LONG TERM ECOLOGICAL BEHAVIOUR OF ABANDONED URANIUM MILL TAILINGS

4. BIOMASS TRANSFER OF RA-226, PB-210 AND URANIUM IN TERRESTRIAL AND SEMIAQUATIC AREAS AND RELATED FOOD CHAINS

1. INTRODUCTION

1.1 GENERAL OBJECTIVES

Environmental pathways of long-lived radionuclides from uranium mill tailings to the environment should be evaluated in communities which as closely as possible refect those of the future. Typical early colonizer species have established on uranium mill tailings two decades after abandonment. The growth characteristics of these early colonizers have been evaluated as well as the radionuclide transfer to the plants in terrestrial and semiaquatic areas on uranium mill tailings in the Bancroft, Elliot Lake and Uranium City areas. This information is placed into an ecological context for the present and the future communities.

1.2 SPECIFIC OBJECTIVES OF THE INVESTIGATION

The specific objectives of this work are to arrive at estimates of mass transfer of radionuclides from the tailings to indigenous pioneering communities which have developed on inactive or abandoned uranium mill tailings sites in the past two decades. These estimates are related to consumption by fauna, which may graze on these specific plants. A review of the ecological dynamics of the vegetation community and biogeochemical cycles on the waste sites is attempted to forecast long term trends.

2. MATERIALS AND METHODS

2.1 TREE DENSITY AND BIOMASS

Crotch - havast, height and weights
Nordic - tree counts
above ground biomass: Crotch - herbs, shrubs, grass
Gunnar- grass

2.2 CATTAIL LITTER AND BIOMASS

Litter collection , standing crop.
Similar to Report # 2

2.3 FOOD CHAIN CONNECTIONS

No site specific data have been collected on the fauna associated with the uranium mill tailings sites.The information on consumers of the plant species has been derived from the literature.

3. RESULTS AND DISCUSSION

3.1 TERRESTRIAL ABOBE GROUND BIOMASS

FIG. 1. height and biomass
Fig. 2 Biomass distribution of white birch less then 50 cm tall.
Table 1: Tree densities for Aspen and Birch.
Table 1a: Ground cover biomass volumes
Table 1b: Estimates of total above ground biomass weights
Fig 3: Ra conc. in washed White Birch
fig.3a:Ra conc. in unwashed white birch
Fig 4: Pb 210 conc. in wahsed White Birch
Fig. 4a: Pb 210 conc. in unwashed white Birch

3.2. WETLAND ABOVE GROUND BIOMASS

Table 2:The concentrations of Ra 22 in biomass components in a cattail stand/m2

Table 2a:The concentrations of Pb 210 in biomass components in a cattail stand/m2

Table 2b:The concentrations of Uranium in biomass components in a cattil stand/m2

One example of the tables 2 is given:

Compartment		Weight collected	Ra conc/g determined	Ra conc/m2 calculated	Max Ra conc accumulated
Leaf litter	E				
	B				
	C				
Fruit litter	E				
	B				
	C				

e t c

3.3 THE CONSUMERS

Table 3: Animals species consuming major pioneering plants growing on uranium mill tailings

Table 4: The range and density of bird populations

Table 5: The range and density of mammal populations

Table 6: Analysis of avian diets

Table 7: Analysis of mammalian diets

TAble 8: Animals and their occurances in relation to the study areas.

3.4. SUCCESSIONAL CHANGES AND THE RECOVERY OF URANIUM MILL TAILINGS

This section will report the data I have for concentrations and ages of White birch and Trembling aspen, Figs. 5. Data from the literature will be discussed on successional changes on waste sites, root zone development and soil development, fire cycles and timeframes for some relevant ecological aspects.

4. CONCLUSION

The conclusion will highlight the complexities in addressing long-term environmental impacts of persistent trace substances such as long lived radionuclides and hence the difficulty in modelling the environment.

5. REFERENCES

References for the consumers are included.

