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## Long term variability in seeds crop of the main tree species in Poland



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# Outline of talk

- Same general information about forests in Poland
- Information about seed base in State Forests
- Infrastructure for seed base management
- Monitoring seed crops of forest tree species
  - methodology
  - results
  - conclusions

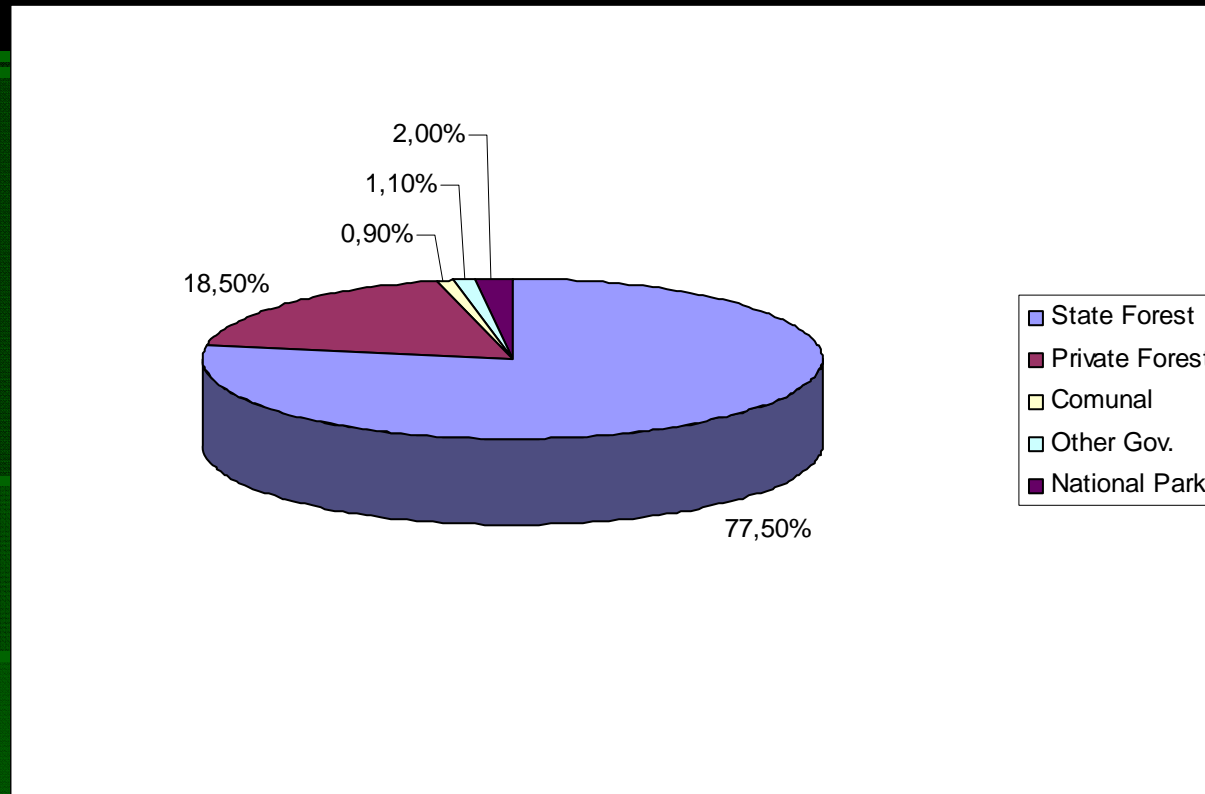
## Information about forests in Poland



Present area of forests in Poland - 9121,3 ths. ha (data GUS 2010)  
29,2 % total area of Poland. The variability in forest area on regional level is rather big and fluctuated between 21,1 % in central Poland to 49,0 % in west and south-east region

# Informations about forests in Poland

## Forest owners



Only 18,5 % forest in Poland are private. The main part of them belong to State Forest (77,5 %) and other governmental organisations.

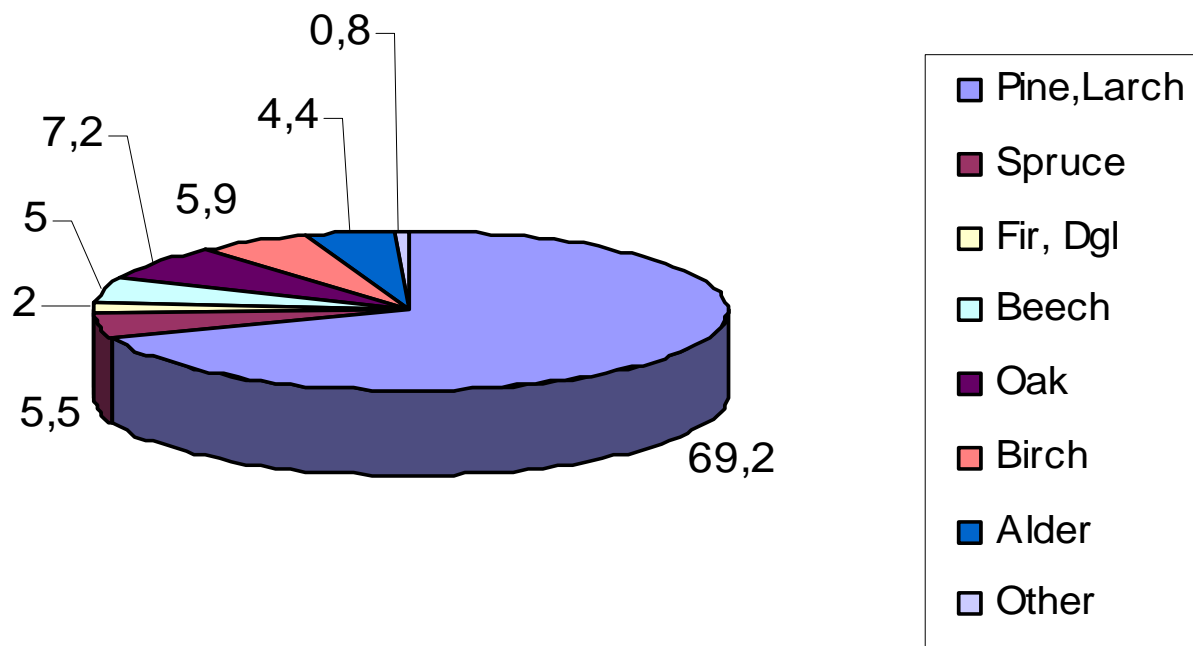
## Information about forests in Poland



Share (percent) of private forest area varied depend on region. Substantial area of that forest are in central, east south part of Poland

## Information about forests in Poland

### Species composition of Polish Forests



## Information about forests in Poland

### ■ Regeneration

- 90 % artificial
- 10 % natural

### ■ Artificial regeneration

- reforestation 55 000 ha
- afforestation 8 000 ha
- replanting 6 000 ha

### ■ Natural regeneration

- 5 500 ha

## Present state of forest seed base in Poland [ha]

Seeds demand of the main forest tree species for the years (1991-2005) (KG)

