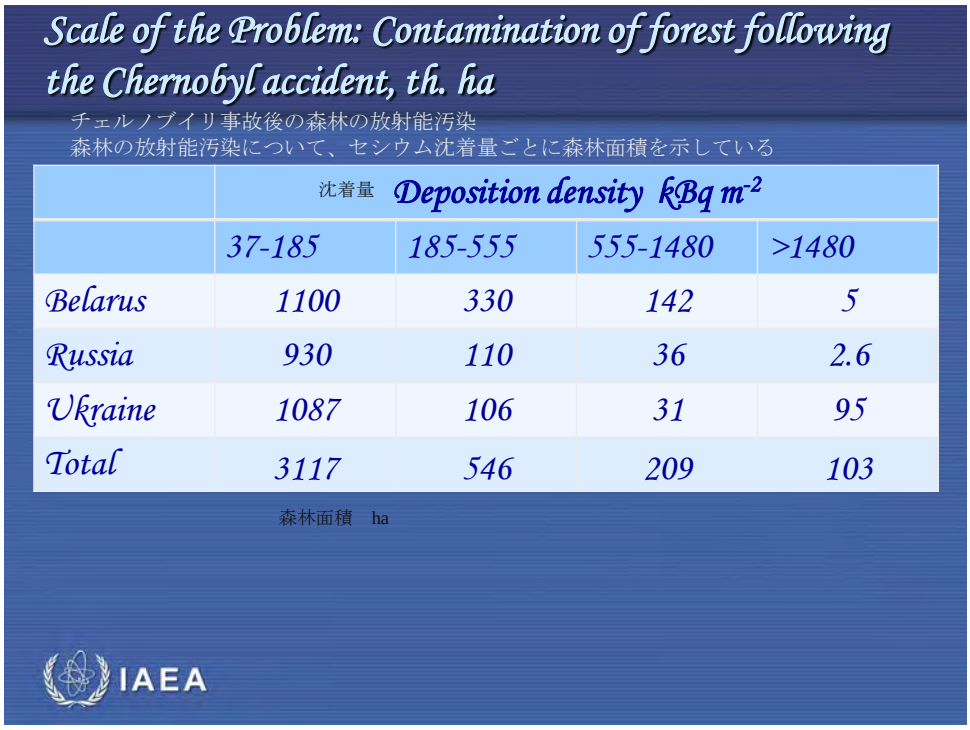
Forest is an essential part of our job, so we provided many big documents on forests. Many projects were started on forests and this is our one of the key activities.



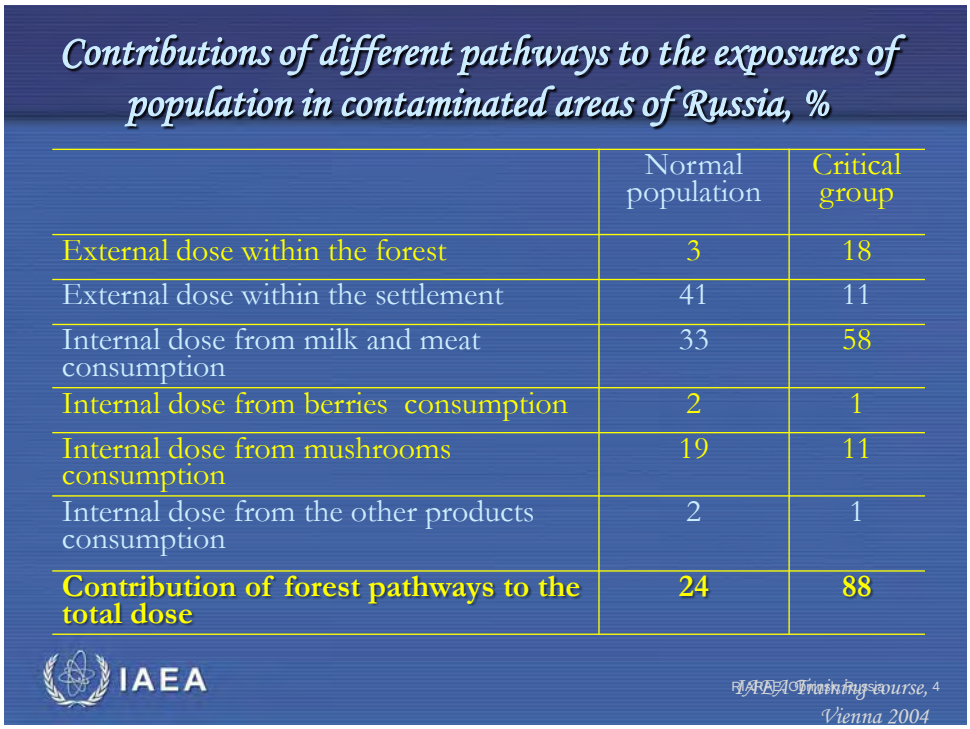
[Unclear] to start with some very pivotal statements why forest are important for the people, for the public, because forests are natural ecosystem which are extensive natural resources which provides a lot of different I would say benefits to the population. Forest is very important for people [Unclear] agricultural, nutritional, recreational, and social benefits.

Contaminated forests [Unclear] serves as an important source of the internal and external exposure for those population. We know some times, in the case of Japan for the whole population, but for some protection groups but it is important source of the population or the exposure of the population.

In the long term after radiation incident, you will see that the importance of radiation in forest, rates will go up, means we would [Unclear] to respond to this challenge. There are so-called critical groups of the population [Unclear] critical groups of the population with high exposure levels due to the consumption of forest products. Natural ecosystems are very sensitive to application of various technical evaluations [ph]. So there are just remedial set of options which are actually available for forest. Do you want me to take it from here?



Just to illustrate these statements, I'd like to show you the areas which are affected by forest after the Chernobyl accident. You see, as I said, [Unclear] after the contamination after the Fukushima incident, and there are high areas, large areas where contamination levels are still high. And you can see the data which we used for the official assessment.

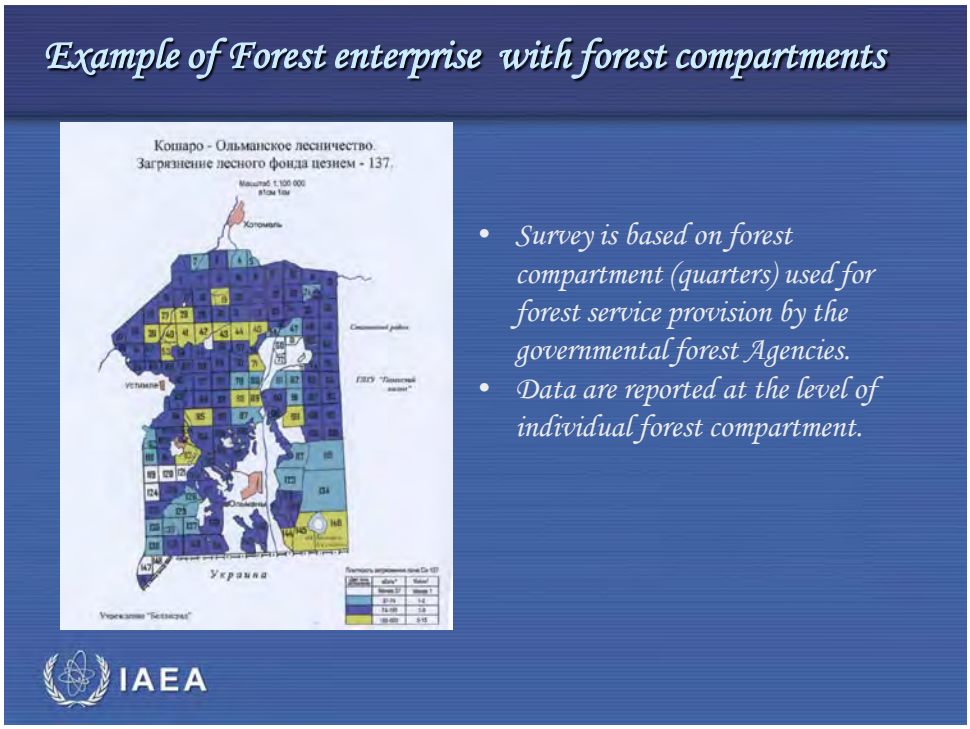


And I was coming to the question asked by [Unclear], a good friend from here in Japan. You can see how much important the contaminated forest, for example, for local population. In the project called Project [Unclear] commission we studied more than 200 settlements located in Russia, west Belarus, and west Ukraine and here we've provided Russian data part. You can see that there are many settlements and critical group of the population for whom the exposure from the forest is very, very important. This is just – impression that forest should be properly processed and proper forest management is of high importance.

Actually to get information for forest management we need to provide some kind of segmental studies. There are actually different segmental studies. Just I would say the growth [ph] is forest [Unclear]. To get information for forest management we have to organize [Unclear] studies.

There are different types of monitoring. Here we started with forest soil survey, so-called snapshot survey.

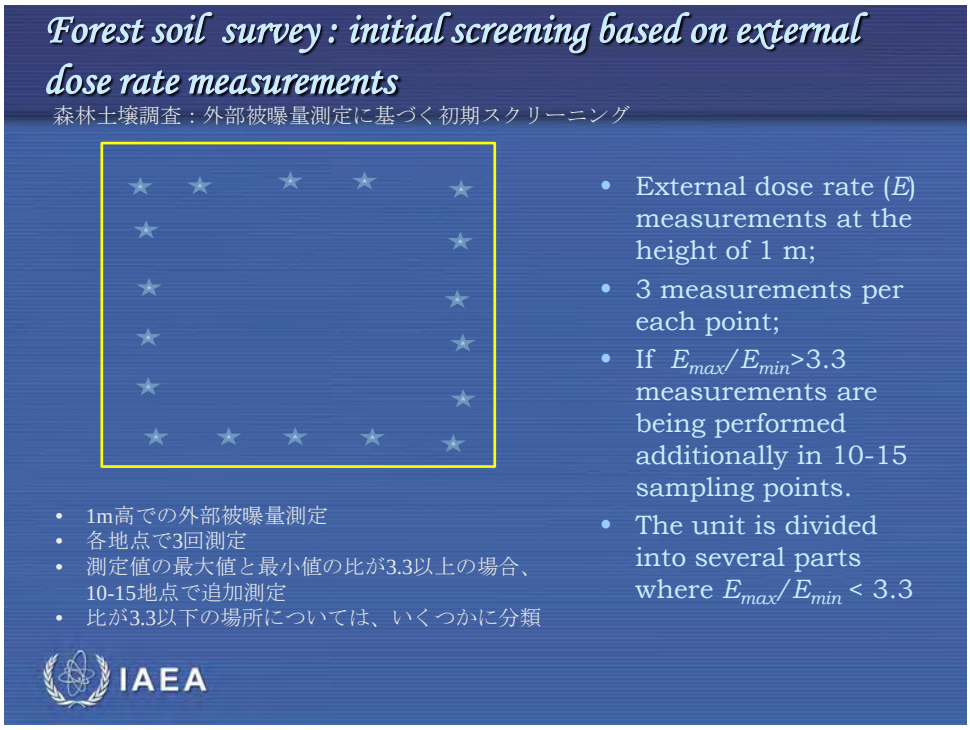
The objectives are to identify forest soil contamination for making decisions to classify soil in terms of their contamination and to – we should provide this information for making decision. Actually this measure includes two steps; first step is screening, using external dose rate measurements.



This is quite simple two-step procedure and it is based on the forest quarters. What is then forest quarters? You can see from this picture because [Unclear] and used to [Unclear] forest compartments so called division of the forest of some parts of some quarters is homogenous basis in terms of the forest trees, forest soil, etcetera. And you can see how it looks with the contaminated forest area. So this is a map gives contamination of the territory, of the forest enterprise which is subdivided into different forest areas.

This is actually a basic subdivision for the method of the contamination of the [Unclear] soil. So we provide average information for [Unclear] forest compartment as you see here. We see here this data given here is a map with a range but for each such forest unit there is exact data available on the different levels of contamination of the – distribution of contamination points etcetera.

The size of this forest unit can vary from 50 hectare to 1 square kilometer or 1000 hectares, dependent on the homogenous of forest [Unclear].



This is actually the result of how we're doing this survey. At the first stage, we provide the measurement of the external dose rates which is in the air, in the around 20 – between 20 and 30 points, around the border of the forest unit and the distance from the border [Unclear] points would be not less than 20 meters.

Actually at every point, we have to take three measurements. We have to make three measurements.

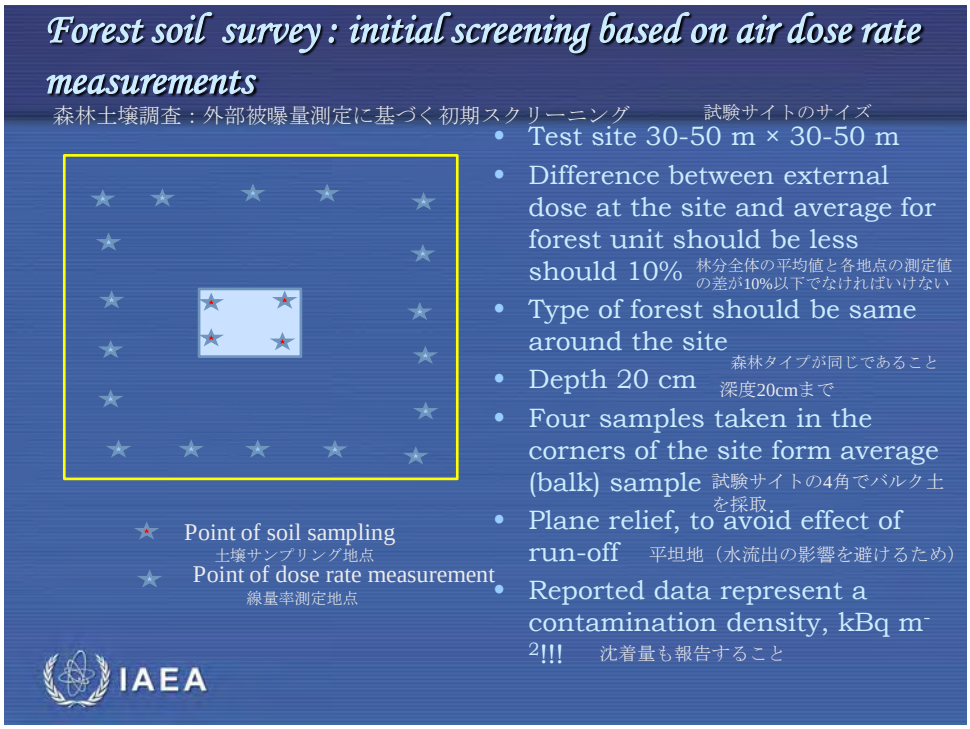
And [Unclear] value used for the calculation [ph] of average sampling point like every point shown here [Unclear] value used for calculation [ph].