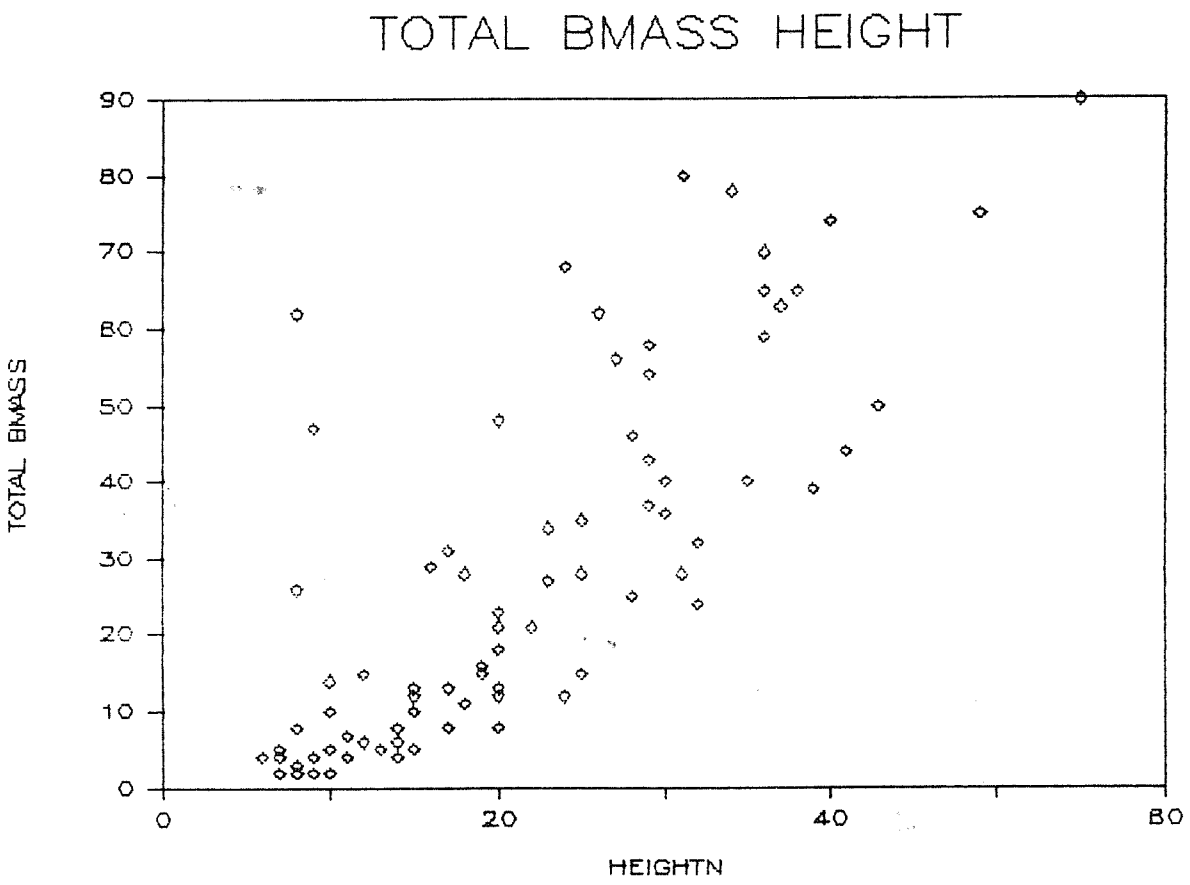


Fig 1: Biomass in gr versus height in cm. for White Birch on Chrotch.

