Water Framework Directive
Western River Basin District

Programme of Measures and Standards

For

Forest and Water
Priority action, relevant pollutant and general component candidate substances for surface waters in Ireland

ESB International

November 2006

Acknowledgement

The Western River Basin District Project gratefully acknowledges the data and information provided by Coillte in preparation of this Report and in particular Michael Keane, Coillte, Newtown Mountkennedy for his valuable contribution.

SCOPE OF WORK FOR SUB-PROJECT ON

FOREST AND WATER

CONTENTS

1. Background

1.1 Development of Measures and Standards for Forest and Waters

The Western RBD Project was tasked by the National Programmes of Measures and Standards (POMS) Coordination Group with the development of Measures for forests and water. One aspect of the work to be undertaken concerns the collection of data and information on the use of Dangerous Substances by Forestry and the provision The Action item set out in the Forest and Water terms of reference requires the development of a Register of potential Dangerous Substances/Priority Substances to the extent possible based on available information in use or used by the Forest Sector to include:

- Type
- Application rates
- Half-life
- Toxicity to fish and aquatic invertebrates
- Period of Use

Existing monitoring data with respect to forest operations and use of pesticides and herbicides will be obtained where possible also.

All information, mapping and data will be provided to the National Dangerous Substances Working Group.

Recommend further actions to update and maintain a Register of Dangerous Substances associated with Forest Practice.

1.2 Collection of Data and Information on Pesticide Use

National Forest Cover
Forests now constitutes some 10.1% of the land cover in Ireland (this includes riparian plantations and broadleaf stands) covering an area of some 699,167 hectares.

TABLE 1 Forest Statistics

Forest area of the Republic of Ireland (end 2002)	*699,167 hectares (ha), 10.1% of total land area of the country*
Standing volume – 2002	*50,859,000 m^3 overbark*
Average Annual Increment – 2002	*3,353,000 m^3 overbark*
Annual Felling – 2002	*2,738,000 m^3 overbark*
Composition of the forest estate	*79% conifer, 21% broadleaf*
Ownership	*57% state (Coillte), 43% private*

From National Report to the Fourth Session of the United Nations Forum on Forestry, Ireland, November 2003 and Forestry and Timber Yearbook 2006

Data to the end of 2004 was extracted from the Forestry and Timber Yearbook 2006 (*data source: Forest Service*).

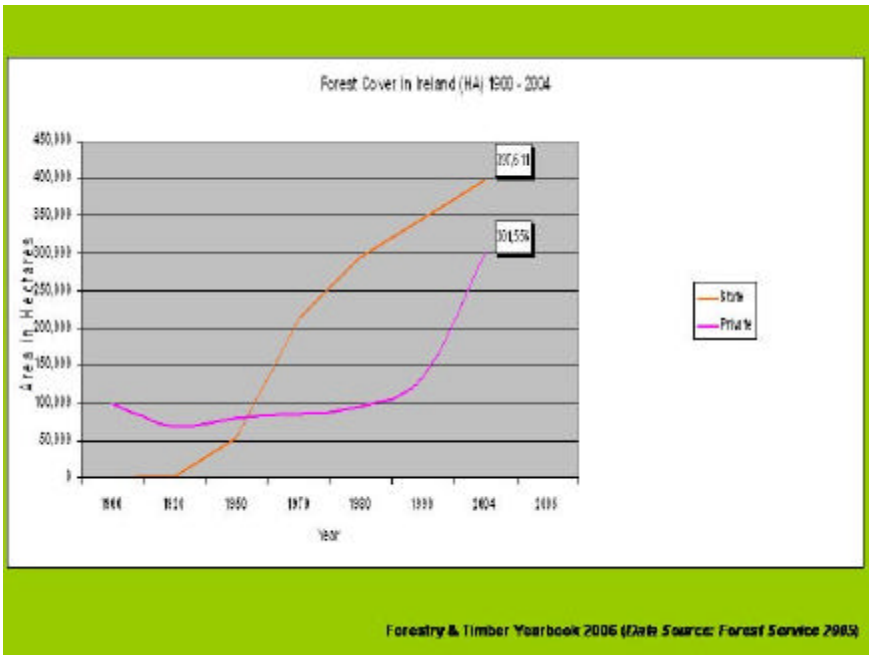


Figure 1 Forest Cover in Ireland 1900 – 2004

The total land under forestry comprises some 699,167 hectares. Of this 57 % is state owned and the balance, 43 %, is privately owned (Table 1 and Figure 1).

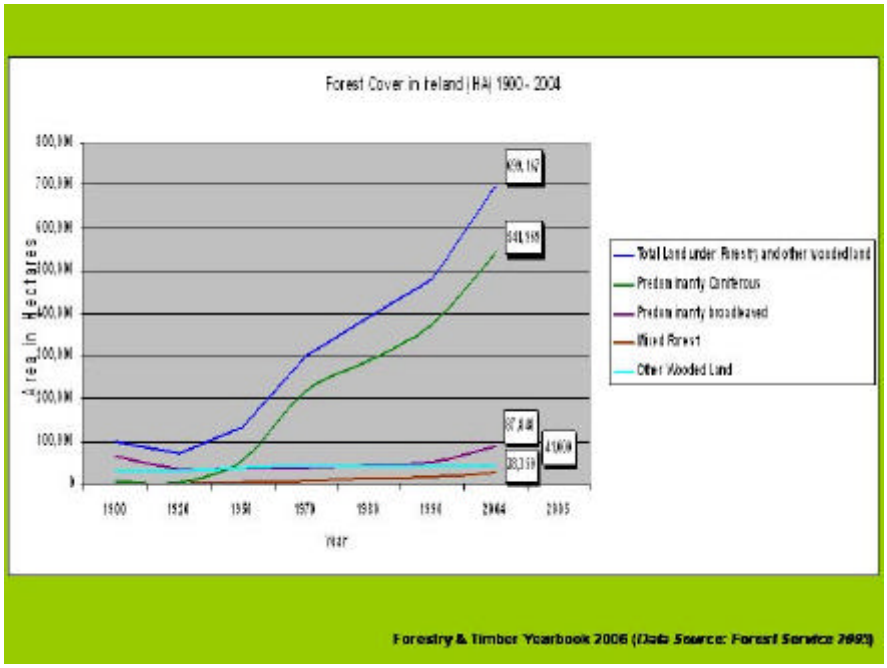


Figure 2 National Forest Cover by type

Forest cover has increased significantly since 1920 from a low of just over 1%. It is predominantly coniferous type in nature, just over 77% in total (93% of State owned and 56.6 % of Privately owned) (Figure 2 and Table 2).