After that we need to have a look at the all variables and to compare maximum values for this – [Unclear] sampling points and we get minimum value.

If this ratio is higher than 3.3 we have to subdivide this forest compartment into several compartments.

And we have to maintain uniform measurements.

If this ratio is lower than 3.3 we can continue with soil survey.



In this case you have to select sampling points, or sampling test site which normally has a size 50 to 30 meters, sorry [Unclear] 50 meters square.

The external dose rate in the perimeter of the square should be lower than 10% from the average identified for the entire forest compartment.

After that we have taken four samples in the corners of this site. After that we take four samples; one, two, three, four in the corners of this site.

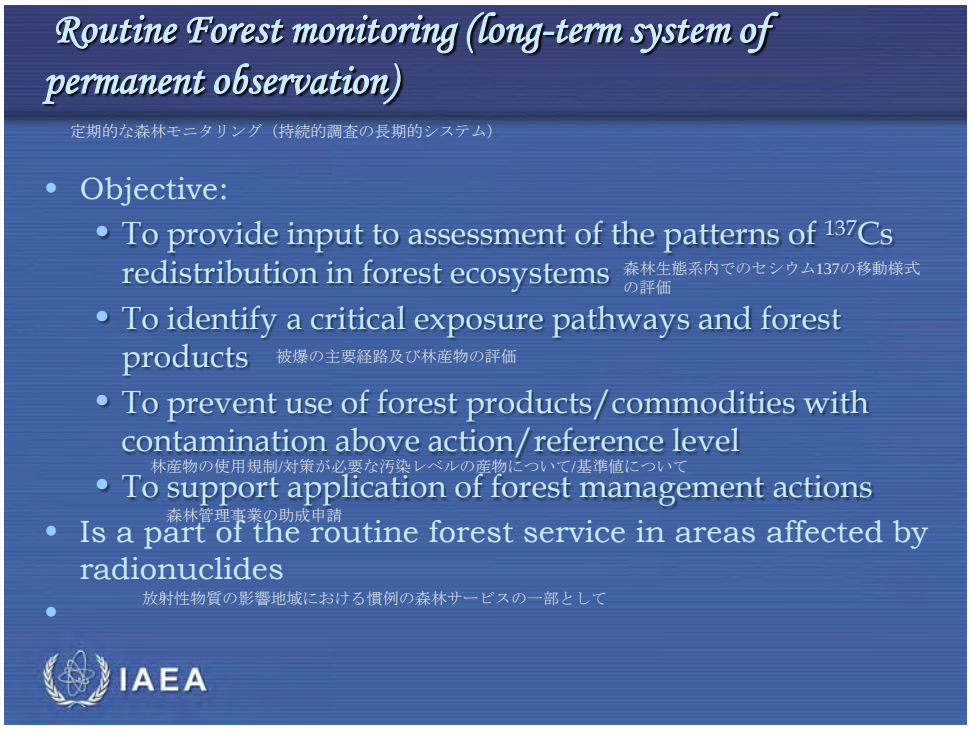
At the depth of the 20 centimeters.

And the four balk samples or [Unclear] samples based on these four samples taken.

Some requirements to that, it should be a plane site. There should be not [Unclear].

Then we report all this data in terms of the kilobecquerel per square meter so in terms of the contamination density.

This is actually different – another system which was implemented in Japan, because Japan provided information in becquerel per kilogram.



Routine forest monitoring, now, it comes from the – way from the system of the permanent observation.

Yeah, forest monitoring. Actually, the purpose is to assess patterns of the redistribution in the forest ecosystem.

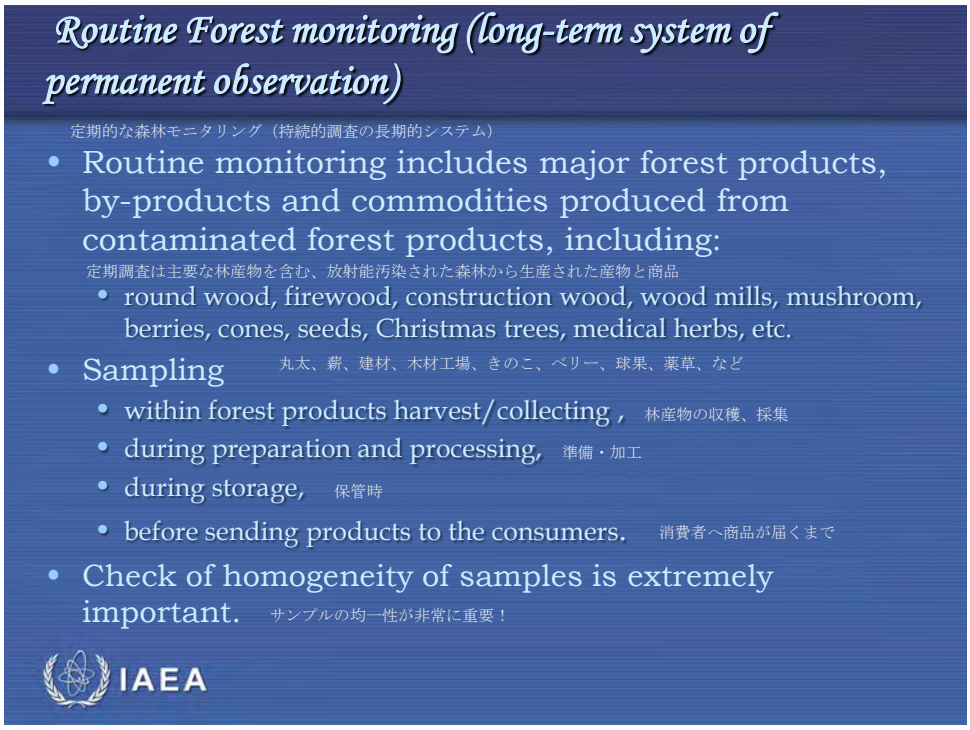
For that we have to measure, of course, every year major areas and some are [Unclear] actually concentrations of cesium in different forest compartments such as, forest soil, forest trees, leaves, understory species, bushes, etcetera, so all these examples will be sampled.

The purpose is to identify critical exposure pathways and to identify most critical exposure forest products. The purpose is also to identify a critical exposure pathways and forest products, critical forest products.

We use the data to prevent use of forest products or forest commodities which have contamination above action/reference levels. Yes, I know that there are no action levels for forest products yet to be published until now, but Russia, Ukraine and Belarus have such levels. To organize such proper management, we needed such action or permissible levels.

Finally, this information was – the goal was to provide appropriate advice for the forest management.

In the Chernobyl affected countries this job is job which provides official government or its authorities.

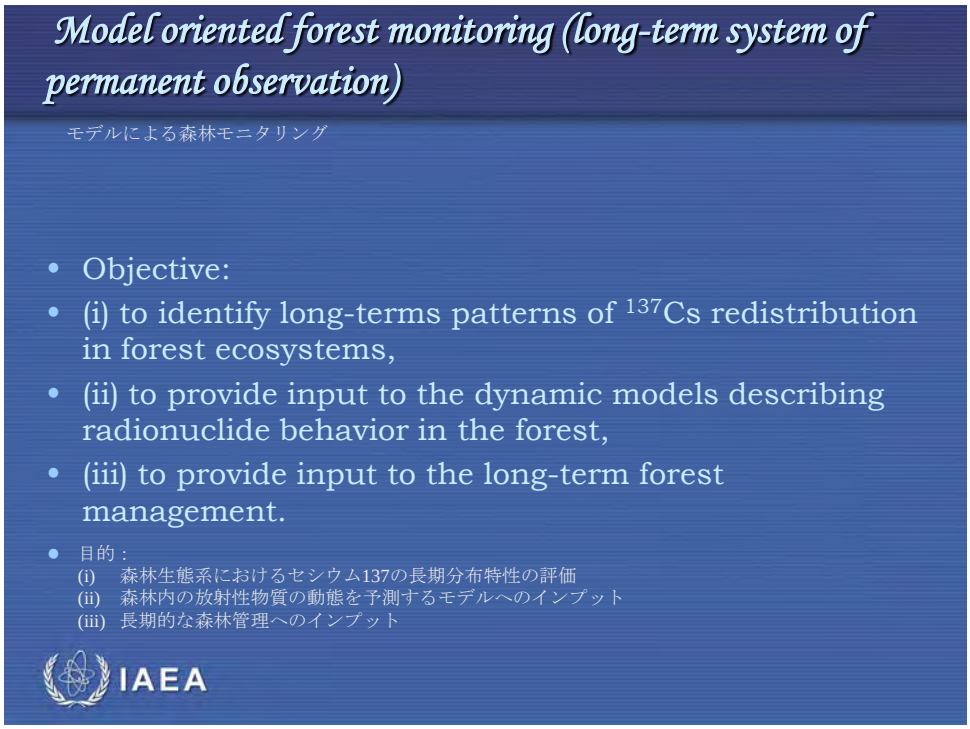


Here I would like to demonstrate which are subject for this forest monitoring so they monitor round wood, firewood, almost all products which are available from the forest.

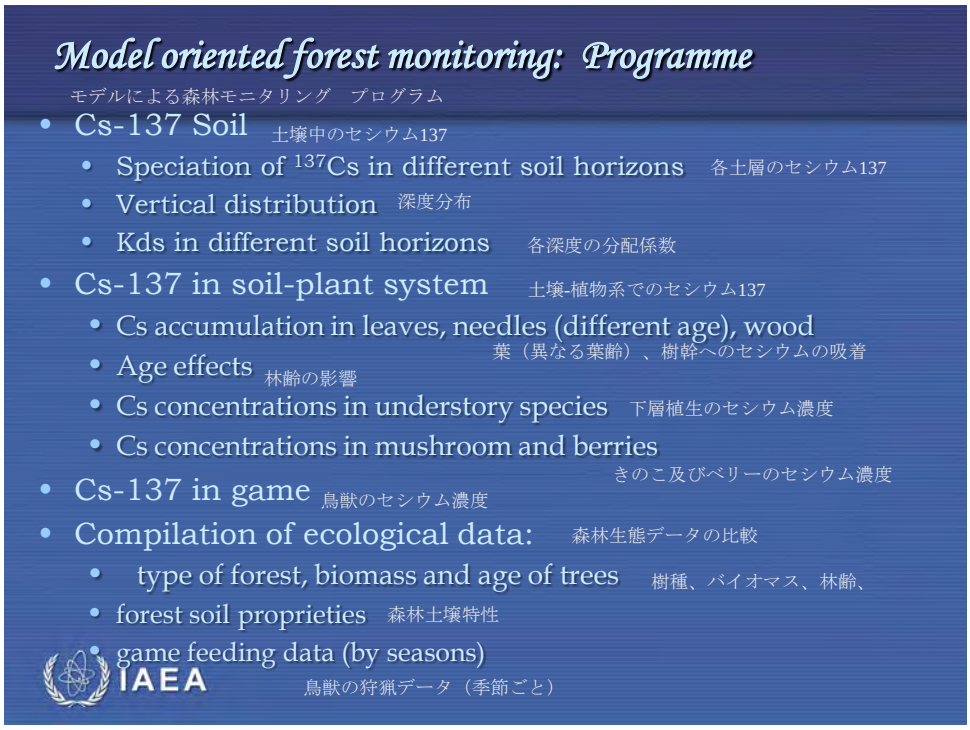
They take samples at different stages of the sampling and comprises of the forest products and forest commodities.

Then continue this monitoring until these commodities or products are sent to the final consumer.

Official procedure was developed to check homogeneity of these samples because you see we have to be aware that we didn't miss some samples is [Unclear] various contamination is [Unclear].



And model oriented forest monitoring, this is already a short type of the monitoring which is intended to identify long-term patterns of cesium behavior in the forest ecosystems. This method is intended to provide input to the dynamic models, to develop such models and to provide input to the long-term forest management.



Okay. These are examples I provide information about our monitoring program which we perform in the Bryansk region, so this monitoring program was recording in details studies of soil.
Including study of the speciation of different soil horizons.
Vertical distributions.
Kds for different soil horizons.
So distribution coefficient.
Distribution coefficient.
Distribution coefficient
Kd means distribution coefficient.
Okay. We study these processes of the typical forest soil [Unclear] representative conditions for the contaminated forest areas. We also study accumulation in seasonal leaves, different [Unclear] season cause the concentration of radionuclides in leaves goes up [Unclear] is much higher than in September, for example. So establish – design processes during the season. We also study contamination of needles of different age, wood in certain sections are subject to forest [Unclear].

It is clear that young people can accumulate cesium much faster than older people, sorry not people, trees. Young trees can accumulate cesium much

higher than with old trees. Various studies also with age effect of the radionuclide transfer to the trees for different version, [ph] statistics.

