Ministry of the Environment Project to Promote Monitoring of Important Ecosystem Surveillance Areas (Monitoring Site 1000)

Monitoring Site 1000: Forest and Grassland Surveys

Manual on Litter and Fallen Seed Survey

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This manual is an English translation of the Japanese version and has not been reviewed by experts. Some technical terms and expressions may not exactly capture the intended nuances.

Introduction

This is a manual for conducting a survey on litter and fallen seeds (litter/seed trap survey) among Monitoring Site 1000: Forest and Grassland Surveys. In 2010, this manual was created by integrating the part describing litter/seed traps in the “Monitoring Site 1000 Survey Manual on Forest Core Sites Establishment ver.1” and the “Monitoring 1000 Forest Department: Simplified Manual on Litter Processing”. Please process and seeds with reference to this manual. **Please try to process at level 2 or higher (See Fig. 5) as much as possible** as a non-binding target.

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1 Purpose of survey

A litter/seed trap survey allows us to estimate the volume of **litter and seed production**. The volume of litter is essential to estimate primary productivity of forests. Moreover, we can find out characteristics of rich or poor harvest of various species by measuring the volume and number of seed production by species. This data is interesting in that it reveals regenerative characteristics of trees. Furthermore, it can serve as background data explaining dynamics and life-history characteristics of animals that eat seeds.

2. Survey

2.1 Layout

As shown in Fig. 1, 25 traps are installed every 20 m in a 1 ha of tree census area. The basic density is one trap per 20 m-square lot. If more than 25 litter-seed traps have been installed in a survey site, select 25 traps for the Monitoring 1000 Project.

2.2 Installation

As shown in a photo (Fig. 2), fix a trap by sticking three polyvinyl chloride pipes into soil and using copper wires. A trap has front and back. On the back side, allowance is turned. Therefore, place it in a way that the back side comes outside (on the polyvinyl chloride pipe side). A polyvinyl chloride pipe has holes on two places whose height is different (Fig. 3). On a slope, place a trap using any of the holes so that its receiving surface becomes horizontal (Fig. 4).

Follow the instructions on fixing below. Firstly, thread a copper wire to a hole of the polyvinyl chloride pipe and maintain the same length on the left side and on the right side with the pipe in the center. Make sure to pierce the two tips of the copper wire **from the top** into the mesh part of the trap's edge, leaving the width of the pipe, and lead them under the mesh. Twist two copper wires coming out twice or three times outside the polyvinyl chloride pipe. If you twist the wires too tight or so many times, they become easier to be cut. A copper wire is ideal, because it can be unwired with hands in case where it is broken and replaced or removed in winter. Avoid fixing a trap with a thick wire that requires pilers.

Once a trap is installed, put a golf ball inside to prevent the mesh part from being turned over by wind. It is better to put two golf balls in a windy area.

Place a number (1~25) to each trap with big vinyl numbering tapes (Fig. 4). Pinch the mesh of the polyethylene tube exterior frame at the trap's edge and place the numbering tape twice with a stationery stapler. When a trap is replaced, remove the numbering tape and reuse it.

In cases where the material is damaged or deteriorated, each site should determine if it is necessary to replace. Please contact the Network Center if you need any material.

2.3 Method of collection

See Fig. 5 for the flow from collection to analysis

The contents inside a trap should be collected at least once a month. Or you may collect them twice a month or every two weeks to find out the timing of dropping of flowers and seeds. Each site should determine the day in which traps are installed and the last day in which they are collected (trap removal date), because traps are damaged during the snow cover period. Make sure to describe the date of installation and collection as well as

the last date of collection (trap removal date) of traps.

A paper bag (Daishowa Paper Products & Packaging summit bag No.14) should be used to collect the contents. Write down the name of survey site, **collection date, and trap number** on the paper bag with a **black marker** (A red or blue marker should not be used due to the lack of weatherability). Collect everything but golf balls put for protection from wind. Since there are fine seeds such as ones of Japanese cherry birch, try to collect everything as much as possible including branches. If a big branch is covering a trap, collect the part that covers the trap. A big branch that requires a saw or a big branch you cannot bring should not be collected. A paper bag used for collection should be brought back inside a big plastic bag.