Table 2 National Forest Cover by Type

Forest Type	State %	Private %	Total %
Predominantly Coniferous	93.3	56.6	77.5
Predominantly broadleaved	2.3	26.1	12.6
Mixed Forest	2.7	5.8	4.1
Other Wooded Land	1.7	11.4	5.9

The continued increase in forest cover is driven by the private sector (Figure 3) Planting by the State has remained at static levels since the mid 1980's whilst Private forest planting has increased dramatically.

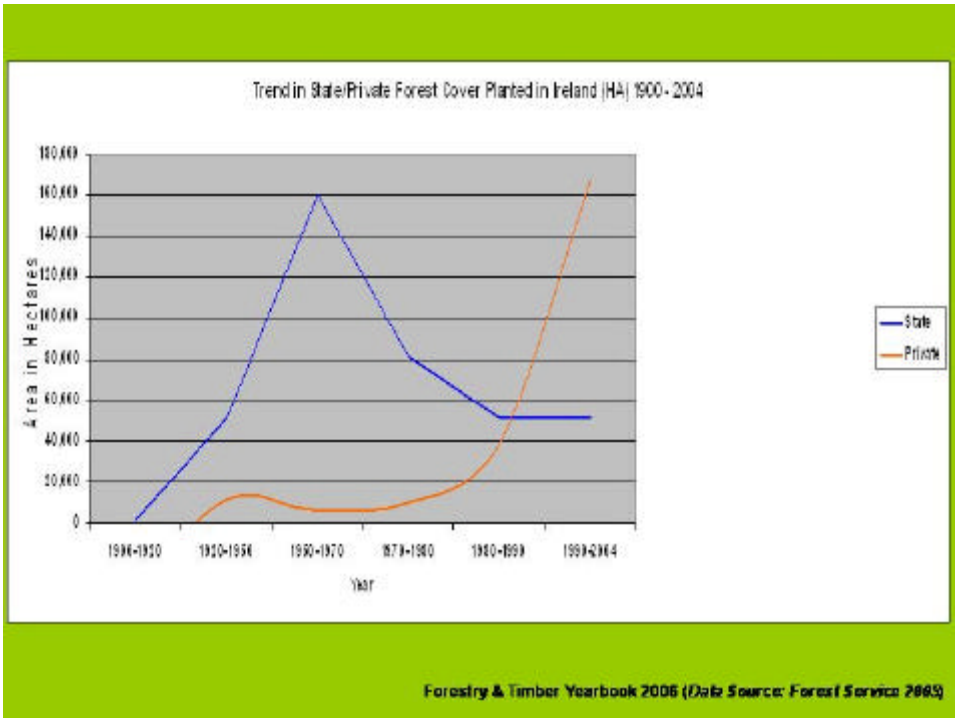


Figure 3 Trend in State versus Private Forest Cover

The growth in broadleaf forest cover is also attributable to the private sector (Table 2) comprising 26% of privately owned forest cover.

2. General Pesticide Use

Both insecticides and herbicides are used in forestry practice in Ireland. The use of such pesticides is authorised by the Pesticide Control Unit (PCS) of the Department of Agriculture and Food, which is the Regulatory Authority with respect to plant protection products in Ireland and through the Forest Stewardship Consul (FSC). The authorisation of use for such plant protection products is administered through

Council Directive 91/414/EEC[1] concerning the placing of plant protection products on the market.

The large pine weevil, *Hylobius abietis*, is the only insect pest of forestry across Europe against which routine protective measures are required. Post clearfelling of conifer crops, particularly pines, the pine weevil breeds in the remaining stumps. Emerging as adults about one year later they feed on the bark and underlying tissue of newly planted trees. Crop losses can be as high as 95% if infestation is left unchecked. The most serious attacks occur in late spring, early summer and again in August and September. The most vulnerable sites are those which carry crops of Lodgepole pine (*Pinus contorta*) and Scots pine (*Pinus sylvestris*). However, attacks are not confined to pine sites, larch, Douglas fir and sitka spruce sites are also susceptible.

The approach used in Ireland by Coillte to control pine weevil attack is primarily through use of insecticides. The main insecticide used (2006) for this purpose is cypermethrin, a synthetic pyrethroid. Other pyrethroids used in the control of pine weevil in the past included permethrin and alpha-cypermethrin, the latter is still in use in some areas.

Application of the insecticide is generally made at two stages, pre planting (dipping) and post planting (spraying). Prior to planting bundles of plants are dipped into insecticide solution using a semi mechanical process. Coillte operates two facilities for this purpose, at Killygordon in Donegal and at Ballintemple in Carlow. Pre dipping reduces the requirement for spray application in the field. Spay application in the field is targeted at the young trees with pesticide being sprayed directly onto the tree stem, the site of weevil attack.

Herbicides are used to control weeds which are the most common and persistent threat of young tree crops. The use of vigorous plants, coupled with site preparation to reduce competing vegetation, reduces the requirement of herbicide application but where weed control is required the use of herbicides is generally the most economically efficient and effective method of crop protection. Herbicides are generally used on young plantations. In afforestation sites where new sites are mounded and trees planted into mounds herbicides are generally not required in the first two years. Thereafter spot application of herbicides may be required to control weed growth. In Afforestation sites where mounding is not used for planting purposes herbicides may be required to be used within a year after planting. The principle herbicide used is glyphosate.