Year	Pine	Spruce	Larch	Fir	Oak	Beech
Mean (81-90)	17189	4016	3453	21486	893310	84483
Mean (91-00)	10574	1926	2222	13958	1189844	90005
2001	7348	1249	1427	9776	1 150311	79373
2002	7593	830	996	6537	869490	83963
2003	6944	840	1102	5974	909805	77861
2004	5996	795	908	6427	890081	87003
2005	6479	788	800	8785	1125543	74857
2006	6907	756	697	6987	1068532	105700
2007	6047	720	614	6730	1085626	79403
2008	5328	675	607	6720	998251	75373
2009	4920	455	453	5667	917792	74021
Mean (00-09)	6396	790	843	7067	1001715	81950
General mean	11559	2294	2219	14163	1023398	85601
In „Program” for 2010-2035	8000	1500	1000	15000	1000000	87000



## Present state of forest seed base in Poland [ha]

The area (ha) of different categories of seed base in Poland

Species	Populations of known origin	Selected stand	Plus trees	Seed orchards	Seedling seed orchards
Pine	154 500	6957	3670	425,78	279,30
Spruce	14 050	2277	950	75,60	10,89
Larch	1020	445	1016	252,11	171,89
Fir	5580	1370	484	80,15	15,35
Black Pine	100	72	232	25,00	110,64
Other coniferous	180	162	583	52,63	47,30
Birch	2 600	195	267	47,62	13,39
Beech	17 300	2076	553	50,47	11,22
Pedunculate Oak	13,325	1370	557	31,95	23,40
Sessile Oak	2 075	1452	332	53,38	11,00
Black Alder	6 700	563	517	50,23	0
Small-leaved Lime	300	142	135	96,56	0
Other deciduous	740	121	499	21,92	4,55
<b>Total</b>	<b>219 100</b>	<b>17203</b>	<b>9795</b>	<b>1263,40</b>	<b>698,93</b>

## Seed base and technical infra-structure

### Seed extractory

- 17 SE - 3000 ton/year

### Seed storages

- 5 for Fir - 7 t,
- 9 for Oaks - 1000 t.
- 8 for Beech - 250 t.

### Seed testing laboratories

- Laboratories 9
- Seed Control station 5





# Nurseries and plants production

## Nurseries in the State Forests,

- Total area 3.095 ha,
- Mean area 2,92 ha,

## Seedling production - tree ( per year)

- bare-root plants
  - Conifers ca. 450 000 thousand
  - Deciduous ca. 550 000 thousand.
- container plants ca. 100 0 thousand

## Seedling production - shrubs

ca. 12 614 thousand

## Monitoring current and long term crop

Each year Forest Districts obtain from the General Directorate of State Forests a questionnaire that has to be filled in with information on seed availability for the following species:

Scots pine (*Pinus sylvestris* L.),

Norway spruce (*Picea abies* (L.) Karst.),

White fir (*Abies alba* Mill.),

European larch (*Larix decidua* Mill.),

Oak (jointly *Quercus robur* L. and *Q. petraea* Liebl. to 2006),

Oak *Quercus petraea* Liebl. (started 2007),

Beech (*Fagus sylvatica* L.).

# Monitoring current and long term crop

The questionnaire asks for the following data:

1. Verified information for the previous year concerning:
  - a) crop magnitude as judged in the autumn, based on the fruiting of trees (since 1962),
  - b) degree of utilisation of the crop,
  - c) weight of cones or seed collected,
2. Prognosis for the current year
  - a) expected magnitude of the crop,
  - b) expected collection in weight of cones or seed,
  - c) seed demand (based on working plan requirements for outplantings)

Crop magnitude is based on the number of seeding trees and its intensity, relative to what is considered a financially justified collection. The classification of crop intensity is defined below.

# Monitoring current and long term crop

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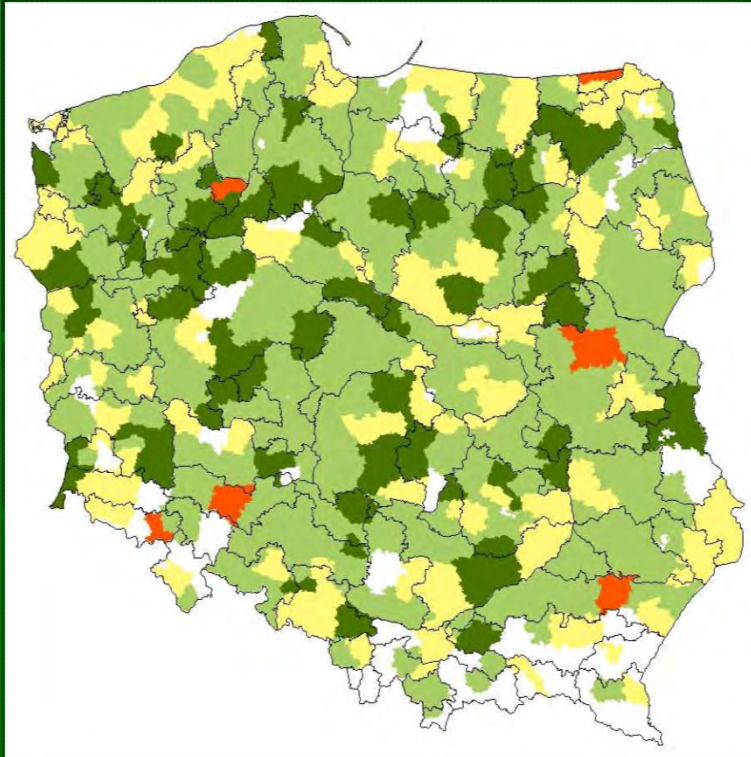
Crop Intensity	Corresponding % of cropping trees	Notes helpful in determining crop intensity
no crop	0	No trees with cones or seed worth collecting
poor crop	10	Only single trees fruit on forest edges
mean crop	30	Numerous edge trees and some inside stands fructify
good crop	100	Substantial % of trees in the stand fructify



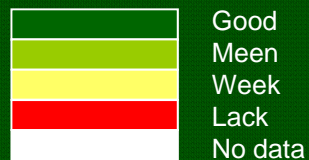
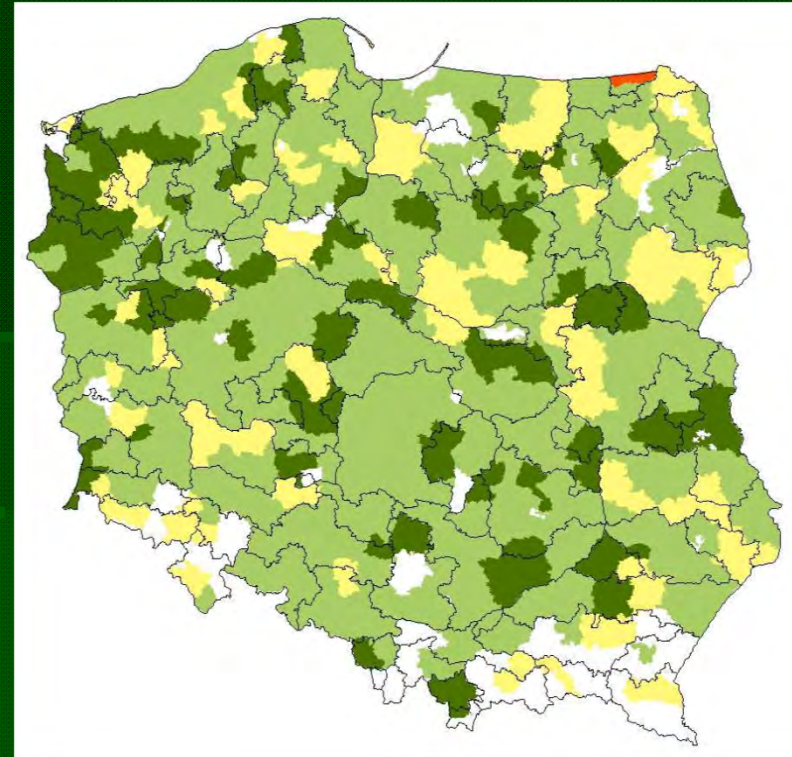
# Information about current crops