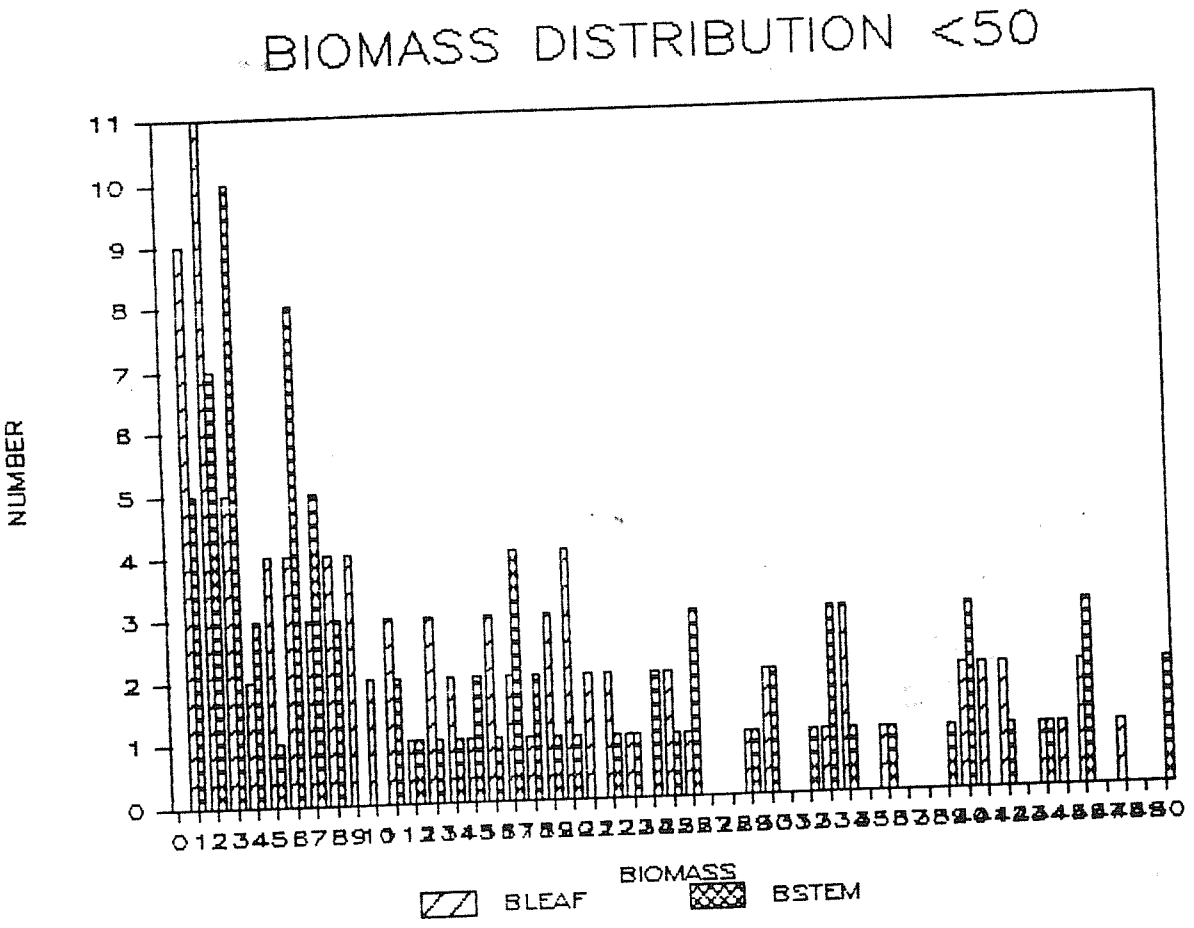


Fig 2: Biomass distribution in White Birch Trees less than 50 cm tall.

Table 1: Density of Trembling Aspen and White birch on Nordic (Elliot Lake , Ont.)

DENSITY AND BIOMASS OF ASPENS ON TAILINGS

Height m	Density trees/m^2	Biomass g/tree	
		Leaves	Stems
<1	0.0536		25*
1 - 2	0.0164	50	
2 - 3	0.0108		100
3 - 4	0.0075	315	200*
			1140

* Leaves and stems

DENSITY AND BIOMASS OF WHITE BIRCH ON TAILINGS

Height m	Density trees/m^2	Biomass g/tree	
		Leaves	Stems
<1	0.0097	11	17
1 - 2	0.0067	120	210
2 - 3	0.0091	520	615
3 - 4	0.0039		700*

* Leaves and stems

Table 1a: Above ground cover composition of Biomass

Add Gunnar values for Grass.

ABOVE GROUND COVER COMPOSITION AND BIOMASS

Composition of 1 m^2	Cover Type 1		Cover Type 2	
	%	g/m^2	%	g/m^2
Herbs	43	55)	25	31
Grass	43	55)		
Shrubs	14	18	75	92