The use of insecticides, such as permethrin, is associated almost entirely with clearfelling and replanting activities associated with State owned forestry. State planting increased in the 1920's and increased significantly from 1950 on. Given the normal time to harvest of 40+ years it is primarily state owned forestry which is being clearfelled and replanted. By contrast private forestry has only increased significantly since the 1990's and significant harvesting will not occur until post 2030.

Herbicides are used by both the state and private sector and are particularly important for control of weed growth in broadleaf plantations in the early years.

[1] **COUNCIL DIRECTIVE of 15 July 1991concerning the placing of plant protection products on the market** (91/414/EEC) (OJ L 230, 19.8.1991, p. 1)

3. Data on Pesticide Use

Data on pesticide use (which includes both insecticides and herbicides) by the Forest Sector (Coillte only) was provided by Coillte (Michael Keane, Coillte, Newtown Mountkennedy, Wicklow). Data is not available for the private forestry sector.

Coillte's estate is divided into 317 Forest Management Units (FMUs) which are combined into 13 forest management districts, Table 1 and Map 1.

Table 1 Coillte Forest Management Districts

Code	Coillte Forest Management District
E1	Dublin/Wicklow
E2	Southeast Counties
E3	Midlands
S1	South Tipperary/Waterford
S2	Lower Shannon
S3	Cork
S4	Southwest Peninsulas
W1	Clare/South Galway
W2	East Galway/Roscommon
W3	Connemara/Mayo
N1	Donegal
N2	Sligo/Leitrim
N3	Lakelands

Coillte have developed District Strategic Plans for each forestry management district setting out the policy and long term vision for the management of these areas (http://www.coillte.ie/managing_our_forests/plans).

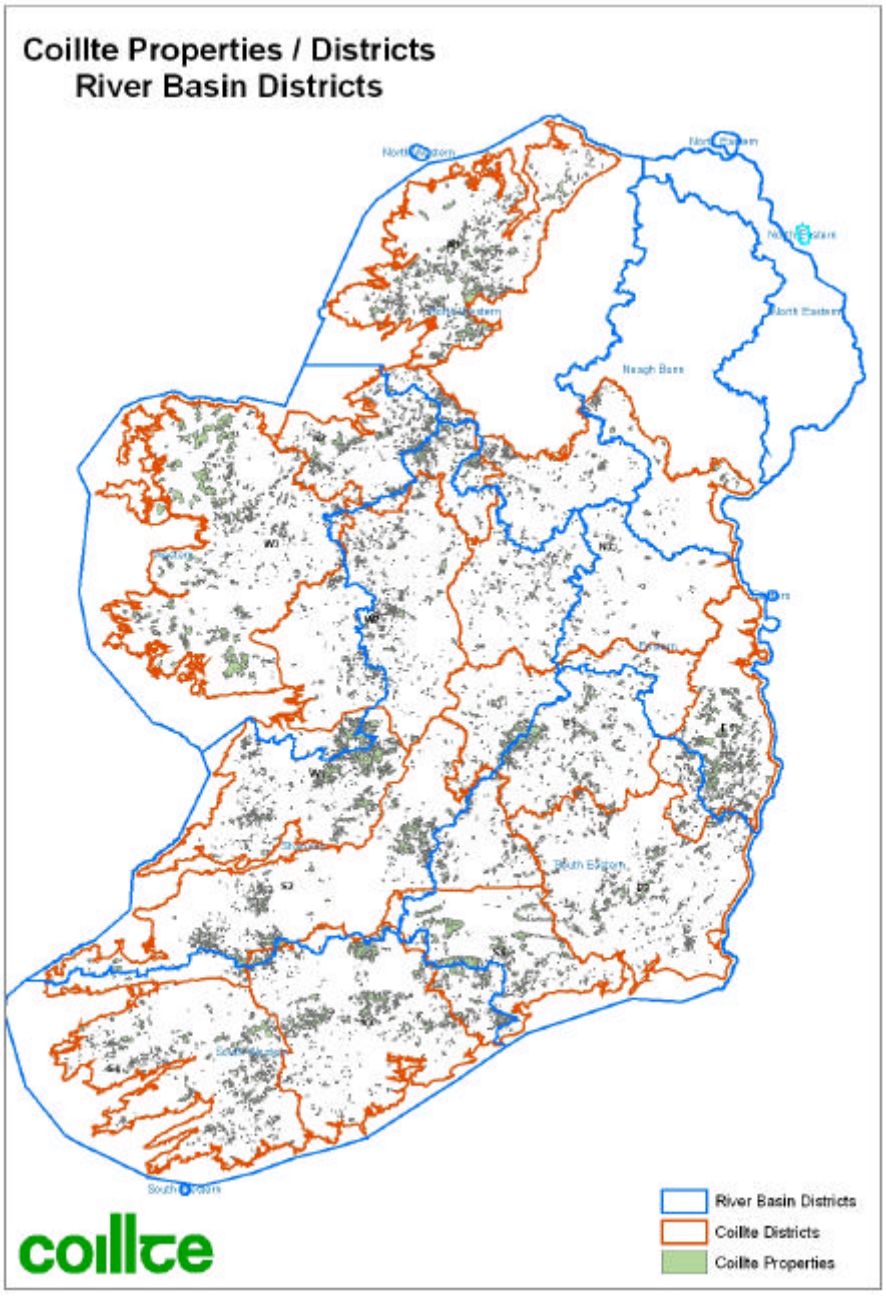
3.1 Summary of Coillte District Pesticide Use.

Data has been supplied in respect of pesticide use by Coillte Management District in summary form for the years 2002 to 2005. More detailed data has also been provided for the year 2005 on the basis of pesticide use on geo referenced forest parcel locations.

Data in respect of the type of pesticide used, quantity used in terms of kilograms of active ingredient (a.i.) and area in hectares to which it was applied has been supplied for each Coillte district. This data has been supplemented with information from the Coillte District Strategic Plans.

The range of pesticides used, including trade name and active ingredient, nature of pesticide (whether insecticide or herbicide) and formulation in terms of g/a.i. per litre is provided in Appendix 1.

Summary data for each Coillte district in terms of kg /a.i. used per year for each pesticide used is presented in Appendix 2. In discussions with Coillte (Michael Keane) it was indicated that the summary data provided is the total quantity applied both in the dipping process and through spray application for each Coillte district.