You can prevent samples from decomposing by spreading paper bags you have brought back on the corridor or shelf for air drying. If samples are wet due to rain, open the paper bag's lid or spread its contents on the shelf, etc. Then, dry them in a fan dryer (below 30~40 degrees C, an entire day and night) once water evaporates to a certain extent.

2.4 Method of analysis

2.4.1 Sorting of contents by four categories

The air-dry weight of dried contents should be measured for each bag (one trap) (although it is troublesome, it serves as a hedge in cases where samples are lost during work). Then, spread them on white paper and separate by hand. Make sure to check each leaf one by one.

The contents should be separated into at least four categories, namely, 1) leaves, 2) branches, 3) reproductive organs (flowers, seeds, and associated organs), and 4) others (bud scale, tree bark, moss, insect feces). The dry weight of these four categories should be measured first. The separated four contents are put into brown envelopes or collection paper bags on which **the name of survey site, date, trap number and separation item** are written with a pencil or **black marker**, and measure the air-dry weight separately (by the 0.01 g). In cases where the weight is less than 0.01 g, enter "0". If there is no content to be measured, enter "-" (half-width hyphen). In case of a missing value (broken trap, etc.) enter "NA" (in all items) (the same rule applies hereinafter).

After mixing samples from all traps, take a sample and dry them with a fan dryer (70 degrees C, 72 hours) to create a formula to convert into bone-dry weight (by the 0.01 g). Each site should make a reasonable effort for creating a conversion formula. Since the water content of plants varies depending on season, create conversion formulas each day of collection of litter/seeds. However, sort reproductive organs (2.4.2 Sorting of reproductive organ) without drying completely (if reproductive organs are dried completely, sorting works become complicated, because flowers and immature seeds are discolored or deformed significantly or stick together).

Enter the overall air-dry weight and the bone-dry weight by each category calculated by a conversion formula (or actually measured) as shown in Table 1.

2.4.2 Sorting of reproductive organ

Among reproductive organs, seeds should be divided further by tree species. Try to separate major tree species and tree species that appear in tree census (Level 2 of Fig. 5) (non-binding target). It is left to the discretion of each site if flowers and seeds are divided further (enhancement, status of pest damage, etc.). At least, try to divide seeds into healthy seeds and others. Count the number of seeds of each tree species, dry them with a fan dryer (70 degrees C, 72 hours), and measure the bone-dry weight. Table 2 shows an example of datasheet entry. Others refer to unhealthy seeds such as moth, empty husks, and premature seeds.

Some of samples of sorted and measured reproductive organs are used to create a conversion formula explained in 2.4.1 (measure the bone-dry weight and enter it in Table 1).

Table 1 Sorting of four categories of contents by trap (yellow cells are obligatory)

プロット名	トラップ番号	トラップ面積	開始日	回収日	葉絶乾重（g）	枝絶乾重（g）	種子乾重（g）	繁殖器官乾重（種子+花など)(g)	その他絶乾重(g)	風乾全量(g)	葉風乾重(g)	枝風乾重(g)	種子風乾重(g)	繁殖器官風乾重(g)	その他風乾重(g)	備考
plot	trap_id	trap_are	s_date1	s_date2	wdry_lea	wdry_bra	wdry_se	wdry_rep	wdry_ot	w_total	w_leaf	w_branc	w_seed	w_rep	w_other	note
苫小牧	1	0.5	20041105	20041112	14.7	0.4	0.03	0.05	0.8							
苫小牧	2	0.5	20041105	20041112	18.2	0.01	0	0.12	–							
苫小牧	3	0.5	20041105	20041112	50.1	0.5	–	0.9	0.9							
	…															
苫小牧	25	0.5	20041105	20041112	NA	NA	NA	NA	NA							トラップ破損
苫小牧	1	0.5	20041112	20041215	20.2	1	0.5	1.1	0							
苫小牧	2	0.5	20041112	20041215	11.1	0.7	–	0.2	0.1							ゴルフボールが外に落ちており、回収物は風で飛ばされた可能性あり
	…															

表内用語

プロット名：Name of plot

トラップ番号：Trap number

トラップ面積：Trap area

開始日：Starting date

回収日：Collection date

葉絶乾重：Leaf bone-dry weight

枝絶乾重：Branch bone-dry weight

種子乾量：Seed dry measure

繁殖器官乾量（種子＋花など）：Reproductive organ dry measure (seeds + flowers)