Fig 3: Radium in unwashed White Birch

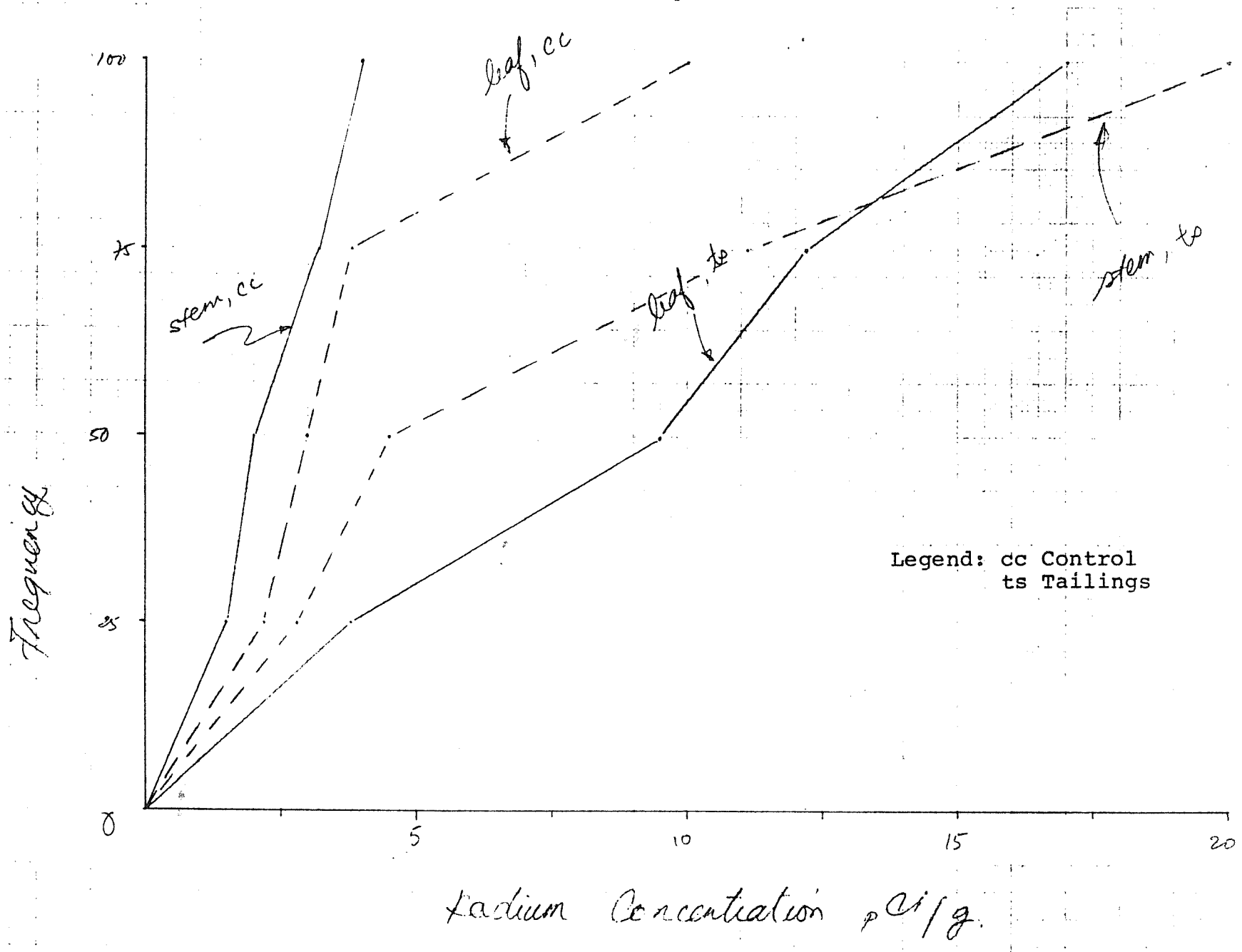