Map 1 Coillte Forest Management Districts (provided by Coillte)

In 2005 Coillte began to use cypermethrin as a dip application for trees in the nursery before planting out. Cypermethrin was not applied as a spray application in the field. Coillte (Michael Keane, 2006) have indicated that cypermethrin will be the only insecticide used for control of pine weevil and alpha cypermethrin will no longer be used in future.

3.2 Coillte Pesticide applied in the field.

The data provided refers to herbicides and insecticides used by Coillte Establishment Teams for the year 2005. Some additional amounts would be used by the Coillte District Teams but these are considered to be very small overall.

The data also refers only to herbicides and insecticides used on restock sites, i.e. those sites planted after clearfelling. These sites represent 94% of the total area planted in Coillte forests in 2005. The balance of planting occurred on farmland type sites.

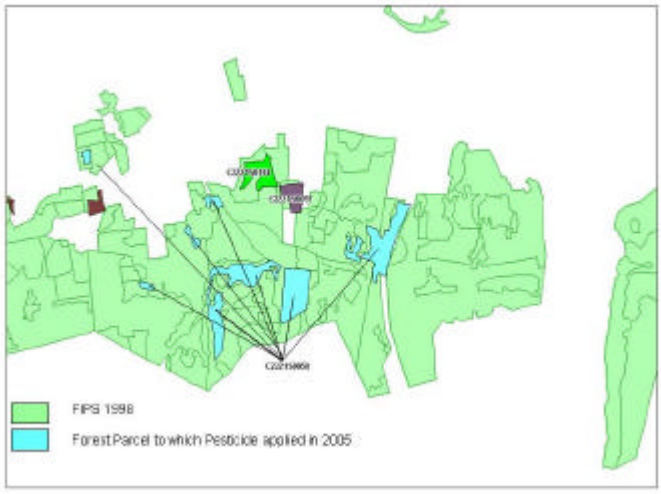
Data was provided in two forms, GIS referenced polygons of forest parcels to which the applications were made (ESRI Shape files) and associated data (xls files) containing relevant information on pesticides. These are described below:

SDP_Mapping (ESRI Shape file): The shape files allow linkage of the xls file data to a mapped GIS location using the common code under Location_ (Table 2)

Table 2 Polygon information

OBJECTID	MANAGEMENT	OID_	COST_CENTR	LOCATION__
13	C0101M0014	187	P107	C0101S0014
16	C0101M0017	189	P107	C0101S0017
18	C0101M0021	193	P107	C0101S0021
22	C0101M0025	198	P107	C0101S0025

The shape file area associated with the Location code (C222150058 for example) can be quite complex. One common code can represent a number of forest parcel areas within the general forest cover. This is illustrated in Map 2 below.



Map 2 Forest Parcels and FIPS data

The Location_ Code C222150058 indicated in blue refers to a number of forest parcel areas where pesticide/herbicide was applied as indicated in Map 2 above. By comparison Location_ C221S0104 and C221S0097 refer to unique forest parcels. The reason for such occurrences is due to a revision procedure of the numbering system occurring in 2005 and the issue is likely to be resolved in 2006 whereby each forest parcel will have a unique number.

Deleted: ¶

info on pesticides to match GIS info (xls workbook): This data refers to application in the 2005 year only. The data is provided as per Table 3:

Table 3 Database of pesticide use

Forest	Date	Location (SDP Code etc)	Pesticide	Pesticide Qty Litres or product used on site
P107	May	C0101S0014	alpha-cypermethrin (Bestseller)	1
P107	May	C0101S0014	alpha-cypermethrin (Bestseller)	1

The location SDP code allows linkage to the polygon of the area where application was made. The general date of the application is also provided. The pesticide/herbicide active ingredient and Trade name is provided (alpha cypermethrin/Bestseller in the example above) and the quantity of product used in litres on the site. A number of applications of specific pesticide or herbicide may be recorded throughout the year for a specific Location.

3.3 Data processing

The quantity of pesticide used was reported in litres of product per site. This was first converted to kg of active ingredient applied at each Location (using the conversion factors provided in Appendix 1).

The annual quantity of each pesticide/herbicide was then calculated for each forest parcel (Location_). A new table was then created in GIS format linking the pesticide/herbicide annual totals to the forest parcel mapped areas.

The average pesticide/herbicide usage per hectare for 2005 was calculated using the polygon mapped area for each forest parcel where such substances were used.

The spatially related data is provide as a GIS ESRI shape file and also as an excel spreadsheet (Appendix III – see attached files in electronic format). An example of the data is provided in Table 4 and Map 3 below.

3.4 Comments:

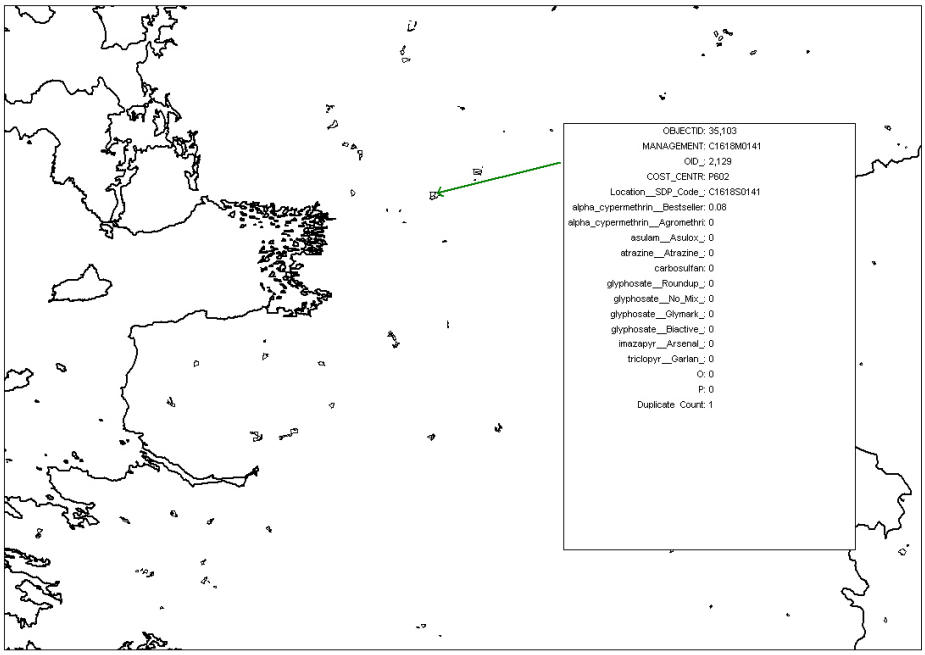
Although cypermetrhin use is reported in the summary tables for Coillte Districts (Appendix 2) this material was not utilised in the field in 2005 and is therefore not spatially represented in the accompanying polygons.