その他絶乾重：Other bone-dry weights

風乾全量：Total air-dried weight

葉風乾重：Leaf air-dried weight

枝風乾重：Branch air-dried weight

種子風重量：Seed air-dried weight

繁殖器官風乾量：Reproductive organ air-dried weight

その他風乾重：Other air-dried weights

備考：Remarks

苫小牧：Tomakomai

トラップ破損：Broken trap

ゴルフボールが外に落ちており、回収物は風で飛ばされた可能性あり：A golf ball fell outside the trap and the collected materials may have been blown away.

Table 2 Number of healthy seeds and their dry weight by trap and by tree species

plot	trap_id	trap_area	s_date1	s_date2	spc	number	wdry	status	form	note
プロット名	トラップ番号	トラップ面積	設置日	回収日	種名	数	絶乾重(g)	状態	形	備考
苫小牧	1	0.5	20050629	20050728	ダケカンバ	1	0	健全	種子	
苫小牧	1	0.5	20050629	20050728	イタヤカエデ	1	0.02	虫	種子	
苫小牧	1	0.5	20050629	20050728	ミズナラ	1	0.03	健全	種子	
苫小牧	2	0.5	20051029	20051130	ブナ	1	0.03	未熟	種子	
苫小牧	2	0.5	20051029	20051130	ブナ	1	0.03	しいな	種子	
苫小牧	2	0.5	20051029	20051130	ブナ	NA	0.01	かけら	種子	
苫小牧	2	0.5	20051029	20051130	カツラ	2	0.4	未熟	果実	
苫小牧	2	0.5	20050629	20050728	トドマツ	3	1.5	健全	球果	
苫小牧	2	0.5	20050629	20050728	トドマツ	1	0	不健全	種子	

健全、虫（穴）、未熟、しいな、かけら、不健全、区別なし、のいずれかを入力

表内用語
プロット名：Name of plot
トラップ番号：Trap number
トラップ面積：Trap area
設置日：Installation date
回収日：Collection date
種名：Name of species
数：Number
絶乾量：bone-dry weights
状態：Status
形：Form
備考：Remarks
苫小牧：Tomakomai
ダケカンバ：Gold birch (*Betula ermanii*)
イタヤカエデ：Painted maple (*Acer mono*)
ミズナラ：Mongolian oak (*Quercus crispula*)
ブナ：Japanese beech (*Fagus crenata*)
カツラ：Japanese Katsura tree (*Cercidiphyllum japonicum*)
トドマツ：Sakhalin fir (*Abies sachalinensis*)
健全：Healthy
虫：Insect
未熟：Premature
しいな：Empty husk
かけら：Fragment
不健全：Unhealthy
種子：Seed
果実：Fruit
球果：Cone

3. Survey records

Please enter survey records as shown in Table 3. In addition, make sure to enter who measured (collected) what, when, where, how, and what for as accurate as possible in a way that anyone can understand (as if you leave records to a total stranger who will see it 50 years later).

Table 3 Example of survey record entry

Year	Starting date of survey	End date of survey	Name of investigator	Special note	Remarks
2007	20070530	20081130	Moni Taro, Moni Hanako		
2008	20080501	20081130	Moni Taro, Moni Hanako	The trap contents were blown away when a typhoon passed on 2008/10/30.	

4. Handling of personal information

As a general rule, data obtained from the Monitoring Site 1000 will be disclosed. In this case, records of the investigators and photographers may be disclosed. In cases where there is any inconvenience in disclosing a personal name, please describe to that effect clearly when submitting data.

5. Storage of samples

It is possible to store measured samples at each site or another organization in accordance with your preference (hereinafter referred to as “requesting site, etc.”). In cases where you desire to store samples that are not collected by yourselves, you need to obtain consent of the site’s representative. The proprietary right of samples stored in a requesting site, etc. should belong to the requesting site, etc. that stores those samples.