## Pine (*Pinus sylvestris*)

Real crop in 2010



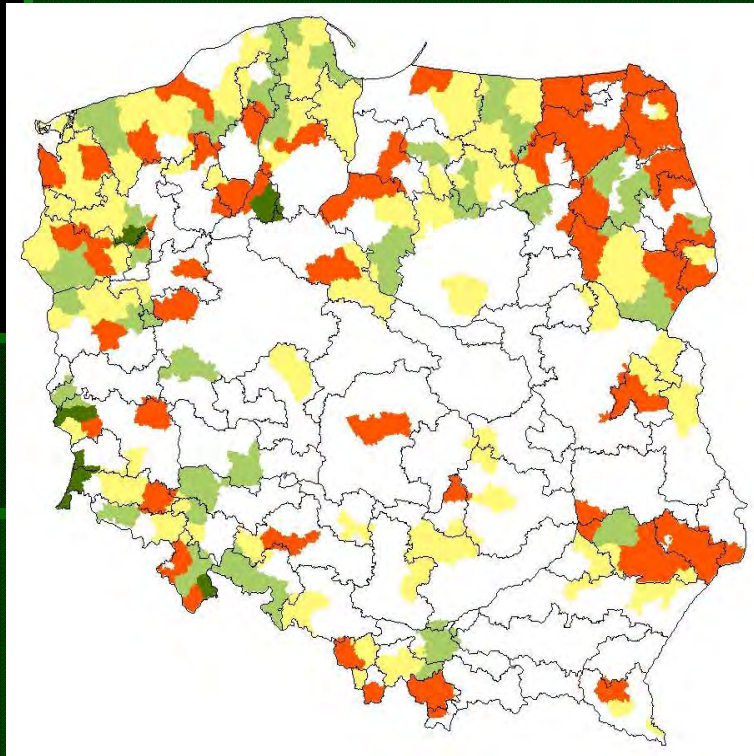
Expected crop in 2011



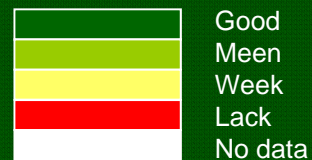
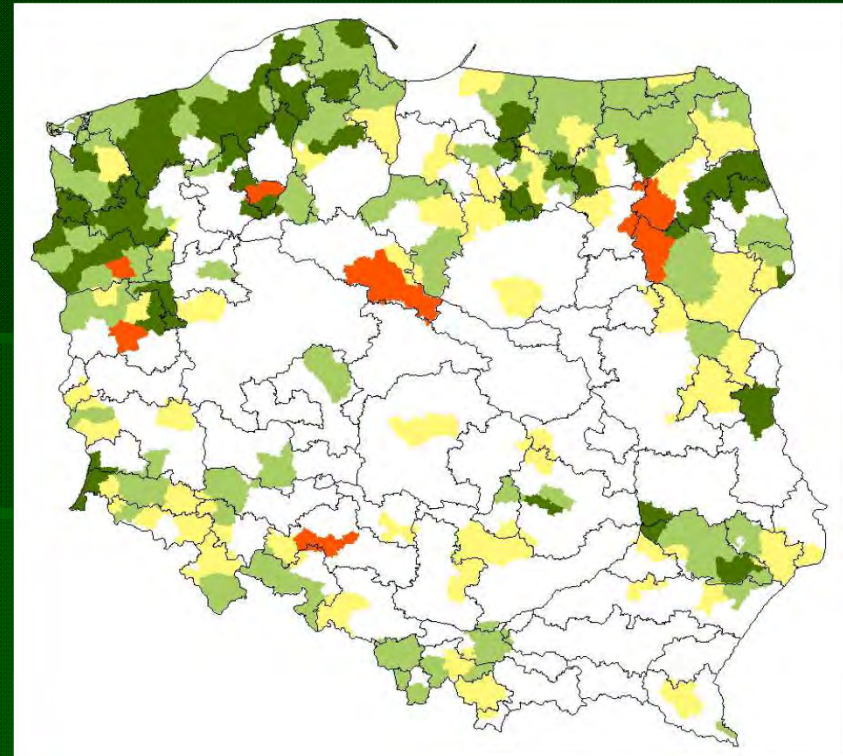
# Information about current crops