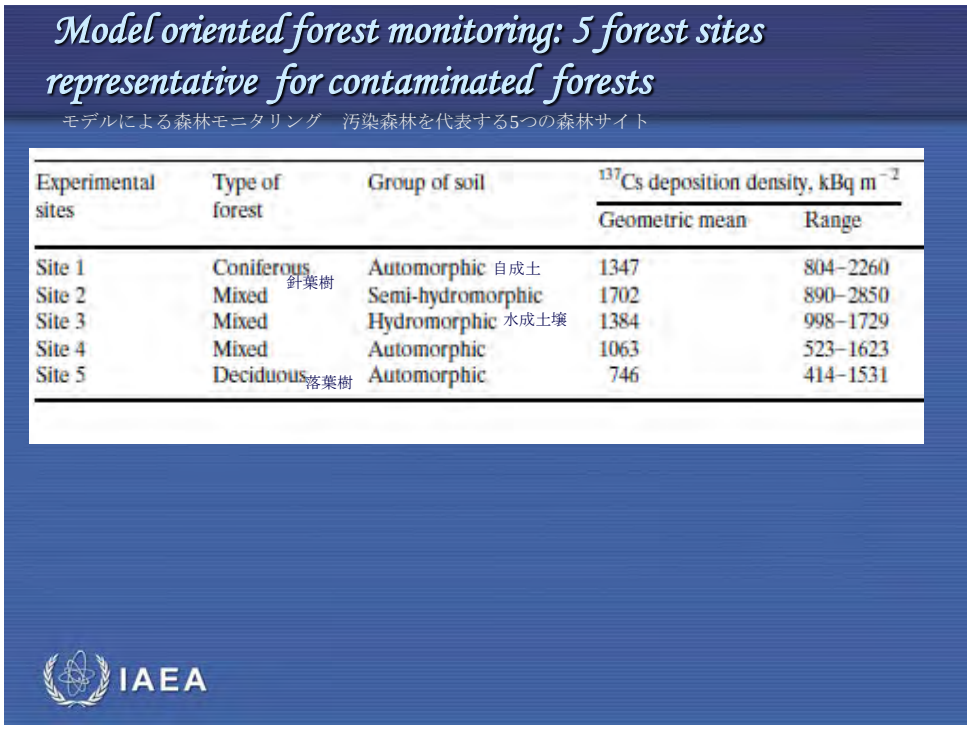
Important point is also to study the concentration of cesium in the understory species because understory species which provide a lot of forest food. It is important also to study the understory species because these understory species such as berries, mushrooms can provide a lot of forest food.

Game is also of highest importance because there are meat hunters who hunt game and they can consume lot of contaminated muscles of game, contaminated meat which can provide [Unclear].

We should be able to explain on growing levels of contamination of meat from game, muscles of game, which is why we study feed duration [ph] of game, we study accumulation of cesium in the species which are consumed by game so such processes are also of importance and such process are also a subject of our studies.

And to – which explain a [Unclear] we need to have a lot of ecological information. For example, distribution of roots, fiber roots in the forest soil, for example, some product [ph] such as contamination values in a specific of trees, of understory is maximum to youth and certainly we need such homogenous [ph] information to make contribution but we also study ecological provisions of this in stages.

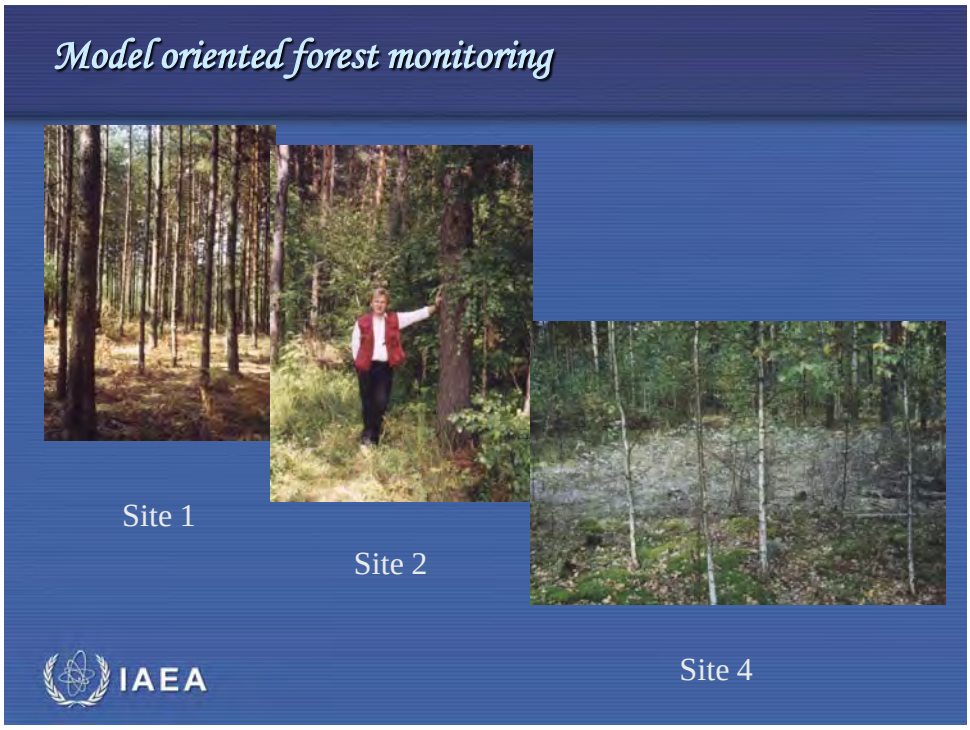
We also studied external growth rates which are dependent on the properties of soil, dependent on the forest biomass, etcetera, such factors, give also insight to the monitoring program.



You can see actually five of our sites where we actually [Technical Difficulty] yet research for the time approximately 7 years, 8 years. These sites are located in the Bryansk region and we see different density and type of soil and type of forest.

Contamination level, as you see, are quite high.

The level of the sites, contamination is close proximity to the Fukushima station and the level of that – around 2000 kilobecquerel per square meter and that was very high to the wildlife.

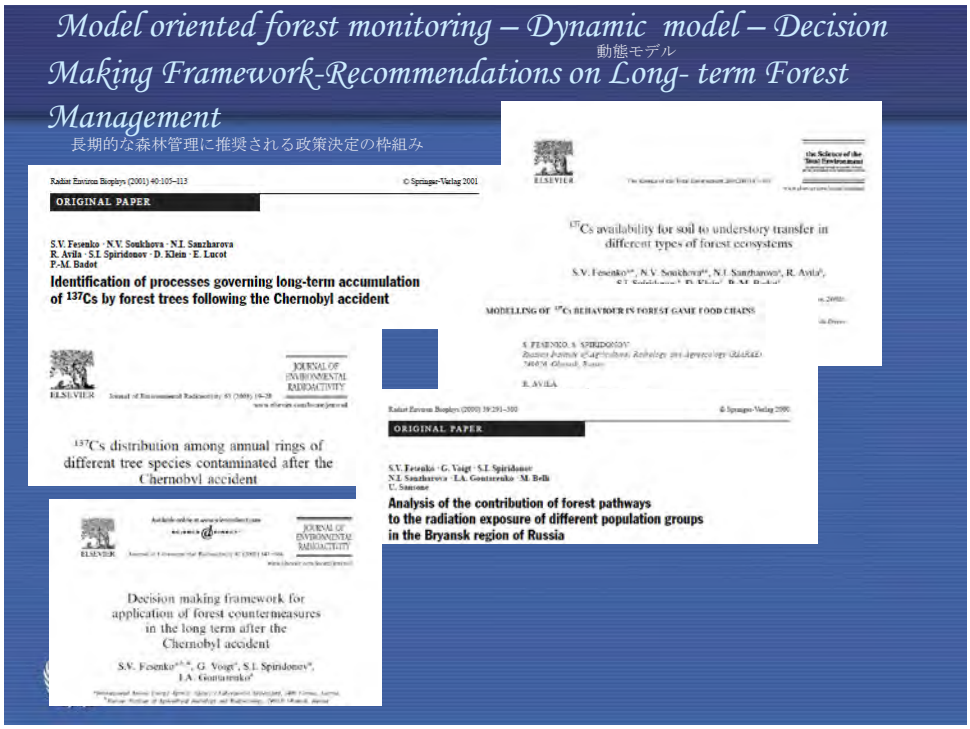


Here I would like to show you the [Unclear] outside. On the left side, this is automorphic, coniferous site. You have pine trees of the automorphic soil. You see forest here and you can compare how this in Japan. This is a site at the automorphic site, site 4. Here is site 3 where you also have deciduous forest at the automorphic site. Actually, we used these sites not only for the study of the behavior of radionuclides [ph] in the forest ecosystem. We also studied the effect of different – in the middle portions there. As I told you, forest is very, I would say, sensitive issue in which [Unclear] actions. That's why we started some actions which should not, which can [Unclear] forest very much. I'm afraid up here you can see some liming. So this area was limed because you see this [Unclear] and we provided some lime to increase activity, concentration of potassium [ph] from soil to plants. You know that forest soil normally have high potassium compared to soil with little potassium.

Our intention was also to develop a model, which would allow us to optimize application of lime for such purpose, depending on the forest soil properties and we developed such model.

It was presented at the conference [Unclear] in 2004 and in some international conferences.

It's been 15 years [Unclear] agency.



Actually, through the system of our internal program was to study experimental [Unclear] fine grade potassium in the forest ecosystems to model this process system, prepare models. After that to provide application of these models for the exposure pathway analysis and after that to provide some decision making framework for the application of the various countermeasures, for the application of the different types of the forest management.

Here I just would like to demonstrate some representative papers which that or everything what I'm saying is available from the international strategy [ph].

If you like, I'll leave my business card at the second table. You can take it then you can send me your request. I can always send you papers, [Unclear] sending information we have on the behavior of the forest and the ecosystems.

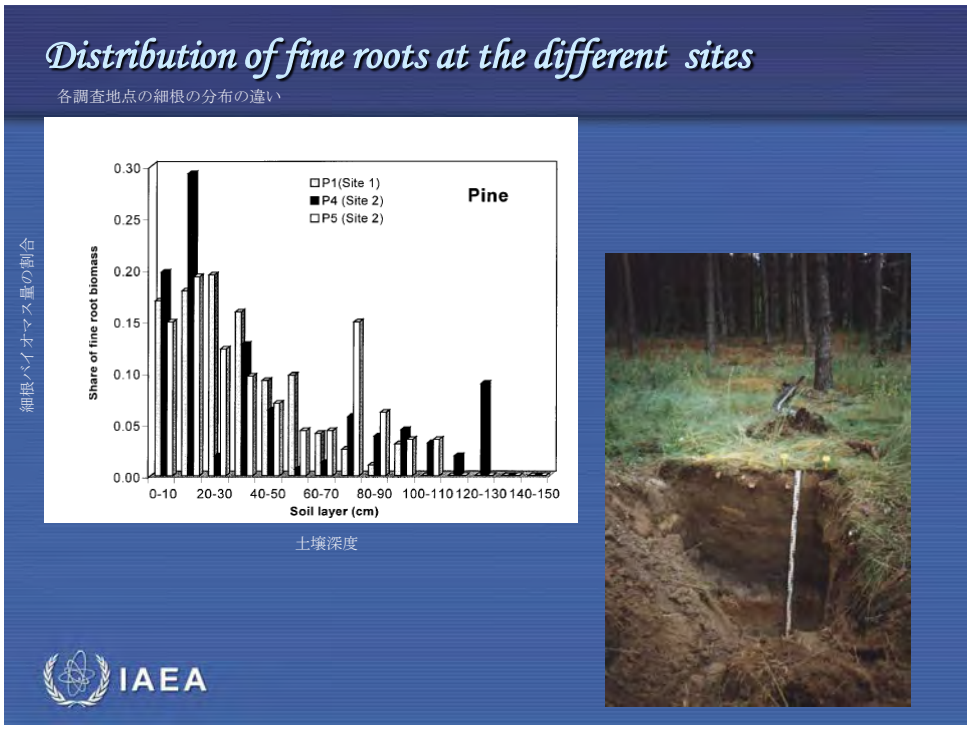
試薬により抽出されたセシウム137の割合

Soil horizon	Depth of the layer (cm)	Percentage of the total activity (%)	Percentage of ^{137}Cs extracted by reagents (%)				
			H_2O	$AcNH_4$	1 N HCl	3 N HCl	Rest
Site 1							
AoL	0–2	2.4	7.5	8.0	6.8	7.9	69.9
AoF	2–3	6.4	0.26	3.9	4.0	10.2	81.6
AoH	3–3.5	18.7	0.08	3.2	4.3	11.6	80.9
AoA1	3.5–5	46.2	0.02	1.1	3.0	9.0	86.8
A1	5–16	18.8	0.17	11.1	7.8	14.9	66.0
A1A2	16–24	6.3	0.28	18.5	8.5	14.1	58.6
B	24–40	1.3	4.4	29.4	15.1	16.9	34.3
Site 2							
AoL	0–2	1.2	8.2	17.0	11.8	18.3	44.7
AoF	2–5	11.3	1.1	8.6	5.7	12.9	71.7
AoH	5–7	43.4	0.28	6.7	5.0	12.3	75.7
A1	7–12	32.9	0.04	3.1	1.4	2.1	93.3
A1A2	12–20	9.8	0.22	3.2	1.4	1.8	93.3
B1	20–40	1.5	2.3	16.1	5.1	12.2	64.4

IAEA

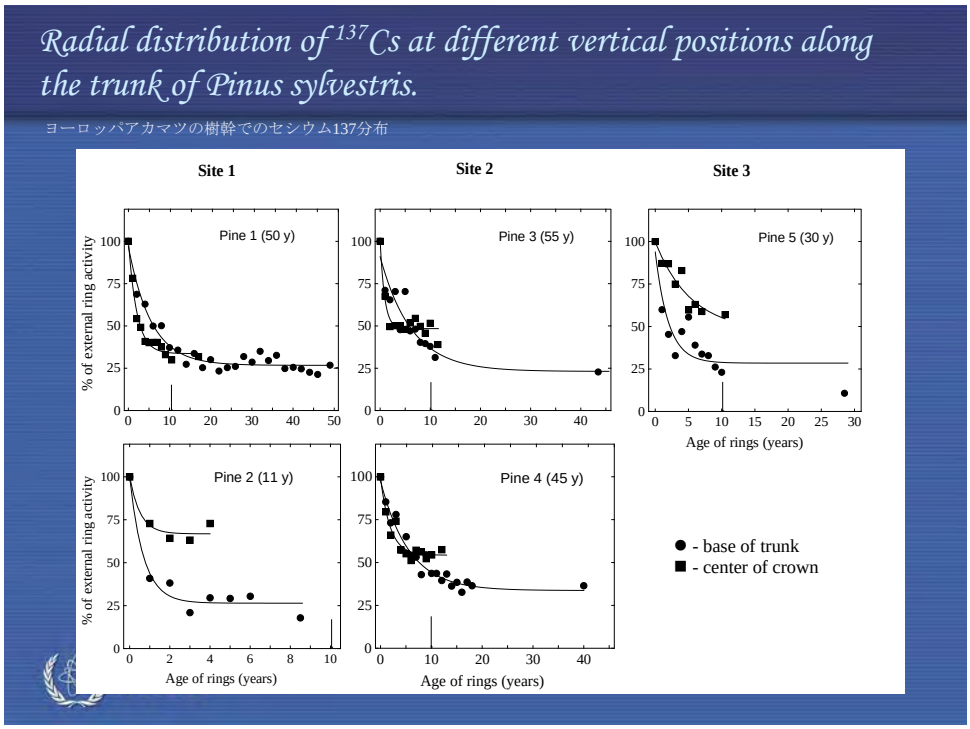
[Unclear] number of the [Unclear] or just give me yours and I will send the information [Unclear].