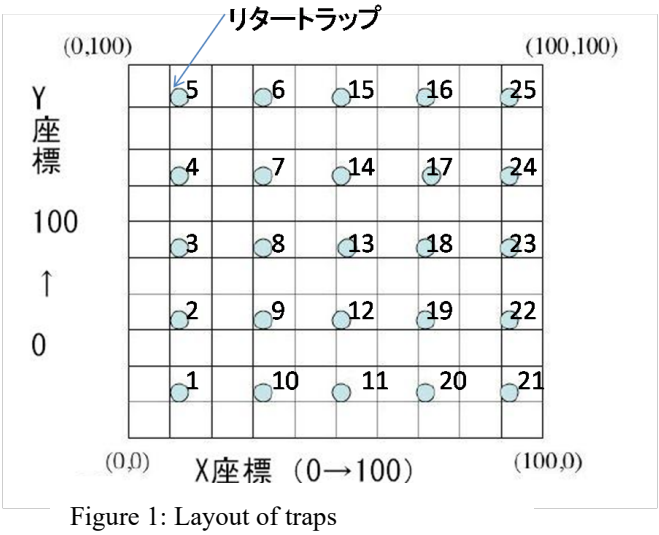


Figure 1: Layout of traps

リタートラップ：Litter trap

Y 座標：Y coordinate

X 座標：X coordinate



Figure 2: Example 1 of installation of trap

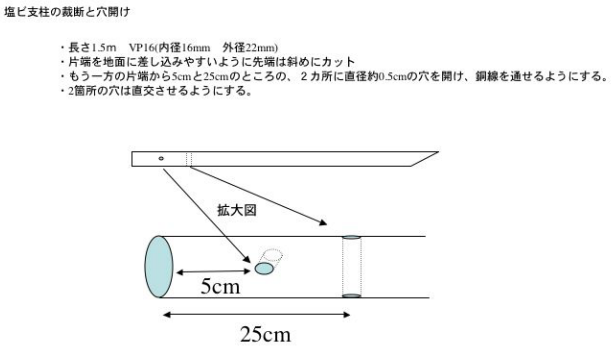


Figure 3: Vinyl chloride pipe for support rod

塩ビ支柱の裁断と穴あけ：Cutting and punching of vinyl chloride pipe
長さ 1.5m：Length: 1.5 m
内径：Inner diameter
外径：Outer diameter
片端を地面に差し込みやすいように先端は斜めにカット：Cut the head diagonally so that one end can be easily inserted into the ground
もう一方の片端から 5cm と 25cm のところの、2 カ所に直径約 0.5cm の穴を開け、銅線を通せるようにする：Make a hole about 0.5 cm in diameter at two places (at 5 cm and 25 cm from the other end) where a copper wire goes through
2 箇所の穴は直交させるようにする：The two holes should bisect each other
拡大図：Enlarged view