## Spruce (*Picea abies*)

Real crop in 2010



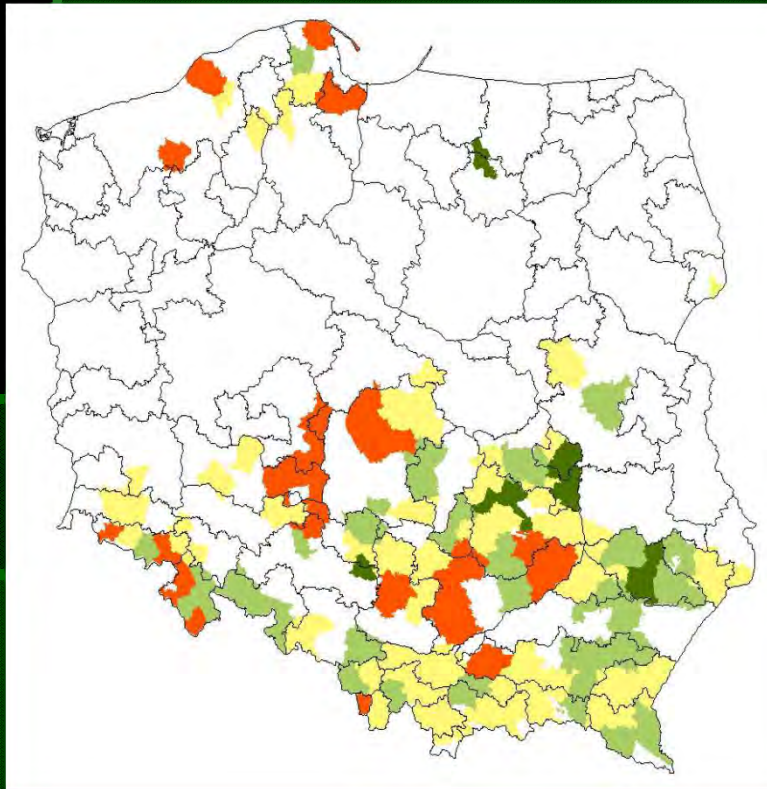
Expected crop in 2011



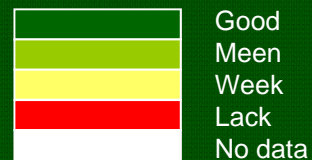
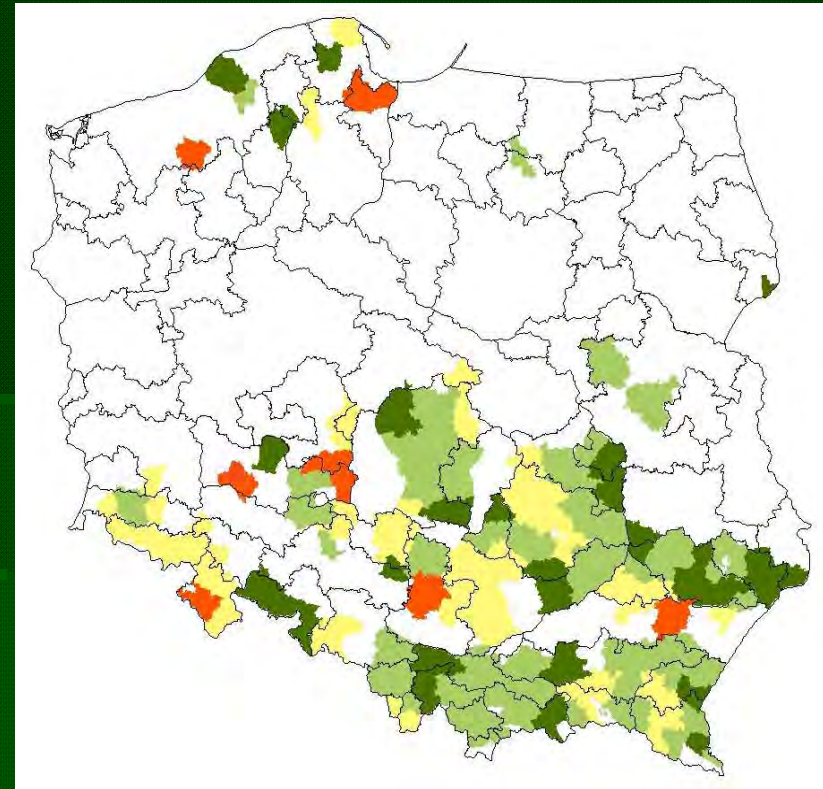
# Information about current crops

## Fir (*Abies alba*)

Real crop in 2010



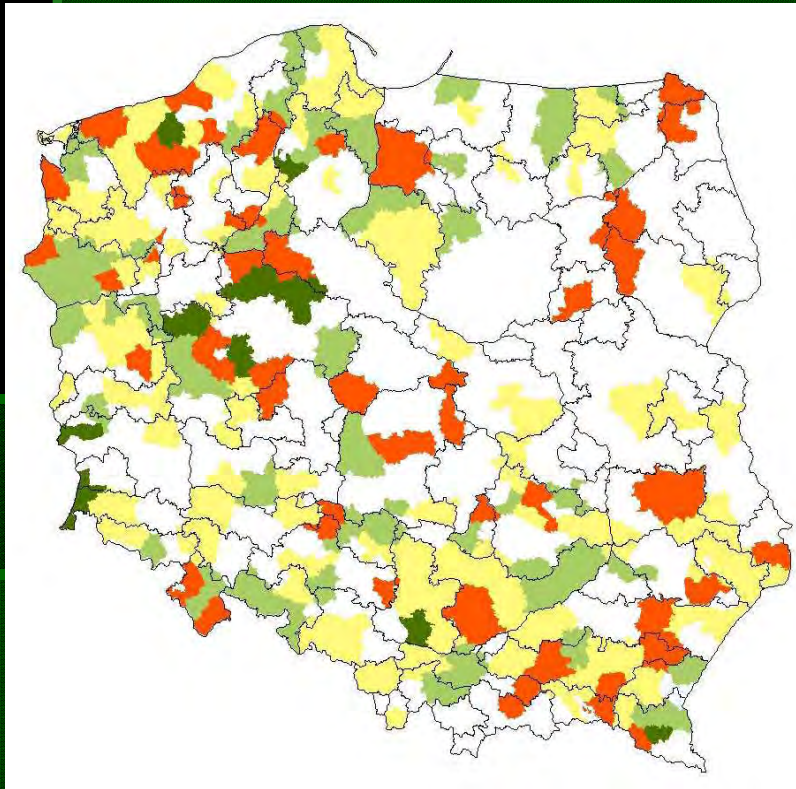
Expected crop in 2011



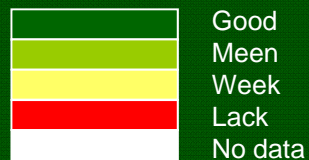
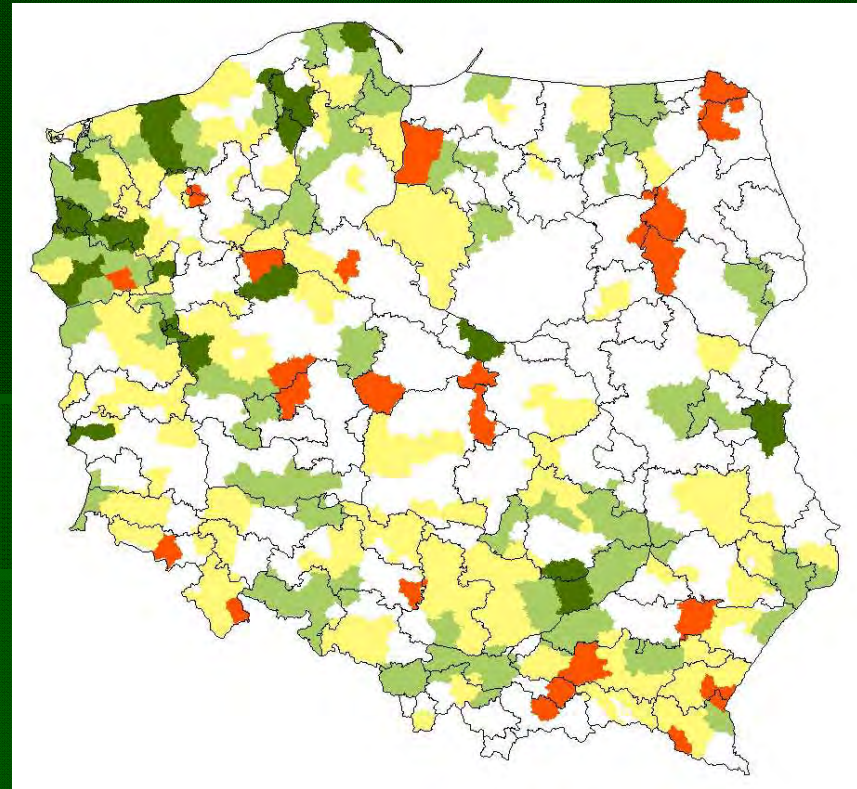
# Information about current crops