And coming to some experimental results which we achieved on these sites. Here, I just would like to show you differences in the, I would say, geochemical performance. It is accepted that the alginates [ph] from we just extracted – which can be extracted from the soil by application of the this different portion of acids, can be used [Unclear] use this approach for assessment of soil in terms of the availability of cesium in those soils.



This is just an example of what we have at this site. This is an example of the distribution of the pine roots because not all roots part are possible for the recognition potential [ph], but I have to study different roots and this is a question which is close to the plant physiology and what [Unclear] with a plant ecologist on site, to study these ecological processes.

I would say, normally, the team which [Unclear] scientist of different categorizations should be used for understand and fully understand [Unclear] processes in the forest.

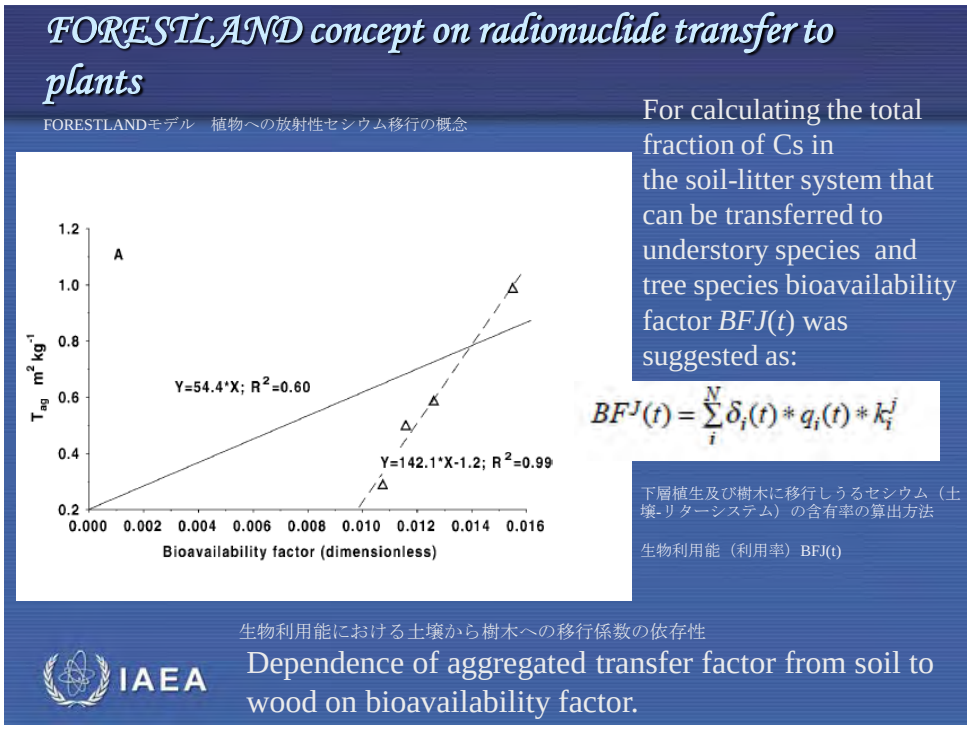


And here you can see [Unclear] radial distribution of cesium of external [ph] rings.

You can see how different patterns dependent on the forest soil and dependent on the age of trees.

We took samples at the height of the breast height. Normally it is 1.3 meters. Our colleague from Japan agency of radiation protection of forest all does it [Unclear] centimeters but we took at [Unclear] centimeters [Unclear] 120.

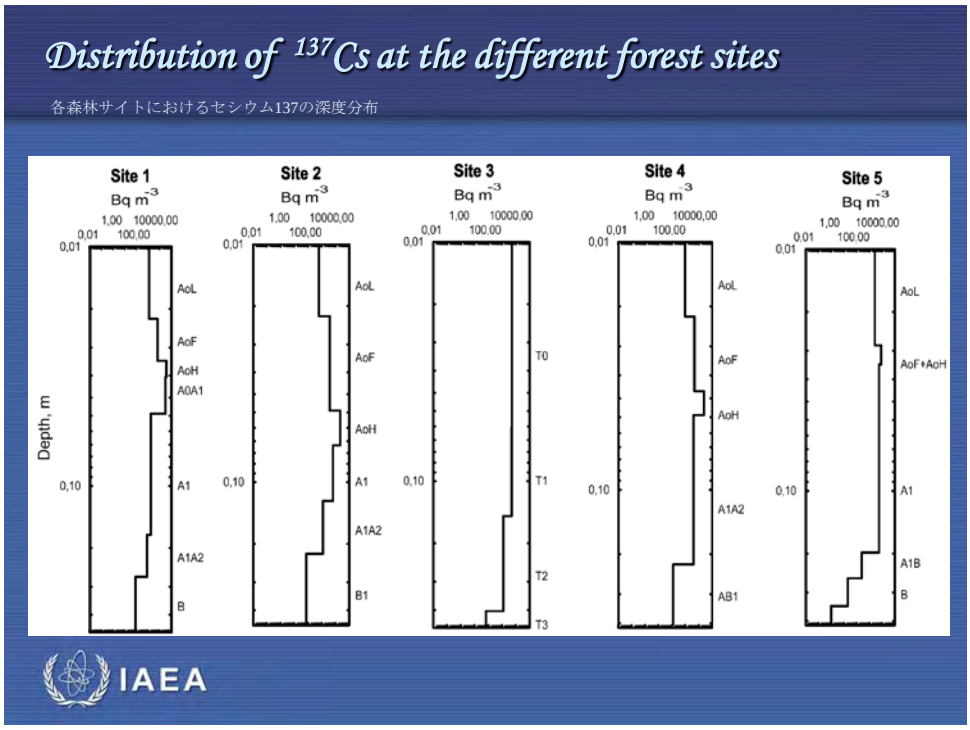
[Unclear] the little trees and the [Unclear] height of trees. This is actually one approach used for the forest trees.



Based on this…

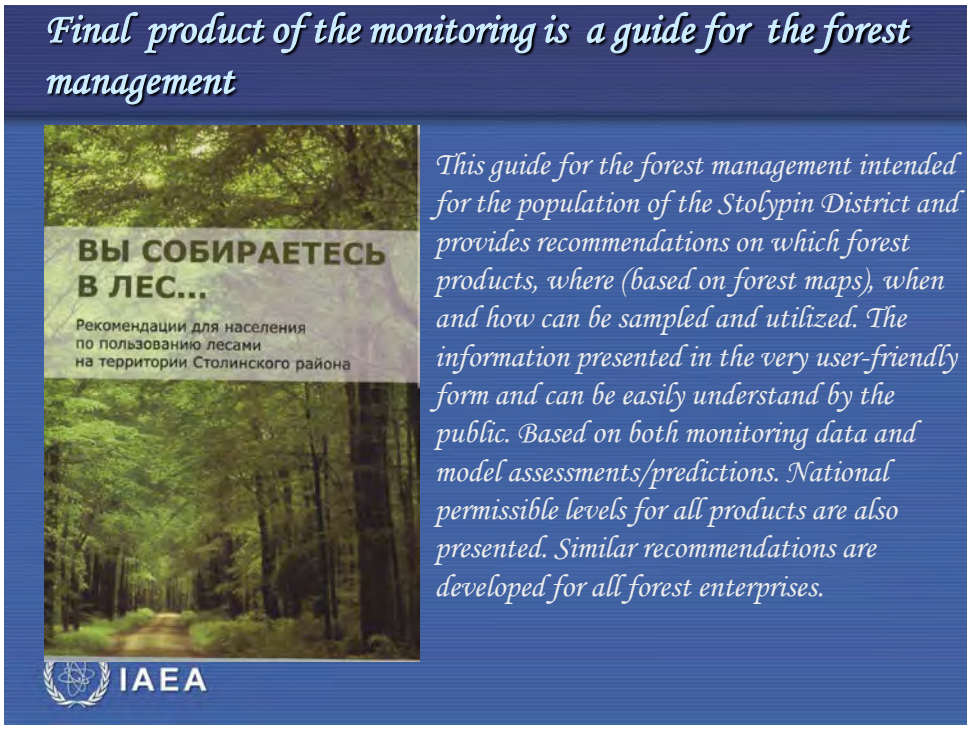
[Unclear] which are used for the development of the FORESTLAND model. For example, our assumption was that the transfer of radionuclides is dependent on the contribution of roots in the contamination with distribution of the radionuclides and it would be – it relates to the available amount of cesium in soil horizons.

For that we used – introduced a simple assessment so called bioavailability factors for trees whose understory differs which is presented here. You can see and we demonstrated that this approach also works for whose understory differs for different berries or mushrooms, etcetera – similar approach.



Here you can see the vertical distribution with [Unclear] soil and you can see how different soils [ph] were found for cesium. Here you took samples each centimeter but here [Unclear] data is according to the different soil horizons upon request of the editor of our paper for the journal.

[Unclear] scale is taken into account the difference is identified [Unclear] to the normal scale [Unclear].

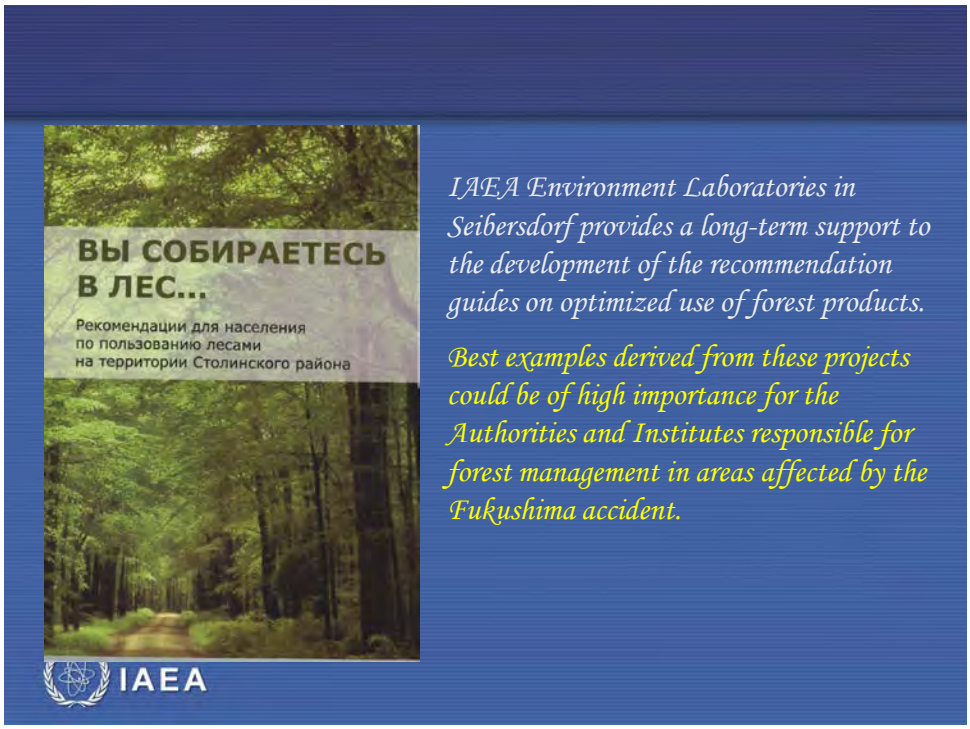


How to use the data? Actually based on that and based on the suggestions made with different models, forest models, related models etcetera, we provided some kind of the guidelines for the optimal or say usable [ph] forest management in the contaminated areas. These documents, these guides were [Unclear], provided for every forest enterprise and for any forest district. This document which includes clear terms and conditions to the public which forest products can be taken, where, how, when and which actually products should be avoided for some areas. Actually we provided also much for every district so people knew actually which [Unclear] can do different activities.

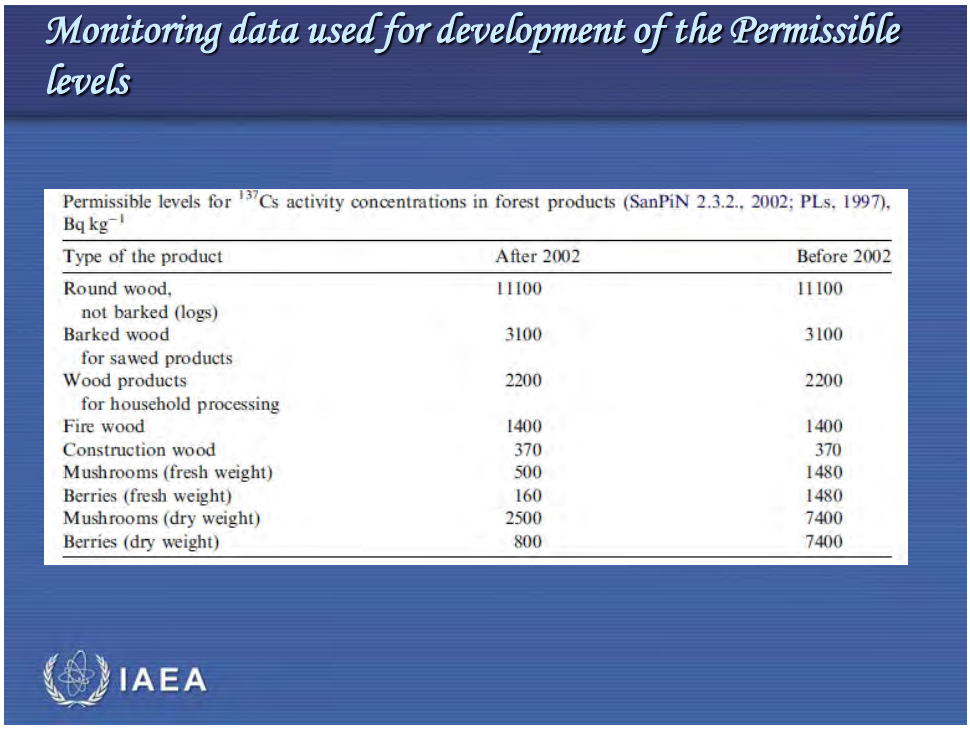
If somebody wants, I can show you this historical reference. We still have some [Unclear].