The trademark products Kerbflo and Agral are also reported as been used by Coillte Districts and appear in the Summary tables in Appendix 2. The quantity of these materials used is small (0.07% and 0.1% of total usage respectively) and were probably used by District Staff rather than establishment teams.

Table 4 Sample of pesticide data related to Coillte Forest Parcels

Coillte Management Unit Code	Coillte Cost Centre	Location__SDP_ Code_	Area_ha	alpha_cypermethrin Total (kg a.i./ha)	asulam (Asulox) (kg a.i.)	asulam (Asulox) (kg a.i./ha)	atrazine (Atrazine) (kg a.i.)	atrazine (Atrazine) (kg a.i./ha)	carbosulfan (Marshal suSCon granules) (kg a.i.)	Carbosulfan (Marshal suSCon granules) (kg a.i./ha)	glyphosate Total (kg a.i./ha)	imazapyr (Arsenal) (kg a.i.)	imazapyr (Arsenal) (kg a.i./ha)	triclo (Garla a.i
C0101M0014	P107	C0101S0014	18.42	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0101M0017	P107	C0101S0017	9.72	0.144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0101M0021	P107	C0101S0021	27.76	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0101M0025	P107	C0101S0025	23.48	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0103M0030	P104	C0103S0030	2.97	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.364	0.000	0.000	0.7
C0103M0044	P104	C0103S0044	3.22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.335	0.000	0.000	0.7
C0103M0046	P104	C0103S0046	12.37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.349	0.000	0.000	2.8
C0104M0054	P104	C0104S0054	7.62	0.126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0104M0058	P104	C0104S0058	20.21	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.178	0.000	0.000	0.0
C0105M0018	P103	C0105S0018	20.56	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.4
C0201M0008	P706	C0201S0008	13.67	0.386	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0201M0014	P706	C0201S0014	28.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.253	0.000	0.000	2.4
C0201M0040	P706	C0201S0040	3.72	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0201M0056	P706	C0201S0056	14.78	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0202M0012	P706	C0202S0012	17.02	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0202M0018	P706	C0202S0018	13.02	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0202M0021	P706	C0202S0021	33.29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.433	0.000	0.000	0.0
C0202M0032	P706	C0202S0032	43.51	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0202M0037	P706	C0202S0037	15.95	0.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
C0202M0138	P706	C0202S0138	10.5	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0

Note – not all data is shown for clarity



Map 3 Example of mapped pesticide use linked to forest parcel

4. Implications for Monitoring:

Effective monitoring of pesticides must reflect the nature of specific activities associated with forestry practice. Insecticides are primarily used to combat the pine weevil on sites where clearfelling has occurred and where replanting has taken place. This activity occurs presently on State owned forest sites. The forest locations clearfelled and replanted will vary annually and this must be taken into account in designing a monitoring programme. Knowledge of and consideration of pesticide use patterns is an essential feature of the planning of monitoring programmes It will therefore be necessary to target monitoring for insecticide use with harvesting and replanting plans for the State sector (Coilte) to some extent.

Herbicides are used primarily to combat weeds and are also associated with afforestation, particularly broadleaf forests, and at replanting sites following clearfelling. Data is lacking on the use of herbicides by the private sector but their use is expected to be similar to that of state owned properties. Herbicides are generally used at the early stages following planting to reduce competition from weed growth. Spot applications may occur at the same newly established forest locations for a number of years. Monitoring for herbicide use needs to target afforestation activities and replanting. This will require linkage with the management of state forestry and private forestry will be required. In the latter case it may be possible to achieve this through the Forest Services, who provide grant assistance to the private forestry sector.
Note:
A sub group of the Forest and Water Working Group has been established to review and develop a more comprehensive approach to Operational Monitoring for forestry.

The approach adopted is to select a number of forest catchments areas representative of forestry on differing hydro-geological settings nationally. These catchments will reflect forestry at all stages of development and hence will reflect all forest activities associated with afforestation, clearfelling and re-establishment.
Suitable monitoring locations will be identified within the target catchments which will serve to monitor all forest related activity. This should provide excellent background data on the level of losses to water bodies and periods over which losses can occur in relation to periods of use.

5. Ecotoxicity

Ecotoxicity data has been obtained for the range of insecticides and herbicides indicated as being used by the forest sector. This data was obtained from the following sources.

Material Safety Data Sheets (MSDS): The Material data Safety Sheets for the trademark products used in Forestry were provided by Coillte. These are attached in Appendix 4. (Note: Ecotoxicity data on these sheets is limited and may be unreliable).

Pesticide Action Network (PAN) Pesticide Database: The PAN Pesticide Database (http://www.pesticideinfo.org) brings together information on pesticides from many different sources, providing human toxicity (chronic and acute), ecotoxicity and regulatory information for about 6,400 pesticide active ingredients and their transformation products, as well as adjuvants and solvents used in pesticide products. This database of active ingredients has been integrated with the U.S. EPA product databases. The information is most complete for pesticides registered for use in the United States. All Ecotoxicity information is taken from the U.S. EPA AQUIRE database. The ecotoxicity data are the latest available as of April 8, 2005, which is the January 2004 data set. The PAN database also provides summaries of ecotoxicity data.
http://www.pesticideinfo.org
Data abstracted from the PAN Database for all products identified as being used by Coillte is provided in Appendix 5. This data has been supplied in html format and allows linkage to the source data on the web. This data provides a good overview of ecotoxicity data.