## Larch (*Larix europea*)

Real crop in 2010



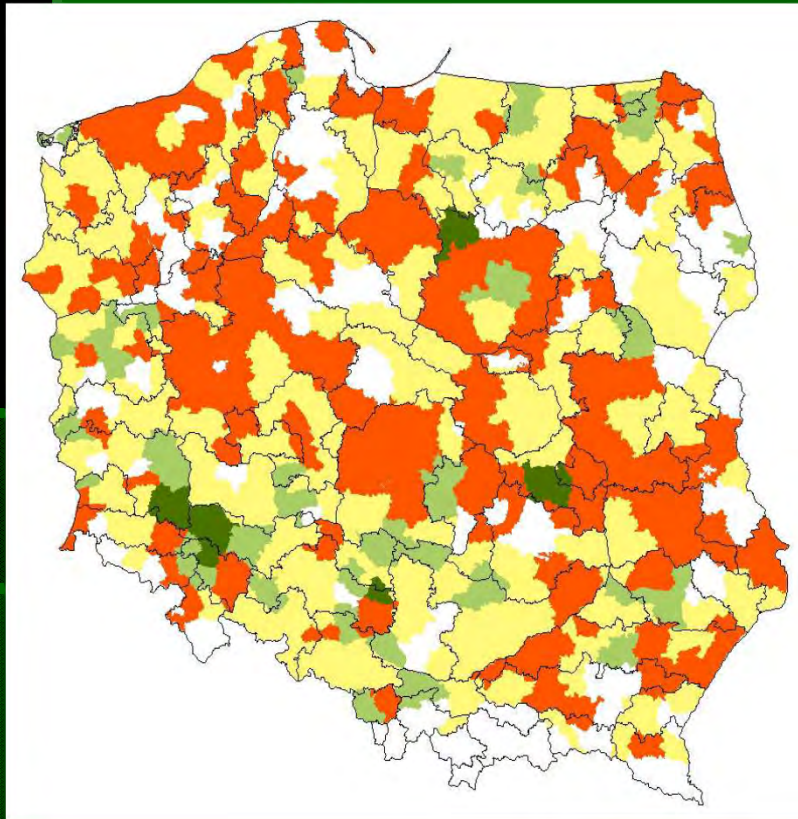
Expected crop in 2011



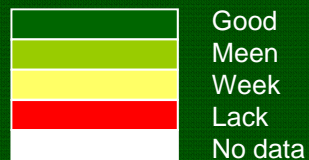
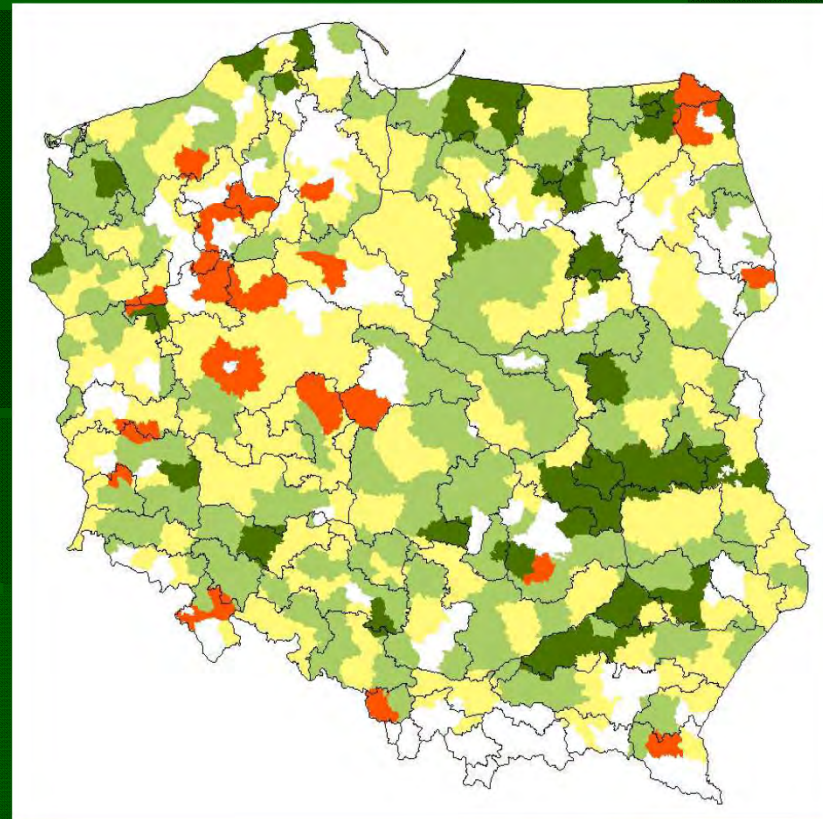
# Information about current crops

## Oak (*Quercus robur*)

Real crop in 2010



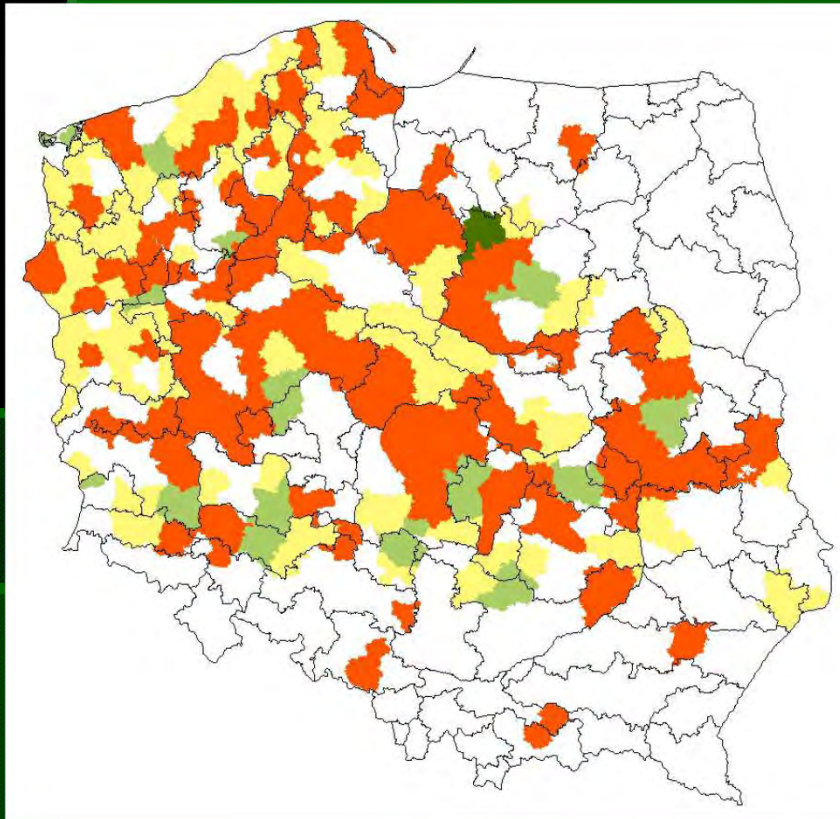
Expected crop in 2011



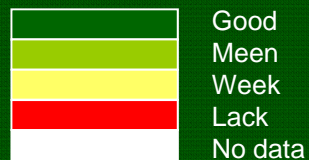
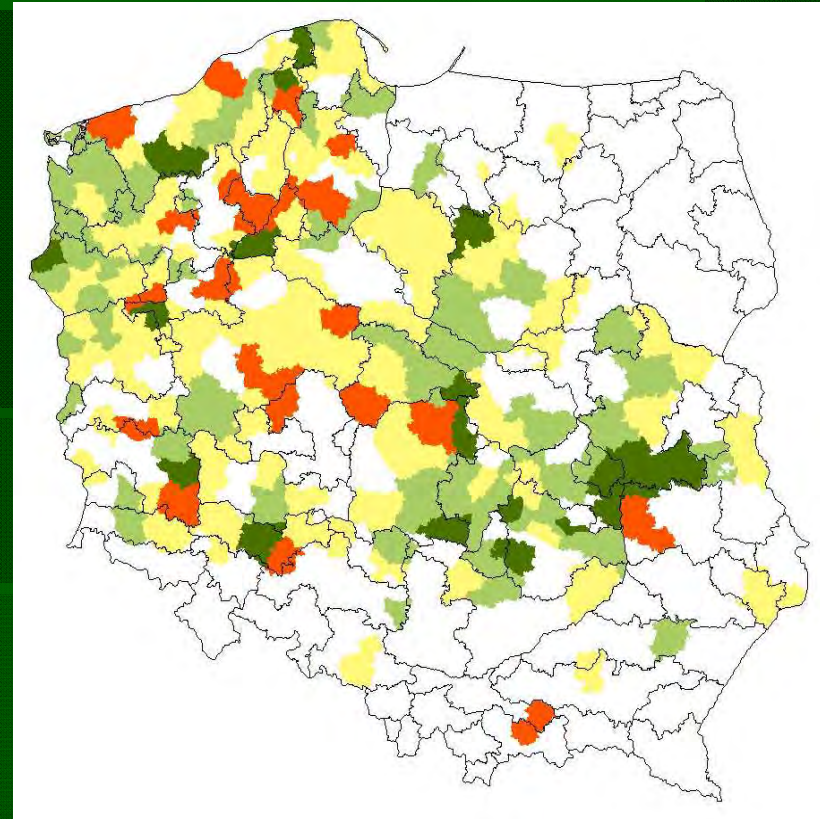
# Information about current crops