As you can see we supported very this activity so they were provided some expense and we provided some assistance [Unclear] very much and negative [Unclear] provision how to organize proper management of this area.

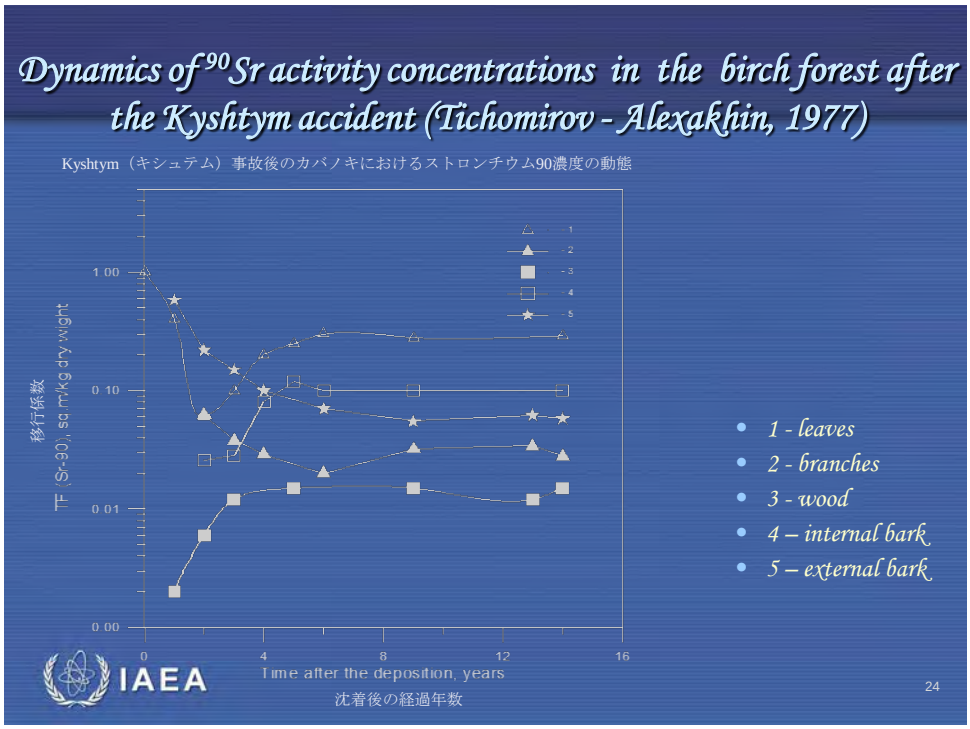
Actually, this document is very simple so it is very user-friendly. So the intention was to explain everything in very simple words to the public.



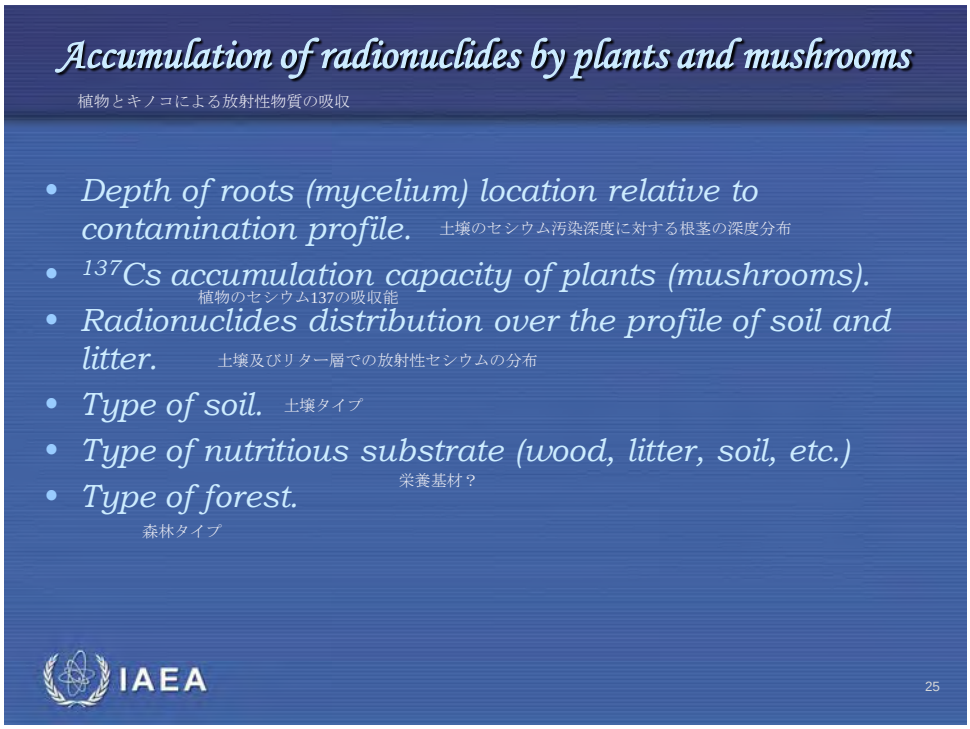
Actually, [Unclear] provided and provides [Unclear] support the relevance of such documents in different countries and actually I will say best examples and best experience from this in development of this document but we also delivered it to Japanese appropriate [Unclear] who were doing similar things.



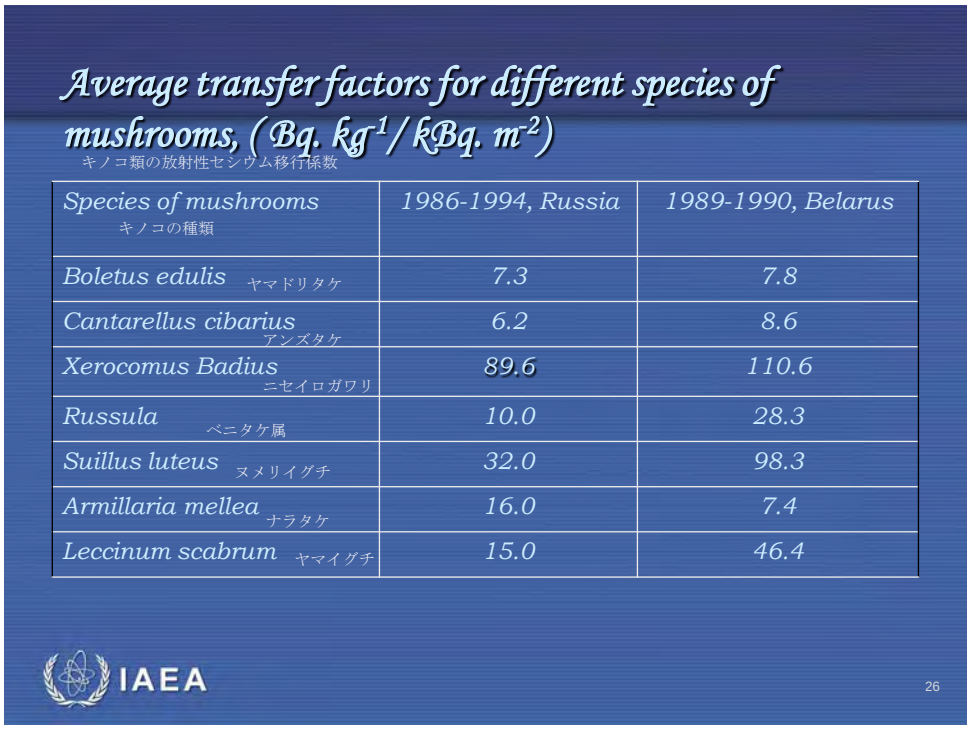
Here you can see another way have we use monitoring data. Monitoring data are very useful to develop historic conventions on permissible levels for different cesium activity concentrations in different forest products and commodities. And key examples such as documents which we have – which people have is in Russia. These documents are very useful because they would allow us to control how dangerous is the products of the contaminated plants. This document was very useful for people to organize proper forest management. Here you can see the example of that.



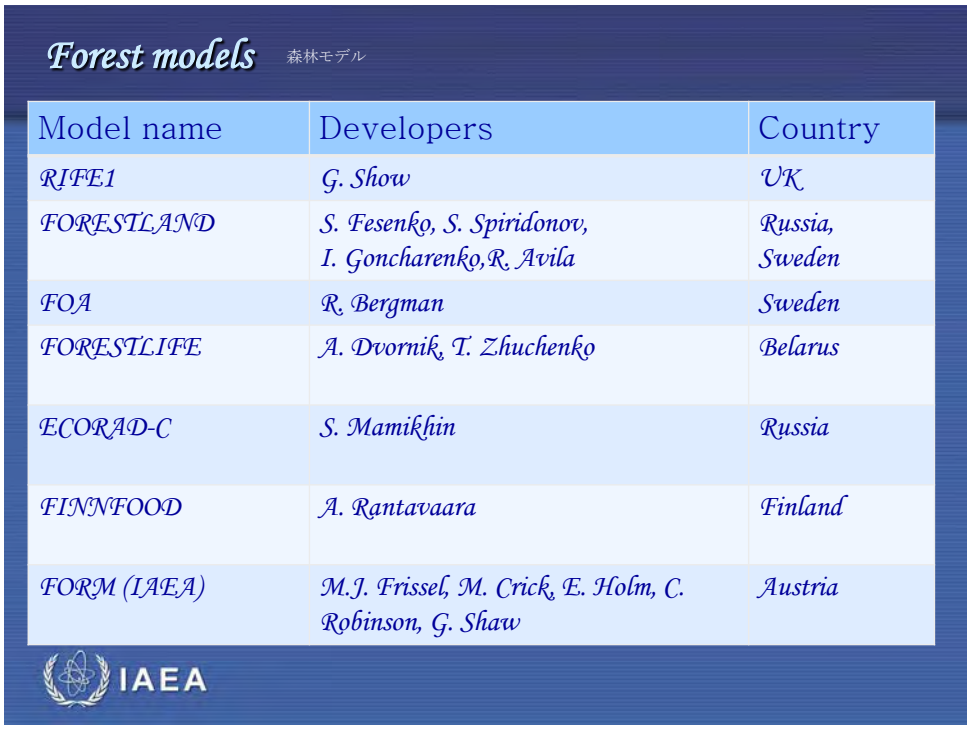
Coming to – this monitoring, I would like to mention that it is not the first case where a forest monitoring was recognized. Actually the first radiation accident where plutonium production [Unclear] was accident at the Kyshtym, a chemical plant. It was in 1958. It was [Unclear], and extensive research work was recognized already at that time. Look here, I've provided some information from those monitoring studies. So this activity concentrations in different compartments for Strontium because you see we still have no such information for Chernobyl. This information [Unclear] experience from Kyshtym accident would be also very useful for Fukushima and for other [Unclear].



Actually I would mention also about contamination of mushrooms and berries. Here I would like to mention that there are a lot of factors which have to be studied. If we look at the mushrooms they are totally different in terms of the accumulation of cesium because actually they are consumed [Unclear]. But the actual contamination levels which depends on the location for the – depends on the root location, capacity of plants for some [Unclear], type of soil and type of the nutritious substrate, because they can be located on wood, [Unclear] litter, soilet cetera where contamination levels are totally different. And when we know such factors, such [Unclear] which can provide for most predictions what we can get in the future not only now.

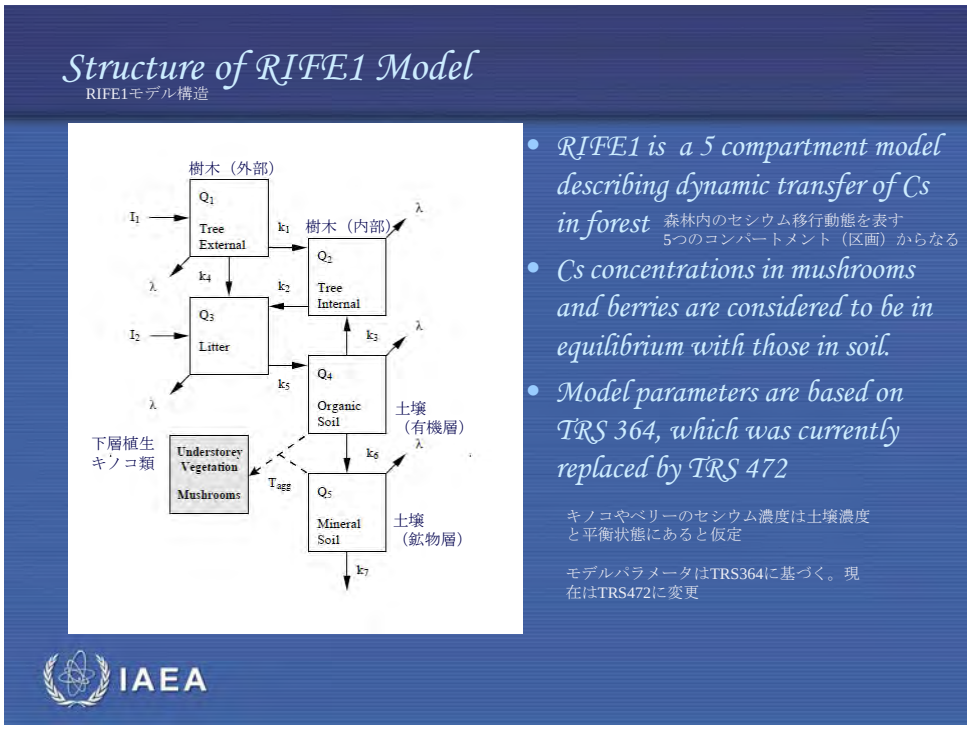


Here you can see some incidences which can be [Unclear] and explained based on this parameter, which we also studied at our sites for many, many site, [Unclear] many, many years.



Then information of the forest research not only in Russia but also in Ukraine and also in Belarus especially, which resulted in the development of the many forest models. Actually, I'd just mention one, two, three, four, five, six, seven models. But [Unclear] international models in the world, agency provided a flow for each comparison studies everywhere.