European Union Pesticide Review Reports: The European Commission, DG Health and Consummer Protection is undertaking a Community-wide review process for all active ingredients used in plant protection products within the European Union. This is expected to be completed in 2008.
(http://ec.europa.eu/food/plant/protection/evaluation/exist_subs_rep_en.htm).

A number of technical review reports have been completed four of which are available for products used by Coillte, (Cypermethrin, alpha Cypermethrin, Glyphosate and Atrazine). The Reports provide summary information on fate in the environment, including persistence in soils and water, and ecotoxicology and are provided in Appendix 6. This is a good source of information when reviews exist for the substances of interest.

Other Potential sources of information
Further source of information include the National Centre for Environmental Toxicology (http://www.wrcplc.co.uk/default.aspx?item=19), European Chemical

Bureau (http://ecb.jrc.it/esis) , the Agriculture & Environment Research Unit (AERU), University of Hertfordshire, UK (http://www.herts.ac.uk/aeru/footprint/), the US EPA ((http://cfpub.epa.gov/ecotox/) and the Institut National de la Recherche Agronomique (INRA), France (http://www.inra.fr/agritox/).

Some information relating to these databases is provided in Table 5 below

Table 5 Ecotoxicity Databases

Database	Owner	Data Recorded	Critical Data Outputs	Size	Comments/Limitations
European chemical Substances Information System (ESIS)	European Chemicals Bureau (http://ecb.jrc.it/esis)	Comprises multiple datasets (including EINECS, ELINCS, No-Longer Polymers, HPVCs, LPVCs, classification and labelling info, IUCLID data sheets and export files, EUSES export files, EU Existing Substances Regulation (ESR) information).	• Multitude of information (including endpoints for physical-chemical, toxicological, environmental fate and ecotoxicological properties)	• Unknown	• Contains both peer-reviewed and non-peer-reviewed data (distinction isn't always clear).
FOOTPRINT Pesticide Properties Database (FOOTPRINT PPDB)	Agriculture & Environment Research Unit (AERU), University of Hertfordshire, UK (developed as part of the EU-funded FOOTPRINT project) (http://www.herts.ac.uk/aeru/footprint/)	Contains chemical and physical properties and ecotoxicological data for EU-approved pesticides (and selected metabolites).	• Description of use of pesticide. • Member States for which use is approved. • General information (type, chemical group, chemical formula, molecular mass etc.). • Environmental fate properties. • Toxicological and ecotoxicological properties.	• Approximately 650 active substances and 200 metabolites.	• Data comes from a range of sources, including EU documents, and is quality rated.
US EPA ECOTOX Database	US EPA (http://cfpub.epa.gov/ecotox/)	Contains single chemical toxicity data for aquatic life, terrestrial plants and wildlife.	• Searchable by chemical, effect or species. • User can generate custom-made reports for query output.	As of 22 February 2006: • Total Chemicals = 10,372 • Total Species = 6,137 • Total References = 19,551	• Data is derived predominantly from peer-reviewed literature. • Only single chemical exposures are included. Results for chemical

Database	Owner	Data Recorded	Critical Data Outputs	Size	Comments/Limitations
				• Total Records = 502,622	mixtures are excluded. • ECOTOX supports Netscape Navigator 4.x (or higher) and Explorer 4.x releases. • In order to execute queries, browser must support JavaScript. • Maximum of 5,000 tabular records can be retrieved in one search. Excel exports will retrieve up to 10,000 records. • Using popup blocker software disables some features.
Agritox	Institut National de la Recherche Agronomique (INRA), France (http://www.inra.fr/agritox/)	Physical/chemical, toxicology, environmental fate and ecotoxicology data for pesticides and their metabolites.	• Identification information. • Physical-chemical endpoints. • Toxicological endpoints. • Environmental fate endpoints.	• Approximately 450 substances.	• Information is in French. • Data is peer reviewed (mainly from EU dossiers or dossiers for French national authorisation).

Database	Owner	Data Recorded	Critical Data Outputs	Size	Comments/Limitations
			• Ecotoxicological endpoints. • Classification and labelling information (risk and safety phrases).		• Limited information on metabolites. • Not easily searchable.

References

COUNCIL DIRECTIVE of 15 July 1991concerning the placing of plant protection products on the market (91/414/EEC) (OJ L 230, 19.8.1991, p. 1)

E1 Coillte Draft District Strategic Plan, 2006-2010, Dublin/Wicklow 'Version: 9th Jan 2006

E2 Coillte Draft District Strategic Plan, 2006-2010, Southeast Counties Version: 19 January 20

E3 Coillte District Strategic Plan, 2006 – 2010, Midland District

N1 Coillte Draft District Strategic Plan, 2006 – 2010, Donegal, Version: Jan 16th 06

N2 Coillte Draft District Strategic Plan, 2006 – 2010, Sligo/Leitrim, Version: Jan 9th 06

N3 Coillte Draft District Strategic Plan, 2006 – 2010, Lakelands District,

S1 Coillte District Strategic Plan, 2006 – 2010, Waterford/South Tipperary

S2 Coillte District Strategic Plan, 2006 – 2010, North Tipperary, Limerick,North and West Kerry, 1st Draft 18th Jan 2006

S3, Coillte District Strategic Plan, 2006-2010, Cork District

S4, Coillte Draft District Strategic Plan, 2006-2010, South Kerry & West Cork, 26/10/2005

W1, Coillte Draft District Strategic Plan, 2006-2010, Clare/South Galway

W2 Coillte Draft District Strategic Plan, 2006-2010, East Galway/Roscommon, Version: 24th Jan 2006

W3, Coillte, District Strategic Plan, 2006-2010, Conemara and Mayo, Version: 9th Jan 2006

Pesticide Action network (http://www.pesticideinfo.org)

European Union Pesticide review Reports (http://ec.europa.eu/food/plant/protection/evaluation/exist_subs_rep_en.htm).