## Oak (*Quercus petraea*)

Real crop in 2010



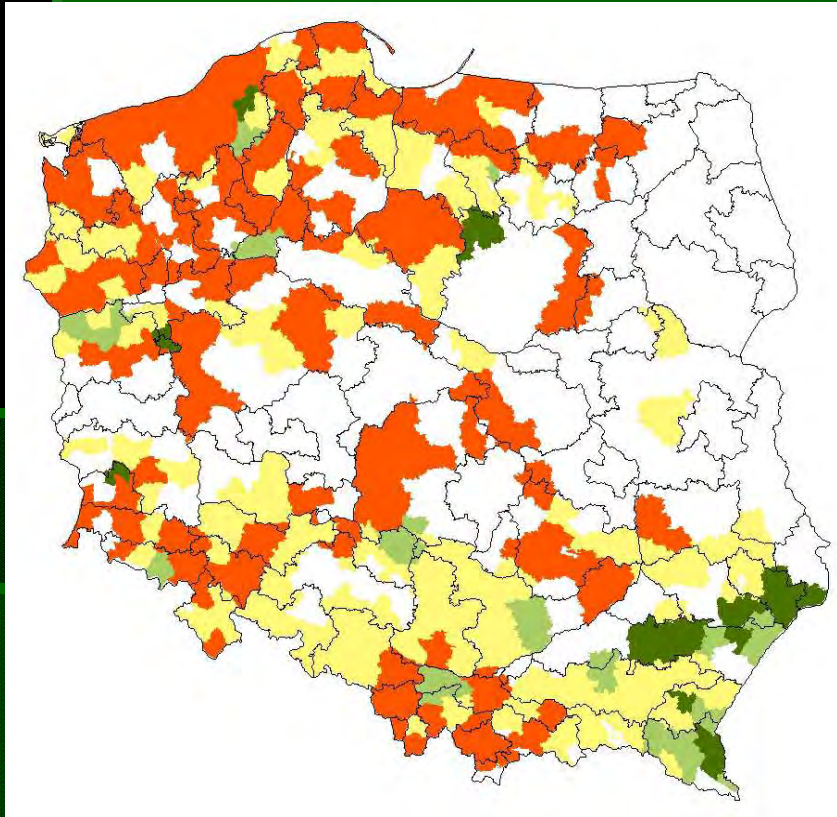
Expected crop in 2011



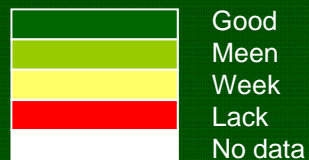
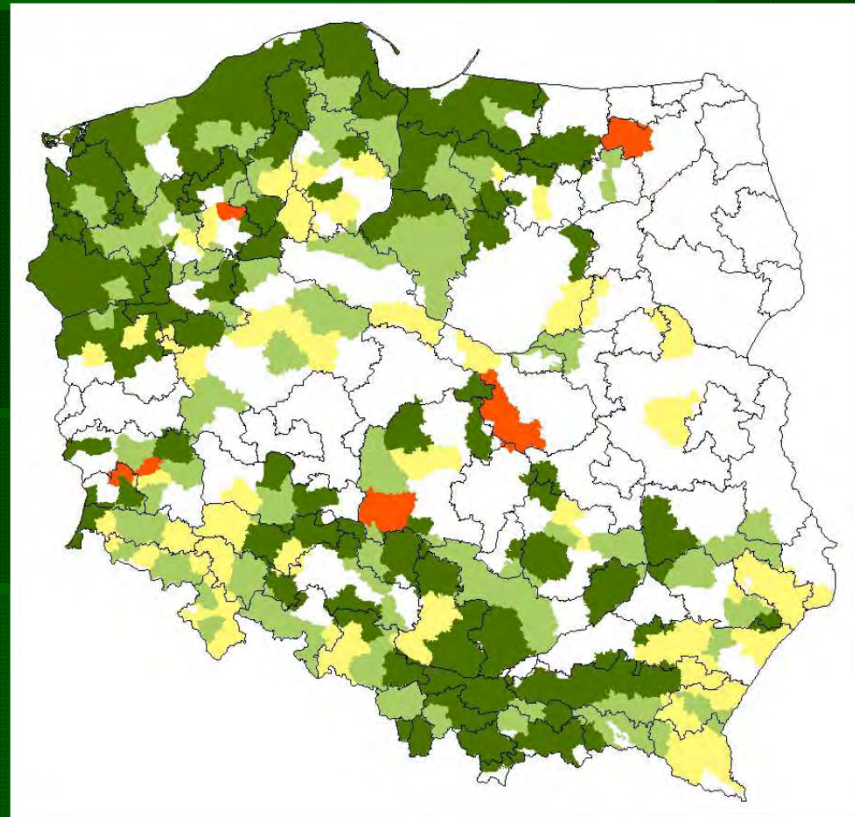
# Information about current crops

## Beech (*Fagus silvatica*)

Real crop in 2010



Expected crop in 2011



## Monitoring long term crop

The data which arrived from Forest Districts was from the very beginning verified in individual cases when there were some doubts.

For example the prognosis was good, utilisation of crop complete and collection small.

The extent of this individual verification was substantially reduced after 1985 since it was observed that with improved storage facilities after good mast years collection and utilisation of current crops did not necessarily reflect the actual fruiting of the year. The self verification by estimating fruiting of the previous year proved sufficient.



## Monitoring long term crop

The data supplied from the Forest Districts was summarised by Regional Forest Directorates (Regionalna Dyrekcja Lasów Państwowych - RDLP), of which there are 17, and published as an annual report (IBL 1951-2012).

Since the boundaries of the RDLPs have been changed several times the data has been interpolated for the current boundaries. On the average there are currently 26 Forest Districts per per RDLP

## Monitoring long term crop

The data on fructification, based on the percentages as defined in Table 1, has been averaged per RDLP and plotted by year and RDLP separately for the 6 tree species.

The size of the circles corresponding to the average percentage (Fig.). This is a method adopted from the study of Chałupka and Giertych (1973) used for the demonstration of Norway spruce crop years in Europe.

Where no circle is shown there was no data, due the species not growing in the Regional Directorate in question. This concerns primarily beech in the Białystok RDLP and white fir in most of northern Poland. However since all these tree species are to some extent planted throughout the country, there have been crop reports also from regions where the given species is non indigenous, particularly in crop years, thus there is also some data for the RDLPs where the species in question is non indigenous.