Kyshtym accident. The Kyshtym accident which has happened in 1958 – September 1958, in south Europe. This was huge accident there in a chemical plant which area was worst contaminated and it was first large scale experiment where people got an experience. This experience was fully utilized after the Chernobyl accident because people who had such experience came from the Kyshtym accident or the Chernobyl accident maybe have to provide their expertise how to manage this accident. So Kyshtym was the first big accident.



Okay. Now, I would like to continue with some short overview – concise overview of the available models of [Unclear] in forests. Just to provide a flavor for these models and how they were developed.

Certainly, I cannot give you many, many [Unclear] compare the advantages of [Unclear].

RIFE1 model was developed by George Shaw from the UK. And in this model – the advantage of this model is that this is a very simple model.

This was based on the TRS 364 which was Agency documents published in 1994.

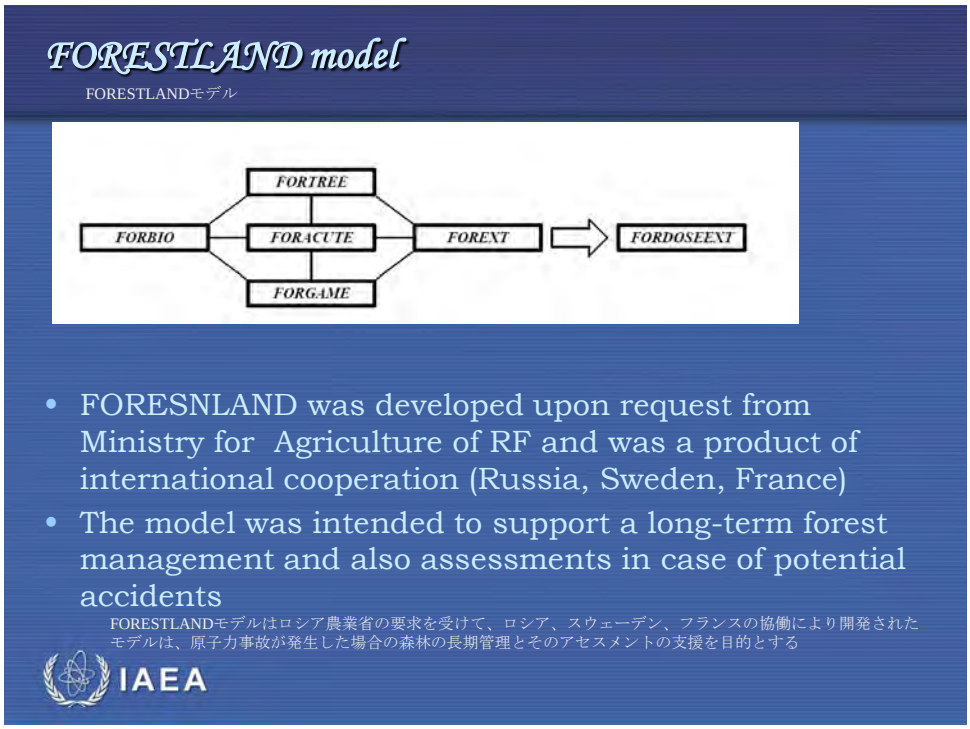
And currently I have to say this document was revised [Unclear] TRS 472 which is successor of the TRS 364.

The model considers five dynamic compartments and one feed [ph] compartment. The model considers five dynamic compartments and some [Unclear] compartments, dynamic compartments.

[Unclear] understory species and mushrooms is based on the concept of the Tag, aggregated transfer factors. So they assumed that contamination of the understory and mushrooms is in equilibrium with cesium concentrations in organic and mineral soils.

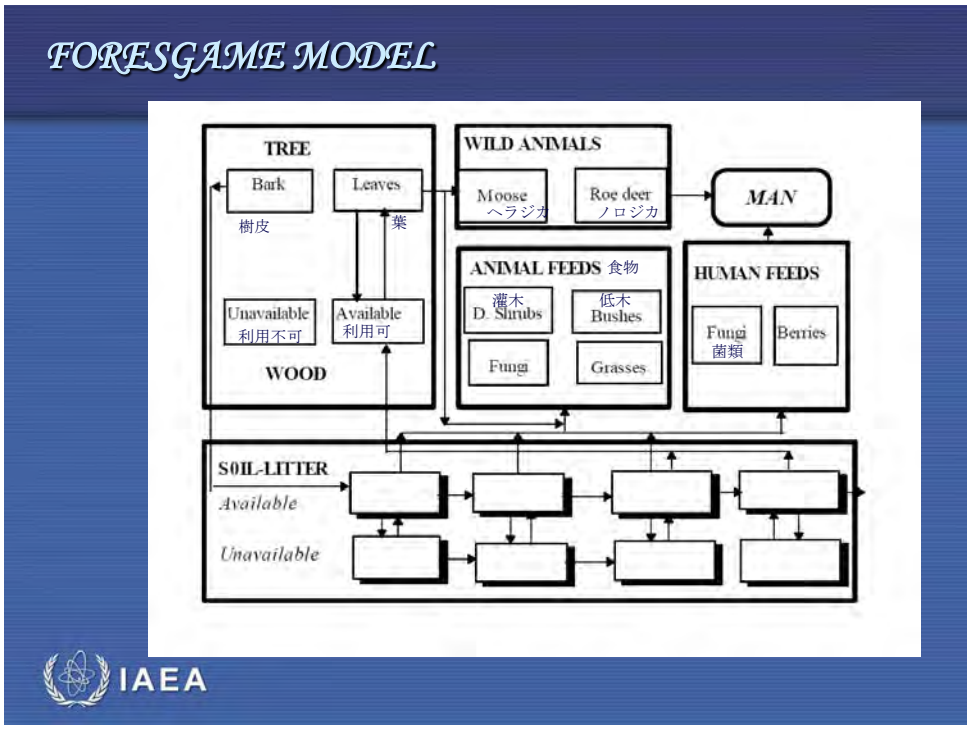
The disadvantage that this model is valid only for some, rather for periods which this model works which is validated [Unclear]. The advantage is the

model is valid for another period during this model was studied, validated. For example, I can explain you why because it is actually the case of almost all such models. Actually the fastest interaction of cesium in soil, greater penetration is directly at the time of the deposition because at that time all cesium is in available form. It's clear? The faster penetration cesium through forest soil movement of cesium through forest soil is directly after the deposition because at that time all cesium is in available form.
After that you have first difference of [Unclear] cesium soil was [Unclear].

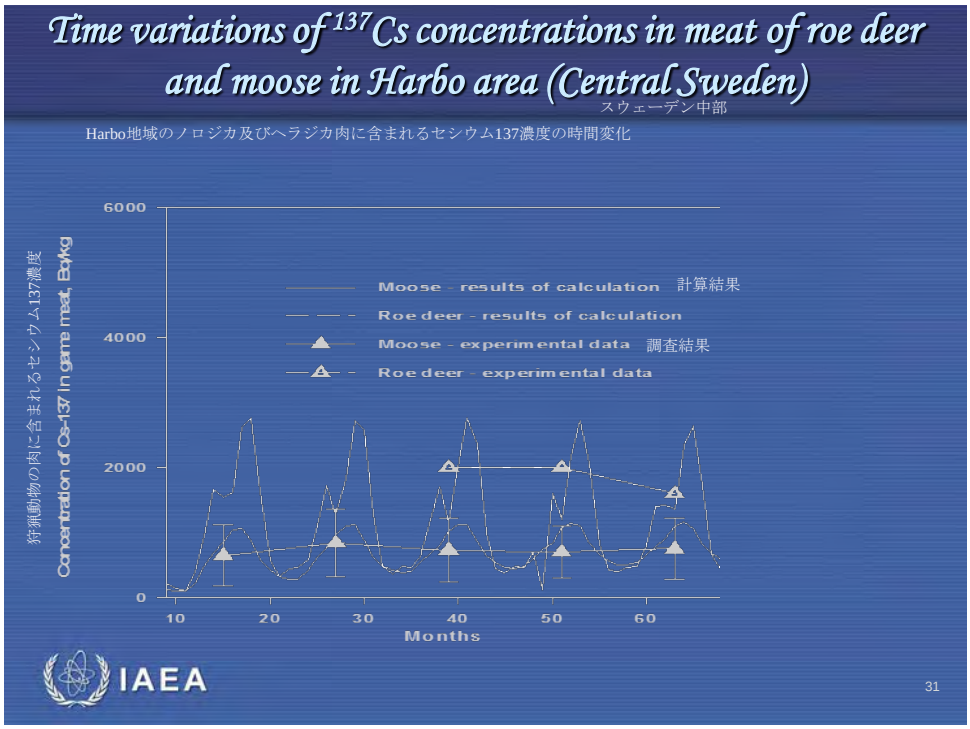


We use average data sometimes for the assessment of the parameters. [Unclear] to make, in any case the screenings [ph] of forest soil. We need to make for the [Unclear] of forest soil we will have to make and slow down the transfer of radionuclides in the forest soil.

Okay. Let's come to the FORESTLAND model which was especially developed upon request from Russian ministry [Unclear] because it also has a forest department which is responsible for the radiation protection [Unclear] forest resources directly, monitoring [Unclear]. The development of the model was supported also by Sweden, France and also this is an international model. The model was intended to assess not only long-term forest management but also for reviewing the case of the potential future accidents because it included actually different models. Actually it is not a single model, essentially a family of model. It could – [Unclear] so a model which can begin to describe the behavior of [Unclear] in forest directly after the deposition but the variable used in the case of future accidents, forest tree [Unclear] limit that information and [Unclear] causes to humans and to non-human species.



Here as you can see [Unclear] FORESTGAME model and compartments and you see this model describes several dynamic [Unclear] shrub or fungi so it describe the [Unclear] potential in different seasons. And the model also describes absorption of cesium in different food [ph] levels. The model describes, also potential to moose and roe deer, the concentration of [Unclear]. In this case the model also model accumulation of cesium in the [Unclear] in animals behavior so the [Unclear] was considered the function of cesium, function of time here. It allow seasonal [Unclear]. And what drives this model was [Unclear] and which addressed the application of different management options.



One example, application of model for the Harbo area in Central Sweden. You can see that model works quite well but here [Unclear] some points. You see, this data was established data, but the seasonal dynamics is quite sharp here.

And this model, I'll give you an example how it could be applied for the assessment of different, I would say forest management options, how to provide forest management here. For example, [Unclear] for the big concentrations of cesium in muscles of animals, for example, here, we can get more clean muscles and so in this case transfer to the public will be much lower.

If you shift hunting periods when people are hunting [Unclear] for example, roe deer is [Unclear] in this case the [Unclear] will be much lower.

[Unclear] but it is not clear from this [Unclear] data.

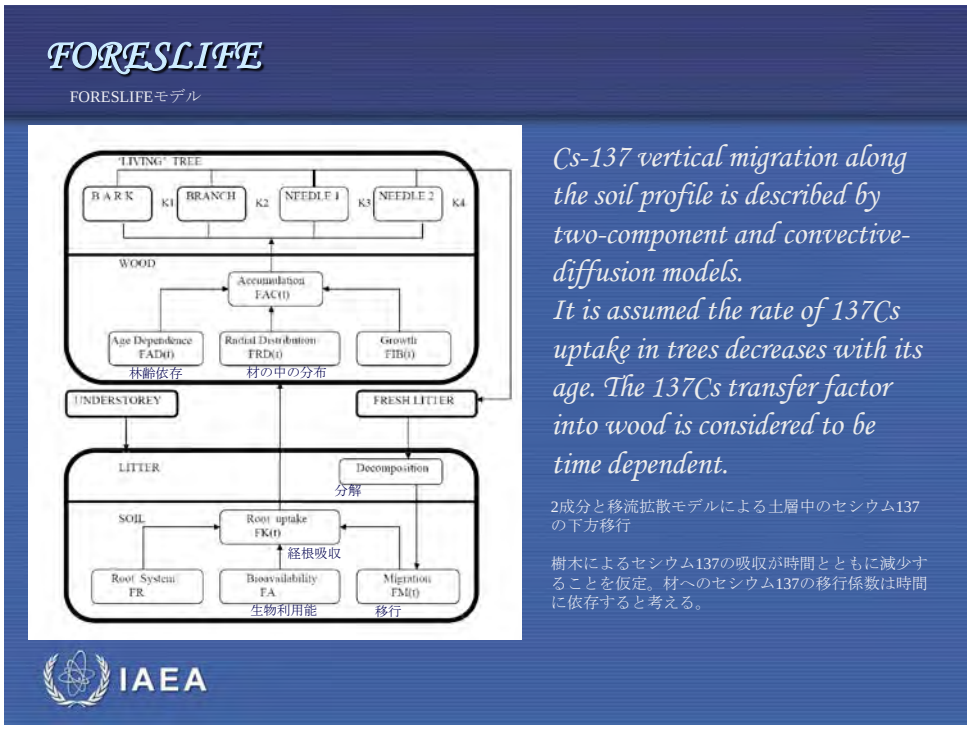
The same thing is for the wild boar, the same thing is for wild pig, wild boar.

And another point [Unclear] application of the salt licks ferrocene for animal range. In this case, you also can decrease contamination of the muscles of the forest game.

You see there are such measure as application of the ferrocene salt licks which [Unclear] salt licks animals like, salt lick because [Unclear] not like [Unclear] ferrocene salt, you can distribute that [Unclear] in the forest, and which

animals game, forest game can eat this ferrocene and in this case also can provide some effect in terms of the decrease of the contamination of game.

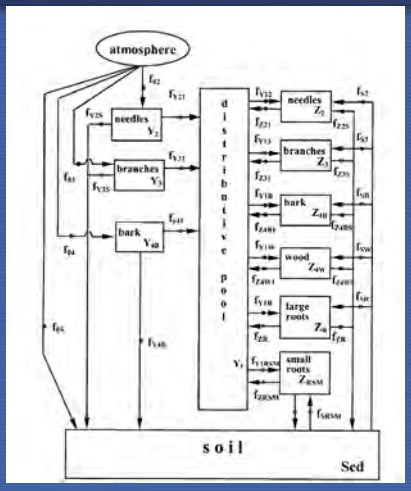
You can see some features of the FORESTLAND here about the method about [Unclear]. The most important that the parameters acquired are transparent here.