Figure 4: Example 2 of installation of trap

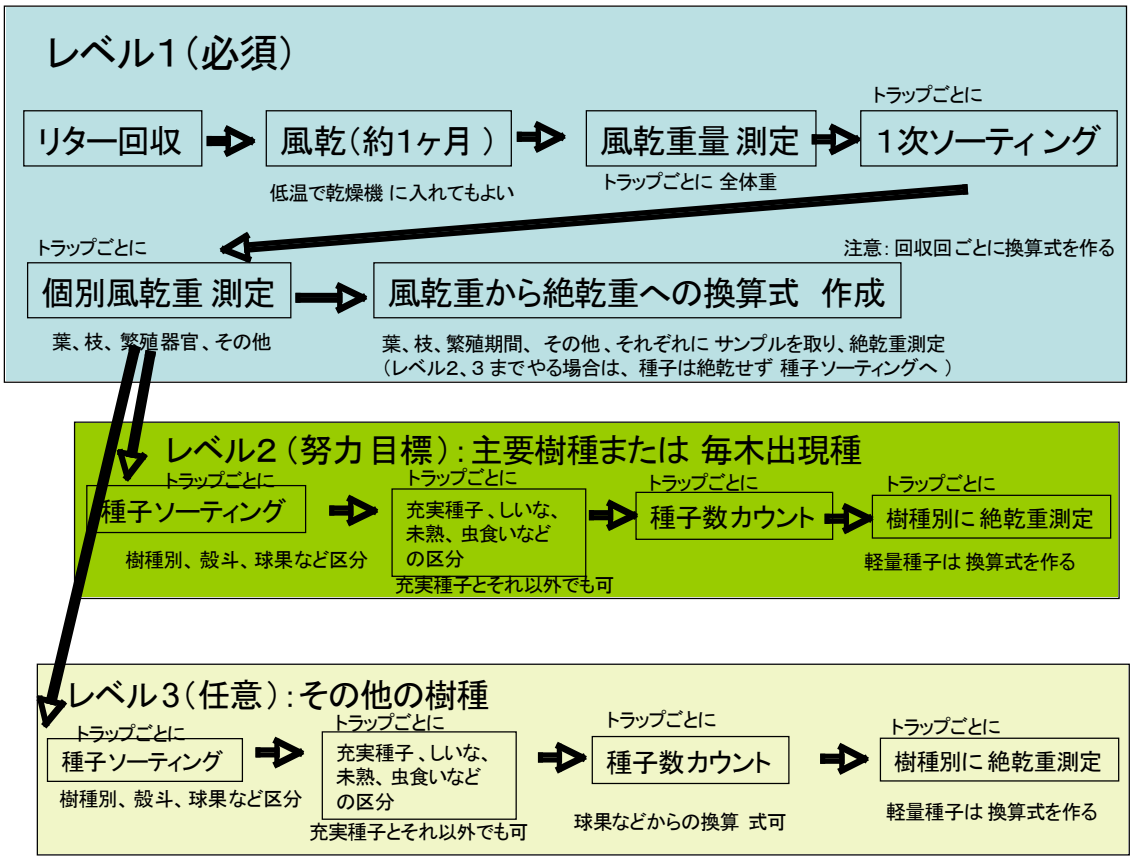


Figure 5: Flow of treatment of litter/seeds (from collection to analysis)

Record unidentified seeds or uncertain seeds at level 2 or 3, and store seed samples.

図内用語

Level 1 (obligatory)

リター回収：Collection of litter

風乾（約 1 ヵ月）：Air dry (about one month)

低温で乾燥機に入れてもよい：It is allowed to put litter into a dryer at a lower temperature

風乾重量測定：Measurement of air-dried weight

トラップごとに全体重：All weight by trap

トラップごとに：By trap

1 次ソーティング：First sorting
個別風乾重測定：Measurement of individual air-dried weight
葉、枝、繁殖器官、その他：Leave, branch, reproductive organs, others
風乾重から絶乾重への換算式作成：Creation of a conversion formula from air-dried weight to bone-dry weight
注意：回収回ごとに換算式を作る：Note: Please create a conversion formula at every collection
葉、枝、繁殖器官、その他、それぞれにサンプルを取り、絶乾重測定：Take samples from leaves, branches, reproductive organs, and others and measure their bone-dry weight
（レベル 2、3 までやる場合は、種子は絶乾せず種子ソーティングへ）：In cases where you proceed to Level 2 and Level 3, proceed to seed sorting without completely drying seeds)

レベル 2（努力目標）：主要樹種または毎木出現種：Level 2 (non-binding target): Major tree species and tree species that appear in tree census
トラップごとに：By trap
種子ソーティング：Seed sorting
充実種子、しいな、未熟、虫食いなどの区分：Segment of fertile seed, empty seed, premature seed, moth, etc.
種子数カウント：Seed count
樹種別に絶乾重測定：Measurement of bone-dry weight by tree species
樹種別、殻斗、球果など区分：Segment of tree species, acorn cup, cone, etc.
充実種子とそれ以外でも可：It is allowed to separate seeds into fertile seeds and others
軽量種子は換算式を作る：A conversion formula should be made for light seeds

レベル 3（任意）：その他の樹種：Level 3 (optional): Other tree species
トラップごとに：By trap
種子ソーティング：Seed sorting
充実種子、しいな、未熟、虫食いなどの区分：Segment of sound seed, empty seed, premature seed, insect-infected seed, etc.
種子数カウント：Seed count
樹種別に絶乾重測定：Measurement of bone-dry weight by tree species
樹種別、殻斗、球果など区分：Segment of tree species, acorn cup, cone, etc.
充実種子とそれ以外でも可：It is allowed to separate seeds into fertile seeds and others
軽量種子は換算式を作る：A conversion formula should be made for light seeds