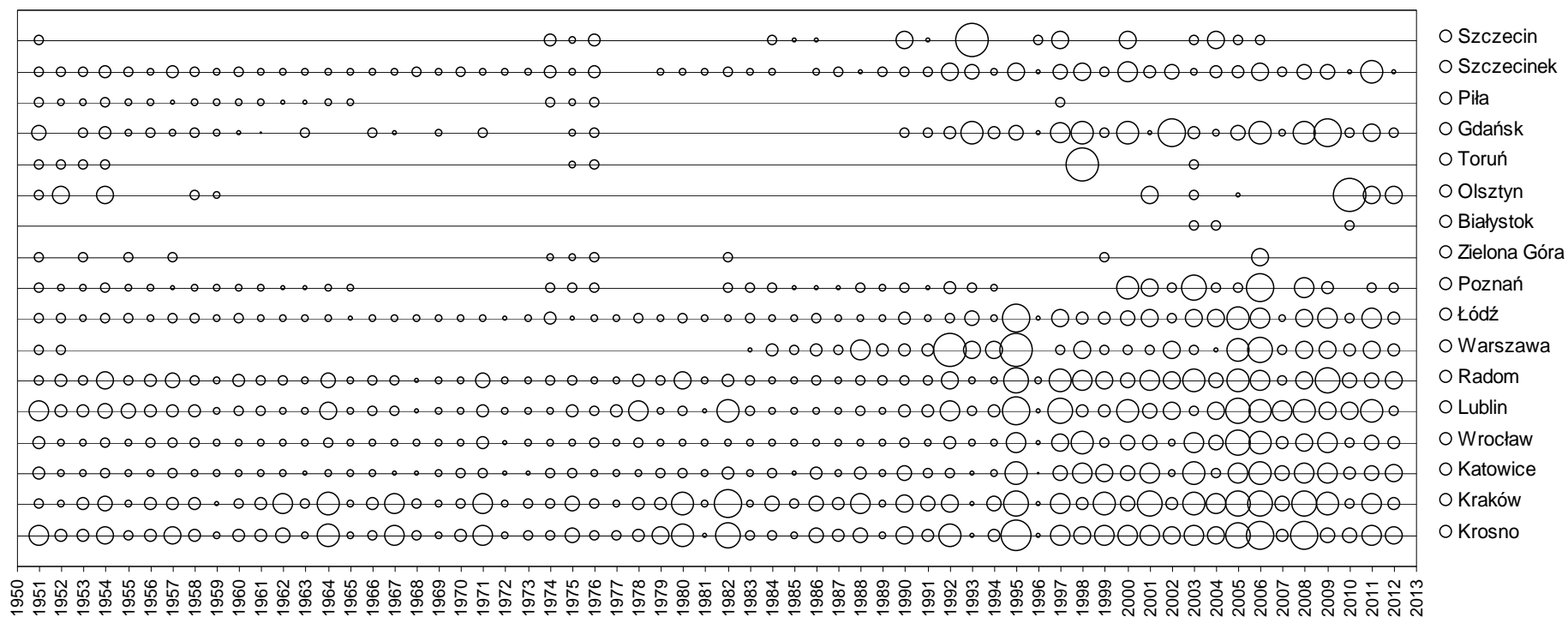




# Data about long term crops

## White fir (*Abies alba* Mill.),

Estimate of seed cropping, indicated by circle size, in various years (1951-2012) for the main forest tree species of Poland nad Regional Directorate of State Forest



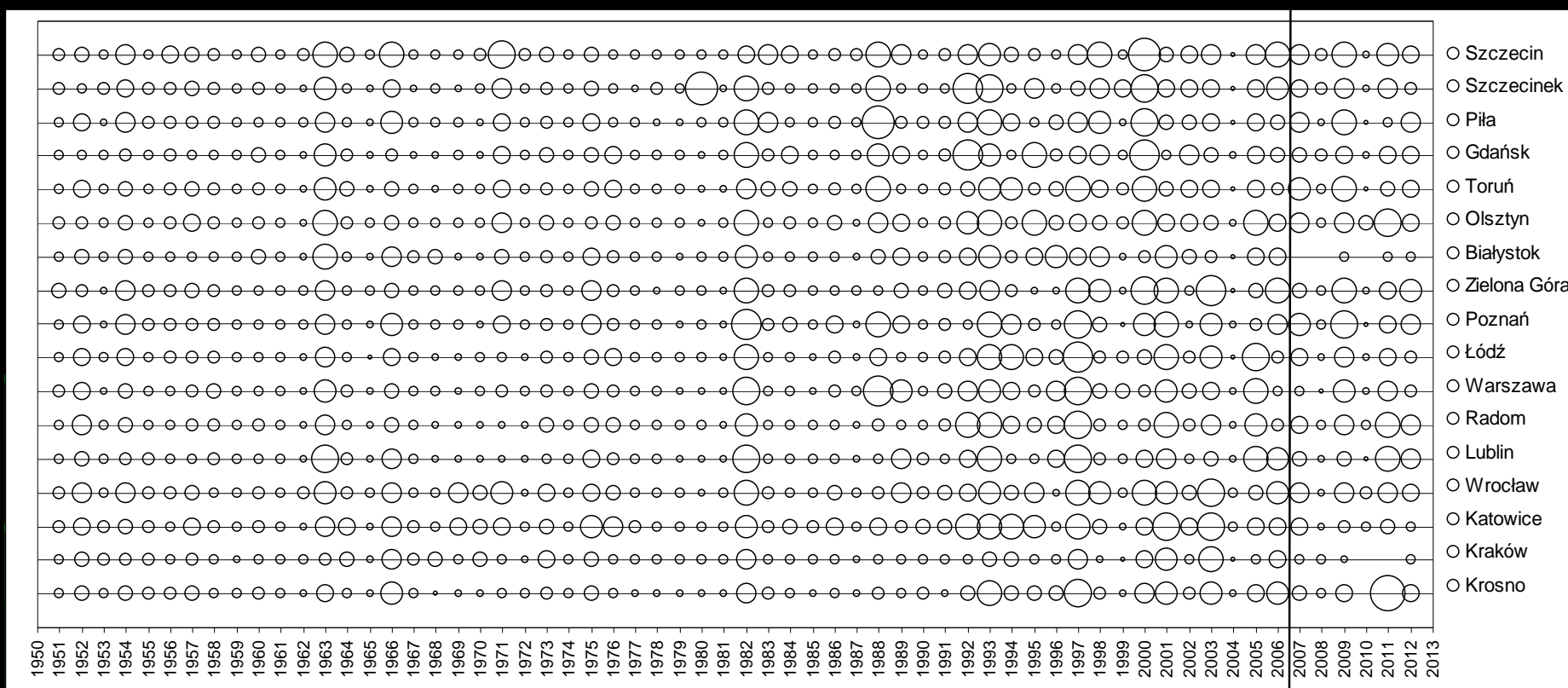




# Data about long term crops

## Oak *Quercus petraea* Liebl.)

Estimate of seed cropping, indicated by circle size, in various years (1951-2012) for the main forest tree species of Poland and Regional Directorate of State Forest