Fig 3a: Radium in washed White Birch

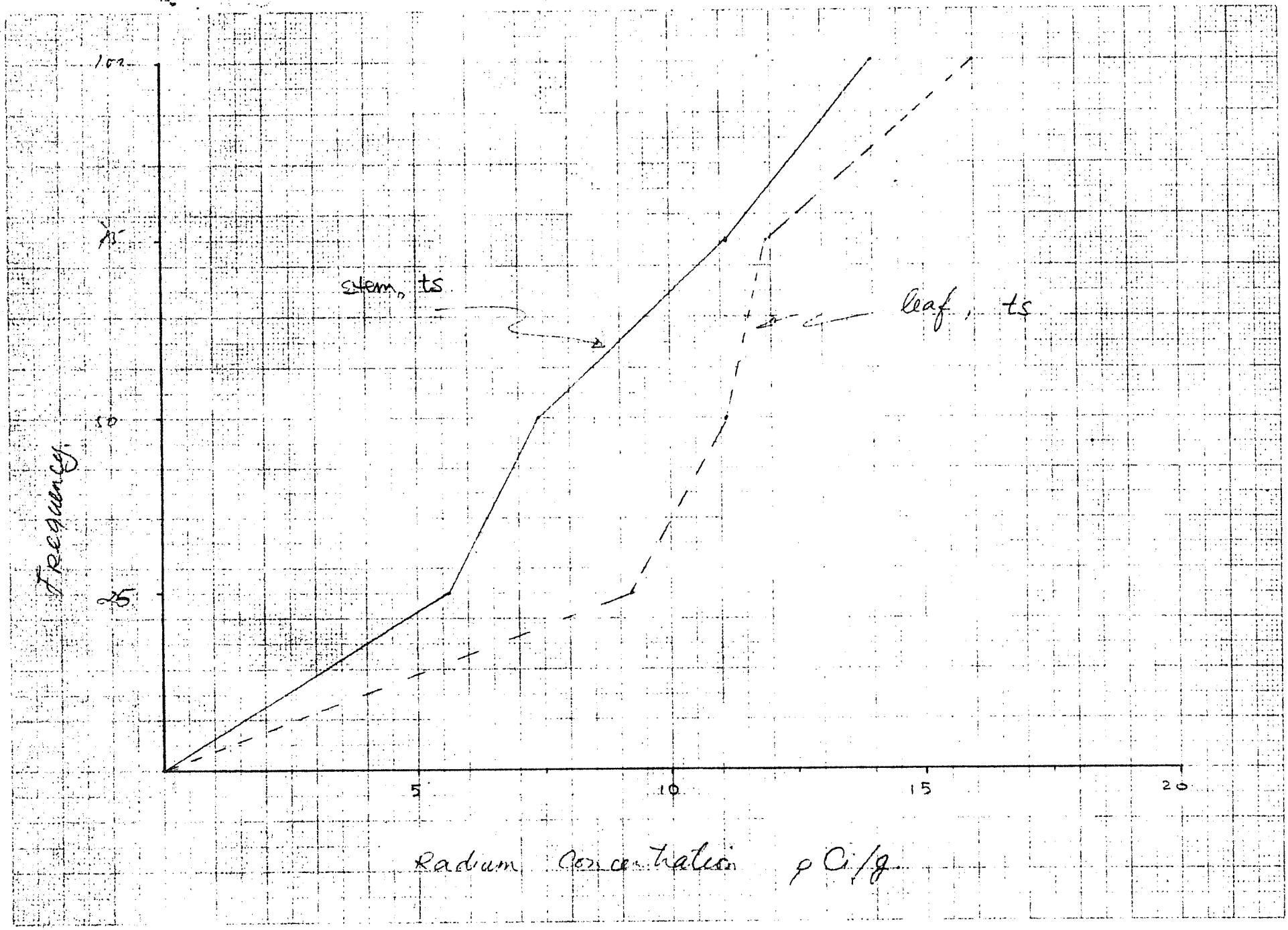


Fig:4 Lead 210 in