FORESTLIFE model was developed in Belarus by Alexander Dvornik and Tatiana Zhuchenko. Actually, my colleague [Unclear] know him quite well. I suspect and as I also [Unclear] FORESTLIFE is a very good model. The only problem in interpretation of this model is that the parameters are not time dependent or for example, [Unclear] fraction of cesium is considered [Unclear] during migration and all other issues [Unclear] say this model is also quite good but I don't go ahead because my time is limited and does not [Unclear] because of that [Unclear] in many time.

ECORAD-C

ECORAD-Cモデル

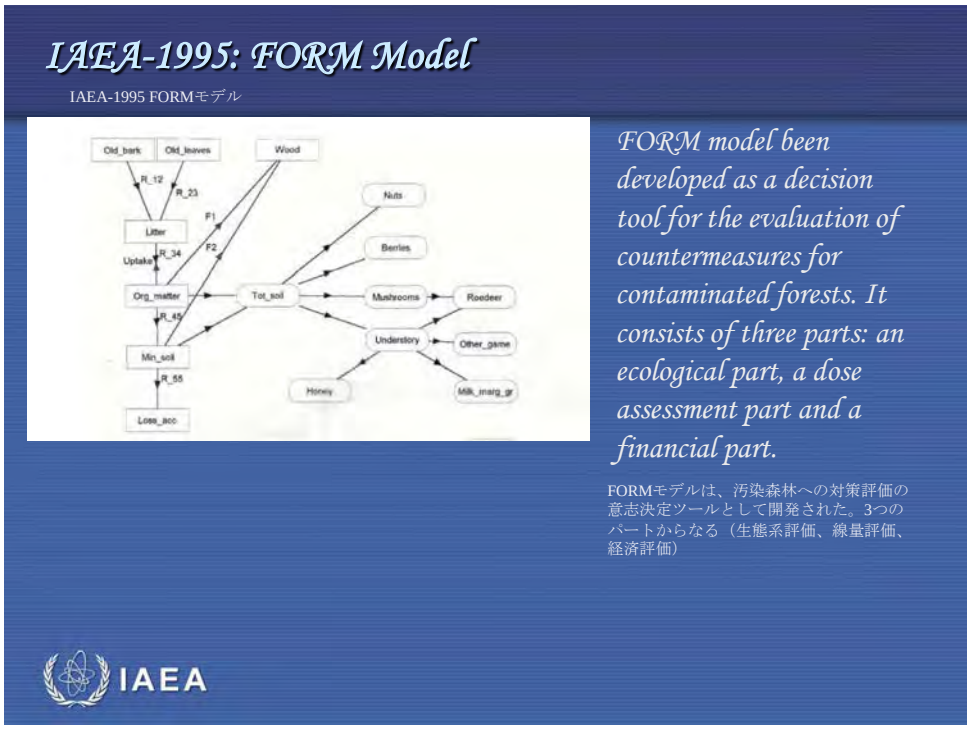


The transfer of Cs-137 is assumed to be similar to that of potassium.
Radionuclide dynamics is considered in parallel with the dynamics of biomass of the tree compartments.
Cs-137 in the vegetation is assumed to be pooled into two basic compartments: external and internal contamination, with separate analysis of each one.
The model was verified using the data obtained during 1986–1994 in the 30 km zone of the accident on Chernobyl NPP.

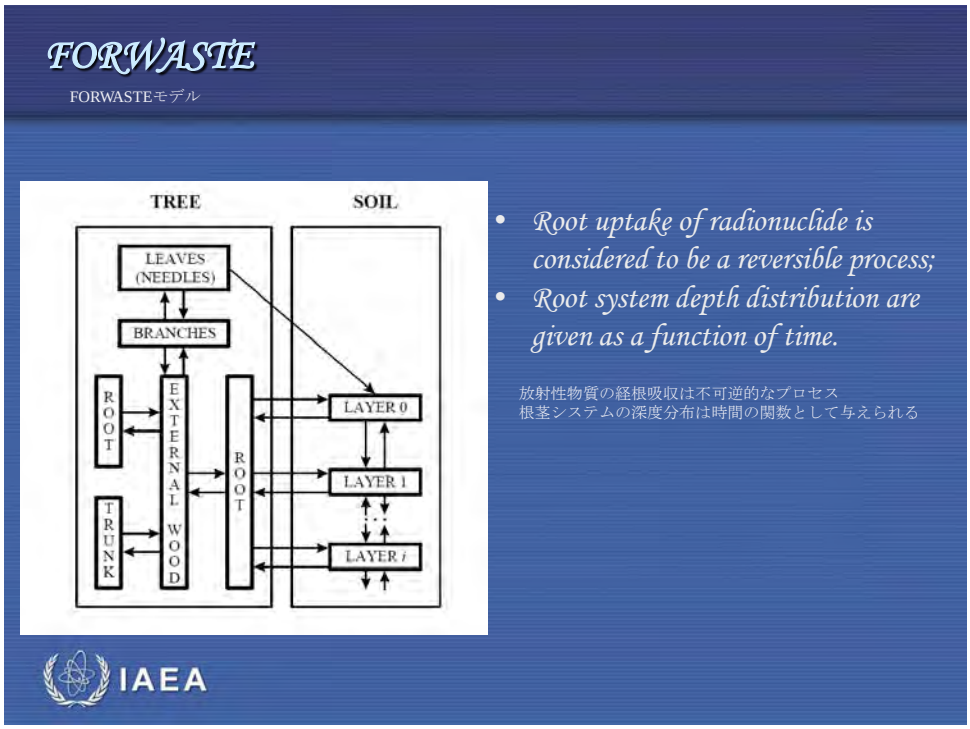
セシウム137の移行はカリウムと類似していると仮定。放射性物質の動態は、樹木成分のバイオマス量と対応する。
植物内のセシウム137は2つの部位に貯留されると仮定。外部及び内部の汚染は別々に解析。
モデル検証には、チェルノブイリから30km以内地域で1986～1994年に得られたデータを使用。

IAEA

PASS

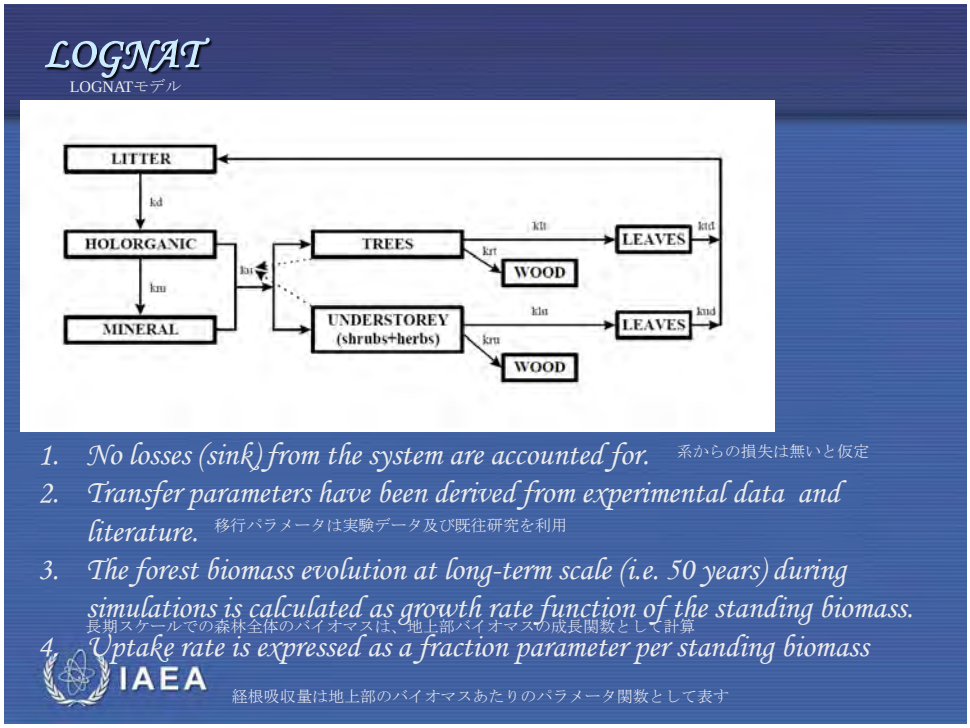


FORM model; actually this model was developed by the IAEA group in 1995. It was especially done to support the evaluation of the countermeasures for contaminated forests. Because as we look at the agency [Unclear] is a subject already for many, many years agency has unique experience in the development of [Unclear]. This feature was adopted was not only for cesium but also for strontium that's good. And the model is quite, I won't say simple but it's a good of schematic [ph] model. It would be used for assessment of some [Unclear] feasibility of the forest. This is the main advantage of this model.



FORWASTE was developed by Alexei Konoplev and his group, so now he is moving from Obninsk to Fukushima and we'll be working in the [Unclear] group. We also – we're expecting not only in the area of [Unclear] but also attend the core group and deliver his point which was actually [Unclear] model as he wished to [Unclear] this model which was [Unclear].

Quite simple model but very good [Unclear] forest so this model would be applicable for the [Unclear] forest I'm afraid demonstrated quite good results for them.

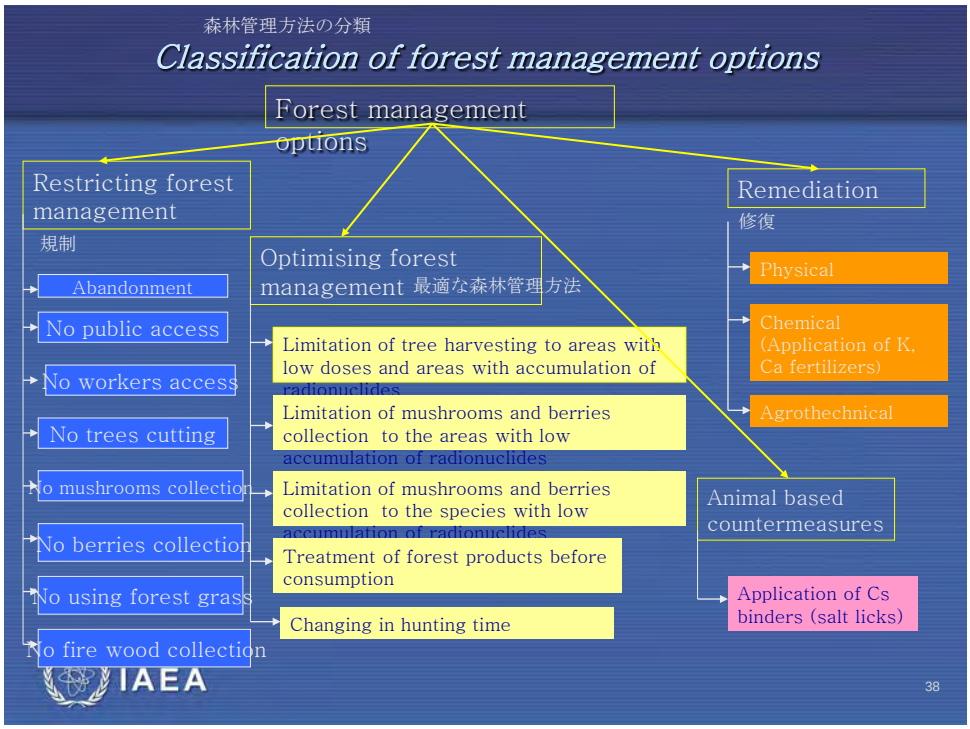


Also a simple model, which you can see from here was developed by Italy from [Unclear] University of Trieste, and based on the also [Unclear]. It considers the dynamic of the biomass intersection and we had the advantage of studying this model, growth rate is considered so. The uptake rate is expressed in fraction of standing biomass.

Actually, a similar model before was also developed in Italy by our colleagues from [Unclear].

Actually similar to other models, features that it considered [Unclear] dynamic on the forest biomass – forest tree biomass.

Feature of the model is also that the uptake rate was expressed as a fraction of the standing biomass, so it was static [ph] parameter.



Okay. Now [Unclear] 10 minutes and 30 minutes more okay, because I have just 2 slides here. My time is almost expired. Okay, let's come to the classification of the forest management options.

As I mentioned, there are not many options for forest.

But you see, actually several options which were tested after the Chernobyl accident. They've been classified into three groups.

Restricted options, or I would say, restricted management options, optimizing the forest management and remediation. We can classify into three groups that is given here.

[Unclear]. So first group includes, abandonment, when we just leave this [Unclear], we can actually close public access, we can close workers access, we can close tree cutting, so you can see all these options which we've listed [ph] here. And all these options can be assessed in terms of the [Unclear] experience. We can consider all that together the abandonment, but we consider also limited options here, no using of forest grass was very important for the forest cows and [Unclear] further and yet dependent on the contamination level.

Here you can see very important group of options, because it is forest optimization. We can optimize many, many things to make doses for the forest [Unclear] much lower based simply on the optimization. For that you

will need to have extended maintenance information. We need to have a look at different options and possibility. And I've tried to summarize these options here, but I can tell you that – I can say these options are quite most effective and most of them were tested in the different areas affected by the Chernobyl accident.

I mentioned already about changing in hunting time, [Unclear].

It cost not so much but [Unclear] incentives in terms of the increase of the contamination of forest products, which are available for harvest.

Valery Kashparov mentioned already about appreciation [ph] of the forest products because I can use different culinary mix to cook forest products. And in this case you also can achieve substantial decrease of the contamination of the final product.