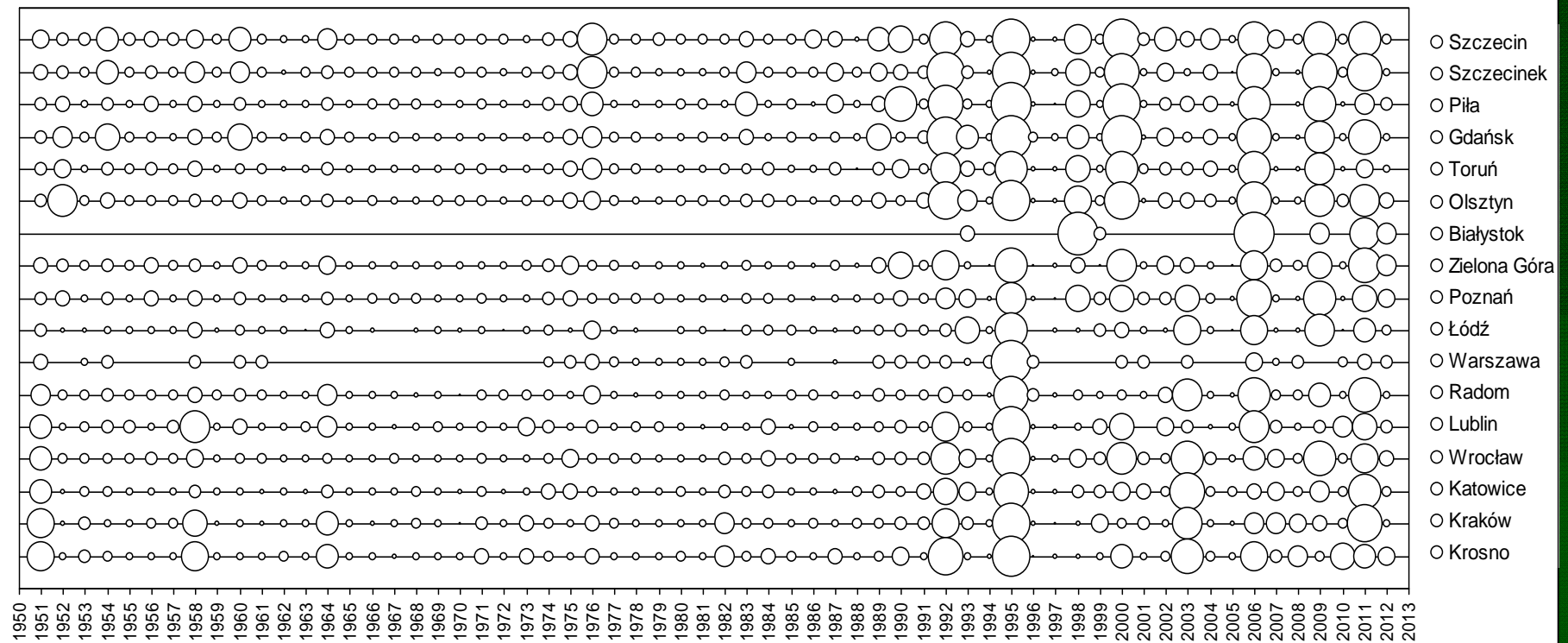




# Data about long term crops

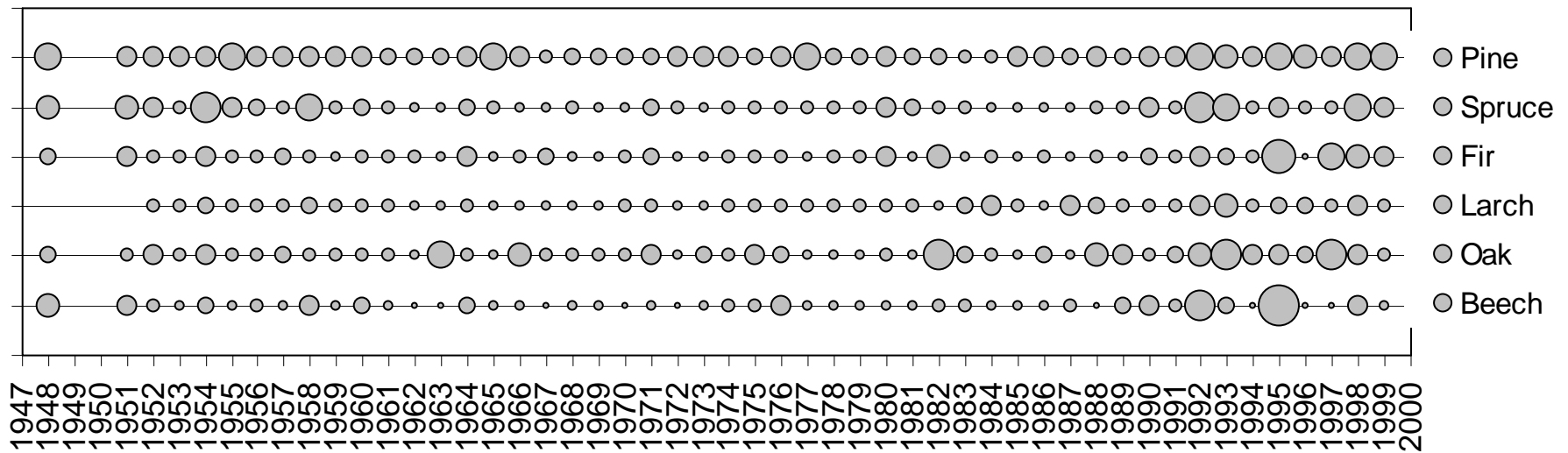
## Beech (*Fagus sylvatica* L.).

Estimate of seed cropping, indicated by circle size, in various years (1951-2012) for the main forest tree species of Poland and Regional Directorate of State Forest



# Data about long term crops

Mean level of fructification of the main forest tree species in the years  
1947-2000



## Information about crops

Species	Percentage of crop		Mean year collection (t)		Mean year seed demand (t)		Expected crop in 2011		
	1951-2910	2001-2010	1951-2910	2001-2010	1951-2910	2001-2010	Percentage of crop	Collection in year (t)	Demand of seeds
Pine	27	36	31,3	6,3	27,4	6,2	40	6,6	5,0
Spruce	18	26	5,6	0,8	4,8	0,7	40	0,6	0,3
Fir	19	35	29,7	9,1	24,6	6,9	35	7,2	5,8
Larch	14	20	3,4	1,3	3,6	0,8	23	0,7	0,4
Oak	20	26	1241,3	776,0	1214,5	979,9	27	577,8	683,6
							23	197,4	323,8
Beech	14	21	64,0	63,8	84,4	79,3	58	110,6	68,9

# Conclusions

1. Each species appears to be fructifying independently of the others. Closest agreement appears to be between fir and beech. Observe the results not only for the exceptionally good crop year 1995 but also for 1998, 1992, 1982, 1964 and 1951. In some way the two species appear to be responding to the same external stimuli with increased fructification.
2. The overall impression is that there is an increase in frequency of seed crops in the past decade. To a lesser extent more frequent crops, at least of pine, spruce, larch and oak appear to be in the fifties. This could possibly be related to industrial pollution, which kept on increasing between 1960 and 1989, to drop drastically after the change of our political system, first as a consequence of drop in industrial output and later due to introduction of new more clean technologies. Another possible explanation could be a periodic fluctuation in the climatic patterns, e.g. global warming and global cooling cycles.
3. On the other hand one must remember that the observations and compilations were made over half a century, with different people involved in the process, thus there could have been changes in an overall approach to the topic of seed collection and registration. With increased storage facilities the dependence on the latest crop is declining and therefore the link between reported crops and needed collection diminishes which could affect the veracity of the reports.

Thank You for Your attention