unwashed White Birch

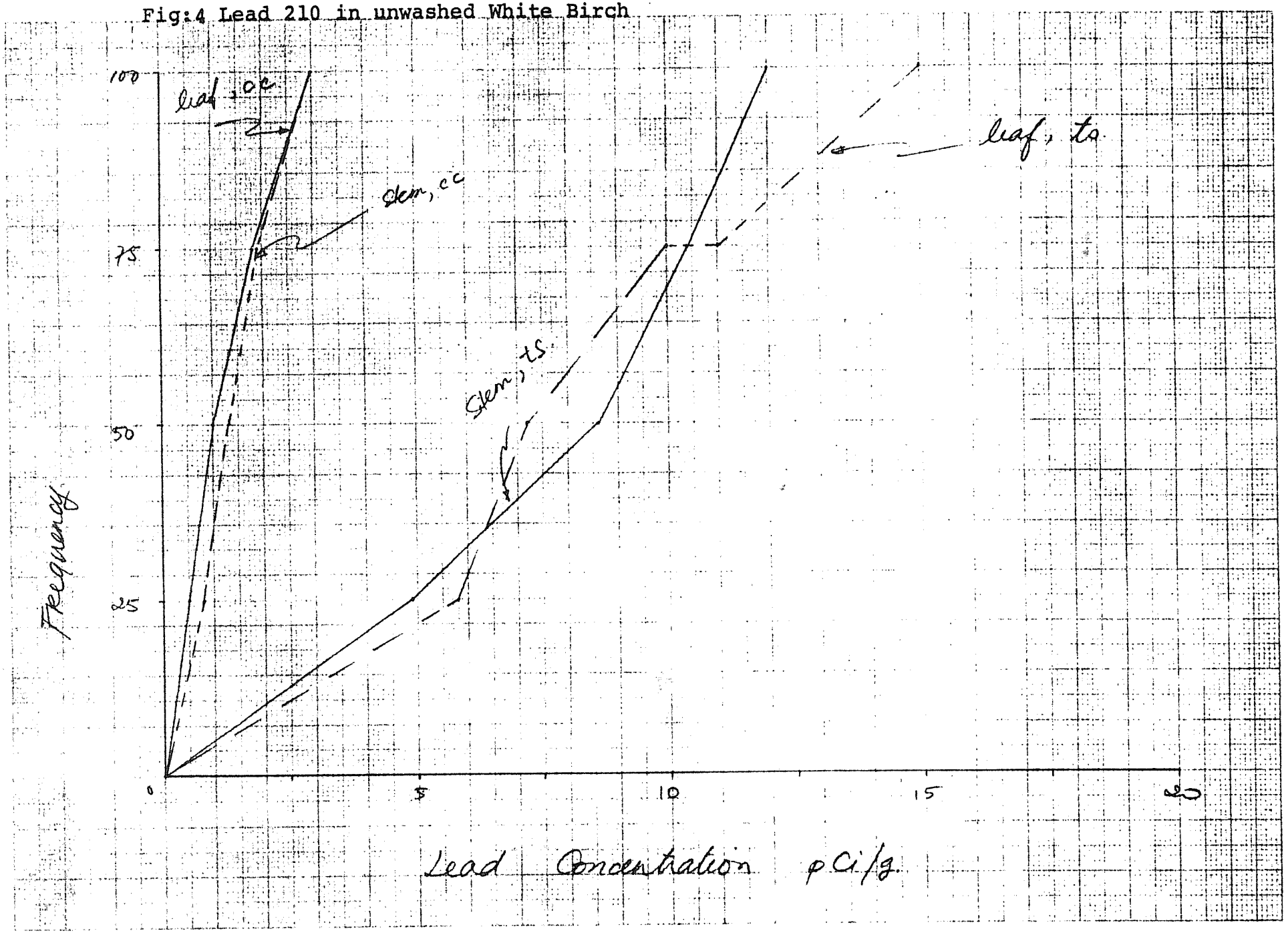


Fig 4a: Lead 210 in washed White Birch