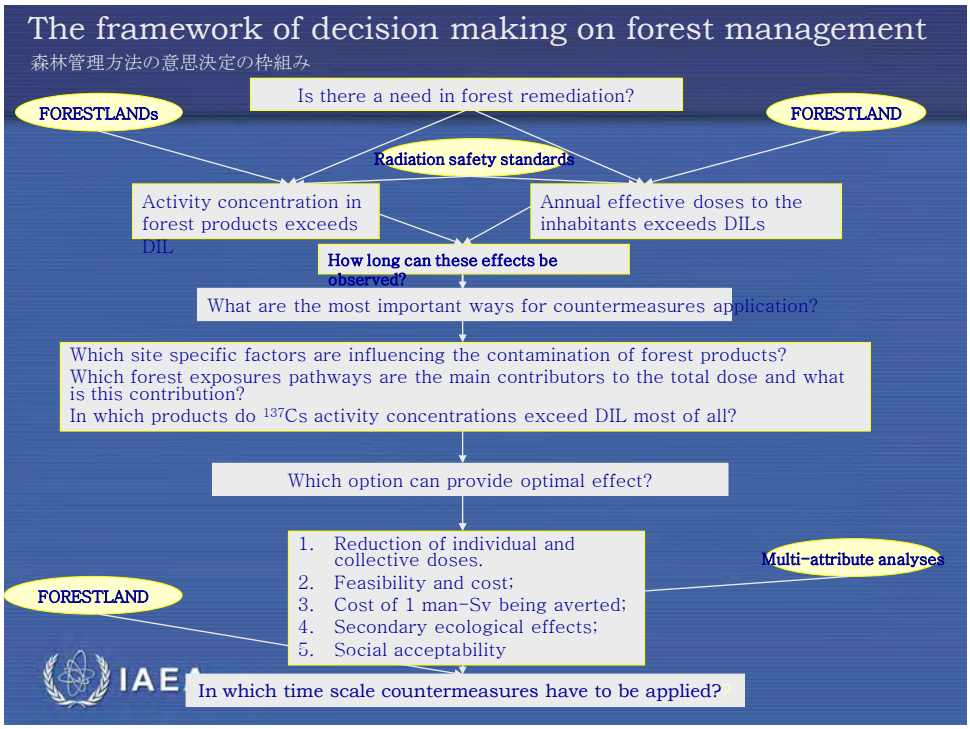
Remediation, physical measures, it is exactly what our colleagues are doing now in Japan, this seen [ph] green [Unclear] etcetera all other options are in fact of the physical, remedial actions.

And we realize that new information is really available here and we would like to extend this option [Unclear] data which now are available for forest department.

Three elements. Next group is chemical options. Actually, as I mentioned already about lime, so lime and fertilizing forest we can increase cesium transfer to trees and to understory species by type so we can get some positive effect for maybe 3, 5, 7 years. Recent studies did in conjunct with [Unclear] and the paper was published in 2011, so we could consider also this option, as a matter, against internal exposure. We need to have clean wood, or something [Unclear].

Agrotechnical, it is just plowing, we could generally remove soil, but you also can plow the forest soil to beyond the contaminated layer. In this case it will increase the external exposure etcetera. This option was also tested in Japan.

Application of the various – application of the salt licks I've talked already, can be executed for animals salt with special properties, which would allow substantial decrease of the contamination of cesium in muscles.



Next slide which demonstrate the system which was implemented in the Bryansk region, Novozybkov region or Bryansk region, how again, we consider, how we select optimal [Unclear] options which in forest how we provide optimal forest management here. First step is now we have to assess whether remediation is really required? Second, we require models to assess doses to the population [Unclear] create resistance and looking at the radiation safety standards at the permissible level, we can come to the conclusion whether we really need to provide some actions or not. This is actually important step [Unclear] application of the remediation.

If we came to the conclusion that remediation is required, some protection is required, we can find the optimal management ways, how to do it. And in this case we can investigate forest exposure pathways, which factors are increasing the contamination of forest products, where DIL is derived investigation levels of accident etcetera. Based on that we can find options which can provide optimal effect.

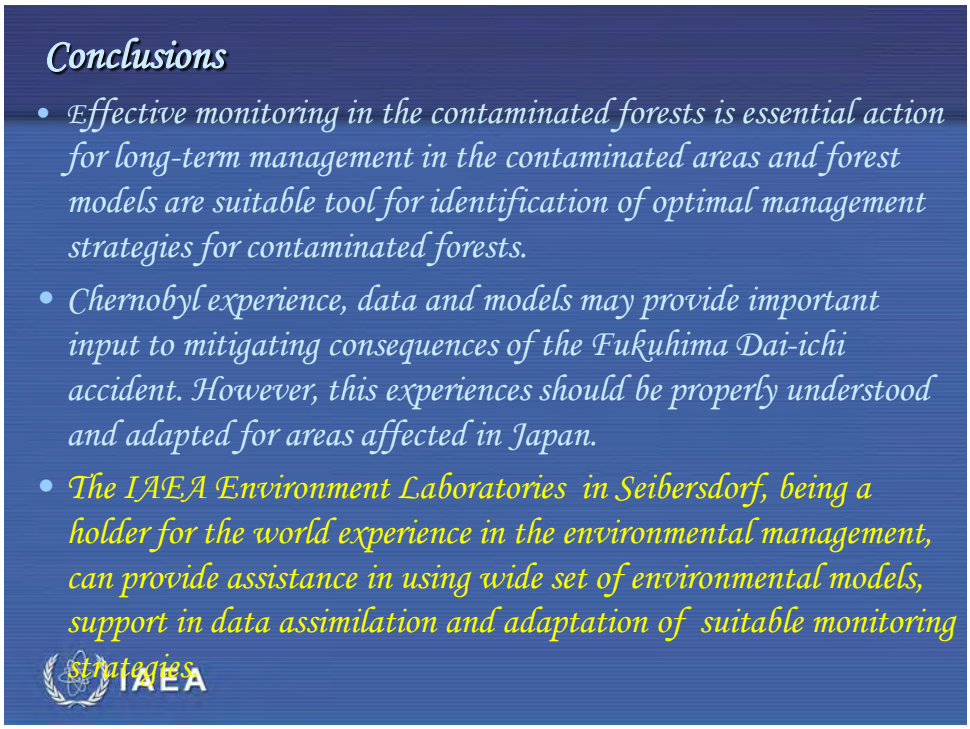
Based on this information, we can assess different parameters for making decision and these parameters cannot be quantified or not all parameters can be quantified. You see quantifying as expressed something in monetary way, quantify something. In numbers, not only…

For example, reduction of individual and collective doses we can express in

some ways. Feasibility can also – [Unclear] but social feasibility we cannot express in some ways. We need a special approach on for doing it. Our decision should be based on the accumulation of different parameters some of them can be quantified, some of them cannot be quantified or qualified. This is actually an approach where we can use a special approach for that multi-attribute utility analyses and this, yes, approach is which inscribed in Agency documents that can provide advice how to involve stakeholders to support [Unclear] etcetera. The final point is I think you will want to translate it. Yes.

And we need to know how long we should provide [Unclear] remedial options. We need to understand the time scale to the problem. For that we need to also apply dynamic model such as FORESTLAND. And what you see is that in course of time the situation will be much more easier than now and in 5 years, 10 years, some [Unclear] for that you need to make some predictions based on the model slides [Unclear] models which I mentioned above. This is about the framework of forest. We identified all the optimal management framework.

And here I can show you some referral documents which have been quite useful for making some decision on the forest management. So this is a recent document where forest is mentioned and approach how to apply – how to identify problems [Unclear] is also addressed here. The documented [Unclear] it describes how to employ these options for urban, for the [Unclear], for the food environment, [Unclear] environment. So you can find this information in the Technical Report Series 475 which was recently was published with involvement of [Unclear] experts make on the remediation. Then also some recent [Unclear] 3 documents on the subject. There are books on the subject and there is also a Chernobyl forum.



And now [Unclear] to establish conclusions. So I tried to prove that effective monitoring is of paramount importance for making decision on proper forest management.

And I also tried here to prove that forest models are very suitable tools for them.

It would be very nice if I was to succeed such [Unclear] and it would be very nice if I would get to accept my point in the future.

And [Unclear] Chernobyl experience, even though environmental conditions are quite different from the Fukushima's environmental conditions, would be very much important for the areas affected by the Fukushima Daiichi accident. At the same time, this experience would be properly evaluated, properly understood and adopted for areas affected in Japan. There's no direct way how to implement it but this way exists.

Agency Environment Laboratories is doing its job for already around 50 years would be [Unclear] in discussions and being a holder of the world experience [Unclear] to provide assistance to any organization looking for the environmental remediation – environmental impart assistance in various affected place accidents like Fukushima.

We can help you with [Unclear] implementation of the models with information, with some scope of different models and we could overcome them with little protection or suitable maintenance programs.

Thank you for your attention and for your patience. I spoke a bit too long but I've tried to cover advantages [ph]. Thank you once again.

質　疑

Male Participant
Thank you very much Sergey. How about a small talk? Yeah.

[Japanese]

Male Participant
Thank you very much for you presentation. It was very, very, very interesting.

Sergey Fesenko
It's my pleasure.

Male Participant
But I have a question about the model because some of them has many compartments and how to measure some, for example, bioavailability of cesium in soil, do you have any details about that?

Sergey Fesenko
Yes, I can. Actually, we have mainly with [Unclear] models which [Unclear], for example, with extraction, different material. If you have a look at our paper published in the central documents, in environment you may get [Unclear] so you can find that there was a poster already published there so we took this information directly. Because that documents we just used [Unclear] for that and we also introduced more simple model, process, time dependence, each parameters is different from [Unclear] level of cesium. For that we don't need to wish that model or the ecosystem. We can model just part of the ecosystem like [Unclear] volume study. So we use such approach for that. Sometimes you use direct ecological parameters. I told you that, each [Unclear], gathers information simply from the [Unclear] so you see I think the proper way for the modeling of such systems it is a combination of the ecological, and radical approach. We have to combine them, of course, you see radical is part [Unclear].

Male Participant

Okay. Thank you very much.

[Japanese]

Sergey Fesenko
My knowledge of Japanese is still not sufficient to answer your question directly.

[Japanese]

Male Participant
In Chernobyl affected areas is there any force to encourage the use of those materials like mushroom or game animals or something like that?

Male Participant
In the surrounding area of the Chernobyl, is there any pressure from the, what you call, the people to use the timber or some forest materials including, some mushrooms, berries and games or the government or some other sector wants to force to the people to use that forest products like is it anyway in the surrounding areas, the condition of that?

Sergey Fesenko
I would say is that now, not because these areas are, [Unclear] they just, you see, the question is if they can consume this forest products without any restrictions? The restrictions is when there is a health episode outside of this area. And in this case some people outside have rejected these forest products, but in Bryansk region this area is, the product consumed wouldn't result in any restriction and there is no pressure. For cucumbers there are actually irrigation safety standards, restrictions which was shown in models presentation. If contamination levels are below these standards, these products will be considered as safe and European Commission, European Union is buying this wood without any restrictions, so there are many customers around [Unclear] and without any pressure.

You see [Unclear] is a natural phenomenon, you have to understand that. For example, cucumbers consists lot of potassium 15 [ph]. If you compare

the selection of the potassium 15 to cesium you'll find that many [Unclear] of natural level of potassium is much higher. There is no reasons to be afraid that this commodity, this root can provide some detrimental effect if contamination of cesium in such commodities or food products are below x levels. This is actually the approach. Now people have good experience, with understanding. Actually it is [Unclear] but if they see the contamination levels below admissible level, we always felt actually it is safe. If it is higher in this case you can face some pressure and some problems.

Male Participant
Thank you very much.

Sergey Fesenko
One thing and should not actually affect these products even it is higher than contamination levels. Because there are many ways how to proceed, how to process these products and [Unclear] product is acceptable safe. [Unclear], I'm expecting your question about [Unclear].

Male Participant
One simple question. You introduced remediation by using the liming or fertilizing. These methods are actually applied to the wide area of the forest, if yes, was it successful economically?

Sergey Fesenko
Actually not, because you see this method is quite expensive. You know, it is very difficult to deliver lime and fertilizers in the forest. It is quite costly. Because it is actually hand dropped [Unclear] it is why costly procedure. We can do it, certainly. Somebody can consider maybe some options to do it may be near the [Unclear]. But actually there were no straight reasons for that. But some small areas, in some cases could be feasible, as I was saying, but not on a large scale application, [Unclear].

Male Participant
Thank you.

Male Participant
Thank you very much. I would like to ask about sampling method. In your presentation you mentioned that, we have – when we set up the monitoring quarter, we have to avoid a relief or runoff or such any kind of…

Sergey Fesenko
Yeah, we should.

Male Participant
Yes. I suppose, you already know the trees from Fukushima is very different from Chernobyl so I'd like to hear about your impression of same in Fukushima situation?

Sergey Fesenko
You see, certainly as I told you the experience from the Chernobyl affected areas shouldn't be transferred directly. It will result any proper interpretation, any analysis. That's why I tried to explain some differences between actually forest and areas affected by the [Unclear] and after that [Unclear]. You need to have a look and you need to develop your approach for the way [ph], your approach for the selection of such sites.

The requirements from my point of view, this approach should be standard designed. It should be for all groups which were standard and wasn't affected [Unclear]. Otherwise we will not get comparable results. Second we need to decide how to, account for run-off in such case. We need to include a number of selection and we need to take it into account, we have to describe in the special document how to do this. It should be implemented somehow.

For now there are no any approaches [Unclear], think about and so we need to develop a document. Agency is organizing a special meeting on sampling. Of course, Agency wants to prepare the international guidelines on sampling strategies, etcetera. Professor [Unclear] who attended this meeting as a participant and help IAEA to [Unclear] Japan. I hope you will raise this point in the group and we'll try to provide some international view on this subject. But you see the reason Japan is actually – first of all it's your business to

propose the approach for that. If you need our advice we're always ready to come and [Unclear].

Male Participant
Okay. Thank you.

Sergey Fesenko
Thank you.

Male Participant
One more technical question. In your presentation you also showed one example of extraction of cesium from soils or litter. But in that table, the residual cesium of litter is very high, even if you extract with three normal hydrochloride, what do you think about very strong acid cannot extract the cesium?

Sergey Fesenko
You see, it is not always possible to extract all cesium. This is as a matter of fact [Unclear] but you see it is based on the actually standard [Unclear] approach used to categorize, the standard [Unclear] approach. This approach people were using [Unclear]. I see that not all cesium was destroyed here was, [Unclear] but that's what you have. Even for the real [ph] 0.2 used for the A8 [ph] level because litter is not only limited sources of fraction [ph] of that which is not easy to dissolve at the time of the extraction, certainly.

Male Participant
Okay, thank you.

[Japanese]

Male Participant
Thank you very much for. So, 20 minutes later a new meeting will shortly happen here.

END