WRc National Centre for Environmental Toxicology (http://www.wrcplc.co.uk/default.aspx?item=19)

Appendix 1 Coillte Pesticide Usage by Type

Type	Active ingredient	Product	Amount of active ingredient (g/l)
Insecticide	alpha-cypermethrin	Agromethrin	40
Insecticide	alpha-cypermethrin	Bestseller	100
Insecticide	cypermethrin	Forester	100
Insecticide	carbosulfan	Marshal suSCon granules	10%*
Herbicide	asulam	Asulox	400
Herbicide	atrazine	Atrazine	500
Herbicide	glyphosate	Roundup	360
Herbicide	glyphosate	Biactive	360
Herbicide	glyphosate	No-Mix Hilite	144
Herbicide	imazapyr	Arsenal	250
Herbicide	triclopyr	Garlon 2	240

* applied as a solid

Appendix 2 Pesticide Usage in Coillte Districts (kg a.i.)

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
District E1	Agral				
	Alph- cypermethrin			11.9	48.1
	Arsenal/Imazapyr				
	Asulox(Asulam)	12		8	
	Atrazine				
	Gardoprim/Terbuthylazine	1.3			
	Glymark				
	Glyphosate	273.9	262.4	126.4	200.9
	Kerb Flo			10	
	No-Mix Systemic	0.9			
	Permasect	137.2	173		
	Triclopyr(Garlon)	45.1	49.6	29.5	48.7
	Total kg a.I. used	**470.4**	**484.9**	**185.8**	**297.7**
	Total Area Treated (ha)	3170	3197	2961	2592
	Chemical Usage (kgs a.i./ha)	**0.1484**	**0.1517**	**0.0628**	**0.1148**
District E2	Agral	15	15	6.8	3.8
	Alph- cypermethrin			20.8	48.2
	Arsenal/Imazapyr				
	Asulox(Asulam)	50.4	9.2	41.6	22
	Atrazine				
	Gardoprim/Terbuthylazine	148.8	2		
	Glymark				
	Glyphosate	288.2	268.1	214.9	162.4
	Kerb Flo				
	No-Mix Systemic	7.9			
	Permasect	284.4	311.7		
	Triclopyr(Garlon)	166.9	189.1	174.5	141.4
	Total Kgs a.i. Used	**946.6**	**780.1**	**458.6**	**377.7**
	Total Area Treated (ha)	3589	3422	3199	2763
	Chemical Usage (kgs a.i./ha)	**0.2638**	**0.228**	**0.1434**	**0.1367**
District E3	Agral				
	Alph- cypermethrin			59	72.6
	Cypermethrin				8
	Arsenal/Imazapyr	26.8	34.3	37.5	30.6
	Asulox(Asulam)	16	9.6	2	
	Atrazine	331.8	361	126	95
	Gardoprim/Terbuthylazine	31.3	12.5		
	Glymark				
	Glyphosate	96.2	118	22	25.4
	Kerb Flo				
	No-Mix Systemic				1
	Permasect	211.9	305.8		
	Triclopyr(Garlon)	54.9	71.7	23	25.3
	Total Kgs a.i. Used	**768.9**	**912.8**	**269.5**	**257.9**
	Total Area Treated (ha)	2183	2293	2602	2852
	Chemical Usage (kgs a.i./ha)	**0.3522**	**0.3981**	**0.1036**	**0.0904**
District N1	Agral				

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
	Alph- cypermethrin			118.4	164
	Cypermethrin				128.8
	Arsenal/Imazapyr		5		
	Asulox(Asulam)	4			
	Atrazine	15	25.7	122	277
	Gardoprim/Terbuthylazine	27.5			
	Glymark				
	Glyphosate	104.5		9	131
	Kerb Flo				
	Marshal suSCon granules			1.8	62.5
	No-Mix Systemic	1.4	3.4		7.7
	Permasect	554.7	393.3		
	Simazine		2		
	Triclopyr(Garlon)	7.6	1.2		
	Total Kgs a.i. Used	**714.7**	**430.6**	**251.3**	**771**
	Total Area Treated (ha)	3523	4142	4379	4220
	Chemical Usage (kgs a.i./ha)	**0.2029**	**0.104**	**0.0574**	**0.1827**
District N2	Agral				
	Alph- cypermethrin			58.6	83.2
	Cypermethrin				6.8
	Arsenal/Imazapyr				
	Asulox(Asulam)				
	Atrazine				
	Gardoprim/Terbuthylazine				
	Glymark				
	Glyphosate		145.9	68.8	61.2
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic				
	Permasect	63.6	77.1		
	Simazine				
	Triclopyr(Garlon)		6.6		2.4
	Total Kgs a.i. Used	**63.6**	**229.6**	**127.4**	**153.7**
	Total Area Treated (ha)	2737	2805	2697	2804
	Chemical Usage (kgs a.i./ha)	**0.0232**	**0.0818**	**0.0472**	**0.0548**
District N3	Agral				
	Alph- cypermethrin			45.5	23.4
	Cypermethrin				
	Arsenal/Imazapyr	22.5	34.8		
	Asulox(Asulam)	2		8	
	Atrazine	41	92	59	54.5
	Gardoprim/Terbuthylazine	2.5			
	Glymark				
	Glyphosate	172.2	130.4	63.4	96.8
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	2.9			
	Permasect	292.5	278		
	Simazine				
	Triclopyr(Garlon)	11.2	21.9	6.1	16.6