Reference

Reference 1: Materials of litter/seed trap nets

品名	規格	トラップ１個に必要な量
寒冷紗	幅1.8m、1mmメッシュ、白色	1m
ミシン糸	ビニロン製ミシン糸	適量
ポリエチレンパイプ（太）（枠用）	長さ2.5m、内径12mm、外径18mm	1本
ポリエチレンパイプ（細）（枠接続用）	長さ0.15m、内径8mm、外径12mm	1本
塩ビパイプ（支柱用）	長さ1.5m、内径16mm、外径22mm	3本
銅線（トラップ固定用）	太さ1mm	0.4m×3本

品名：Name of product

規格：Specifications

トラップ 1 個に必要な量：Quantity required for one trap

寒冷紗：Super

幅 1.8m、1mm メッシュ、白色：Width 1.8 m, 1 mm mesh, white

ミシン糸：Sewing yarn

ビニロン製ミシン糸：Vinylon sewing yarn

適量：As needed

ポリエチレンパイプ（太）（枠用）：Polyethylene pipe (wide) for frame

長さ 2.5m、内径 12mm、外径 18mm：Length 2.5 m, inner diameter 12 mm, outer diameter 18 mm

1 本：1

ポリエチレンパイプ（細）（枠接続用）：Polyethylene pipe (narrow) for connection of frames

長さ 0.15m、内径 8mm、外径 12mm：Length 0.15 m, inner diameter 8 mm, outer diameter 12 mm

塩ビパイプ（支柱用）：Vinyl chloride pipe for support rod

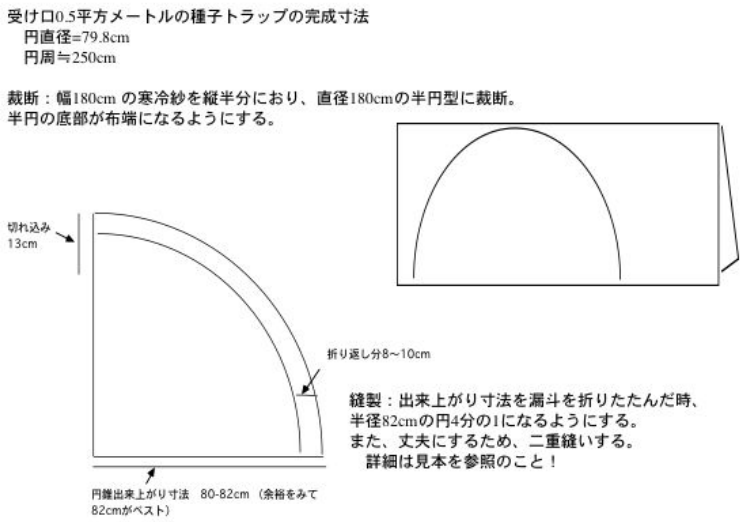
長さ 1.5m、内径 16mm、外径 22mm：Length 1.5 m, inner diameter 16 mm, outer diameter 22 mm

3 本：3

銅線（トラップ固定用）：Copper wire for fixing trap

太さ 1mm：Width 1 mm

Reference 2: Cut and sewing of litter/seed trap nets



受け口 0.5 平方メートルの種子トラップの完成寸法：Finished dimension of seed trap whose receiving groove is 0.5 square meter
円直径：Diameter
円周：Perimeter
裁断：Cutting
幅 180cm の寒冷紗を縦半分におり、直径 180cm の半円型に裁断：Fold the super whose width is 180 cm in half lengthwise and cut it in the semicircle shape whose diameter is 180 cm
半円の底部が布端になるようにする：The bottom of the semicircle should come to the end of the cloth
切れ込み：Slit
折り返し分：Folding margin
円周出来上がり寸法：Finished dimension of perimeter
余裕をみて 82cm がベスト：82 cm is the best taking into account margin
縫製：出来上がり寸法を漏斗を折りたたんだ時、半径 82cm の円 4 分の 1 になるようにする：Sewing: When a funnel is folded, the finished size should be one-fourth of the circle whose radius is 82 cm
また、丈夫にするため、二重縫いにする：Use double stitches for the reason of durability
詳細は見本を参照のこと！：See a sample for more details

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