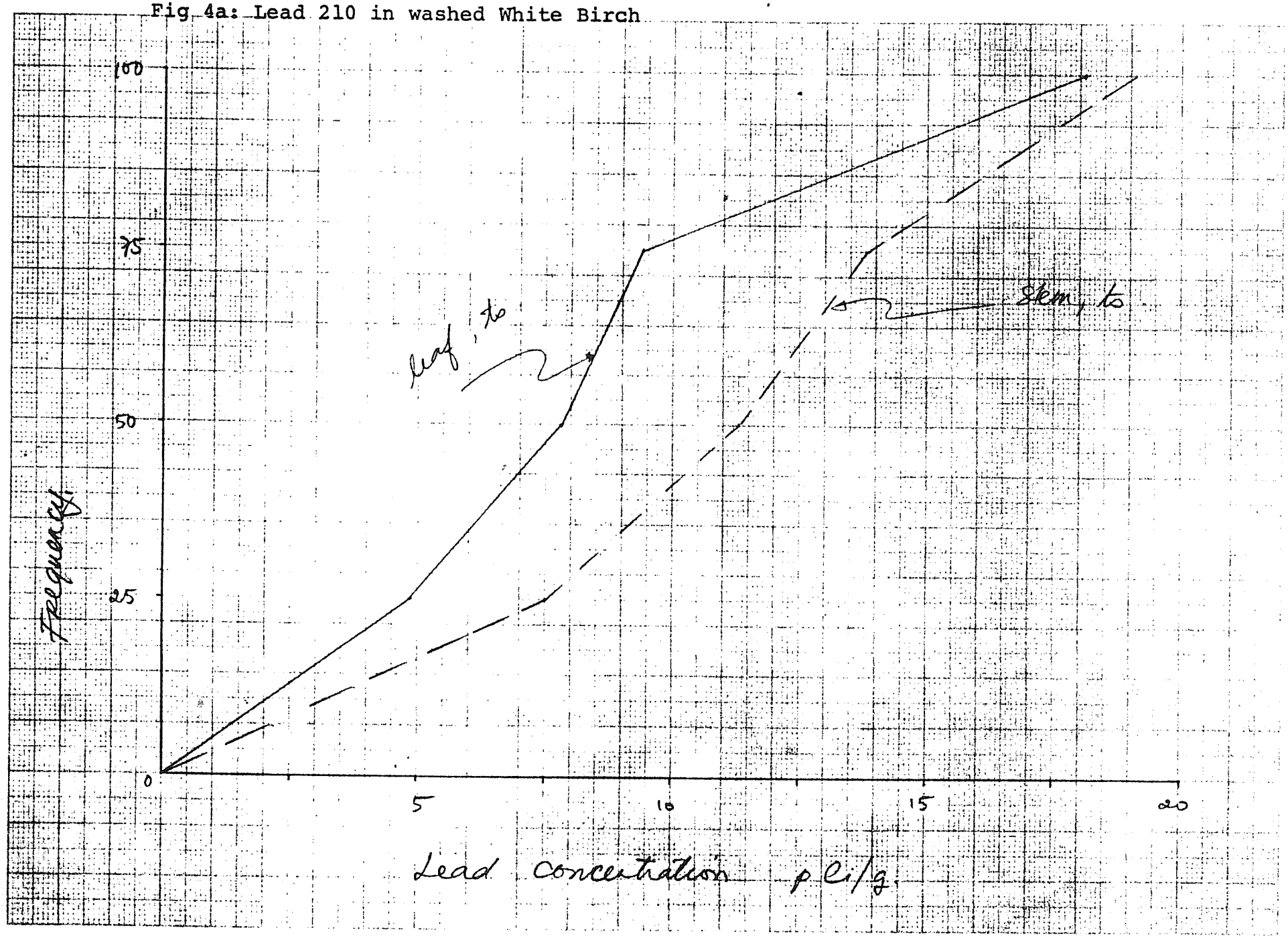
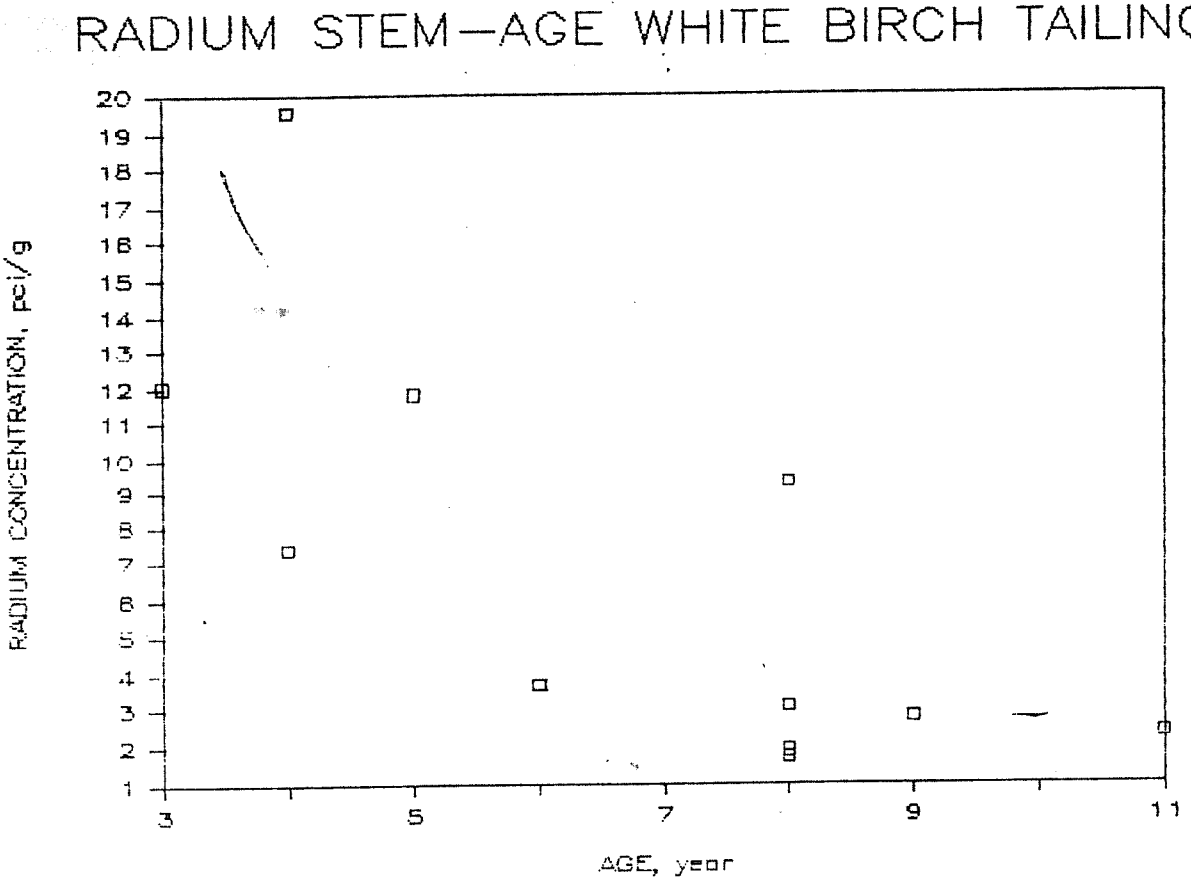