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
	Total Kgs a.i. Used	**546.8**	**557**	**182.1**	**191.3**
	Total Area Treated (ha)	2708	2633	3099	2527
	Chemical Usage (kgs a.i./ha)	**0.2019**	**0.2116**	**0.0587**	**0.0757**
District S1	Agral				
	Alph- cypermethrin			72.7	137.2
	Cypermethrin				
	Arsenal/Imazapyr	0.8	0.8		
	Asulox(Asulam)	92.4	27.6	57.6	18
	Atrazine			5	
	Gardoprim/Terbuthylazine	41	41		
	Glymark				
	Glyphosate	265.1	253.2	173.9	227.9
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	11.3	15.7	61.8	28.2
	Permasect	377.6	481		
	Simazine				
	Triclopyr(Garlon)	55.9	61	81.7	8
	Total Kgs a.i. Used	**844.2**	**880.3**	**452.8**	**419.3**
	Total Area Treated (ha)	5127	5102	4293	4058
	Chemical Usage (kgs a.i./ha)	**0.1647**	**0.1725**	**0.1055**	**0.1033**
District S2	Agral			6	
	Alph- cypermethrin			29.4	84.9
	Cypermethrin				
	Arsenal/Imazapyr				
	Asulox(Asulam)	2			
	Atrazine				
	Gardoprim/Terbuthylazine	74.5	18.6	6.3	
	Glymark				
	Glyphosate	91.4	92.1	67.8	117.4
	Kerb Flo			6.1	
	Marshal suSCon granules				
	No-Mix Systemic	73.3	306.3	94.3	237.3
	Permasect	132.1	265.9		
	Simazine				
	Triclopyr(Garlon)	18.8	32.9	44.2	44.1
	Total Kgs a.i. Used	**392.1**	**715.9**	**254**	**483.7**
	Total Area Treated (ha)	3188	3238	3558	3606
	Chemical Usage (kgs a.i./ha)	**0.123**	**0.2211**	**0.0714**	**0.1341**
District S3	Agral				
	Alph- cypermethrin			71.9	142
	Cypermethrin				2.4
	Arsenal/Imazapyr				
	Asulox(Asulam)		16	16	
	Atrazine			21.2	
	Gardoprim/Terbuthylazine	102	34.1	10.5	
	Glymark				
	Glyphosate	68.9	86.6	103.3	20.7
	Kerb Flo			4.9	
	Marshal suSCon granules				14.5

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
	No-Mix Systemic	1.3			0.4
	Permasect	482.1	717.5		
	Simazine				
	Triclopyr(Garlon)	29	57.7	36.7	18.4
	Total Kgs a.i. Used	**683.4**	**911.9**	**264.5**	**198.3**
	Total Area Treated (ha)	4776	4837	4389	4321
	Chemical Usage (kgs a.i./ha)	**0.1431**	**0.1885**	**0.0603**	**0.0459**
District S4	Agral				
	Alph- cypermethrin			39.7	87.5
	Cypermethrin				2.1
	Arsenal/Imazapyr				
	Asulox(Asulam)	8			
	Atrazine				4.2
	Gardoprim/Terbuthylazine	56.5	26.5		
	Glymark				
	Glyphosate	4	10.5	12.1	27
	Kerb Flo				
	Marshal suSCon granules				5.3
	No-Mix Systemic				
	Permasect	164.3	304.2		
	Simazine				
	Triclopyr(Garlon)	0.5	3.4		4
	Total Kgs a.i. Used	**233.2**	**344.6**	**51.8**	**130**
	Total Area Treated (ha)	1512	1612	1748	1754
	Chemical Usage (kgs a.i./ha)	**0.1542**	**0.2138**	**0.0296**	**0.0741**
District W1	Agral				
	Alph- cypermethrin			41.3	33.6
	Cypermethrin				2
	Arsenal/Imazapyr				
	Asulox(Asulam)				
	Atrazine		7.5		
	Gardoprim/Terbuthylazine	148.5	68.5	5	
	Glymark				
	Glyphosate	13.9	45.5	61.3	38.7
	Kerb Flo				2.5
	Marshal suSCon granules				
	No-Mix Systemic				
	Permasect	253.1	281.1	5.8	
	Simazine				
	Triclopyr(Garlon)	7.1	13.4	10.7	10.8
	Total Kgs a.i. Used	**422.6**	**416.1**	**124**	**87.7**
	Total Area Treated (ha)	3839	3449	2898	2450
	Chemical Usage (kgs a.i./ha)	**0.1101**	**0.1206**	**0.0428**	**0.0358**
District W2	Agral				
	Alph- cypermethrin			35.9	27.3
	Cypermethrin				
	Arsenal/Imazapyr	2			
	Asulox(Asulam)				
	Atrazine	9			
	Gardoprim/Terbuthylazine		3		

Coillte Districts	Product	Kg Active Ingredient Used per year			
		2002	2003	2004	2005
	Glymark				
	Glyphosate	235.4	108.4	83	38.6
	Goltix			14	
	Kerb Flo				
	Marshal suSCon granules			19	
	No-Mix Systemic	1.8			
	Permasect	132.2	208.9		
	Simazine				
	Triclopyr(Garlon)	21.9	2.4	6.5	8.8
	Total Kgs a.i. Used	**402.3**	**322.7**	**158.5**	**74.7**
	Total Area Treated (ha)	1703	1842	1862	1857
	Chemical Usage (kgs a.i./ha)	**0.2362**	**0.1752**	**0.0851**	**0.0402**
District W3	Agral				
	Alph- cypermethrin			77.2	77.8
	Cypermethrin				
	Arsenal/Imazapyr				
	Asulox(Asulam)	20.8			
	Atrazine				
	Gardoprim/Terbuthylazine		5		
	Glymark				
	Glyphosate	12.6	52.6	8.9	29.3
	Goltix				
	Kerb Flo				
	Marshal suSCon granules				
	No-Mix Systemic	12.2	13.6		
	Permasect	459.4	377.9		
	Simazine				
	Triclopyr(Garlon)	43.2		0.4	0.2
	Total Kgs a.i. Used	**548.3**	**449.1**	**86.5**	**107.3**
	Total Area Treated (ha)	3484	3312	3149	3073
	Chemical Usage (kgs a.i./ha)	**0.1574**	**0.1356**	**0.0275**	**0.0349**

Appendix 3 Spatially related data -GIS ESRI shape file and excel spreadsheet (see attached files in electron format).

Appendix 4 Material Safety Datasheets

(Files provided in electronic format)

Appendix 5 Pesticide Action Network (PAN) Pesticide Database

(Files provided in electronic format)

Appendix 6 European Union Pesticide Review Reports

(Files provided in electronic format)