Fig 5: Age of trees in relation to Radionuclide concentrations



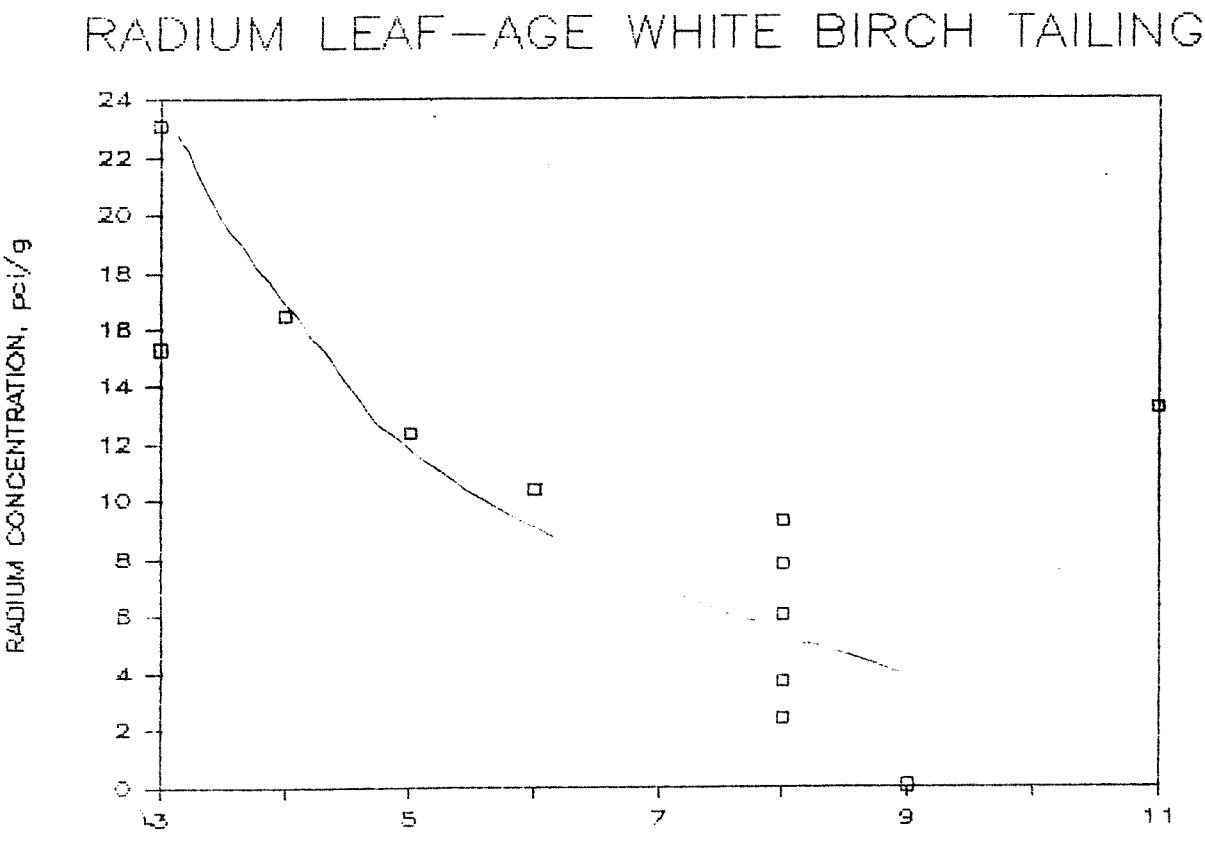


TABLE 3: ANIMAL SPECIES CONSUMING THE MAJOR PIONEERING PLANT SPECIES OF URANIUM TAILING SITES

PLANT SPECIES	BIRDS	MAMMALS
BETULACEAE Betula papryifera	Chickadee, Black-capped* Crossbill, Red Finch, Purple Goldfinch, American Grouse, Ruffed Sharp-tailed Spruce Nuthatch, Red-breasted Siskin, Pine Sparrow, Fox* Waxwing, Cedar	Beaver Caribou Deer, White-tailed Hare, Varying Moose Mouse, Woodland Jumping Porcupine Squirrel, Red
CYPERACEAE Scirpus spp.	Coot, American Dowitcher, Short-billed* Duck, Baldpate (American Widgeon) Black Canvasback* Goldeneye, Common Mallard Pintail, Northern Redhead* Ring-necked Shoveller, Northern Scaup, Lesser Teal, Blue-winged Green-winged Goose, Canada Grouse, Sharp-tailed Spruce Rail, Sora Snipe, Wilson's(Common) Swallow, Tree	Beaver Chipmunk, Least Muskrat Vole, Meadow
GRAMINEAE Hordeum jubatum L. Other grasses	Goose, Canada Bobolink* Coot Cowbird, Brown-headed Duck, Baldpate (American Widgeon) Black Mallard Pintail Redhead* Ring-necked Scaup, Lesser Teal, Blue-winged Green-winged Goose, Canada Grouse, Ruffed* Sharp-tailed Junco, Slate-coloured* Lark, Horned Partridge, Gray Sparrow, Chipping* Savannah* Song* White-crowned* White-throated	 Beaver* Chipmunk, Eastern(?) Least Deer, White-tailed Hare, Varying Moose* Mouse, Deer Meadow Jumping Woodland Jumping Muskrat* Vole, Meadow
SALICACEAE Populus spp.	Finch, Purple Grouse, Ruffed Sharp-tailed	Beaver Deer, White-tailed Hare, Varying Moose Porcupine* Squirrel, Red Vole, Meadow*
TYPHACEAE Typha spp.	Duck, Teal, Green-winged Goose, Canada	Beaver Moose Muskrat

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